Final Environmental Impact Statement for American Fisheries Act Amendments 61/61/13/8

United States Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service
Alaska Region

February 2002

FINAL ENVIRONMENTAL IMPACT STATEMENT
for
AMERICAN FISHERIES ACT AMENDMENTS:

- Amendment 61 to the *Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area*,
- Amendment 61 to the *Fishery Management Plan for Groundfish of the Gulf of Alaska*,
- Amendment 13 to the *Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crab*, and
- Amendment 8 to the *Fishery Management Plan for the Scallop Fishery off Alaska*.

February 2002

Lead Agency:	National Marine Fisheries Service Alaska Region Juneau, Alaska
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Cooperating Agencies:	North Pacific Fishery Management Council Alaska Department of Fish and Game

Abstract: On October 21, 1998, the President signed into law the American Fisheries Act (AFA) which mandated sweeping changes to the conservation and management program for the pollock fishery of the Bering Sea and Aleutian Islands (BSAI) and to a lesser extent, affected the management programs for the other groundfish fisheries of the BSAI the groundfish fisheries of the Gulf of Alaska, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska. Under the Magnuson-Stevens Fishery Conservation and Management Act of 1976, the Council has prepared Amendments 61/61/13/8 to implement the provisions of the AFA in the groundfish, crab and scallop fisheries off Alaska. The purpose of Amendments 61/61/13/8 is to incorporate the relevant provisions of the AFA into the FMPs and establish a comprehensive management program to implement the AFA. The purpose of this Environmental Impact Statement (EIS) is to provide decision makers and the public with an evaluation of the environmental and economic effects of the management program that would be implemented under proposed Amendments 61/61/13/8, as well as the effects of possible alternative management programs to implement the AFA. It is intended that this EIS serve as the central environmental document for management measures developed by the National Marine Fisheries Service and the North Pacific Fishery Management Council to implement the provisions of the AFA.

UNITED STATES DEPARTMENT OF COMMERCE
The Deputy Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

FEB 21 2002

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act of 1969 (NEPA), we enclose for your review the final Environmental Impact Statement (FEIS) for American Fisheries Act Amendments: Amendment 61 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands, Amendment 61 to the Fishery Management Plan for Groundfish of the Gulf of Alaska, Amendment 13 to the Fishery Management Plan for the Bering Sea and Aleutian Islands King and Tanner Crab, and Amendment 8 to the Fishery Management Plan for the Scallop Fishery off Alaska.

These amendments will address the following: (1) In the pollock fishery, they will limit access to and allocate total allowable catch to the various sectors within the industry; (2) formation and management of fishery cooperatives; (3) protect other fisheries from spillover effects resulting from the rationalization in the BSAI pollock fishery; (4) implement catch weighing and monitoring requirements for vessels fishing for pollock and for the cooperative vessels fishing in other fisheries.

Any written comments or questions you have should be submitted to James W. Basliger, Administrator, Alaska Region, P.O. Box 21668, Juneau, Alaska 99802 by March 25, 2002. NOAA is not required to respond to comments received as a result of issuance of the FEIS, however comments will be reviewed and considered for their impact on issuance of a record of decision (ROD). The ROD will be printed in the Federal Register some time after March 25, 2002. Also, one copy of your comments should be sent to the Office of Policy & Strategic Planning in Room 6117, U.S. Department of Commerce, Washington, DC 20230.

Sincerely,

for Margaret L. McCalla

Scott B. Gudes
Deputy Under Secretary
for Oceans and Atmosphere

Enclosure

Executive Summary

Introduction

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) which mandated sweeping changes to the conservation and management program for the pollock fishery of the Bering Sea and Aleutian Islands (BSAI) and to a lesser extent, affected the management programs for the other groundfish fisheries of the BSAI the groundfish fisheries of the Gulf of Alaska (GOA), the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska. With respect to the fisheries off Alaska, the AFA requires a suite of new management measures that fall into four general categories: (1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the BSAI pollock fishery, (3) regulations to protect other fisheries from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the BSAI pollock fishery.

Under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act), the North Pacific Fishery Management Council (Council) has prepared FMP amendments to implement the provisions of the AFA in the groundfish, crab and scallop fisheries off Alaska. These are Amendment 61 to the *Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area*, Amendment 61 to the *Fishery Management Plan for Groundfish of the Gulf of Alaska*, Amendment 13 to the *Fishery Management Plan for the King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands*, and Amendment 8 to the *Fishery Management Plan for the Scallop Fishery off Alaska* (Amendments 61/61/13/8). The full text of Amendments 61/61/13/8 is contained in Appendix B. The purpose of Amendments 61/61/13/8 is to incorporate the relevant provisions of the AFA into the FMPs and establish a comprehensive management program to implement the AFA.

The purpose of this Environmental Impact Statement (EIS) is to provide decision makers and the public with an evaluation of the environmental and economic effects of the management program that would be implemented under proposed Amendments 61/61/13/8, as well as the effects of alternative management programs to implement the AFA. It is intended that this EIS serve as the central environmental document for management measures developed by NMFS and the Council to implement the provisions of the AFA.

Primary elements of Amendment 61/61/13/8

Amendments 61/61/13/8 were developed by the Council during an extensive public process over the course of 12 Council meetings. Each alternative is presented in the same format and contains the same four primary management components that are necessary to implement the provisions of the AFA in the fisheries off Alaska. These components are (1) Limited access and sector allocations, (2) fishery cooperatives, (3) Sideboards, and (4) Catch weighing and monitoring.

Component 1: Limited access and sector allocations. This management component includes regulations that (1) define the various sectors of the BSAI pollock industry, (2) determine which vessels and processors are eligible to participate in each industry sector, (3) establish allocations of BSAI pollock total allowable catch (TAC) to each industry sector as directed fishing allowances, and (4) establish excessive share limits for harvesting BSAI pollock. These regulations are necessary to achieve the AFA's objective of decapitalization and rationalization of the BSAI pollock fishery. The AFA addresses these issues with explicit statutory. The Council and NMFS do not have authority to recommend or implement a program that would define the pollock industry sectors differently, change the sectors allocation percentages, or change the lists of vessels and processors that are authorized to participate in each sector. Consequently, all four of the AFA-based alternatives in this EIS (Alternatives 2-5) mirror the provisions of the AFA with respect to pollock industry sectors and sector allocations.

Component 2: Fishery cooperatives. This management component addresses the formation and management of fishery cooperatives. Fishery cooperatives are a relatively new type of entity in the groundfish fisheries of the North Pacific and are formed by groups of vessel owners to provide an alternative to the open access race for fish. Under a fishery cooperative, the members of a cooperative agree to divide up the available quota among themselves in a manner that eliminates a wasteful race for fish and allows participants to maximize productivity. The AFA authorizes the formation of fishery cooperatives in all sectors of the BSAI pollock fishery, grants anti-trust exemptions to cooperatives in the mothership sector, and imposes operational limits on fishery cooperatives in the BSAI pollock fishery. The AFA provides more flexibility for NMFS and the Council to develop management measures to govern the formation and operation of fishery cooperatives. The AFA-based alternatives in this EIS (Alternatives 2-5) differ with respect to the level of autonomy and flexibility provided to fishery cooperatives to manage BSAI pollock and sideboard fishing activities.

Component 3: Sideboards. Sideboards are measures to protect other fisheries from spillover effects resulting from the rationalization of the BSAI pollock fishery and from the formation of pollock fishery cooperatives. Participants in other fisheries are concerned about the potential for large and efficient pollock vessels and processors to spillover into other fisheries as a result of the AFA. This could occur as a result of rationalization in the BSAI pollock fishery as surplus vessels and processing capacity is no longer needed in the absence of a race for fish. Cooperatives also provide competitive advantages to the BSAI pollock fleet. For example, members of cooperatives have the flexibility to time their pollock fishing activities in a manner that would allow them to expand into other concurrent fisheries to a greater extent than would be possible if a race for fish still existed in the BSAI pollock fishery. The AFA authorized fishery cooperatives in the catcher/processor sector beginning in 1999 but did not provide for the formation of fishery cooperatives in the mothership and inshore sector until 2000. Largely as a consequence of this timing, Congress set out specific sideboard measures for catcher/processors in the AFA to begin in 1999 but deferred to the Council and NMFS to develop sideboard measures for the inshore and mothership sectors. The AFA-based alternatives differ in their approach to establishing sideboard amounts for the various AFA fleets and in their approach to managing sideboard fishing. The choice of appropriate sideboard measures depends in part on the approach taken with respect to managing fishery cooperatives. Alternatives that provide greater autonomy to cooperatives to manage their pollock fishing activities also provide greater autonomy to cooperatives to manage their participation in sideboard fisheries. Sideboards are also the only AFA component with measures that affect the crab and scallop fisheries off Alaska under Amendments 13 and 8 to the crab and scallop FMPs, respectively. AFA catcher vessels face sideboard limits on entry into crab and scallop fisheries and AFA processors face limits on the amount of crab they may process.

Component 4: Catch weighing and monitoring requirements. Because the catcher/processor sector was authorized to form fishery cooperatives in 1999, the AFA mandated specific observer coverage and scale requirements for AFA catcher/processors. All listed AFA catcher/processors are required to carry two NMFS observers at all times they are fishing for groundfish in the BSAI and they must weigh all catch on NMFS-approved scales. Because the AFA delayed the implementation of fishery cooperatives in the inshore and mothership sector until 2000, Congress left it to the Council and NMFS to develop adequate catch measurement and monitoring requirements for those two sectors. To a large extent, the decisions made with respect to management of cooperatives and sideboard fishing determine what type of monitoring and catch weighing programs are appropriate. Alternatives that sub-allocate pollock and sideboard quotas to individual cooperatives require a more intensive monitoring regime than alternatives in which NMFS manages the fishing activities of AFA fleets in the aggregate.

Alternatives analyzed

This EIS contains five management alternatives that are designed to capture the range of management options developed and considered by the Council over the two years in which Amendments 61/61/13/8 have been under development. During the course of developing a preferred alternative for Amendments 61/61/13/8, the Council examined a myriad of suboptions under each management component. However, it is not practical to construct an EIS that considers the environmental and economic consequences of every permutation of suboptions considered by the Council during the entire public process of developing a preferred alternative. Instead, the alternatives presented in the EIS are designed to capture the range of key issues and decision points that the Council, affected industry, and public have identified during scoping as critical from an environmental, economic, and socioeconomic perspective. The following is a brief synopsis of each alternative.

Alternative 1 **No action.** Under this alternative, NMFS would take no action to implement the provisions of the AFA. Management of the BSAI pollock fishery would return to the previous Inshore/Offshore management regime that governed the fishery from 1990 until the passage of the AFA in October 1998. While this alternative is clearly contrary to the statutory requirements of the AFA, it is included for analytical purposes to provide a baseline against which the environmental and economic effects of the AFA alternatives may be compared. The National Environmental Policy Act (NEPA) requires the examination of a no-action alternative even if such an alternative is contrary to existing law.

Alternative 2 **AFA baseline.** This alternative would implement the required elements of the AFA without additional modifications by NMFS or the Council. This alternative may be viewed as an "AFA baseline" alternative against which the Council and NMFS-proposed changes or modifications contained in Alternatives 3, 4, and 5 may be compared. Alternative 2 contains the four basic components required of all AFA alternatives: (1) measures defining the pollock sectors and the BSAI pollock allocations to each sector, (2) measures governing the formation and operation of fishery cooperatives, (3) sideboard protections for other fisheries, and (4) catch measurement and monitoring requirements for the AFA pollock fleet.

Alternative 3 **Preferred.** Alternative 3 would implement the required provisions of the AFA as set out in Alternative 2 with a series of modifications and additions recommended by the Council and NMFS under Amendments 61/61/13/8. Alternative 3 represents a co-management approach under which NMFS would issue sideboards and season/area apportionments of pollock at the sector level and would rely on fishery cooperatives for much of the day-to-day management of fishing activity at the co-op and individual vessel level. Successful implementation of Alternative 3 requires the development of an inter-cooperative agreement between all of the cooperatives to prevent season/area competition for pollock and an "Olympic" race for fish in sideboard fisheries. Alternative 3 contains various adjustments to the organizational rules for inshore catcher vessel cooperatives designed to facilitate the formation and operation of such cooperatives and contains various other adjustments to harvesting and processing sideboards recommended by the Council.

Alternative 4 **Co-op autonomy.** Alternative 4 would implement the required provisions of the AFA as set out in Alternative 2 with a series of modifications and additions considered by the Council during the development of Amendments 61/61/13/8 that would allocate pollock to each co-op by season and area, and sub-allocate each groundfish and prohibited species catch (PSC) sideboard species to each cooperative. The intent of this alternative is to provide maximum autonomy to each individual cooperative to manage fishing activity in the directed pollock fishery and sideboard fisheries. In contrast to the co-management approach contained in Alternative 3, Alternative 4 would rely on NMFS management to regulate pollock and sideboard fishing by each individual cooperative. As a consequence, Alternative 4 contains substantially greater catch measurement and monitoring requirements than any of the other alternatives and would be the most burdensome and costly alternative for industry.

Alternative 5 **Independent catcher vessel proposal.** Alternative 5 is very similar to the preferred Alternative 3 with one significant change to the inshore co-op program to allow inshore catcher vessels to change cooperatives from year to year without spending a year fishing in the open access sector of the inshore fishery. The purpose of Alternative 5 is to increase the market flexibility for independently-owned catcher vessels. This alternative, (also known as the "Dooley-Hall" alternative after two of its primary proponents), was considered by the Council as a way to alleviate potential negative effects of the AFA on independently-owned catcher vessels. At its June 2000 meeting, the Council postponed action on this proposal until such time as adverse effects to independent catcher vessels could be demonstrated and gave notice that it could consider adopting this alternative at any point in the future. This alternative also was the subject of a separate analysis prepared for the Council by University of Washington researchers which is included as Appendix D.

Summary of the environmental effects of the alternatives

The environmental effects of the alternatives under consideration derive primarily from changes in pollock fishing and processing patterns that are expected to result from the AFA-based structural and organizational changes in the BSAI pollock fishery. The most significant structural change resulting from the AFA is the replacement of the previous inshore/offshore allocation regime with a new allocation formula for the BSAI pollock fishery that increases the Community Development Quota (CDQ) allocation to 10 percent of the TAC and subdivides the remaining TAC 50 percent to the inshore sector, 40 percent to the catcher/processor sector, and 10 percent to the mothership sector as directed fishing allowances. The most significant organization change resulting from the AFA is the emergence of fishery cooperatives which have eliminated the Olympic-style race for fish and has allowed for rationalization of the fishery.

These major structural and organizational changes are expected to affect patterns of pollock fishing and processing in the BSAI. Among the effects examined are:

- **Changes to pollock fishing patterns.** How will each of the alternatives affect when and where pollock fishermen chose to fish?

- **Changes to fleet composition.** How will each of the alternatives affect the composition of the various pollock fishing fleets?

- **Changes to pollock processing patterns.** How will each of the alternatives affect pollock processing (i.e. processing locations, product forms, and recovery rates)?

The task of describing how a particular fishery is expected to conduct itself under a comprehensive new set of rules involves some degree of conjecture and speculation. This is because the circumstances that lead fishermen and industry to behave in a certain manner are dependent on such a wide variety of unpredictable factors including such things as weather patterns, sea ice conditions, the migratory patterns of the target species, worldwide market conditions, other regulatory changes, and a host of other factors that are difficult or impossible to predict. Nevertheless, the re-organization of the BSAI pollock fishery under the AFA that is reflected in each of the AFA-based alternatives (Alternatives 2-5) will result in certain predictable changes to fishing and processing practices and these changes will have some predictable environmental and economic consequences.

Changes to fleet composition. The composition of fishing fleets evolves in response to many variables including management measures, changing costs, and availability of target species. Since the passage of the AFA, all sectors of the BSAI pollock fleet have experienced reductions in fleet size as marginal vessels have been removed from the fishery through fishery cooperatives and buybacks. Fishery cooperatives, which allow for the transfer of fishing quota to the most efficient operators, have encouraged the removal of marginal vessels including both small vessels and large vessels that were inefficient, either because of high fuel costs or high maintenance costs. As a result, streamlined fleets developed by 2000 in all of the BSAI pollock sectors with the expectation that permanent fleet reductions will be on the order of 30 percent for all three sectors of the industry.

Changes to fishing patterns: Temporal dispersion. The emergence of fishery cooperatives in the BSAI pollock fishery has eliminated the open access race for fish and, along with other measures such as the buyout of nine catcher/processors, has resulted in a dramatic slowing in the pace of the BSAI pollock fishery. Several reasons account for this slower pace of fishing. First, under the system of cooperatives which operate as a type of private IFQ system, each operator is issued a fixed quota which may be fished or leased to other operators. Fishermen are, therefore, guaranteed a fixed harvest and no longer need to race for fish at the same time as the rest of the fleet in order to assure their harvest. Under the prior open access regime, fishermen were forced to fish at the start of every fishery opening announced by NMFS or they would forfeit catch to their competitors. Secondly, fishermen may fish slower under cooperatives because they may be targeting a more specific size range of pollock for fillet or surimi processing, or may be ranging farther in attempts to locate higher quality catch. Thirdly, under cooperatives, processors may chose to operate at different times of the year than their competitors for logistical or market reasons. For example, a processor may wish to schedule pollock processing to avoid conflicts with salmon or crab processing activity so that the same processing crews and facilities may be more efficiently used in multiple fisheries. And finally, differences in markets may lead one processing operation to operate at different times of the year from its competitors. The advent of fishery cooperatives has provided this flexibility to all sectors of the BSAI pollock fleet where previously they had to compete with each other directly during each open access pollock opening to guarantee a percentage of the harvest.

Changes to fishing patterns: Spatial dispersion. Since the implementation of the AFA in 1999, the Bering Sea pollock fishery also has disbursed more widely on a spatial basis than had been the case in previous years. The most significant reason for this spatial dispersion of fishing effort was the 1999 implementation of Steller sea lion protection measures which established strict limits on harvests within the Steller sea lion Conservation Area (SCA) which was composed of a combination of the Catcher Vessel Operational Area (CVOA) and the major foraging area designated as Steller sea lion Critical Habitat (CH). However, a second reason for the increased spatial dispersion may be the slower pace of fishing under the AFA cooperatives. Because pollock is a migratory species, a side effect of slowing the pace of fishing may be the fishermen need to range over a wider area to encounter migrating schools of pollock at different times of the year. However the extent to which increased spatial dispersion of fishing effort is due to a slower-paced fishery under the AFA is difficult to estimate because it is difficult to disentangle the effects of the AFA from the effects of Steller sea lion protection measures that were implemented simultaneously. Nevertheless, while increased temporal dispersion of catch is the most obvious and dramatic effect of AFA implementation, some degree of spatial dispersion of catch is also a likely consequence of the AFA.

Changes to processing patterns. Since implementation of the AFA, higher utilization rates have resulted from fishermen and processors being guaranteed a specific percentage of the BSAI pollock fishery. Since the approximate amount of pollock going into a processing plant is known at the beginning of the year, the only way to increase production is to better utilize the fish being delivered. Slowing the rate pollock can be harvested while still allowing vessels and processors to maintain their share of the fishery has resulted in more product being produced. This occurred because the factories can operate slower, taking more care to extract useable products from the fish that are harvested. Pollock processors are keenly aware of the importance of utilization rates in terms of their own bottom line.

Since implementation of the AFA, pollock processors have reported increases in product recovery rates. Utilization rates in the catcher/processor sector increased about 26 percent from 1998 to 1999 (the overall utilization rate in 1999 was just over 25 percent) and about 35 percent from 1998 to 2000 (the overall utilization rate in 2000 was just over 27 percent). Inshore sector processors increased their utilization rate about 2.3 percent from 1999 to 2000. Their overall utilization rates increased from 35.8 percent in 1999 to 36.6 percent in 2000 (their utilization rate was about the same in 1998 as it was in 1999). While their increase was not as great as that seen in the catcher/processor sector, it still indicates they were able to produce about 4,000 mt more product in 2000 relative to what they would have produced had their utilization rate remained at the 1999 levels. The mothership sector's overall utilization rate rose from 20.7 percent in 1998 to 26.6 percent in 2000, an increase of almost 29 percent.

Effects of these changes on the environment. The EIS examines how these projected changes to pollock fishing and processing patterns are expected to affect the physical and biological resources of the BSAI and GOA. Table ES-1 displays the major conclusions with respect to environmental impacts of the alternatives. In summary, conditionally negative effects on Steller sea lions and predator-prey relationships have been identified for Alternative 1 primarily as a result of the expected increase in temporal and spatial concentration of fishing effort under Alternative 1. Alternatives 2 through 5 are expected to have conditionally positive effects on Steller sea lions as a result of the expected temporal and spatial dispersion of fishing effort and the expectation that fishery cooperatives will provide increased ability to micro-manage fishing activity at the individual vessel level. This increase in management capacity is expected to facilitate the implementation of Steller sea lion protection measures under Amendments 70/70. For all other components of the environment analyzed, the effects of all of the alternatives was found to be either insignificant or unknown.

Table ES-1 Summary of the predicted environmental effects of the alternatives.

Affected Environment	*Alt. 1 (no action)*	*Alt. 2 (AFA baseline)*	*Alt. 3 (preferred)*	*Alt. 4 (Co-op autonomy)*	*Alt. 5 (Ind. CV proposal)*	*Comments and Summary*
Effects on the physical environment						
Substrate and benthic habitat	I	I	I	I	I	Pelagic trawl gear is mandated in the BSAI directed pollock fishery by regulation. The exclusive use of pelagic trawl gear in the BSAI directed pollock fishery is not expected to have significant impacts on benthic habitat and EFH.
Essential fish habitat (EFH)	I	I	I	I	I	
Effects on marine mammals						
Steller sea lions	CS-	CS+ (relative to the no-action alternative)	CS+ (relative to the no-action alternative)	CS+ (relative to the no-action alternative)	CS+ (relative to the no-action alternative)	Reverting to open access under Alt. 1 could lead to increased spatial/temporal concentration of catch and exacerbate Steller sea lion protection efforts. Formation of co-ops under Alts. 2-5 could decrease the spatial/temporal concentration of catch. Also, the increased ability to micro-manage vessel activity through co-ops is likely to facilitate the implementation of Amendment 70/70 protection measures.
ESA-listed cetaceans	I	I	I	I	I	These species to not prey primarily on pollock and/or their primary range does not overlap significantly with the primary pollock fishing areas.
Other cetaceans	I	I	I	I	I	
Northern fur seals	U	U	U	U	U	A shift in fishing effort northward away from the Steller sea lion conservation area (SCA) as a result of Steller sea lion protection measures and the emergence of fishery cooperatives could result in increased pollock removals from Northern fur seal foraging areas around the Pribilof Islands. The effects of this potential northward shift in fishing effort on Northern fur seals is unknown.
Harbor seals	I	I	I	I	I	These species to not prey primarily on pollock and/or their primary range does not overlap significantly with the primary pollock fishing areas.
Other pinnipeds	I	I	I	I	I	
Sea otters	I	I	I	I	I	
Effects on fish and shellfish species						
Pollock	I	I	I	I	I	None of the alternatives would affect total removals of pollock or the TAC-setting process.
Other groundfish	I	I	I	I	I	None of the alternatives would affect total removals of other groundfish species or the TAC-setting process for those species.
Prohibited species	I	I	I	I	I	Bycatch rates of all prohibited species in the directed pollock fishery are low and are not expected to significantly affect the health of those species under all of the alternatives. The increased ability of co-ops to micro-manage individual vessel activity may enable co-ops to further reduce salmon bycatch.

Affected Environment	*Alt. 1 (no action)*	*Alt. 2 (AFA baseline)*	*Alt. 3 (preferred)*	*Alt. 4 (Co-op autonomy)*	*Alt. 5 (Ind. CV proposal)*	*Comments and Summary*
Forage species	I	I	I	I	I	Bycatch of forage species is negligible under all of the alternatives
			Effects on seabirds			
Non-piscivorous seabirds	I	I	I	I	I	Information voids for various aspects of seabird ecology make it difficult to predict impacts of fishery management changes on seabirds. Effects of spatial/temporal concentrations of prey on piscivorous seabirds considered unknown and insignificant for non-piscivorous seabirds.
Piscivorous (fish eating) seabirds	U	U	U	U	U	
			Ecosystem effects			
Predator-prey relationships	CS-	U	U	U	U	Concentrated removals of pollock has been a concern in status-quo regime, especially with respect to Steller sea lions. The effects of a more dispersed fishery under Alternatives 2 through 5 on predator-prey relationships are considered unknown
Energy flow and balance	I	I	I	I	I	Combined evidence regarding the level of discards relative to natural sources of detritus and no evidence of changes in scavenger populations that are related to discard trends suggests that all of the alternatives would have insignificant ecosystem impacts through energy removal and redirection.
Biological diversity	I	I	I	I	I	No fishing-induced extinctions of groundfish or other marine species have been documented in the last 30 years or so. No fishing-induced changes in trophic diversity have been detected under current management regime.

S- Significant Negative
CS- Conditionally Significant Negative
I Insignificant
CS+ Conditionally Significant Positive
S+ Significant positive
U Unknown

Summary of the economic and socio-economic effects of the alternatives

The EIS also examines the economic and socio-economic impacts of the alternatives. Impacts to the BSAI pollock industry, the Alaska groundfish industry as a whole, affected coastal communities, U.S. consumers, and net-benefits to the Nation are examined and summarized below.

Benefits to the BSAI pollock industry. The co-op system that is authorized under Alternatives 2 through 5 is expected to increase the profitability of BSAI pollock fishing and processing. The AFA reduced the transactions costs of organizing to eliminate problems flowing from the common property status of fisheries resources. The AFA defined and limited potential participants in the fishery, created relatively homogenous groupings of operations within the fishery, and provided the legal structure for the formation of the cooperatives within those groupings. The cooperatives, and other institutions (such as the Intercooperative Agreement) that emerged from the AFA, led to significant rationalization of the fishery harvest. This has lead, and will almost certainly continue to lead, to operational economies for the pollock fishery in the BSAI.

These economies flow from the elimination of excess capital and labor from the fisheries, and from more effective coordination and use of the vessels and crew that remain. These economies will be greater for alternatives that allow relatively greater reductions in fishing capacity, and for those options that provide relatively more flexibility for cooperatives in their operations.

Experience in 1999 and 2000 indicates that the cooperatives are taking advantage of the program to remove excess fishing capacity with expectations of up to 30 percent reductions in fleet size for all three sectors of the BSAI pollock fishery. The co-op system also allows cooperatives to make more effective, coordinated, use of the vessels remaining in the cooperatives. This is expected to reduce costs and increase revenues in many ways:

- The end of the race for the fish allows operations to fish more slowly and to process more carefully. The result is likely to be an ability to obtain more added value from harvested fish. In 1999, the first year of the cooperatives, the vessels in the catcher/processor sector were able to increase utilization of harvested pollock resources by about 20 percent.

- Reports from catcher/processors suggest that, freed from the “race for the fish” the operators have been harvesting fewer fish per tow. This reduces bruising in the flesh, and may have contributed to improved roe quality.

- Operations are able to trade quota allocations between vessels within a given cooperative. This makes it possible to harvest allocations from the vessels that can do so at least cost in a given time and place.

- The increased flexibility offered by the cooperative system also allows fleets to respond more rapidly to market cues. This was an advantage to the catcher/processor sector in early 1999, when this flexibility allowed them to respond to increased demand and rising fillet prices by increasing fillet production while decreasing surimi production.

There are, however, factors built into the AFA that will probably prevent the industry from fully maximizing the profitability of the fishery. Although the AFA has eliminated the race for fish and the associated perverse incentive to increase fishing capacity, incentives to maintain existing capacity remain for several reasons. First, the AFA may be revised or repealed in the future; therefore, risks are involved with retiring excess fishing and processing capacity. Second, the current rules governing cooperatives in the inshore sector will tend to limit consolidation of processing that would eliminate excess processing capacity. Third, inter-annual transfers among vessels of catch histories and the associated shares of the TAC for the inshore sector are prohibited; therefore, there is a strong incentive not to retire catcher vessels.

Benefits to U.S. consumers. The end of the "race for the fish" will make it easier for fishermen and fish processors to address the needs of their different markets. The race for fish induced processors to emphasize surimi production because it is the fastest way to process large quantities of fish caught at one time. Under the AFA-based alternatives, processors will have the time to produce products of higher value. The elimination of the race for the fish has allowed companies to increase the yields from pollock harvests. Processors are also now able to concentrate on the production of less valuable ancillary products such as oil and fishmeal. The end of the race for the fish also provides vessels more time to search for the size of fish most conducive to the products processors want to produce leading to increased product recovery and value. Another benefit has been that vessels can now justify catching fewer fish per trip. Catching fewer fish per trip improves product quality and utilization by reducing bruising and damage to the fish.

Safety. Commercial fishing is a dangerous occupation. From 1991 to 1998, the occupational fatality rate in groundfish fishing off of Alaska was 46 in 100,000. This occupational fatality rate is about 10 times the national average. Part of the reason is that fishermen who compete for fish in a common property fishery are often compelled to fish at times and places that are not very safe if they want to take a share of the fishery total allowable catch. Moreover, higher costs and lower revenues in a common property fishery may lead to lower profits margins and, indirectly, to less investment or attention to issues of safety.

This suggests that the introduction of the co-op system will allow fishermen more flexibility in their harvest and permit a greater consideration of safety issues. In addition, the program should increase the profitability of the fishery and lead, indirectly, to increased investment in safety. These factors should reduce risks of death, injury, and property loss in the BSAI pollock fishery.

Reports from the 1999 and 2000 fishing seasons indicate that the pollock fishery is being conducted in a safer manner under the AFA. The U.S. Government Accounting Office (GAO) reports that the pollock fishing industry views itself as safer. The GAO report noted, "Deep-sea fishing in the Bering Sea has historically been a hazardous occupation, and the hazards are increased when vessel operators believe they must operate in extremely bad weather to land a share of the catch. Because the cooperative agreements give members specific shares of the catch, vessels can now avoid fishing in such weather conditions."

Impacts on other fisheries. The passage of the AFA and the introduction of co-ops in the BSAI pollock fishery raised concerns among fishermen in other fisheries that the rationalization of the pollock fishery would (1) free up excess fishing and processing capital that could be exported to other fisheries, and (2) would permit a more organized harvest of pollock and allow vessels and processing plants continuing in the pollock fishery to reallocate at least some of their time and capacity to other fisheries.

To protect the fishing and processing operations involved in other fisheries, the AFA provided for an elaborate system of "sideboards" or restrictions on what AFA vessels and plants could harvest and process in other fisheries. These sideboard regulations, and the ways they vary across alternatives, are described in detail in Chapter 2 of the EIS. In general, the sideboards work to limit AFA harvests of sideboard species to the proportions of the harvests of these species taken by the AFA sectors in the period 1995 to 1997. The alternatives do vary somewhat with respect to the exemptions to these limitations, and there are variations in the computations used to relate sideboard limits to harvests during that period.

The efficiency impacts of the sideboards on other fisheries are difficult to determine and may not be large. Overall the catch of non-pollock species by AFA vessels may be somewhat reduced by these amendments, because the groundfish sideboards are based on landed catch history under the preferred alternative and the crab sideboards are more restrictive than the current license limitation program in most cases. Yet given the open access nature of these fisheries and the capacity that exists in other fleets, any harvest forgone by the AFA fleet will almost certainly be harvested by members of the non-AFA fleets. Differences among the alternatives for effecting sideboards do have the potential for distributional gains and losses; primarily these are trade-offs between the AFA and non-AFA vessels. While relative operating costs and other factors would affect the “net” results of such trade-offs, the basic intent of the sideboards is to maintain the status quo, in terms of the distribution of harvest between AFA and non-AFA vessels, and therefore inter-sectoral “net” impacts would be expected to tend towards neutral.

Summary of the benefit-cost analysis. Table ES-2 summarizes the benefit-cost analysis. Although the analysis is qualitative, the results permit a partial ranking of the different alternatives. Alternative 1, the fishery prior to the AFA, produces the smallest benefits. Moreover, it is precluded under the terms of the AFA. Of the four alternatives that are legal under the AFA, Alternative 2, minimum implementation, has the lowest net benefits. The problems with this alternative flow from the relatively large costs it imposes on the formation of the co-ops in the inshore catcher vessel sector. This raises questions about the ability of this sector to rationalize its part of the pollock fishery through the formation of co-ops. Alternative 4 appears to produce higher net benefits than Alternatives 1 and 2 because it tends to facilitate inshore co-ops, but it may produce lower net benefits than Alternatives 3 and 5 because of the high monitoring costs it would impose on industry.

Table ES-3 suggests that Alternative 3, has less net benefits than Alternative 5. Nevertheless, Alternative 3 has been designated as the “preferred” alternative. Benefit-cost analysis is only one element in a public decision making process. Benefit-cost analysis is based on very specific assumptions that not all persons may hold. Issues other than social efficiency may be important to many persons. For these reasons this benefit-cost analysis is supplemented with an analysis of the distributional implications of the alternatives, and an analysis on the impacts on small business, non-profit, and government entities in the accompanying Initial Regulatory Flexibility Analysis. In addition to these concerns, this benefit-cost analysis has been qualitative, and has incorporated a margin of error that makes it impossible to say for certain that Alternative 3 has smaller net benefits than Alternative 5.

Moreover, Alternative 3 is a compromise that was developed in legislative and Council processes. It incorporates compromises among interest groups that were essential to bringing the AFA and the implementing regulations into existence. In particular, the difference between Alternatives 3 and 5 reflects a decision about the allocation of AFA benefits between inshore processors and inshore catcher vessels. In postponing action on the independent catcher vessel’s proposal reflected in Alternative 5, the Council chose not to change the terms of this agreement after it had been reached, but indicated that it could take the issue up again at any point if evidence suggested that independent catcher vessels were harmed as a result of the co-op structure contained in the AFA. Thus Alternative 3 is the preferred alternative, although it may not absolutely maximize net benefits as interpreted in benefit-cost analysis.

Table ES-2 Summary of benefit-cost analysis.

Benefit/Cost	***Alternative 1***	***Alternative 2***	***Alternative 3***	***Alternative 4***	***Alternative 5***
Organizing theme	*Open access "race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes*	*Foster development of co-ops and inter-co-op agreements with NMFS-industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels.*
Capital and operating cost reductions	Least	This alternative allows co-ops in the catcher/processor sector but imposes higher costs (that in Alternatives 3-5) for inshore catcher vessel co-ops. Benefits are greater than for Alternative 1, but less than for Alternatives 3 to 5.	This alternative facilitates co-ops in the inshore sector as well as the catcher/processor sector. It is thus expected to produce significantly larger social net benefits than Alternatives 1 and 2.	This alternative facilitates co-ops in the inshore sector as well as the catcher/processor sector. It is thus expected to produce significantly larger social net benefits than Alternatives 1 and 2.	This alternative facilitates inshore co-op formation in a way that is similar to Alternative 3. In addition, it allows inshore catcher vessels more flexibility to switch co-ops than does Alternative 3. Therefore, it may produce larger social net benefits.
Management expenses	Least	Second least expensive	Tied for third least expensive	Most expensive due to increased monitoring costs.	Tied for third least expensive
Consumer benefits and revenues from abroad	Least	Higher due to cooperative flexibility	Higher due to cooperative flexibility	Higher due to cooperative flexibility	Higher due to cooperative flexibility
Impacts on other fisheries	No large and systematic distinction identified among these alternatives.				
Relative ranking (from 1=highest net benefits to 5 = lowest net benefits)	5	4	2	3	1

Impacts to fishing communities. Four fishing communities (Unalaska/Dutch Harbor, King Cove, Sand Point, and Akutan are directly affected by the presence of AFA processors. Of these four communities, Unalaska/Dutch Harbor and King Cove are expected to benefit from the AFA-based alternatives. Impacts on these communities would be linked with benefits that would result from increased inshore pollock allocations and from AFA cooperatives by the establishment of a stable long-term supply of pollock to their neighboring shore-based processing plant. Such economic stability is expected to translate positively to these two neighboring communities.

The impacts of the AFA on Sand Point may be negative. While this community historically received deliveries of BSAI pollock, these deliveries may cease under the AFA-based alternatives because the Trident plant in Sand Point is not associated with a catcher vessel cooperative. Vessels that had historically delivered to that plant had delivered more pollock to Trident's Akutan plant and were therefore eligible to join that cooperative. This means that the long-term flow of BSAI pollock into the Sand Point community is less stable than under the status quo.

The community of Akutan is not identified as a small community that would be impacted by AFA fishery cooperatives. This determination is based on materials provided in 1995 to the Council, NMFS, and the State of Alaska by the Aleutian Pribilof Island Community Development Association on behalf of Akutan. The Council, State of Alaska, and NMFS, agreed these materials sufficiently documented no significant impacts were accrued by the community of Akutan from the presence of the neighboring Trident Seafood processing facility. This claim of no significant economic linkage between the Trident facility and the community of Akutan directly resulted in a 1996 regulatory change that included Akutan as an eligible participant in the CDQ program.

Impacts to CDQ groups. A total of six groups of Western Alaskan Communities comprise the CDQ program. These groups are considered small entities by NMFS and the Small Business Administration. No negative impacts should have been realized by these groups as a result of the AFA. The overall allocation to the CDQ program is increased from the 7.5 percent of the BSAI TAC (Alternative 1 - status quo) to 10 percent annually under Alternatives 2 through 5. The change amounts to a 33 percent increase in the overall CDQ pollock allocation. That increase is equal to 25,000mt when the BSAI TAC is 1 million metric tons. In revenue terms, if CDQ groups receive 8.5 cents per pound for their pollock allocation, it equates to an annual increase in revenues of over $4.6 million. On average, that is equal to an annual increase of more than $750,000 per CDQ group.

In addition to the increased CDQ allocation, the more stringent U.S. ownership requirements under the AFA have caused at least one of the largest pollock companies to restructure its ownership. During the restructuring process, the company formerly know as American Seafoods sold 20 percent of the entity to a CDQ corporation. Therefore, changing the ownership requirements has allowed some small entities to increase their ownership stake in the BSAI pollock fishery. If profits are being generated in the fishery, and it is assumed that they are, this is also a benefit to the CDQ groups, since these groups would share in the profits generated by the company.

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List of Commonly Used Acronyms

ACC	Alaska Coastal Current
AAC	Alaska Administrative Code
ADF&G	Alaska Department of Fish & Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
AI	Aleutian Islands
AKAPAI	Alaska Peninsula and Aleutian Island Region
AKKO	Kodiak Island Region
AKR	NMFS Alaska Region
AKSC	Southcentral Alaska Region
AKSE	Southeast Alaska Region
AMAP	Arctic Monitoring and Assessment Program
AP	Advisory Panel
APA	Administrative Procedures Act
APEC	Asia-Pacific Economic Cooperation
APIDA	Aleutian Pribilof Island Community Development Association
AYK	Angoon-Yukon-Kuskokwim
BBEDC	Bristol Bay Economic Development Corporation
BBRKC	Bristol Bay Red King Crab
BOD	Biochemical Oxygen Demand
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands Management Area
CBSFA	Central Bering Sea Fisherman's Association
CDQ	Community Development Quota
CE	Confidence Interval
CMS	Centimeters
C/P	Catcher Processor
CPUE	Catch per Unit Effort
CRP	Comprehensive Rational Program
CV	Catcher Vessel
CVOA	Catcher Vessel Operating Area
CVRF	Coastal Villages Region Fund
DAH	Domestic Annual Harvest
DAP	Domestic Annual Processing
DCRA	Alaska Department of Community and Regional Affairs
DFA	Directed Fishing Allowance
DO	Dissolved Oxygen
DOR	Alaska Department of Revenue
EA	Environmental Assessment
EBS	Eastern Bering Sea
EEZ	Exclusive Economic Zone
EFH	Essential fish habitat
EIMWT	Echo-Integration Midwater Trawl
EIS	Environmental Impact Statement
EIT	Echo-Integration Trawl
ENSO	El Niño/Southern Oscillation Events
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESAG	Eastern Subarctic Gyre
ESU	Evolutionary Significant Units
EU	European Union
EYKT	East Yakutat District
FAO	Food and Agricultural Organization
FCV	Fixed Gear Catcher Vessel
FMP	Fishery Management Plan
FOB	Free on Board
FOCI	Fisheries Oceanography Coordinated Investigation
FONSI	Finding of No Significant Impact
FR	Federal Register
FRFA	Final Regulatory Flexibility Analysis
FTE	Full time equivalent
FWS	US Fish and Wildlife Service
GHL	Guideline Harvest Level
GOA	Gulf of Alaska Management Area
HAPC	Habitat Area of Particular Concern
H&G	Head and Gut (type of processing)
ICB	Information Collection Budget
IFQ	Individual Fishing Quota
INPFC	International North Pacific Fisheries Commission
I/O1	Inshore/Offshore 1
I/O2	Inshore/Offshore 2
I/O3	Inshore/Offshore 3
I/O4	Inshore/Offshore 4
IRI	Index of Relative Importance
IR/IU	Improved Retention/ Improved Utilization Program
IQF	Individually Quick Frozen
IRFA	Initial Regulatory Flexibility Analysis
JV	Joint Venture
JVP	Joint Venture Processing
LCV	Longline Catcher Vessel
LLP	License Limitation Program
LOA	Length Overall
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MS	Mothership

mt or t	Metric Ton
NEPA	National Environmental Policy Act of 1996
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NOAA GC	National Oceanic and Atmospheric Administration General Counsel
NPFMC	North Pacific Fishery Management Council
NPI	National Pacific Index
NDEDC	Norton Sound Economic Development Corporation
NS&T	National Status and Trends
OFL	Over Fishing Level
OMB	Office of Management and Budget
ORCO	Oregon Coast Region
OSCURS	Ocean Surface Current Simulation Model
PAH	Polycyclic aromatic hycrocarbons
PCV	Pot Catcher Vessel
PDO	Pacific Decadal Oscillations
PMP	Preliminary Fishery Management Plan
POP	Pacific Ocean Perch
PRA	Paperwork Reduction Act
PRR	Product Recovery Rate
PSC	Prohibited Species Bycatch
PWS	Prince William Sound
RFRPA	Revised Final Reasonable and Prudent Alternative
RIR	Regulatory Impact Review
RFA	Regulatory Flexibility Analysis
SAFE	Stock Assessment Fishery Evaluation
SBREA	Small Business Regulatory Fairness Act
SCA	Steller Sea Lion Conservation Area
SEBSCC	South East Bering Sea Carrying Capacity
SEIS	Supplemental Environmental Impact Statement
SEO	Southeast Outside District
SIA	Social Impact Analysis
SSC	Scientific and Statistical Committee
TAC	Total Allowable Catch
TALFF	Total Allowable Level of Foreign Fishing
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System
TMDL	Total Maximum Daily Load
WAIW	Washington Inland Waters Region
WGOA	Western Gulf of Alaska
WPR	NMFS Weekly Production Reports
YKD	Yukon Delta
YKFDA	Yukon Delta Fisheries Development Association

Chapter 1: Purpose and need

1.1 Introduction

In 1976, Congress passed into law what is currently known as the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This law authorized the United States to manage its fishery resources from 3 to 200 (4.8 to 320 km) nautical miles off its coast (the Exclusive Economic Zone, or EEZ). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in Regional Fishery Management Councils. In the Alaska region, the North Pacific Fishery Management Council (NPFMC or Council) has the responsibility to prepare Fishery Management Plans (FMPs) for marine resources requiring conservation and management, as determined by Council. The U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) is charged with carrying out the federal mandates of the Department of Commerce with regard to commercial fisheries such as approving and implementing FMPs and FMP amendments submitted by the Council.

Under the Magnuson-Stevens Act, the Council prepared and the Secretary approved the *Fishery Management Plan for the Groundfish fishery of the Bering Sea and Aleutian Islands Area* in 1982, *the Fishery Management Plan for Groundfish of the Gulf of Alaska* in 1978, the *Fishery Management Plan for the King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands* in 1989, and the *Fishery Management Plan for the Scallop Fishery off Alaska* in 1995. National Environmental Policy Act (NEPA) Environmental Impact Statements (EISs) were prepared for the groundfish FMPs when they were approved by the Secretary. Environmental analysis documents were prepared for each subsequent FMP amendment and regulatory action, and a supplemental EIS was prepared for both groundfish FMPs in 1998.

1.2 Action area

The subject fisheries occur in the North Pacific Ocean and Bering Sea in the EEZ from 50°N to 65°N (Figure 1.2.1). The subject waters are divided into two management areas; the Bering Sea and Aleutian Islands Management Area (BSAI) and the Gulf of Alaska Management Area (GOA). The BSAI is further divided into two subareas (Bering Sea and Aleutian Islands). The GOA is further divided into three subareas (western, central, and eastern).

The groundfish fisheries off Alaska are governed by two FMPs, The *Fishery Management Plan for the Groundfish fishery of the Bering Sea and Aleutian Islands Area* governs groundfish fisheries in the BSAI. The *Fishery Management Plan for Groundfish of the Gulf of Alaska* governs groundfish fishing in the GOA. The *Fishery Management Plan for the King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands* governs king and Tanner crab fisheries in the BSAI. Finally, the *Fishery Management Plan for the Scallop Fishery off Alaska* governs scallop fishing in both the BSAI and GOA.

1.3 Purpose and need of Amendments 61/61/13/8

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) (Appendix A) which mandated sweeping changes to the conservation and management program for the pollock fishery of the BSAI and to a lesser extent, affected the management programs for the other groundfish fisheries of the BSAI the groundfish fisheries of the GOA, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska. With respect to the fisheries off Alaska, the AFA requires a suite of new management measures that fall into four general categories: (1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the BSAI pollock fishery, (3) regulations to protect other fisheries

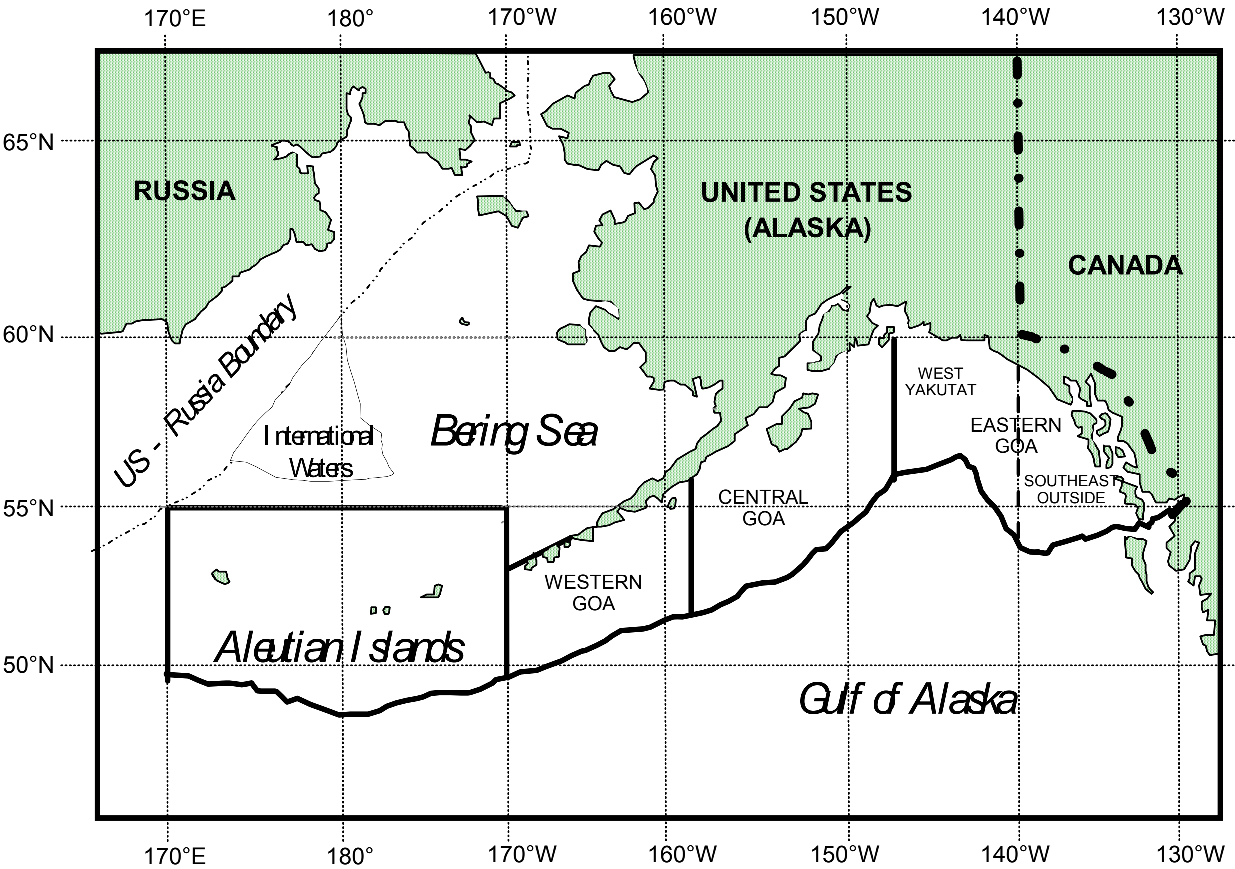

Figure 1.2.1 Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Management Areas.

from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the BSAI pollock fishery.

Under the Magnuson-Stevens Act, the Council has prepared FMP amendments to implement the provisions of the AFA in the groundfish, crab and scallop fisheries off Alaska. These are Amendment 61 to the *Fishery Management Plan for the Groundfish fishery of the Bering Sea and Aleutian Islands Area*, Amendment 61 to the *Fishery Management Plan for Groundfish of the Gulf of Alaska*, Amendment 13 to the *Fishery Management Plan for the King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands*, and Amendment 8 to the *Fishery Management Plan for the Scallop Fishery off Alaska* (Amendments 61/61/13/8). The full text of Amendments 61/61/13/8 is contained in Appendix B. The purpose of Amendments 61/61/13/8 is to incorporate the relevant provisions of the AFA into the FMPs and establish a comprehensive management program to implement the AFA.

The purpose of this EIS is to provide decision makers and the public with an evaluation of the environmental and economic effects of the management program that would be implemented under proposed Amendments 61/61/13/8, as well as the effects of alternative management programs to implement the AFA. It is intended that this EIS serve as the central environmental document for management measures developed by NMFS and the Council to implement the provisions of the AFA.

1.4 Purpose and need of the American Fisheries Act

The AFA had two primary objectives; (1) to complete the process begun in 1976 to give U.S. interests a priority in the harvest of U.S. fishery resources, and also (2) to significantly decapitalize the Bering Sea pollock fishery. The AFA was unprecedented in the 23 years since the enactment of what is now known as the Magnuson-Stevens Act. With the Council system, congressional action is generally not needed to address fishery conservation and management issues in specific fisheries. However, Congress believed that the state of overcapacity that existed in the BSAI pollock fishery at the time of passage of the AFA in 1998 was the result of mistakes in, and misinterpretations of, the 1987 Commercial Fishery Industry Vessel Anti-Reflagging Act (Anti-Reflagging Act) that only Congress had the capacity to fix (*Cong. Rec.* 1998, 12777-12782).

The goals of the Anti-Reflagging Act were to: (1) require the U.S.-control of fishing vessels that fly the U.S. flag; (2) stop the foreign reconstruction of U.S. flag vessels, and (3) require U.S.-flag fishing vessels to carry U.S. crews. Of these three goals, only the U.S. crew requirement was achieved. Due to the manner in which it was interpreted by the U.S. Coast Guard, the Anti-Reflagging Act did not stop foreign interests from owning and controlling U.S. flag fishing vessels. In fact, about 30,000 of the 33,000 existing U.S.-flag fishing vessels were not subject to any U.S. controlling interest requirement prior to the passage of the AFA. The Anti-Reflagging Act also failed to stop the rebuilding of U.S. vessels in foreign shipyards between 1987 and 1990 that brought almost 20 large factory trawlers into the Bering Sea pollock fishery as foreign rebuilds. The Council and NMFS had no authority to turn back the clock by removing fishery endorsements or provide the funds required under the Federal Credit Reform Act to allow for the $75 million loan to remove capacity, to strengthen U.S. controlling interest standards for fishing vessels, or to implement the inshore cooperative program contained in the AFA (*Cong. Rec.* 1998, 12777-12782).

In addition to addressing what Congress believed were mistakes in the Anti-Reflagging Act, and providing for the decapitalization of the BSAI pollock fleet, the AFA resolved the longstanding sectoral allocation battle in the BSAI pollock fishery which began in 1991 with the passage of Amendments 13/19 which made inshore and offshore allocations of pollock in the BSAI and GOA. Meeting the AFA's objective of decapitalization of the BSAI pollock fleet through buyouts and a new limited entry program involving fishery cooperatives, the resolution of the pollock allocation battle through a new sectoral allocation formula, and the need to address the spillover effects of these two actions, forms the purpose and need for Amendments 61/61/13/8.

1.4.1 Primary elements of the AFA

The AFA is a complex piece of legislation with numerous provisions that affect the management of the groundfish and crab fisheries off Alaska, the AFA. Key provisions of the AFA include:

- A requirement that owners of all U.S. flag fishing vessels comply with a 75 percent U.S. controlling interest standard.

- A prohibition on the entry of any new fishing vessels into U.S. waters that exceed 165 ft registered length, 750 gross registered tons, or 3,000 shaft horsepower.

- The buyout of nine pollock catcher/processors and the subsequent scrapping of eight of these vessels through a combination of $20 million in federal appropriations and $75 million in direct loan obligations.

- A new allocation scheme for BSAI pollock that allocates 10 percent of the BSAI pollock total allowable catch (TAC) to the Community Development Quota (CDQ) Program, and after allowance for incidental catch of pollock in other fisheries, allocates the remaining TAC as follows: 50 percent to vessels harvesting pollock for processing by inshore processors, 40 percent to vessels harvesting pollock for processing by catcher/processors, and 10 percent to vessels harvesting pollock for processing by motherships.

- A fee of six-tenths (0.6) of one cent for each pound round weight of pollock harvested by catcher vessels delivering to inshore processors for the purpose of repaying the $75 million direct loan obligation.

- A prohibition on entry of new vessels and processors into the BSAI pollock fishery. The AFA lists by name vessels and processors and/or provides qualifying criteria for those vessels and processors eligible to participate in the non-CDQ portion of the BSAI pollock fishery.

- An increase in observer coverage and scale requirements for AFA catcher/processors.

- New standards and limitations for the creation of fishery cooperatives in the catcher/processor, mothership, and inshore industry sectors;

- A quasi-Individual Fishing Quota (IFQ) program under which NMFS grant individual allocations of the inshore BSAI pollock TAC to inshore catcher vessel cooperatives that form around a specific inshore processor and agree to deliver at least 90 percent of their pollock catch to that processor.

- The establishment of harvesting and processing restrictions (commonly known as "sideboards") on fishermen and processors who have received exclusive harvesting or processing privileges under the AFA to protect the interests of fishermen and processors who have not directly benefitted from the AFA; and

- A 17.5 percent excessive share harvesting cap for BSAI pollock and a requirement that the Council to develop excessive share caps for BSAI pollock processing and for the harvesting and processing of other groundfish.

1.4.2 AFA-related actions taken to date

The AFA is divided into two subtitles. *Subtitle I–Fisheries Endorsements* includes new nationwide U.S. ownership and vessel length restrictions for U.S. vessels with fisheries endorsements. These new requirements are currently being implemented by the Maritime Administration and the U.S. Coast Guard under the Department of Transportation and are not the subject of this EIS. *Subtitle II–Bering Sea Pollock Fishery* contains the new requirements related to the management of BSAI pollock fishery and is the basis for Amendments 61/61/13/8.

In addition, certain other elements of the AFA have already been implemented by NMFS through permanent rulemaking and are not the subject of this action. The buyout and scrapping of the nine ineligible factory trawlers was completed by NMFS in 1999 under the schedule mandated by the AFA. This action was accomplished by contract with the vessel owners and not through regulation. Also, the inshore pollock fee program required by the AFA was implemented by NMFS through final regulations published February 3, 2000 (65 FR 5278).

In addition, NMFS has implemented the remaining required elements of the AFA on an interim basis for the 2000 fishing year through two emergency interim rules. The first emergency interim rule (65 FR 380, January 5, 2000, revised and extended at 65 FR 39107, June 23, 2000) set out the permit requirements for vessels, processors, and cooperatives wishing to participate in the BSAI pollock fishery. The second emergency interim rule (65 FR 4520, January 28, 2000, revised and extended at 65 FR 39107, June 23, 2000) set out general AFA management measures including pollock allocations, sideboard protections for other fisheries, and monitoring and catch measurement requirements for AFA vessels and processors.

1.5 Public participation

Amendments 61/61/13/8 and this EIS were developed with numerous opportunities for public participation. The FMP amendments were developed by the Council over a series of 12 public Council meetings beginning with a special Council meeting in November 1998 to address the passage of the AFA. Scoping included a Notice of Intent to prepare the EIS, advertised opportunity for the public and Council to comment on the EIS at the Council's April 2000 meeting, and numerous discussions and meetings with individuals and groups throughout the development of Amendments 61/61/13/8 and the preparation of this document.

1.5.1 Notice of Intent and Scoping

The formal scoping period opened with publication of the Notice of Intent to produce an Environmental Impact Statement. It was published in the *Federal Register* on April 6, 2000 (65 FR 18028) (Appendix C). Public comments were due May 8, 2000. NMFS solicited input from the public on which issues should be addressed in the analysis and what alternatives to status quo management should be considered. In addition, scoping was conducted at the April 2000 Council meeting where NMFS solicited comment from the Council and the public on which issues should be addressed in the analysis. All public comments received were considered by NMFS and used to identify the key environmental and economic issues to be addressed in the EIS.

1.5.2 Public participation in development of Amendments 61/61/13/8

In addition to the formal Scoping process, much of this opportunity for public participation has occurred through the lengthy FMP amendment development process undertaken by the Council for Amendments 61/61/13/8. The public has participated extensively in the development of Amendments 61/61/13/8 including the construction of alternatives and discussion of preferred alternatives. The public had opportunity to comment and participated significantly in the development of Amendments 61/61/13/8 over the twelve Council meetings during which the amendments were under development or revision by the Council. The public also has had opportunity to participate at various public meetings held by NMFS and the Council to address various technical issues during the development of Amendments 61/61/13/8. This process is described in detail in Section 2.2.

1.5.3 Coordination with other agencies

Federal: NMFS has requested the assistance of the Council, as authors of Amendments 61/61/13/8 and advisors to the Secretary in matters of policy, to provide technical support for this EIS. Both the U.S. Fish and Wildlife Service (USFWS), and the United States Coast Guard (USCG) have non-voting seats on the Council. USFWS has trust authority for seabird and other avian species in the management areas. Expert USFWS staff serve on the Council groundfish Plan Teams and provided assistance in this analysis. The Environmental Protection Agency (EPA) is a reviewing agency for this EIS. Comments received from the EPA have been used to guide the preparation of this analysis. Each of these agencies agreed to participate in the development of this EIS and provided data, staff, and review for this EIS.

State: Representatives from Alaska, Washington, and Oregon have voting seats on the Council. Expert staff from the appropriate state fish management agencies also serve on the Council's scientific and statistical committee and provided assistance in this EIS.

1.5.4 Issues to be addressed in the EIS

A review of all the scoping comments and the public record developed during the preparation of Amendments 61/61/13/8 suggested the following issues. It is NMFS' intent to address all of the issues brought up during scoping and the development of Amendments 61/61/13/8 to the extent practicable. NMFS has grouped comment received during the scoping period and during the development of Amendments 61/61/13/8 into the following key issues:

- The effects of the alternatives on marine mammals, especially the question of whether or not a slower-paced cooperative pollock fishery tends to mitigate potential adverse effects to Steller sea lions.
- The effects of the alternatives on target groundfish species
- The effects of the alternatives on bycatch of groundfish and prohibited species
- The effects of the alternatives on social economics of the pollock fishery
- The effects of the alternatives on participants in other groundfish and shellfish fisheries
- The effects of the alternatives on coastal communities
- The effects of the alternatives on independent fishermen and other small entities
- The effects of an increase in inshore pollock processing on the water quality of nearshore water bodies

Given their importance, NMFS has highlighted each of these issues in its organization of Chapter 4, Environmental and Economic Consequences.

1.6 Related NEPA analyses

A variety of other EIS and other NEPA documents are under preparation concurrently with this document. The most significant documents that are heavily referenced in this document are the Alaska Groundfish Programmatic Supplemental EIS and the Steller Sea Lion Protection Measures Draft Supplemental EIS.

1.6.1 Alaska Groundfish Fisheries Draft Programmatic SEIS

This EIS is being prepared concurrently with a much larger Alaska Groundfish Fisheries Draft Programmatic Supplemental EIS (SEIS) on the BSAI and GOA groundfish FMPs (NMFS 2001a). This concurrent SEIS is a broad environmental review of the GOA and BSAI groundfish FMPs, includes a cumulative impact analysis of actions that have occurred as a whole, and examines policies and potential future actions from a variety of environmental perspectives. The EIS on Amendments 61/61/13/8 is a action-specific analysis and is intended to complement rather than duplicate the material contained in this larger programmatic SEIS. The focus of this EIS is to examine the environmental, economic, and socioeconomic consequences of different alternatives to implementing the management regime set out in the AFA relative to the no action alternative of reverting to the prior management regime. While this EIS does address broader cumulative impacts of the groundfish fisheries taken as a whole, it does not do so with the same degree of detail found in the larger SEIS. Readers wishing to find more detail on the overall cumulative effects of the groundfish fisheries taken as a whole are referred to the SEIS. Likewise, while the SEIS provides an analysis and discussion of the BSAI pollock fishery under the AFA, it does not address the specific elements of the AFA or Amendments 61/61/13/8 with the same level of detail found in this EIS.

1.6.2 Steller Sea Lion Protection Measures Draft Supplemental EIS

In 2000, a Biological Opinion prepared under Section 7 of the Endangered Species Act on all aspects of the groundfish fisheries off Alaska concluded that fisheries for pollock, Pacific cod, and Atka mackerel, jeopardize the continued existence of Steller sea lions and adversely modify their critical habitat due to competition for prey and modification of their prey field. The fisheries must be modified and brought into compliance with all federal laws. Several alternative fisheries management proposals have been developed as proposed Amendments 70/70 to the groundfish FMPs for the BSAI and GOA. The SEIS for Amendments 70/70 (NMFS 2001d) evaluates proposed Amendment 70/70 alternatives to mitigate potential adverse effects as a result of competition for fish between Steller sea lions. Amendments 70/70 would be implemented concurrently with Amendments 61/61/13/8.

1.6.3 Other related NEPA analyses

In addition, NMFS and the Council have prepared a variety of other NEPA documents that are relevant to understanding Amendments 61/61/13/8. In 1998, the Council prepared an extensive Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) for Amendments 51/51 (inshore/offshore 3) to examine the environmental, economic, and socioeconomic effects of alternative inshore/offshore allocation regimes for BSAI pollock prior to the passage of the AFA. That analysis contained an extensive profile of the BSAI pollock industry and was the basis for much of the economic analysis contained in this document. In addition, the Council prepared an extensive EA/RIR to examine various sideboard management alternatives for the emergency rule to implement AFA measures for the year 2000. That analysis forms the basis for much of the discussion of harvesting and processing sideboards contained in this document.

Chapter 2: Alternatives

Chapter 2 is divided into five parts including:

- a discussion of how alternatives were developed, and what constitutes an alternative,
- a full description of the alternatives that are considered in detail,
- a comparison of the alternatives,
- a discussion of alternatives considered but eliminated from detailed study, and
- a discussion of the relationship of this action to other federal laws.

2.1 Development of the alternatives

Amendments 61/61/13/8 were developed by the Council during an extensive public process over the course of 12 Council meetings. This section provides a discussion of the essential components that make up a complete management alternative for Amendments 61/61/13/8 and provides background on the process of analysis and development of alternatives that was undertaken by NMFS and the Council since the passage of the AFA in October 1998.

2.1.1 How the alternatives are constructed

Each alternative is presented the same format and contains the same four primary management components that are necessary to implement the provisions of the AFA in the fisheries off Alaska. These components are (1) Limited access and sector allocations, (2) fishery cooperatives, (3) Sideboards, and (4) Catch weighing and monitoring.

Component 1: Limited access and sector allocations

This management component includes regulations that (1) define the various sectors of the BSAI pollock industry, (2) determine which vessels and processors are eligible to participate in each industry sector, (3) establish allocations of BSAI pollock TAC to each industry sector, and (4) establish excessive share limits for harvesting BSAI pollock. These regulations are necessary to achieve the AFA's objective of decapitalization and rationalization of the BSAI pollock fishery. The AFA addresses these issues with explicit statutory language. The Council and NMFS do not have authority to recommend or implement a program that would define the pollock industry sectors differently, change the sectors allocation percentages, or change the lists of vessels and processors that are authorized to participate in each sector. Consequently, all four of the AFA-based alternatives in this EIS (Alternatives 2-5) mirror the provisions of the AFA with respect to pollock industry sectors and sector allocations.

Component 2: Fishery cooperatives

This management component addresses the formation and management of fishery cooperatives. Fishery cooperatives are a relatively new type of entity in the groundfish fisheries of the North Pacific and are formed by groups of vessel owners to provide an alternative to the open access race for fish. Under a fishery cooperative, the members of a cooperative agree to divide up the available quota among themselves in a manner that eliminates a wasteful race for fish and allows participants to maximize productivity. The AFA authorizes the formation of fishery cooperatives in all sectors of the BSAI pollock fishery, grants anti-trust exemptions to cooperatives in the mothership sector, and imposes operational limits on fishery cooperatives in the BSAI pollock fishery. The AFA provides more flexibility for NMFS and the Council to develop management measures to govern the formation and operation of fishery cooperatives. The AFA-based alternatives in this EIS (Alternatives 2-5) differ with respect to the level of autonomy and flexibility provided to fishery cooperatives to manage BSAI pollock and sideboard fishing activities.

Component 3: Sideboards

Sideboards are measures to protect other fisheries from spillover effects resulting from the rationalization of the BSAI pollock fishery and from the formation of pollock fishery cooperatives. Participants in other fisheries are concerned about the potential for large and efficient pollock vessels and processors to spillover into other fisheries as a result of the AFA. This could occur as a result of rationalization in the BSAI pollock fishery as surplus vessels and processing capacity is no longer needed in the absence of a race for fish. Cooperatives also provide competitive advantages to the BSAI pollock fleet. For example, members of cooperatives have the flexibility to time their pollock fishing activities in a manner that would allow them to expand into other concurrent fisheries to a greater extent than would be possible if a race for fish still existed in the BSAI pollock fishery. The AFA authorized fishery cooperatives in the catcher/processor sector beginning in 1999 but did not provide for the formation of fishery cooperatives in the mothership and inshore sector until 2000. Largely as a consequence of this timing, Congress set out specific sideboard measures for catcher/processors in the AFA to begin in 1999 but deferred to the Council and NMFS to develop sideboard measures for the inshore and mothership sectors. The AFA-based alternatives differ in their approach to establishing sideboard amounts for the various AFA fleets and in their approach to managing sideboard fishing. The choice of appropriate sideboard measures depends in part on the approach taken with respect to managing fishery cooperatives. Alternatives that provide greater autonomy to cooperatives to manage their pollock fishing activities also provide greater autonomy to cooperatives to manage their participation in sideboard fisheries. Sideboards are also the only AFA component with measures that affect the crab and scallop fisheries off Alaska under Amendments 13 and 8 to the crab and scallop FMPs, respectively. AFA catcher vessels face sideboard limits on entry into crab and scallop fisheries and AFA processors face limits on the amount of crab they may process.

Component 4: Catch weighing and monitoring requirements

Because the catcher/processor sector was authorized to form fishery cooperatives in 1999, the AFA mandated specific observer coverage and scale requirements for AFA catcher/processors. All listed AFA catcher/processors are required to carry two NMFS observers at all times they are fishing for groundfish in the BSAI and they must weigh all catch on NMFS-approved scales. Because the AFA delayed the implementation of fishery cooperatives in the inshore and mothership sector until 2000, Congress left it to the Council and NMFS to develop adequate catch measurement and monitoring requirements for those two sectors. To a large extent, the decisions made with respect to management of cooperatives and sideboard fishing determine what type of monitoring and catch weighing programs are appropriate. Alternatives that sub-allocate pollock and sideboard quotas to individual cooperatives require a more intensive monitoring regime than alternatives in which NMFS manages the fishing activities of AFA fleets in the aggregate.

2.1.2 Key policy issues and decision points in the development of the alternatives

This EIS contains five management alternatives that are designed to capture the range of management options developed and considered by the Council over the two years in which Amendments 61/61/13/8 have been under development. During the course of developing a preferred alternative for Amendments 61/61/13/8, the Council examined a myriad of suboptions under each management component. However, it is not practical to construct an EIS that considers the environmental and economic consequences of every permutation of suboptions considered by the Council during the entire public process of developing a preferred alternative. Instead, the alternatives presented in the EIS are designed to capture the range of key issues and decision points that the Council, affected industry, and public have identified during scoping as critical from an environmental, economic, and socioeconomic perspective. The following key issues and decision points arose during the development of Amendments 61/61/13/8 and are captured in the range of alternatives[1]:

- **Inshore co-op qualification criteria.** Who may join a particular inshore co-op? Of particular interest to the Council and the public are questions related to (1) whether an inshore catcher vessel can retire from the pollock fishery while remaining a member of an inshore cooperative, and (2) whether vessels should be free to switch cooperatives from year to year without first fishing for a year in the open access portion of the inshore pollock fishery.

- **Inshore co-op allocation formulas.** What formula will be used to determine the allocation of pollock to each inshore cooperative? The AFA defines a formula based on the aggregate 1995-1997 inshore landings of the member vessels in a cooperative relative to total inshore landings during those years. The Council considered three changes to this formula: (1) Using the best 2 of 3 years landings for each vessel during 1995-1997, (2) compensating inshore vessels for offshore landings made during the 1995-1997 qualifying period, and (3) changing the formula's denominator to eliminate the 1995-1997 inshore catch history of vessels that are not AFA inshore qualified so that the catch history of non-AFA vessels does not provide an unintended windfall for the open access sector.

- **Catcher/processor (C/P) and catcher/vessel (CV) sideboard amounts**. What formula will be used to determine catcher/processor groundfish sideboards? The AFA sets out a formula for catcher/processor sideboards based on the 1995-1997 harvest of each sideboard species by the 20 listed AFA catcher/processors and the nine ineligible catcher/processors in fisheries other than the BSAI pollock fishery relative to the available TAC during those years but authorizes the Council to develop alternative sideboard measures. The AFA does not provide specific sideboard measures for catcher vessels but directs the Council to develop and recommend such measures. A particularly important issue to the Council is whether sideboard amounts should be based on retained or total catch during the qualifying years. Put another way, the decision is whether AFA fleets should receive "sideboard credit" for groundfish that they discarded at sea during the qualifying years or whether sideboard amounts should be based only on the amounts of fish that such vessels actually retained and utilized during the qualifying years.

- **Aggregate or individual catcher vessel sideboards?** Should catcher vessel groundfish sideboards be managed in the aggregate for all AFA catcher vessels or should separate groundfish sideboard be issued to each individual catcher vessel cooperative? This decision determines whether cooperatives will be forced to work together to manage sideboard fishing activities or whether each cooperative can operate autonomously. A program that issues individual sideboard amounts to each individual cooperative requires a much more intensive monitoring and management regime than one in which catcher vessels and catcher/processors are managed in the aggregate.

- **Catcher vessel sideboard exemptions**. Should certain catcher vessels be exempt from some sideboards? The Council considered a range of sideboard exemptions to prevent disproportionate impacts on AFA catcher vessels with relatively modest pollock fishing histories and extensive histories of participation in other fisheries. The Council was particularly concerned about smaller vessels that fish primarily in other groundfish and crab fisheries but that met the AFA qualification

[1] Certain key elements of the AFA such as the sector allocation percentages and the listed vessels and processors were resolved by Congress and are not within the jurisdiction of the Council or NMFS to change. Consequently the Council and the public did not spend time discussing or analyzing alternatives to these non-discretionary AFA elements in the development of Amendments 61/61/13/8, and these non-discretionary AFA elements were not considered key policy issues or decision points in the development of the amendments.

criteria and did not want to impose highly restrictive sideboards on such vessels in their primary fisheries when such vessels did not benefit greatly from the AFA due to their low level of participation in the BSAI pollock fishery during the qualifying years.

- **Sideboard management approach.** How should sideboards be managed? Through directed fishing closures issued by NMFS, or as "hard caps" which shut down all fishing activity in an area when a sideboard is reached? One approach is to use sideboards to control access into the other directed fisheries and prohibit directed fishing in non-pollock fisheries when sideboard amounts are reached. The ability to prosecute the pollock fishery would not be affected by sideboard closures. A second approach is to treat the sideboard amounts as hard caps which would trigger the closure of all fishing in an area, including pollock fishing, when a sideboard amount is reached. Under this second approach, small amounts of bycatch of a sideboard species could force the closure of the BSAI pollock fishery if hard caps are enforced rigorously. Given that sideboard amounts for many groundfish species will be very low due to the lack of historic catch of such species by AFA vessels from 1995-1997 this second approach would require extremely careful monitoring of bycatch by the AFA fleets to prevent premature closure of the BSAI pollock fishery.

- **Crab processing sideboards.** Should the crab processing sideboards contained in the AFA be implemented unchanged? Or should the alternative approach recommended by the Council be used to protect the interests of non-AFA crab processors? The AFA establishes crab processing sideboards based on the 1995-1997 crab processing history of the AFA inshore and mothership processing entities to protect the interests of non-AFA crab processors. However, some members of industry have questioned whether 1995-1997 are the most appropriate years for determining crab processing history and some crab fishermen believe such limits lower the prices paid to crab fishermen due to the loss of competition for their catch. Consequently under Amendments 61/61/13/8 the Council has recommended that 1998 be added to the range of years for processing history and be given double weight (counted twice).

- **Catch monitoring, scales, and observer requirements.** What should the scale and observer requirements be for pollock processors? The AFA defines minimum observer and scale requirements for AFA catcher/processors but is silent with respect to scale and observer requirements for AFA motherships and AFA inshore processors. To a large extent, the appropriate level of monitoring depends on the decisions made with respect to co-op and sideboard management. Alternatives that suballocate each pollock and sideboard quota to individual cooperatives require a much more intensive monitoring program than alternatives in which NMFS manages such activities in the aggregate.

2.1.3 NMFS and Council development of Amendments 61/61/13/8

Since the passage of the AFA in October 1998, NMFS and the Council have undertaken an extensive public process to develop the management program proposed under Amendments 61/61/18/8. This public process has extended over 12 Council meetings and other public meetings during a two year period. The following time line provides a summary of this process:

- **November 1998.** After the passage of the AFA in October 1998, the Council held a special meeting in November 1998, in Anchorage to address among other things, the new requirements of the AFA and the effect of the AFA on the fisheries under the jurisdiction of the Council. The Council made various recommendations to NMFS regarding the regulation of cooperatives in the catcher/processor sector and the management of sideboards for AFA catcher/processors for the upcoming 1999 fishery and began the process of identifying issues and alternatives for upcoming AFA-related actions.

- **December 1998.** At its December 1998 meeting in Anchorage, the Council approved two emergency rules to implement required provisions of the AFA for the 1999 fishing year. The first emergency interim rule required two observers on all AFA-listed catcher processors and motherships, and established procedures for making inseason sideboard closures (64 FR 3435, January 22, 1999; extended at 64 FR 33425, June 23, 1999). The second emergency interim rule made several technical changes to the CDQ program regulations to accommodate the new requirements of the AFA (64 FR 3887, January 26, 1999; extended at 64 FR 34743, June 29, 1999). After extensive public testimony and input from the Council's Advisory Panel (AP) and Scientific and Statistical Committee (SSC), the Council identified a suite of alternatives for the management program that subsequently became known as Amendments 61/61/13/8.

- **February 1999.** At its February 1999 meeting in Anchorage, the Council finalized sideboard and AFA management measure alternatives with the intent that a draft analysis would be reviewed at the April 1999 meeting with a final decision scheduled for June 1999 to allow the Council to meet the July 1999 deadline imposed by the AFA for recommendation of sideboard measures. The Council also began preparation of a separate discussion paper to examine the structure of the inshore cooperative program. This separate analysis was in response to a proposal by a group of independent catcher vessel owners who advocated a change in the program to allow the formation of an independent vessel cooperative that would not be tied to a particular processor. A draft analysis was scheduled for review in June 1999, with further discussion in October 1999.

- **April 1999.** At its April 1999 meeting in Anchorage, the Council reviewed its draft analysis for Amendments 61/61/13/8, and received extensive public testimony regarding alternatives and issues that should be considered under Amendments 61/61/13/8. The Council directed staff to make various revisions and additions to the analysis with the intent that the amendment package would be before the Council for final action in June 1999. The Council also reviewed its discussion paper on the structure of the inshore cooperative program and the proposed independent catcher vessel cooperative and requested that a broader analysis be prepared for initial review at the October 1999 meeting. In addition, the Council formed an inshore cooperative implementation committee to advise NMFS on many of the technical issues related to the formation and management of inshore cooperatives.

- **May 1999.** The Council's inshore co-op implementation committee held a public meeting with NMFS on May 10-13 in Seattle to examine alternative management approaches for inshore catcher vessel cooperatives. The approach to implementing and managing inshore cooperatives developed at this meeting forms the basis of the inshore cooperative management program proposed under Amendments 61/61/13/8.

- **June 1999.** At its June 1999 meeting in Kodiak the Council reviewed Amendments 61/61/13/8 and after extensive public testimony, approved a suite of AFA-related recommendations including restrictions on the formation and operation of cooperatives, harvesting sideboards for catcher/processors and catcher vessels, and catch weighing and monitoring requirements. However, the Council was unable to reach a decision on two AFA-related issues; groundfish processing sideboards and excessive processing share caps. To address these issues, the Council established an industry committee to further examine alternatives and work with State of Alaska (State) and federal managers to resolve implementation issues with the intent that the Council would review the committee's recommendations in October 1999.

- **August 1999.** The Council's processing sideboard industry committee held a public meeting in Seattle to examine alternatives for processing sideboards and excessive processing share caps. The committee was unable to reach complete consensus on a recommended approach for processing sideboard caps. However, the committee did develop some general recommendations for the Council and provided the Council with some requests for additional analysis and information.

- **October 1999.** At its October 1999 meeting in Seattle, the Council reviewed its analysis on the structure of the inshore cooperative program, including the proposal to allow formation of independent catcher vessel cooperatives, and received extensive public discussion on this issue. However, the Council voted to postpone action until February 2000 and requested further analysis on this issue. The Council also re-examined its June 1999 catcher vessel sideboard exemption recommendations and requested that NMFS delay implementation of these measures until the Council had the opportunity to analyze and discuss possible revisions to its recommended catcher vessel sideboard exemptions. The Council announced that it would be revising its sideboard exemption recommendations at its December 1999 meeting. Finally, the Council reviewed what had now become a separate analysis of groundfish processing sideboards and excessive processing share caps. After extensive discussion and public comment on this issue, the Council chose to expand and revise its analysis with intent to review the issue again in February 2000 with final action scheduled for June 2000.

- **December 1999.** At its December 1999 meeting in Anchorage, the Council approved two emergency interim rules to implement required provisions of the AFA for the 2000 fishing year. These measures were necessary to meet certain statutory deadlines in the AFA while the comprehensive suite of permanent management measures under Amendments 61/61/13/8 continued to undergo development, revision, and analysis by the Council and NMFS. The first emergency interim rule set out permit requirements for AFA vessels, processors, and cooperatives (65 FR 380, January 5, 2000; extended at 65 FR 39107, June 23, 2000). The second emergency interim rule established sector allocations, co-op regulations, sideboards, and catch monitoring requirements for the AFA fleets (65 FR 4520, January 28, 2000; extended at 65 FR 39107, June 23, 2000).

- **February 2000.** At its February 2000 meeting in Anchorage, the Council reviewed its revised analysis of groundfish processing sideboards and excessive share processing caps and requested analysis of several additional issues with the intent that the analysis would be reviewed again in June 2000. The Council postponed action on proposed changes to the structure of the inshore cooperative program and independent catcher vessel proposal until June 2000. Finally, at this meeting, the Council and NMFS decided it would be appropriate to expand the environmental assessment (EA) prepared for Amendments 61/61/13/8 into an EIS given the magnitude of the proposed management program to implement the AFA.

- **April 2000.** At its April 2000 meeting in Anchorage, the Council received extensive testimony from industry on several elements of Amendments 61/61/13/8. Catcher vessel owners requested that the Council consider revising several of its recommendations related to catcher vessel sideboards, retirement of vessels, and the formula for calculating inshore co-op allocations. The Council requested preparation of a supplemental analysis of these issues for consideration in June 2000. The Council also received testimony from crab fishermen who opposed the crab processing caps implemented in 2000 through emergency interim rule. The Council announced its intent to examine alternatives for crab processing caps at its June 2000 meeting with final action on any changes scheduled for September 2000. In addition, the April Council meeting was used as a scoping meeting to solicit input from the public on issues and alternatives that should be addressed in the EIS under preparation for Amendments 61/61/13/8.

- **June 2000.** At its June 2000 meeting in Portland, the Council reviewed its analysis of proposed structural changes to the inshore cooperative program including the independent catcher vessel proposal. The Council voted to postpone action on the independent catcher vessel's proposal until such time that adverse effects of the AFA on independent catcher vessels could be demonstrated and gave notice that it could take up the issue again at any point in the future if data showed evidence of adverse impacts to independent catcher vessels. In addition, the Council recommended two changes related to retirement of vessels and allocation formulas that would supersede the measures set out in the AFA. These changes were incorporated as revisions to Amendments 61/61/13/8. The Council also examined the issue of groundfish processing sideboards and excessive processing share caps and voted to release its analysis for public review with intent to take final action on these measures at its October 2000 meeting. The Council's original intent was to include groundfish processing sideboards and excessive processing share caps in Amendments 61/61/13/8. However, due to the extensive additional analysis required for these two issues, the Council decided to address these issues on a separate timetable with a separate analysis.

- **September 2000.** At its September 2000, meeting in Anchorage the Council examined proposed changes to crab processing sideboard limits and adopted a revision to the basis years used to calculate crab processing sideboard amounts by adding 1998 processing history and giving it double-weight. In other words, 1995-1998 would be used to determine crab processing history with the 1998 year counting twice.

- **October 2000.** At its October 2000 meeting in Sitka, Alaska, the Council considered the issues of BSAI pollock excessive processing share limits and groundfish processing sideboard limits. The Council adopted a 30 percent excessive processing share limit for BSAI pollock that would be applied using the same 10 percent entity rules set out in the AFA to define AFA entities for the purpose of the 17.5 percent excessive harvesting share limit contained in the AFA. This action represents the Council's final revision to Amendments 61/61/13/8 before official submission of the Amendments to the Secretary of Commerce for review and approval. With respect to groundfish processing sideboards, the Council took no action. The Council believed that placing non-pollock groundfish processing limits on AFA processors could have negative effects on markets for both AFA and non-AFA catcher vessels. In addition, the Council concluded that its suite of harvesting sideboard restrictions on AFA catcher vessels and catcher/processors also served to protect non-AFA processors in the BSAI which are primarily non-AFA catcher/processors. Instead of imposing non-pollock processing limits on AFA processors, the Council indicated its intent to explore revisions to its Improved Retention/Improved Utilization (IR/IU) program that could provide a more level playing field for non-AFA catcher/processors.

Figure 2.1.1 displays a decision tree that shows how the five alternatives under consideration in this EIS relate to each other and how each alternative addresses the key decision points under each major management component of the AFA. Each individual alternative is further described below in the following sections.

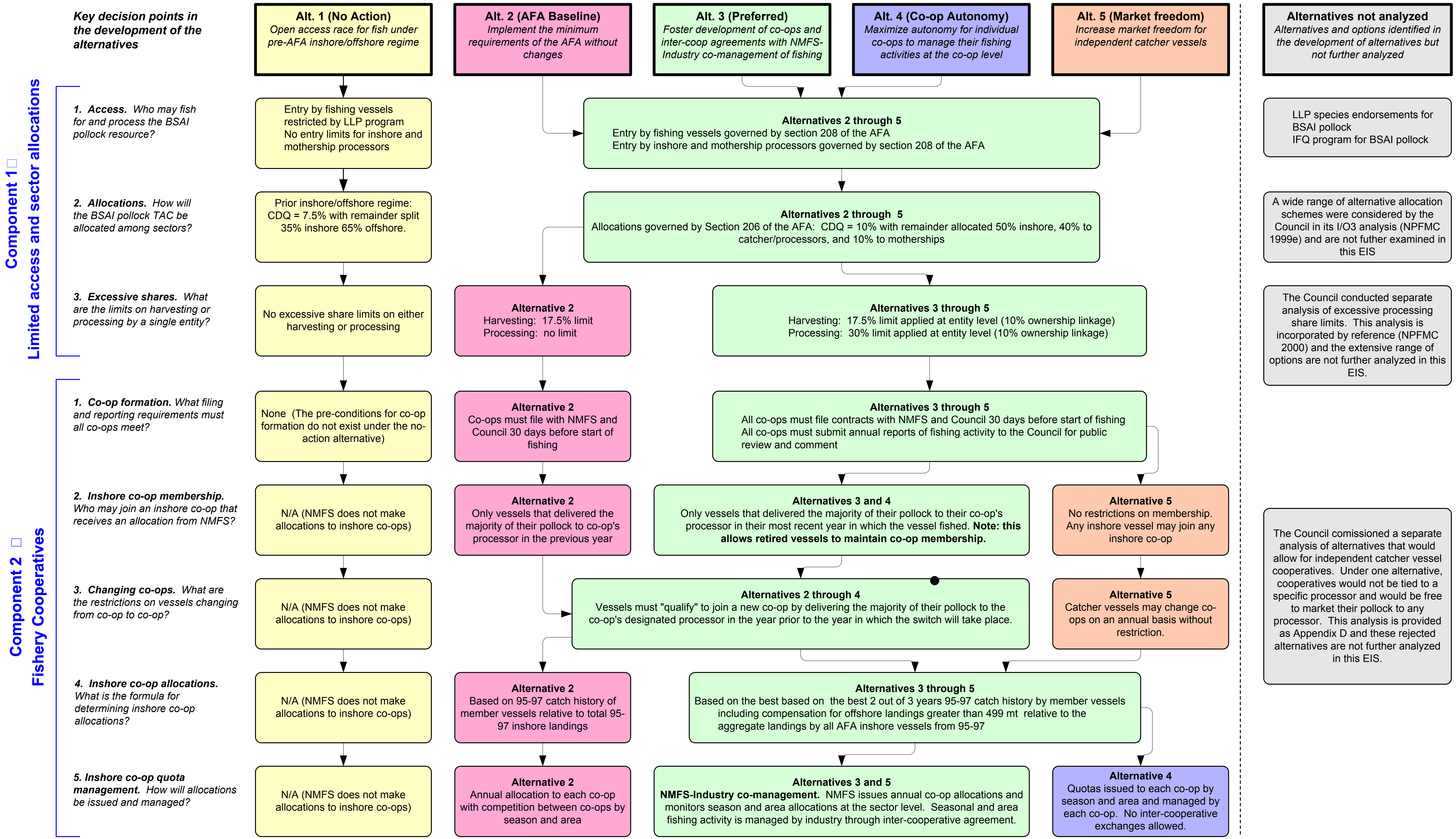

Figure 2.1.1 **Decision tree showing main decision points in the development of the five alternatives.**

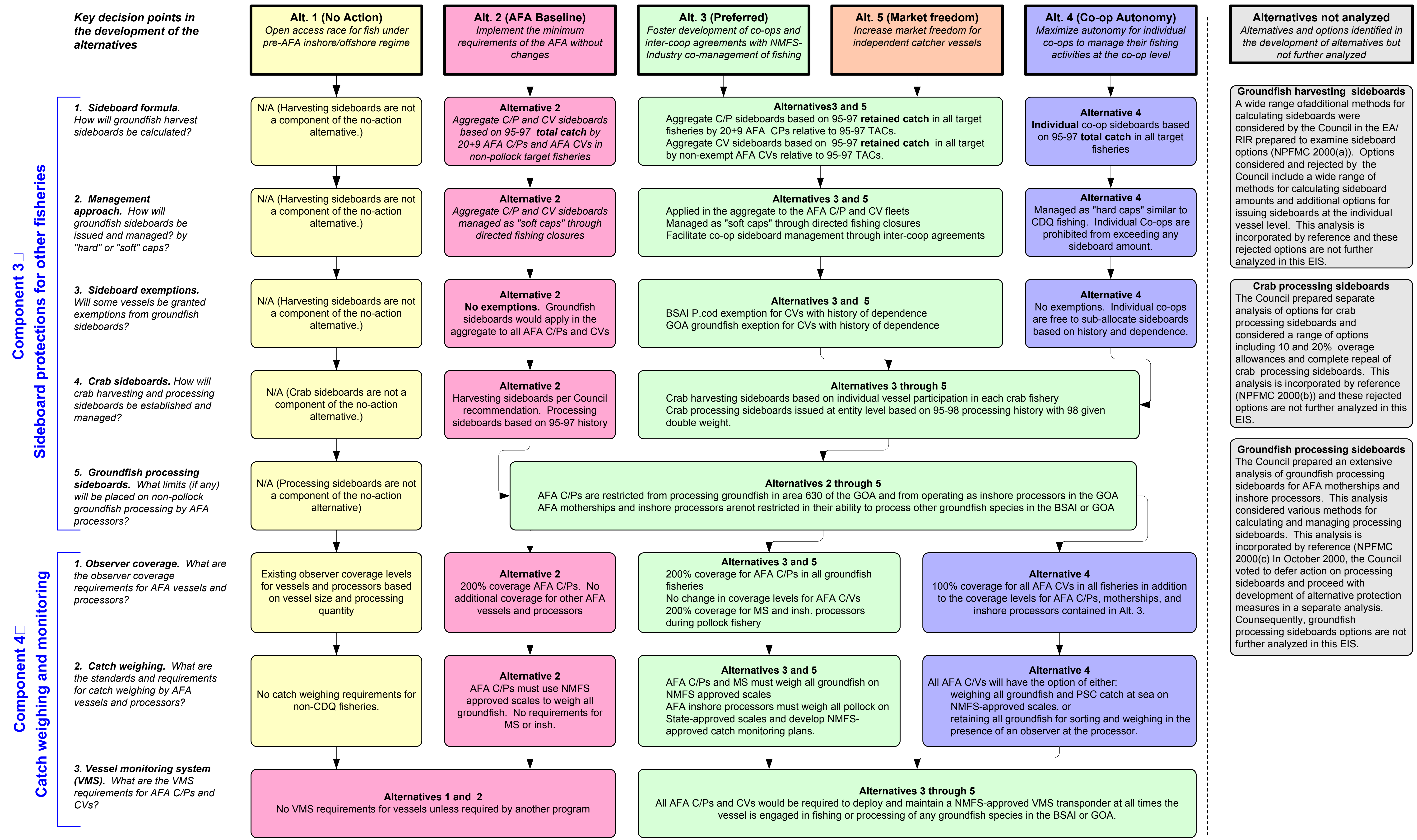

Figure 2.1.1 **Decision tree showing main decision points in the development of the five alternatives (Continued).**

2.2 Alternative 1: No Action. Revert to pre-AFA management regime

The theme of Alternative 1 is to continue with the prior inshore/offshore management regime that was in place prior to passage of the AFA

Under this alternative, NMFS would take no action to implement the provisions of the AFA. Management of the BSAI pollock fishery would return to the previous inshore/offshore management regime that governed the fishery from 1990 until the passage of the AFA in October 1998. While this alternative is clearly contrary to the statutory requirements of the AFA, it is included for analytical purposes to provide a baseline against which the environmental and economic effects of the AFA alternatives may be compared. NEPA requires the examination of a no-action alternative even if such an alternative is contrary to existing law.

2.2.1 Limited access and sector allocations under Alternative 1

Under Alternative 1, the BSAI pollock fishery would revert to the previous inshore/offshore management regime that was in place prior to the passage of the AFA in October 1998. Under this management regime, the BSAI pollock TAC would be allocated as follows:

- 7.5 percent of BSAI TAC allocated to CDQ. Prior to the passage of the AFA, the allocation of pollock to the CDQ program was 7.5 percent.

- 35 percent (of TAC minus CDQ) to vessels catching pollock for processing by the inshore component (shoreside processors and stationary floating processors), and

- 65 percent (of TAC minus CDQ) to vessels catching pollock for processing by the offshore component (catcher/processors and motherships).

The existing license limitation program would be the only limit on access for fishing vessels and there would be no limits on entry for inshore and mothership processors.

2.2.2 Fishery cooperatives under Alternative 1

Alternative 1, the no action alternative would contain no regulations or measures to facilitate the formation of fishery cooperatives or regulate their activities. Absent a defined class of eligible participants and specific allocations of pollock to each industry sector, it is extremely unlikely that any fishery cooperatives could form and operate successfully in the BSAI pollock fishery.

2.2.3 Sideboard protections for other fisheries under Alternative 1

Sideboards are a unique component of the AFA and were not used as a management measure in the BSAI pollock fishery prior to the AFA. Consequently, no sideboard protections would be implemented under Alternative 1, the no-action alternative

2.2.4 Observer coverage, catch weighing, and monitoring requirements under Alternative 1

Under Alternative 1, the BSAI pollock fishery would be subject to the same catch measurement and monitoring requirements currently in place of other groundfish fisheries off Alaska. These include observer coverage requirements based on vessel size and the tonnage processed by quarter by inshore processors. Neither vessels or processors would be subject to specific scale or catch measurement requirements for the non-CDQ pollock fishery other than those requirements that apply to BSAI groundfish fisheries generally.

2.3 Alternative 2 (AFA Baseline)

*The theme of Alternative 2 is to meet the minimum statutory requirements of the AFA without additional modification*s

Alternative 2 would implement the required elements of the AFA without additional modifications by NMFS or the Council. This alternative may be viewed as an "AFA baseline" alternative against which the Council and NMFS-proposed changes or modifications contained in Alternatives 3, 4, and 5 may be compared. Alternative 2 contains the four basic components required of all AFA alternatives: (1) measures defining the pollock sectors and the BSAI pollock allocations to each sector, (2) measures governing the formation and operation of fishery cooperatives, (3) sideboard protections for other fisheries, and (4) catch measurement and monitoring requirements for the AFA pollock fleet.

2.3.1 Limited access and sector allocations under Alternative 2

The first component of Alternative 2 is a limit on access for vessels and processors in each sector of the BSAI pollock fishery and the allocations of BSAI pollock to each sector. The AFA defines four industry sectors (catcher/processor, mothership, inshore, and CDQ) and, with the exception of the CDQ sector, the AFA determines which vessels and processors are authorized to participate in each industry sector. The AFA also establishes a formula by which the BSAI pollock resource must be allocated among the industry sectors. In the case of the inshore sector, the AFA also establishes a formula by which the inshore sector pollock allocation is further subdivided among catcher vessel cooperatives that meet certain criteria and restrictions.

Authorized vessels and processors

Under Alternative 2, only vessels and processors listed by name in the AFA or meeting qualification criteria set out in the AFA would be eligible to participate in the BSAI directed pollock fishery.

- **Listed AFA catcher/processors.** Catcher/processors (also known as factory trawlers) are large fishing vessels that both harvest and process groundfish at sea. The AFA lists by name 20 catcher/processors that are eligible to fish for and process pollock in the catcher/processor sector of the BSAI directed pollock fishery. These 20 vessels are the AMERICAN DYNASTY, KATIE ANN , AMERICAN TRIUMPH, NORTHERN EAGLE, NORTHERN HAWK, NORTHERN JAEGER, OCEAN ROVER, ALASKA OCEAN, ENDURANCE, AMERICAN ENTERPRISE, ISLAND ENTERPRISE, KODIAK ENTERPRISE, SEATTLE ENTERPRISE, US ENTERPRISE, ARCTIC STORM, ARCTIC FJORD, NORTHERN GLACIER, PACIFIC GLACIER, HIGHLAND LIGHT, and STARBOUND.

- **Unlisted AFA catcher processors.** The AFA also provides that any "unlisted" catcher/processor that harvested more than 2,000 mt of pollock in the 1997 BSAI directed pollock fishery is also eligible to participate in the BSAI directed pollock fishery except that such catcher/processors are limited in the aggregate to harvesting not more than 0.5 percent of the catcher/processor sector directed fishing allowance. Only one catcher/processor, the OCEAN PEACE, is believed to qualify to participate in the BSAI directed pollock fishery as an unlisted AFA catcher/processor.

- **AFA catcher vessels delivering to catcher/processors.** The AFA lists seven catcher vessels that are authorized to fish for pollock in the catcher/processor sector of the BSAI directed pollock fishery. These vessels are the AMERICAN CHALLENGER, FORUM STAR, MUIR MILACH, NEAHKAHNIE, OCEAN HARVESTER, SEA STORM, and TRACY ANNE. In addition, the AFA provides that any vessel determined by NMFS to have delivered at least 250 mt and at least

75 percent of the pollock it harvested in the directed pollock fishery in 1997 to catcher/processors is also eligible to participate in the catcher/processor sector of the BSAI directed pollock fishery. However, no additional catcher vessels are believed to qualify under this provision.

- **AFA motherships.** Motherships are large processing ships that operate offshore and receive unsorted codends deliveries from catcher vessels. Unsorted codends are transferred from catcher vessels to motherships via towing cables. Paragraphs 208(d)(1) through (3) of the AFA list three motherships that are eligible to process pollock harvested in the mothership sector of the BSAI directed pollock fishery. These three motherships are the EXCELLENCE, GOLDEN ALASKA, and OCEAN PHOENIX.

- **AFA catcher vessels delivering to AFA motherships.** The AFA lists 19 catcher vessels that are authorized to deliver BSAI pollock to motherships under the AFA. These vessels are the ALEUTIAN CHALLENGER, ALYESKA, AMBER DAWN, AMERICAN BEAUTY, CALIFORNIA HORIZON, MAR-GUN, MARGARET LYN , MARK I , MISTY DAWN, NORDIC FURY, OCEAN LEADER, OCEANIC, PACIFIC ALLIANCE, PACIFIC CHALLENGER, PACIFIC FURY, PAPADO II, TRAVELER, VESTERAALEN, and WESTERN DAWN. The AFA also establishes criteria under which additional vessels may qualify to deliver to motherships if they are determined by NMFS to have delivered at least 250 mt of BSAI pollock to motherships in 1996, 1997, or between January 1 and September 1, 1998. Only one additional vessel, the VANGUARD is believed to qualify under this provision.

- **AFA inshore processors.** Under the AFA, any inshore processor that processed more than 2,000 mt of pollock harvested in the BSAI directed pollock fishery in both 1996 and 1997 is eligible to process inshore pollock under the AFA. Eight inshore processors qualify under this provision. Six of these inshore processors are shoreplants located in Alaska communities: UniSea Seafoods, Westward Seafoods, and Alyeska Seafoods in Dutch Harbor; Trident Seafoods in Akutan, Trident Seafoods in Sand Point, and Peter Pan Seafoods in King Cove. In addition, two floating processing ships qualify as inshore processors, the ARCTIC ENTERPRISE and NORTHERN VICTOR. The AFA also provides that any inshore processor that processed inshore-sector pollock in 1996 or 1997 but that processed less than 2,000 mt in each year also is eligible to process pollock harvested in the BSAI directed pollock fishery under the AFA. Two inshore processors located in Kodiak are believed to qualify under this provision.

- **AFA catcher vessels delivering to AFA inshore processors.** Under the AFA, any catcher vessel that delivered at least 250 mt of BSAI pollock to inshore processors in 1996, 1997, or between January 1 and September 1, 1998 is eligible to fish for pollock in the inshore sector under the AFA. In addition, any vessel under 60 ft LOA that delivered at least 40 mt of BSAI pollock to inshore processors during those same years also is eligible to fish for pollock in the inshore sector under the AFA. Between 95 and 100 vessels are believed to be eligible under these provisions. Some of these vessels are dual-qualified to fish for the mothership sector as well, however no vessel is dual-qualified to fish for both the inshore and catcher/processor sectors. The complete list of AFA eligible inshore catcher vessels is available in Appendix E.

Sector allocations of the BSAI pollock TAC

Under Alternatives 2-5, the Bering Sea subarea and Aleutian Islands subarea pollock TACs would be allocated according to the formula set out in section 206 AFA. The following example shows the hypothetical allocation of a 1 million mt pollock TAC for the Bering Sea subarea using the percentage formulas contained in the AFA.

Table 2.3.1 Bering Sea subarea pollock TAC allocation procedures under Alternative 2 using a hypothetical Bering Sea subarea pollock TAC of 1 million mt.

Allocation of Bering Sea subarea pollock TACs under Alternative 2	*Hypothetical allocations in mt*	*Percent of BSAI TAC*
Step 1: Establish TAC for the Bering Sea Subarea. Separate TACs are established for the Bering Sea subarea and Aleutian Islands Subarea. In this hypothetical example, the Bering Sea Subarea pollock TAC is set at 1 million mt.	1,000,000	100 percent
Step 2: Allocate 10 percent of TAC to CDQ. Under the AFA, 10 percent of the Bering Sea and Aleutian Islands subarea TACs are allocated to the Western Alaska Community Development Quota (CDQ) program	100,000	10 percent
Step 3: Establish ICA. Establish an incidental catch allowance (ICA) to account for incidental catch of pollock in other groundfish fisheries. Approximately 5 percent in recent years.	50,000	5 percent
Step 4: Establish DFA. Establish the directed fishing allowance (DFA) for the pollock target fisheries. The DFA is the TAC minus the CDQ and ICA amounts	850,000	85 percent
Step 5: Allocate 40 percent of DFA to catcher/processor sector. Under the AFA, the catcher/processor sector is allocated 40 percent of the DFA. In addition, not less than 8.5 percent of the catcher/processor sector DFA is allocated to catcher vessels delivering to catcher processors, and the unlisted AFA catcher/processors are limited in the aggregate to 0.5 percent of the C/P sector DFA.		
Catcher/processor (C/P) sector DFA (40 percent)	340,000	34 percent
C/P sector catcher vessel set-aside (8.5 percent)	28,900	2.89 percent
Unlisted AFA C/Ps (0.5 percent)	1,700	0.17 percent
Step 6: Allocate 10 percent of DFA to mothership sector. Under the AFA, the mothership sector is allocated 10 percent of the DFA.	85,000	8.5 percent
Step 7: Allocate 50 percent of DFA to inshore sector. Under the AFA, the inshore sector is allocated 50 percent of the DFA. The inshore sector allocation is further divided into allocations to individual inshore catcher vessel cooperatives and to the open access inshore sector which is composed of AFA inshore catcher vessels not in cooperatives.	425,000	42.5 percent
Step 8: Allocate to inshore cooperatives. Under the AFA, any inshore catcher vessel cooperative that is composed of at least 80 percent of the vessels that delivered the majority of their pollock to a particular inshore processor and that has agreed to deliver at least 90 percent of its pollock to that same inshore processor is eligible for a suballocation of the inshore sector DFA. The cooperative's allocation is a percentage of the inshore sector DFA that is equal to the aggregate catch histories of the member vessels from 1995-1997 relative to total inshore landings during that same period. Up to eight inshore catcher/vessel cooperatives may form under the AFA to match the eight AFA inshore processors. In this example, it is assumed that vessels representing 95 percent of the 1995-1997 inshore catch history have joined cooperatives	398,884	39.9 percent
Step 9: Allocate to inshore open access fishery. Under the AFA, vessels that do not join inshore catcher vessel cooperatives are eligible to fish in the open access sector of the inshore pollock fishery. The open access sector allocation is equal to the inshore DFA minus the aggregate allocation of pollock to cooperatives	26,116	2.6 percent

2.3.2 Fishery cooperatives under Alternative 2

The second component of Alternative 2 are regulations addressing the formation and operation of fishery cooperatives. Fishery cooperatives are legal entities formed under Fisherman's Collective Marketing Act of 1934 (15 U.S.C. 521) which provides limited anti-trust exemptions to enable such cooperatives to operate collectively rather than in competition. Under the AFA, vessels participating in all sectors of the

BSAI pollock fishery are authorized to form fishery cooperatives for the purpose of collectively managing the harvest of the BSAI pollock resource. The AFA also imposes certain requirements on the formation and operation of fishery cooperatives, and, for the inshore sector, establishes additional qualifying criteria and operational restrictions on cooperatives.

Public notice requirements

Under subsection 210(a) of the AFA, any fishery cooperative intending to operate in the BSAI directed pollock fishery must give public notice of its intent to operate by filing a copy of its cooperative contract with the Council and with the Secretary not less than 30 days prior to the start of fishing under the contract. In addition, each cooperative must file a copy of a letter from a party to the contract requesting a business review letter on the fishery cooperative from the Department of Justice and any response to such request.

In addition, the cooperative must make available to the public such information about the contract, contract modifications, or fishery cooperative as the Council and Secretary deem appropriate. At a minimum this shall include a list of the parties to the contract, a list of the vessels involved, and the amount of pollock and other fish to be harvested by each party to such contract; and make available to the public in such manner as the Council and Secretary deem appropriate information about the harvest by vessels under a fishery cooperative of all species (including bycatch) in the directed pollock fishery on a vessel-by-vessel basis.

Catcher/processor sector fishery cooperatives

Under the AFA, fishery cooperatives are authorized to form in the catcher/processor sector of the BSAI pollock fishery. A single cooperative may form that includes both catcher/processor and catcher vessels delivering to catcher/processors, or the catcher/processors and catcher vessels may form separate cooperatives and enter into an inter-cooperative agreement to govern fishing for pollock in the catcher/processor sector of the pollock fishery.

Mothership sector fishery cooperatives

Under the AFA, fishery cooperatives are authorized to form in the mothership sector of the BSAI pollock fishery. In addition, if at least 80 percent of the mothership-sector catcher vessels enter into a fishery cooperative then the three AFA motherships are also eligible to join the cooperative and retain a limited anti-trust exemption under the Fisherman's Collective Marketing Act.

Inshore sector fishery cooperatives

Under the AFA, fishery cooperatives are authorized to form in the inshore sector of the BSAI pollock fishery. However, unlike the catcher/processor and mothership sector cooperatives which must form at the sector level to collectively manage directed fishing for pollock, individual inshore sector cooperatives may form around each AFA inshore processor. If an inshore catcher vessel cooperative forms around a specific inshore processor and meets certain qualifying criteria, then NMFS is required to issue that inshore cooperative an exclusive allocation of BSAI pollock.

Qualifying criteria for inshore cooperatives

Under the AFA, an inshore catcher vessel cooperative that wishes to receive an exclusive allocation of BSAI pollock must meet the following criteria:

- **Qualified vessels.** Under the AFA, an inshore catcher vessel is qualified to join a specific inshore cooperative only if the vessel delivered more BSAI pollock to the cooperative's designated AFA inshore processor than any other inshore processor during the year prior to the year in which the fishery cooperative will be in effect. Under this definition, each inshore catcher vessel is only qualified to join one cooperative during a given year and if the vessel did not make any landings of BSAI pollock in the previous year the vessel would not be qualified to join any inshore cooperative.

- **80 percent membership threshold.** To qualify for an exclusive allocation of pollock under the AFA, at least 80 percent of the qualified catcher vessels must enter into an inshore cooperative contract. Cooperatives could form without 80 percent of the qualified vessels, however such a cooperative would be ineligible to receive an exclusive allocation of pollock and, would therefore, be forced to operate in the open access portion of the fishery.

- **90 percent delivery requirement**. To qualify for an exclusive allocation of pollock under the AFA, an inshore cooperative contract must contain a provision that requires at least 90 percent of the cooperative's pollock quota to be delivered to the cooperative's associated inshore processor.

Formula for allocating pollock to inshore cooperatives

The AFA sets out a specific formula for making allocations of BSAI pollock to qualified inshore cooperatives. Subparagraph 210(b)(1)(B) states that each inshore co-ops allocation shall be a percentage of the BSAI inshore sector allocation that is equal to "the aggregate total amount of pollock harvested by [the members of the cooperative] in the directed pollock fishery for processing by the inshore component during 1995, 1996, and 1997 relative to the aggregate total amount of pollock harvested in the directed pollock fishery for processing by the inshore component during such years."

In effect, each inshore cooperative would receive an allocation of the inshore sector pollock TAC that is equal to the aggregate percentage of the 1995-1997 inshore pollock harvest that was caught by its member vessels.

Formula for allocating pollock to the inshore open access sector

The AFA uses the term "open access" to describe those vessels that are not in cooperatives but does not specify a formula for determining the allocation to the "open access" sector of the inshore pollock fishery. By default, all remaining inshore pollock TAC not allocated to cooperatives would be available to the open access vessels.

2.3.3 Sideboard protections for other fisheries under Alternative 2

The second component of Alternative 2 is a suite of sideboard restrictions that are designed to prevent the various sectors of the pollock industry from using the flexibility and exclusive privileges granted under the AFA to expand into other fisheries at levels that exceed their historic participation. These sideboard measures are required under Section 211 of the AFA which sets of specific sideboard measures for catcher processors and requires that the Council recommend sideboard measures for catcher vessels, shoreside processors, and motherships. Alternative 2 contains a suite of sideboard restrictions that represent the minimum harvesting and processing sideboards that are required under section 211 of the AFA.

Catcher/processor harvest restrictions.

Catcher/processor harvest restrictions would be based on subsection 211(b) of the AFA which contains the following restrictions on the 20 catcher/processors listed in subsection 208(e) of the AFA:

- **GOA fishing prohibition.** The 20 listed AFA catcher/processors would be prohibited from fishing for groundfish in the GOA.

- **BSAI groundfish sideboards.** Except for Atka mackerel, the non-pollock groundfish harvest limits for the 20 listed AFA catcher/processors would be set as a percentage of each TAC that is equivalent to the total harvest of each species by the 29 listed catcher processors in 1995-1997 in fisheries other than the BSAI pollock fishery relative to the total amount of each species available for harvest in those years. Atka mackerel harvests for the 20 listed AFA catcher processors would be set at 11.5 percent in the central Aleutians and 20 percent in the western Aleutians.

- **BSAI Prohibited Species Catch (PSC) sideboards.** Prohibited species limits for the 20 listed AFA catcher/processors would be set as a percentage of the total PSC harvested by the 29 listed catcher processors in 1995-1997 relevant to the total amount available for harvest in those years.

Groundfish and PSC limits would be managed in the aggregate through directed fishing closures in non-pollock target fisheries to prevent the 20 listed AFA catcher/processors from exceeding each sideboard limit.

Catcher vessel harvest restrictions

Under paragraph 211(c)(1) of the AFA, the Council is required to "recommend conservation and management measures to prevent [AFA catcher vessels] from exceeding in the aggregate the traditional harvest levels of such vessels in other fisheries under the authority of the North Pacific Council as a result of fishery cooperatives in the directed pollock fishery." The Council considered a wide suite of options for catcher vessel sideboards and made final recommendations for catcher vessel sideboards at its June 1999 meeting. The Council's recommendations were further revised at its December 1999 meeting. The complete suite of Council-recommended sideboard measures are set out in Alternative 2. The catcher vessel sideboard restrictions set out below in Alternative 2 below represent the most simplified version of measures considered by the Council under its suite of alternatives and are intended to provide a reference against which the Council's preferred alternative may be compared.

Catcher vessel groundfish and PSC sideboards

Under Alternative 2, groundfish and PSC sideboards for AFA catcher vessels would be established according to the following formulas.

- **Groundfish sideboards.** BSAI and GOA groundfish sideboards except for BSAI Pacific cod would be set as a percentage of each TAC that is equivalent to the total harvest of each species by the AFA catcher/vessels in 1995-1997 relative to the total amount of each species available for harvest in those years. The BSAI Pacific cod sideboard limit would be set based on 1997 harvests only.

- **PSC sideboards.** Due to lack of historic PSC data for individual AFA catcher vessels, prohibited species sideboards will be based on the ratio of 1995-1997 catch in each non-pollock target relative to the PSC cap for that target.

Under Alternative 2, catcher vessel groundfish and PSC limits would be managed in the aggregate through directed fishing closures in non-pollock target fisheries to prevent AFA catcher vessels from exceeding each sideboard limit. Catcher vessel sideboard amounts would not be further subdivided by sector or cooperative.

Catcher vessel BSAI crab fishery sideboards

Under Alternative 2, AFA catcher vessels would be ineligible to participate in any BSAI crab fishery unless the vessel in question has a valid LLP license and catch history in the crab fishery in question according to the following criteria:

- **Bristol Bay Red King Crab (BBRKC).** A legal landing of any BSAI king or Tanner crab species in 1996, 1997, or on or before February 7, 1998.

- **St. Matthew Island blue king crab.** A legal landing of St. Matthew Island blue king crab in that fishery in 1995, 1996, or 1997.

- **Pribilof Island red and blue king crab.** A legal landing of Pribilof Island blue or red king crab in that fishery in 1995, 1996, or 1997.

- **Aleutian Islands (Adak) brown king crab.** A legal landing of Aleutian Islands brown king crab in each of the 1997/1998 and 1998/1999 fishing seasons.

- **Aleutian Islands (Adak) red king crab.** A legal landing of Aleutian Islands red king crab in each of the 1995/1996 and 1998/1999 fishing seasons.

- **Opilio Tanner crab.** A legal landing of Opilio Tanner crab in each of 4 or more years from 1988 to 1997.

- **Bairdi Tanner crab.** A legal landing of Bairdi Tanner crab in 1995 or 1996.

Alaska scallop fishery sideboard restrictions

AFA catcher vessels would be limited to harvesting in the aggregate a percentage of the annual guideline harvest level (GHL) of scallops equal to AFA catcher vessel scallop harvest in 1997 relative to the upper end of the state-wide guideline harvest level in 1997. The cap would be this percentage applied to the upper end of the state-wide guideline harvest level established each year and implemented by the State of Alaska under the FMP for the Scallop fishery off Alaska.

Groundfish and crab processing sideboards

Paragraphs 211(b)(3) and 211(b)(4) of the AFA contain processing restrictions for listed AFA catcher/processors. In addition, paragraph 211(c)(2) contains crab processing restrictions for AFA inshore processors and motherships that receive pollock from catcher vessel cooperatives. The following processing sideboard limits would give effect to these provisions of the AFA

- **BSAI crab processing by AFA catcher/processors.** Listed AFA catcher/processors would be prohibited from processing any species of crab harvested in the BSAI.

- **BSAI pollock processing by AFA catcher/processors.** Listed AFA catcher/processors would be prohibited from processing any pollock allocated to the inshore or mothership sectors of the BSAI pollock fishery.

- **Gulf pollock and Pacific cod processing by AFA catcher/processors.** Listed AFA catcher/processors would be prohibited from processing any inshore sector Pacific cod or pollock harvested in the GOA.

- **Central GOA groundfish processing by AFA catcher/processors.** Listed AFA catcher/processors would be prohibited from processing any groundfish harvested in area 630 of the GOA.

- **BSAI crab processing by AFA inshore or mothership entities.** Each entity that owns or controls 10 percent or more of any AFA mothership or AFA inshore processor that processes pollock harvested by a fishery cooperative would receive a crab processing cap for each BSAI king and Tanner crab species. Each entity's crab processing cap would be a percentage of the pre-season guideline harvest level for each species that is equal to the percentage of each BSAI crab species that such entity processed in 1995-1997 relative to the total amount of crab processed during those years.

2.3.4 Observer coverage, catch weighing, and monitoring requirements under Alternative 2

Paragraph 211(b)(6) of the AFA sets out minimum requirements for observers and catch-weighing on listed AFA catcher/processors but defers to NMFS and the Council to develop monitoring requirements for the other sectors of the BSAI pollock fleet. However, successful implementation of individual co-op quotas and the sideboard measures required by the AFA necessitate an increased level of monitoring and recordkeeping and reporting relative to the no-action alternative. At a minimum, two observers and scales capable of weighing total catch are necessary on catcher/processors and motherships to allow NMFS to monitor and manage the fisheries using total catch information rather than back-calculated product information. Two observers are also necessary at AFA inshore processors to provide 24 hour coverage and monitoring of inshore co-op landings. In addition, management of the AFA system of multiple inshore pollock quotas and catcher vessel sideboards requires an electronic shoreside reporting system that provides vessel-by-vessel landings information on a daily basis. Alternative 2 would implement the following monitoring, recordkeeping, and reporting requirements.

Monitoring requirements for catcher/processors and motherships

Observer requirements for listed AFA catcher/processors and motherships. Listed AFA catcher processors and motherships would be required to carry two NMFS-certified observers at all times that groundfish is harvested or processed.

Scale requirements for listed AFA catcher/processors and motherships. Listed AFA catcher/processors and motherships would be required to maintain NMFS approved scales and sampling stations on board the vessel and weigh all groundfish harvested or received in accordance with existing regulations for scale use in the CDQ fisheries.

Observer and scale requirements for unlisted AFA catcher/processors. Unlisted AFA catcher/processors that qualify under paragraph 208(e)(21) of the AFA would be required to meet the above observer and scale requirements when engaged in directed fishing for pollock only. Because catcher/processor sideboards do not apply to unlisted catcher/processors, an increased level of monitoring is not required for such vessels in non-pollock fisheries.

Monitoring requirements for AFA inshore processors

Observer requirements for AFA inshore processors. AFA inshore processors would be required to have one NMFS-certified observer for each 12 consecutive hour period that pollock harvested in the BSAI is received and processed. This means an AFA processor operating more than 12 hours per day would be required to have two observers. However, a processor that receives or processes BSAI pollock for less than 12 consecutive hours in a day would only be required to have one observer for each such day.

Reporting requirements for AFA inshore processors. All inshore processors (including non-AFA processors) that receive groundfish from AFA catcher boats would be required to report all groundfish landings to NMFS daily using electronic reporting software approved by NMFS.

Monitoring requirements for AFA catcher vessels

Under Alternative 2, no additional monitoring, recordkeeping, or reporting requirements would be imposed in AFA catcher vessels. Existing observer coverage and logbook requirements applicable to all vessels harvesting groundfish in the BSAI and GOA would continue to apply to AFA catcher vessels.

Monitoring requirements for AFA inshore cooperatives

Under Alternative 2, Inshore cooperatives would be required to report their BSAI pollock landings to NMFS on a weekly basis using an electronic reporting system approved by NMFS. No additional observer or catch measurement requirements would be imposed on inshore processors.

2.4 Alternative 3: (preferred) Proposed Amendments 61/61/13/8

The theme of Alternative 3 is to foster the development of pollock harvesting cooperatives and encourage the formation of inter-cooperative agreements that would be responsible for controlling fishing for pollock and sideboard species at the individual co-op and vessel level.

Alternative 3 would implement the provisions of the AFA with a series of modifications and additions recommended by the Council and NMFS under Amendments 61/61/13/8. Alternative 3 would provide a co-management approach to AFA implementation under which NMFS would manage pollock quotas at the sector level and manage catcher vessel and catcher/processor sideboards as fleet-wide aggregates. Cooperatives would be responsible for managing fishing activities at the co-op and individual vessel level. Alternative 3 contains all of the AFA elements set out in Alternative 2 (AFA baseline) with additional measures and modifications recommended by the Council under Amendments 61/61/13/8. In addition to the measures set out in Alternative 2, Alternative 3 contains the following modifications and additions to Alternative 2 (AFA baseline).

2.4.1 Limited access and sector allocations under Alternative 3

Under Alternative 3, the definitions of sectors and eligible participants in each sector are the same as under Alternative 2 (AFA baseline). These sector definitions and eligible participants are derived from sections 206 and 208 of the AFA and are not subject to modification by NMFS or the Council.

In addition, the allocations of the BSAI pollock TAC to each sector under Alternative 3 are the same as Alternative 2 (AFA baseline). These allocations are based on section 206 of the AFA which is not subject to modification by NMFS or the Council.

2.4.2 Fishery cooperatives under Alternative 3

Alternative 3 would authorize fishery cooperatives in the BSAI pollock fishery in the same manner as Alternative 2 (AFA baseline) except for the following changes to the structural requirements for inshore catcher vessel cooperatives and formula for allocating pollock to inshore cooperatives. Subsection 213(c) of the AFA authorizes the Council to recommend conservation and management measures that supersede the provisions of the AFA except for sections 206 (sector allocations) and 208 (authorized vessels and processors). Under Amendments 61/61/13/8 and using the authority provided in subsection 213(c), the Council recommended the following changes to the structure of inshore catcher vessel cooperatives set out in the AFA and reflected in the Alternative 2 (AFA baseline alternative).

Supersede AFA definition of "qualified catcher vessel" to allow vessel retirement

Under Alternative 2, the definition of "qualified catcher vessel" set out in paragraph 210(a)(3) of the AFA would be superseded to allow inactive or retired AFA catcher vessels to maintain membership in inshore cooperatives without making qualifying landings in the year prior to the year in which the cooperative will be in effect. The definition of qualified catcher vessel would be changed to allow an inactive catcher vessel to maintain membership in the cooperative associated with the inshore processor to which the vessel delivered the majority of its pollock during the last year in which it made landings of pollock in the BSAI inshore directed pollock fishery. This purpose of this change is to allow industry to retire capacity from the BSAI pollock fishery without affecting the pollock quota shares issued to each inshore cooperative.

Supersede AFA formula for allocating pollock to inshore cooperatives.

Under Alternative 3, three changes would be made to the formula used to allocate pollock to each inshore catcher vessel cooperative:

1. Each AFA inshore catcher vessel's best 2 of 3 years from 1995-1997 would be used to calculate co-op allocations rather than the 3-year formula contained in the AFA and Alternative 2,

2. Inshore catcher vessels with more than 499 mt of landings to offshore processors other than the three listed AFA motherships would have such offshore pollock landings included in their 1995-1997 inshore catch histories.

3. 1995-1997 inshore landings by non-AFA inshore qualified vessels would be excluded from the formula used to determine the allocation to each inshore cooperative and the open access fishery. This is in contrast to the formula set out in the AFA and reflected in Alternative 2 under which such landings by non-AFA vessels are included in the open access fishery allocation by default.

Approach to managing inshore cooperative pollock allocations.

Under Alternative 3, NMFS will issue annual allocations of pollock to each inshore cooperative that are not subdivided by area and season. Instead, aggregate area and season apportionments will be managed by NMFS for the inshore co-op sector as a whole. This approach is designed to provide maximum flexibility to inshore cooperatives to govern fishing activities. However, successful implementation of Alternative 3 will require an inter-cooperative agreement to govern the amount of pollock each cooperative harvests by area and season. Otherwise, individual cooperatives could find themselves in a race for fish during the roe season when pollock are most valuable. Alternative 3 is designed to provide industry with the greatest degree of flexibility to administer inter-cooperative exchanges of pollock by area and season provided that sector limits are not exceeded. For example, under Alternative 3, two cooperatives could enter into an agreement under which one cooperative would be free to harvest its entire annual allocation during the A/B seasons while the second cooperative would be free to harvest its entire annual allocation during the C/D season. There would be no limits on such season and area quota exchanges provided that sector-wide season and area limits are not exceeded and each inshore cooperative does not exceed its annual pollock allocation.

2.4.3 Sideboard protections for other fisheries under Alternative 3

In addition to the harvesting and processing sideboards set out in the AFA and reflected in Alternative 2, Alternative 3 would contain the following changes, additional measures, and exemptions.

Catcher/processor harvest sideboards

- **Retained catch formula for calculating sideboards**. Under Alternative 3, harvest sideboards or listed AFA catcher/processors would be calculated based on the 1995-1997 retained catch of each BSAI groundfish species (other than Atka mackerel) by the 20 listed AFA catcher vessels and the nine catcher/processors bought out under the AFA. This is a change from the formula set out in the AFA and reflected in Alternative 2 under which total catch rather than retained catch would be used to calculate catcher/processor sideboards. Under Alternative 3, the listed AFA catcher/processor fleet would not receive sideboard credit for groundfish that was discarded by the 20 listed AFA catcher/processors and the nine ineligible vessels.

Catcher vessel harvest sideboards

- **Catcher vessel sideboard exemptions.** Alternative 3 contains the same suite of catcher vessel sideboard measures set out in Alternative 1 except that under Amendments 61/61/13/8 the Council has recommended a series of sideboard exemptions for AFA catcher vessels that have relatively low history of fishing in the BSAI pollock fishery and extensive history of fishing in other fisheries during the same period. These exemptions are reflected in Alternative 2 as follows:

- **BSAI Pacific cod sideboard exemption.** AFA catcher vessels less than or equal to 125 ft LOA that averaged less than 1,700 mt of BSAI pollock landings from 1995-1997 and that made 30 or more landings in the BSAI directed fishery for Pacific cod from 1995-1997 would be exempt from BSAI Pacific cod sideboards.

- **Mothership-sector BSAI Pacific cod sideboard exemption.** AFA catcher vessels with mothership sector endorsements would be exempt from BSAI Pacific cod sideboards after March 15 of each year.

- **GOA Groundfish sideboard exemption.** AFA catcher vessels less than or equal to 125 ft LOA that averaged less than 1,700 mt of BSAI pollock landings from 1995-1997 and that made 30 or more landings groundfish in the GOA from 1995-1997 would be exempt from GOA groundfish sideboards.

- **BSAI crab sideboard exemption.** AFA catcher vessels that participated in every bairdi, opilio and Bristol Bay red king crab fishery from 1991 through 1997 would be exempt from BSAI crab sideboard measures.

Catcher vessel groundfish and PSC sideboard management approach

Inter-coop sideboard management responsibilities. Under Alternative 3, the aggregate sideboard management program contained in Alternative 2 would be supplemented with a requirement that each catcher vessel cooperative contract contain penalties to prevent each non-exempt member catcher vessel from exceeding an individual vessel sideboard limit for each BSAI or GOA groundfish sideboard species or species group that is issued to the vessel by the cooperative in accordance with the following formula:

1. The aggregate individual vessel sideboard limits issued to all member vessels in a cooperative must not exceed the aggregate contributions of each member vessel towards the overall groundfish sideboard amount as calculated by NMFS, or

2. In the case of two more cooperatives that have entered into an inter-cooperative agreement, the aggregate individual vessel sideboard limits issued to all member vessels subject to the inter-cooperative agreement must not exceed the aggregate contributions of each member vessel towards the overall groundfish amount as calculated by NMFS.

Each catcher vessel cooperative would be responsible for managing the fishing of each non-exempt member vessel in each sideboard fishery using data provided by NMFS including groundfish landings data for each member catcher vessel, aggregate discard data for the catcher vessel fleet as a whole, and aggregate PSC rates for the catcher vessel fleet as a whole.

NMFS sideboard management responsibilities. Under Alternative 3, NMFS would continue to management aggregate groundfish and PSC sideboards through directed fishing closures in coordination with catcher vessel co-op managers. NMFS would not issue sideboard closures to individual cooperatives, relying instead on co-op managers to restrict sideboard fishing by non-exempt vessels at the co-op level.

2.4.4 Observer coverage, catch weighing, and monitoring requirements under Alternative 3

Under Alternative 3, the complete suite of catch measurement and monitoring requirements set out in Alternative 2 would be implemented with the following additional monitoring measures that are specific to Alternative 3.

Vessel Monitoring System requirement for all AFA vessels harvesting pollock in the BSAI

Under Alternative 3, all AFA catcher vessels and catcher/processors that engage in directed fishing for pollock in the BSAI would be required to install and operate a NMFS-approved vessel monitoring system (VMS). The mandatory use of VMS in the pollock fishery is necessary under Alternative 3 to provide more precise information on fishing location for both observed and unobserved pollock fishing vessels. Precise position information is necessary so that cooperatives may manage their fishing inside and outside of the Steller sea lion conservation area (SCA) regardless of whether an observer is on board the vessel. Without an observer on board, or VMS, NMFS Steller sea lion protection regulations require that all catch on unobserved catcher vessels be considered as having been taken inside the SCA anytime the SCA is open to directed fishing for pollock. The deployment of VMS aboard observed catcher vessels and catcher/processors provides additional management benefits in that the VMS position becomes the authoritative record of vessel location and will resolve conflicts that occur when locations reported by observers and vessels do not match. In addition, VMS will provide a more effective tool for enforcing closed areas under co-op fishing.

Inshore processor catch weighing

Under Alternative 3, NMFS would implement catch weighing standards for AFA inshore processors that address three areas related to catch measurement and monitoring: plant layout and operation, observer facilities and equipment, and scale testing. Under Alternative 3, each AFA inshore processor would be required to develop a catch measurement and monitoring plan that meets the following performance standards:

- NMFS must be able to verify that all catch is sorted, weighed, and reported by species.
- All scales used to weigh groundfish species must be approved by the State of Alaska, meet minimum standards for accuracy, and must produce paper printouts of scale weights that would be retained by the plant for use by observers and for auditing and verification by other NMFS personnel.
- Each plant must develop scale testing and calibration procedures and scales must be tested upon request by NMFS-authorized personnel.
- An observer work station must be provided that contains: A platform scale with at least 50 kg capacity, a work table of at least 2 square meters, at least 4.5 square meters of floor space, is free of safety hazards, has adequate lighting, and has a secure cabinet for the observer's use.
- Each plant must have observation area where an observer can see the entire flow of fish, or otherwise ensure that no unobserved removals of catch can occur, between the catcher vessel and the location where all sorting has taken place and each species has been weighed.

The catch monitoring plans would be reviewed by NMFS. Plans that met the standards would be approved. After plan approval, the plant would make any required alterations to the factory and purchase all necessary scales, printers, test weights and other equipment. The plant would then be inspected to ensure that the design met the performance standards.

Each scale used to weigh catch would have to be approved annually by the State of Alaska, Division of Measurement Standards. Additionally, the plant would be required to submit a scale testing plan that would list the procedures the plant would use to test each scale used to weigh catch. The plan would:

- Describe the procedure for testing the accuracy of each scale throughout its range of use;
- List the test weights and equipment needed to test each scale;
- Describe where the test weights and equipment will be stored;
- List the plant personnel responsible for conducting the test;
- Be posted in a prominent location in the scale house or observer sampling station.

With no less than an hour's notice, NMFS staff, or NMFS-authorized personnel could demand that any scale used to weigh catch be tested by plant personnel at any time, provided that scale had not been tested and found to accurate within the last 24 hours. Any scale tested would be required to meet the tolerances specified in NIST (National Institute of Science and Technology) Handbook 44. Any scale outside of those tolerances could not be used until repaired, recalibrated, or re-approved by the State of Alaska, Division of Measurement Standards.

Finally, each plant would be required to maintain a printed record of the total weight of each delivery. If catch is weighed before sorting, only the automatic hopper scale would need to be equipped with a printer. If catch was sorted before weighing, each scale used to weigh catch components would have to be equipped with a printer.

2.5 Alternative 4: Emphasis on autonomy for individual co-ops

The theme of Alternative 4 is to provide maximum autonomy to each individual co-ops to manage pollock and sideboard fishing activity at the co-op level.

Alternative 4 would implement the required provisions of the AFA as set out in Alternative 2 with a series of modifications and additions considered by the Council during the development of Amendments 61/61/13/8 that would allocate pollock to each co-op by season and area, and sub-allocate each groundfish and PSC sideboard species to each cooperative. The theme of this alternative is to provide maximum autonomy to each individual cooperative to manage fishing activity in the directed pollock fishery and sideboard fisheries.

2.5.1 Limited access and sector allocations under Alternative 4

Under Alternative 4, the definitions of sectors and eligible participants in each sector are the same as under Alternative 2 (AFA baseline). These sector definitions and eligible participants are derived from sections 206 and 208 of the AFA and are not subject to modification by NMFS or the Council.

In addition, the allocations of the BSAI pollock TAC to each sector under Alternative 4 are the same as Alternative 2 (AFA baseline). These allocations are based on section 206 of the AFA which is not subject to modification by NMFS or the Council.

2.5.2 Fishery cooperatives under Alternative 4

Alternative 4 would authorize fishery cooperatives in the BSAI pollock fishery in the same manner as Alternative 3 (preferred) except that Alternative 4 would implement an inshore pollock quota management regime similar to that currently in effect for the CDQ and halibut/sablefish IFQ programs. Under Alternative 4, NMFS would apportion each inshore co-op's pollock allocation by area and season. This is in contrast to Alternative 3 (preferred) under which season and area allocations of pollock are governed by an inter-cooperative agreement rather than seasonal allocation from NMFS. The different management approaches presented in Alternatives 3 and 4 represent a tradeoff between management flexibility and autonomy. Under Alternative 4, each inshore cooperative would receive an individual allocation of pollock by season and area making an inter-cooperative agreement unnecessary. However, transfers of quota between cooperatives by area and season would not be allowed and "rollovers" of unharvested fish from one season to the next would not be accommodated due to the need for NMFS to assure that sector-wide Steller sea lion management measures are achieved. Under Alternative, 4, NMFS would not manage the inshore cooperative sector through inseason closures. Rather, each cooperative would be individually responsible for staying within its season and area apportionments of the pollock TAC. NMFS would simply monitor landings by each cooperative and take appropriate post-season enforcement action against any cooperative that exceeded a season or area quota. While Alternative 4 provides the greatest degree of autonomy to each individual cooperative, it provides considerably less management flexibility to the inshore sector industry as a whole relative to Alternative 3.

2.5.3 Sideboard protections for other fisheries under Alternative 3

The most significant characteristics of Alternative 4 have to do with how sideboards are allocated and managed. Under Alternative 4, sub-allocations of each groundfish sideboard amount would be issued to each catcher/processor, mothership, and inshore cooperative and each cooperative would be individually responsible for insuring that its member vessels do not exceed any sideboard amount.

Catcher/processor sideboards

Under Alternative 4, catcher/processor BSAI groundfish and PSC sideboard amounts would be calculated based on the 1995-1997 total catch of each groundfish and PSC species by the 20+9 listed AFA vessels in all groundfish fisheries including the pollock fishery (with the exception of Atka mackerel which has percentages set in the AFA). This formula is different from Alternative 2 (AFA baseline) which sets sideboard amounts based on total catch of groundfish in non-pollock targets only. This difference is important and necessary because sideboards would be managed differently under Alternative 4. Under Alternatives 2 and 3, NMFS has the responsibility to manage sideboard fishing through directed fishing closures of sideboard fisheries. Under Alternative 4, NMFS would make no such directed fishing closures. The cooperatives operating in the catcher/processor sector would be responsible for managing their own pollock and sideboard fishing to prevent any sideboard cap from being exceeded as a result of directed fishing activities or incidental catch in the pollock fishery. The catcher/processor cooperative would be prohibited from exceeding any sideboard amount and would need to carefully manage its fishing activity because NMFS would not play an active role in sideboard management through traditional directed fishing closures. Rather, NMFS would simply monitor landings by the cooperative and take appropriate post-season enforcement action against the catcher/processor cooperative if it exceeded any sideboard limit regardless of circumstances. NMFS would reserve the right to close all fishing (including pollock fishing) by listed AFA catcher/processors for the remainder of a fishing year should the cooperative fail to manage its fishing activity under the sideboard amounts. Under this alternative, the catcher/processor cooperative would be granted the greatest degree of autonomy to manage its sideboard fishing activities but would also risk drastic action by NMFS to close all fishing activity for the remainder of a fishing year should the cooperative fail to operate within its sideboard limits.

Catcher vessel sideboards

Calculation of groundfish and PSC sideboard amounts. Under Alternative 4, catcher vessel groundfish and PSC sideboards amounts would be would be calculated using the formula set out in Alternative 2 except that NMFS would increase each groundfish sideboard amount to account for estimated discards during the 1995-1997 basis years. Because catcher vessel discard data is not available on a vessel-by-vessel basis, NMFS would generate fleet-wide discard rates for each sideboard fishery and species and apply these assumed rates to the catcher vessel sideboard amounts. Each catcher/processor-sector, mothership-sector, and inshore-sector catcher vessel cooperative would then receive individual allocations of each sideboard amount based on the individual catch histories of each member vessel.

Groundfish and PSC sideboard exemptions. Under Alternative 4, no catcher vessels would be exempt from groundfish or PSC sideboards. Each cooperative would be issued a sideboard amounts based on the fishing history of all of the vessels in the cooperative and each cooperative would be responsible for managing the sideboard fishing activities of each member vessel. Sideboard exemptions are less necessary because each individual cooperative has the opportunity to insure that member vessels are able to participate in sideboard fisheries to the extent that they did so historically.

Management of groundfish and PSC sideboards. Under Alternative 4, each catcher vessel cooperative would be responsible for managing its pollock and sideboard fishing to prevent member vessels from exceeding any sideboard amount. Each cooperative would be prohibited from exceeding any sideboard amount and would need to carefully manage its fishing activity because NMFS would not play an active role in sideboard management through traditional directed fishing closures. Rather, NMFS would simply monitor landings by each cooperative and take appropriate post-season enforcement action against any cooperative that exceeded any sideboard limit regardless of circumstances. NMFS would reserve the right to close all fishing (including pollock fishing) by vessels in a cooperative for the remainder of a fishing year should the cooperative fail to manage its fishing activity under the sideboard amounts.

Under this alternative, each catcher vessel cooperative would be granted the greatest degree of autonomy to manage its sideboard fishing activities but would also risk drastic action by NMFS to close all fishing activity for the remainder of a fishing year should the cooperative fail to operate within its sideboard limits. Under Alternative 4, an inter-cooperative agreement would not be needed to govern sideboard fishing by individual cooperatives. However, the management flexibility provided under Alternative 3 would not be available under Alternative 4 meaning that transfers of sideboard amounts between cooperatives would not be allowed.

2.5.4 Observer coverage, catch weighing, and monitoring requirements under Alternative 4

Alternative 4 requires a substantially greater degree of monitoring on board AFA catcher vessels compared to the other alternatives due to the subdivision of each groundfish and PSC sideboard amount at the co-op level. Under Alternative 4, NMFS may no longer use fleet-wide observer estimates of discards and PSC bycatch to monitor individual co-op sideboard allocations. Consequently, increased catcher vessel observer coverage and increased retention requirements are necessary. Alternative 4 contains the complete suite of monitoring, recordkeeping, and enforcement requirements set out in Alternative 3 with the following additional changes:

Catcher vessel observer requirements

Under Alternative 4, all AFA catcher vessels would be required to have 100 percent observer coverage when fishing for any groundfish species in the BSAI or GOA. This increased observer coverage is necessary to monitor sideboard harvests by individual cooperatives. The existing mix of 100 percent and 30 percent coverage under the status quo is designed to generate fleet-wide harvest estimates and is inadequate to monitor groundfish and PSC harvests at the cooperative level.

Catch weighing requirement for catcher vessels

Under Alternative 4, all groundfish harvested by AFA catcher vessels must be weighted on NMFS or State-approved scales. Catcher vessels would have two options to meet this requirement: (1) All groundfish could be retained on board the vessel and weighed at the processing plant on scales approved by the State of Alaska, or (2) catcher vessels could install NMFS-approved scales and weigh all groundfish bycatch prior to discarding.

2.6 Alternative 5: Independent catcher vessel proposal

The theme of Alternative 5 is to increase market flexibility for operators of catcher vessels

Alternative 5 is very similar to the preferred Alternative 3 with one significant change to the inshore co-op program to allow inshore catcher vessels to change cooperatives from year to year without spending a year fishing in the open access sector of the inshore fishery. The theme of Alternative 5 is to increase the market flexibility for independent catcher vessels. At its June 2000 meeting, the Council considered whether to adopt Alternative 5 (then known as the "Dooley Hall" proposal) as its preferred alternative and voted to postpone action on the proposal until such time that adverse impacts to catcher vessels could be demonstrated under the preferred alternative (Alternative 3).

The differences between the preferred Alternative 3 and Alternative 5 are outlined below:

Elimination of inshore cooperative definition of "qualified catcher vessel." Under Alternative 5, the AFA definition of "qualified catcher vessel" would be eliminated. Under the existing language of the AFA, catcher vessels are only "qualified" to join the cooperative that is associated with the processor to which the vessel delivered the majority of its pollock in the previous year. This definition prevents inshore catcher vessels from having any flexibility in their markets from year to year. Eliminating the definition of "qualified catcher vessel" would allow catcher vessel owners to join the cooperative of their choice on an annual basis.

Elimination of 80 percent threshold for formation of inshore cooperatives. Under Alternative 5, the AFA requirement that 80 percent of the qualified catcher vessels join an inshore cooperative before being authorized by NMFS would be eliminated. This change would be necessary with the elimination of the definition of "qualified catcher vessel"

2.7 Comparison of the five alternatives

Tables 2.7.1 through 2.7.4 show a side-by-side comparison of how each of the four primary components of the management regime would be implemented under each alternative.

Table 2.7.1 Comparison of the five alternatives with respect to component 1: Limited access and sector allocations.

Management Issue	***Alternative 1 (No Action)***	***Alternative 2 (AFA baseline)***	***Alternative 3 (Preferred)***	***Alternative 4 (Co-op autonomy)***	***Alternative 5 (Independent catcher vessel proposal)***
Organizing theme	*Open access"race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes.*	*Foster development of co-ops and inter-coop agreements with NMFS- industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels*
Industry sector definitions	Three sectors CDQ Inshore Offshore (C/P & MS)	Four sectors CDQ Inshore Catcher/processor Mothership	Four sectors CDQ Inshore Catcher/processor Mothership	Four sectors CDQ Inshore Catcher/processor Mothership	Four sectors CDQ Inshore Catcher/processor Mothership
Eligible participants in each sector	Vessels. Limited by existing LLP program Inshore and MS processors. No limits on entry	Vessels and processors are eligible by virtue of being listed by name in the AFA or meeting qualifying criteria specified in AFA	Vessels and processors are eligible by virtue of being listed by name in the AFA or meeting qualifying criteria specified in AFA	Vessels and processors are eligible by virtue of being listed by name in the AFA or meeting qualifying criteria specified in AFA	Vessels and processors are eligible by virtue of being listed by name in the AFA or meeting qualifying criteria specified in AFA
Sector Allocations	7.5 percent CDQ (with remainder split) 35 percent inshore 65 percent offshore	10 percent CDQ 5 percent ICA (with remainder split) 50 percent inshore 40 percent to C/Ps 10 percent to motherships	10 percent CDQ 3 percent ICA for non-AFA vessels only (with remainder split) 50 percent inshore 40 percent to C/Ps 10 percent to motherships	10 percent CDQ 3 percent ICA for non-AFA vessels only (with remainder split) 50 percent inshore 40 percent to C/Ps 10 percent to motherships	10 percent CDQ 3 percent ICA for non-AFA vessels only (with remainder split) 50 percent inshore 40 percent to C/Ps 10 percent to motherships

Table 2.7.2 Comparison of the five alternatives with respect to component 2–cooperatives.

Management Issue	***Alternative 1 (No Action)***	***Alternative 2 (AFA baseline)***	***Alternative 3 (Preferred)***	***Alternative 4 (Co-op autonomy)***	***Alternative 5 (Independent catcher vessel proposal)***
Organizing theme	*Open access"race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes.*	*Foster development of co-ops and inter-coop agreements with NMFS- industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels*
Formula for determining inshore co-op allocations	n/a	95-97 pollock catch divided by 95-97 total inshore catch	95-97 best 2 out of 3 years divided by aggregate best 2 of 3 years for all inshore AFA CVs	95-97 best 2 out of 3 years divided by aggregate best 2 of 3 years for all inshore AFA CVs	95-97 best 2 out of 3 years divided by aggregate best 2 of 3 years for all inshore AFA CVs
Inshore co-op compensation for offshore landings	n/a	no	yes	yes	yes
Retired inshore CVs allowed to maintain co-op membership?	n/a	no	yes	yes	yes
Active inshore CVs allowed to change co-ops without spending a year in open access?	n/a	no	no	no	yes

Table 2.7.3 Comparison of the five alternatives with respect to component 3–sideboards.

Management Issue	***Alternative 1 (No Action)***	***Alternative 2 (AFA baseline)***	***Alternative 3 (Preferred)***	***Alternative 4 (Co-op autonomy)***	***Alternative 5 (Independent catcher vessel proposal)***
Organizing theme	*Open access"race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes.*	*Foster development of co-ops and inter-coop agreements with NMFS- industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels*
Formula for setting BSAI C/P harvest sideboards	n/a	Based on 95-97 total groundfish catch of 20+9 listed vessels in non-pollock target fisheries. Fixed percentages for Atka mackerel	Based on 95-97 retained groundfish catch of 20+9 listed vessels in all directed fisheries. Fixed percentages for Atka mackerel	95-97 total catch of 20+9 listed vessels in all directed fisheries. Fixed percentages for Atka mackerel	95-97 retained catch of 20+9 listed vessels in all directed fisheries. Fixed percentages for Atka mackerel
Formula for setting BSAI C/P PSC sideboards	n/a	based on 1995-1997 PSC bycatch of 20+9 vessels in non-pollock fisheries	based on 1995-1997 PSC bycatch of 20+9 vessels in non-pollock fisheries	based on 1995-1997 PSC bycatch of 20+9 vessels in non-pollock fisheries	based on 1995-1997 PSC bycatch of 20+9 vessels in non-pollock fisheries
Management of BSAI C/P groundfish and PSC harvest sideboards	n/a	NMFS-managed directed fishing closures	NMFS-managed directed fishing closures	Hard quotas managed by fleet	NMFS-managed directed fishing closures
Formula for setting CV groundfish sideboards for BSAI and GOA	n/a	Aggregate limit based on 95-97 landings by all AFA CVs except BSAI P.cod which is 1997 landings only.	Aggregate limit based on 95-97 landings by non-exempt AFA CVs except BSAI P.cod which is 1997 landings only.	Individual co-op limit based on 95-97 landings by member CVs adjusted upwards to include 95-97 estimated discards.	Aggregate limit based on 95-97 landings by non-exempt AFA CVs except BSAI P.cod which is 1997 landings only.
Formula for setting CV PSC sideboards for BSAI and GOA	n/a	Aggregate PSC limits based on the ratio of AFA CV catch in each non-pollock target to the PSC cap for that target.	Aggregate PSC limits based on the ratio of AFA CV catch in each non-pollock target to the PSC cap for that target.	Individual co-op PSC limits based on the ratio of member vessel's catch in each non-pollock target to the PSC cap for that target.	Aggregate PSC limits based on the ratio of AFA CV catch in each non-pollock target to the PSC cap for that target.

Table 2.7.3 Comparison of the five alternatives with respect to component 3–sideboards (cont.).

Management Issue	*Alternative 1 (No Action)*	*Alternative 2 (AFA baseline)*	*Alternative 3 (Preferred)*	*Alternative 4 (Co-op autonomy)*	*Alternative 5 (Independent catcher vessel proposal)*
Organizing theme	*Open access"race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes.*	*Foster development of co-ops and inter-coop agreements with NMFS- industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels*
Management of BSAI and GOA CV groundfish and PSC sideboards	n/a	NMFS-managed directed fishing closures.	NMFS-managed directed fishing closures.	Hard quotas managed by each individual co-op. Co-ops are prohibited from exceeding any groundfish or PSC sideboard amount.	NMFS-managed directed fishing closures.
CV sideboard exemptions?	n/a	no	Exemptions for certain vessels with significant histories in BSAI crab, BSAI P.cod and GOA groundfish	no	Exemptions for certain vessels with significant histories in BSAI crab, BSAI P.cod and GOA groundfish
CV crab sideboards	n/a	Permit endorsements for vessels with histories in a BSAI crab fishery.	Permit endorsements for vessels with histories in a BSAI crab fishery plus aggregate caps for BBRKC and Bairdi.	Permit endorsements for vessels with histories in a BSAI crab fishery plus aggregate caps for BBRKC and Bairdi.	Permit endorsements for vessels with histories in a BSAI crab fishery plus aggregate caps for BBRKC and Bairdi.
Crab processing sideboards	n/a	Entity-by-entity cap based on 1995-1997 crab processing history by AFA entities	Entity-by-entity cap based on 1995-1998 crab processing history by AFA entities with 1998 given double-weight.	Entity-by-entity cap based on 1995-1997 crab processing history by AFA entities	Entity-by-entity cap based on 1995-1997 crab processing history by AFA entities
Pollock excessive harvesting share limits	n/a	17.5 percent	17.5 percent	17.5 percent	17.5 percent
Pollock excessive processing share limits	n/a	17.5 percent	30 percent	30 percent	30 percent

Table 2.7.4 Comparison of the five alternatives with respect to component 4–catch measurement and monitoring.

Management Issue	***Alternative 1 (No Action)***	***Alternative 2 (AFA baseline)***	***Alternative 3 (Preferred)***	***Alternative 4 (Co-op autonomy)***	***Alternative 5 (Independent catcher vessel proposal)***
Organizing theme	*Open access"race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes.*	*Foster development of co-ops and inter-coop agreements with NMFS- industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels*
C/P & mothership scales and sampling station requirements	none	NMFS-approved scales and sampling station	NMFS-approved scales and sampling station	NMFS-approved scales and sampling station	NMFS-approved scales and sampling station
CV observer coverage	status quo based on vessel length	status quo based on vessel length	status quo based on vessel length	100 percent observer coverage for all AFA CVs	status quo based on vessel length
CV scales and/or retention requirements	no scale requirement for CVS but full retention of pollock & cod	no scale requirement for CVS but full retention of pollock & cod	no scale requirement for CVS but full retention of pollock & cod	must either weigh all groundfish at sea using NMFS-approved scales or retain all groundfish for weighing by processor	no scale requirement for CVS but full retention of pollock & cod
VMS requirement for AFA pollock vessels	no	no	yes	yes	yes
Inshore processor observer requirements	One NMFS-certified observer	One NMFS-certified observer	Two NMFS-certified observers	Two NMFS-certified observers	Two NMFS-certified observers
Inshore processor scale and sampling station requirements	none	none	Must meet minimum design and performance standards for scales and plant layout	Must meet minimum design and performance standards for scales and plant layout	Must meet minimum design and performance standards for scales and plant layout

2.8 Alternatives eliminated from detailed study

Over the past decade numerous proposals have surfaced during the Council process that were intended to address the allocation of pollock in the BSAI and comprehensive rationalization of the pollock fleet. Alternatives to the AFA that were eliminated from detailed study because they fall outside the scope of Amendments 61/61/13/8 include the following:

Individual fishing quota (IFQ) program for the BSAI pollock fishery. One possible alternative to the co-op based management regime authorized by the AFA would be an IFQ program for the BSAI pollock fishery. While the inshore co-op program authorized by the AFA does contain many characteristics of an IFQ program and, in fact, meets the strict definition of an IFQ program contained in the Magnuson-Stevens Act. It is not a traditional IFQ program in which individual vessel owners are issued individual transferrable quotas. The development and submission of a traditional IFQ program for the BSAI pollock fishery in place of Amendments 61/61/13/8 would be in direct violation of the AFA which authorizes allocations of BSAI pollock to fishery cooperatives rather than individual vessel owners. And, such a program would be in violation of the moratorium on the submission of IFQ programs set out at section 303(d) of the Magnuson-Stevens Act. While a traditional IFQ program could have been developed in the analysis as an alternative to the management program proposed under Amendments 61/61/13/8, such an alternative would be immensely complex to construct in detail and was determined to be beyond the scope of Amendments 61/61/13/8.

Inshore/offshore 3 allocation scheme. In June 1998 prior to the passage of the AFA, the Council developed and adopted Amendments 51/51 (inshore/offshore 3) which were submitted to the Secretary for approval on September 4, 1998 just a month prior to the passage of the AFA. Amendment 51 to the BSAI groundfish FMP would have allocated the BSAI pollock TAC 61 percent to the offshore sector (composed of catcher/processors and motherships) and 39 percent to the inshore sector. Amendment 51 to the GOA groundfish FMP also allocated the GOA pollock TAC 100 percent to the inshore sector and the GOA Pacific cod TAC 90 percent to the inshore sector and 10 percent to the offshore sector. In November 1998, the Council recommended that NMFS disapprove Amendment 51 to the BSAI because it was inconsistent with the new statutory requirements of the AFA and Amendment 51 to the BSAI groundfish FMP was subsequently disapproved by NMFS with the consent of the Council given the new statutory mandates of the AFA. However, Amendment 51 to the GOA FMP was approved by NMFS and continues to govern allocations of pollock and Pacific cod in the GOA. One alternative to the AFA-based alternatives presented in the EIS would be the implementation of the 61/39 allocation scheme proposed under Amendments 51/51. However, this alternative was eliminated from detailed analysis because it would be inconsistent with the statutory requirements of the AFA. In addition, the environmental, economic, and socioeconomic consequences of Amendments 51/51 were analyzed in detail along with a wide range of alternative allocation schemes in the EA/RIR/IRFA prepared for Amendments 51/51 (NPFMC 1999e). Interested readers are directed to that analysis for a thorough treatment of alternative allocation schemes.

Alternatives for cooperative-based management regimes in other fisheries. Many participants in other groundfish and crab fisheries off Alaska have begun to examine the possibility of cooperative-based management regimes in their fisheries as well. Specifically, participants in the BSAI crab fisheries, GOA groundfish fisheries, and BSAI Pacific cod longline fisheries have began to examine options for cooperatives in their fisheries. However, these efforts fall outside the scope of the AFA. Both NMFS and the Council believe it is both beyond the scope of Amendments 61/61/13/8 and premature to propose alternatives that would establish cooperative management regimes for other fisheries off Alaska. Rather, such proposals are better addressed through separate analyses and amendment proposals. Committees have already formed to examine and develop such proposals for the BSAI crab and GOA groundfish fisheries and it is not the purpose of this analysis to pre-determine what a cooperative-based management regime should look like for the BSAI crab and GOA groundfish fisheries in advance of this public process. Consequently, alternatives that would develop cooperative-based management regimes for other fisheries off Alaska were eliminated from further study in this EIS.

2.9 Relationship of this action to other federal laws and actions

While NEPA is the primary law directing the preparation of this EIS, a variety of other federal laws and policies require environmental, economic, and socioeconomic analysis of proposed federal actions. These laws include the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the Magnuson-Stevens Act, the Regulatory Flexibility Act (RFA), and Executive Order (E.O.) 12866 which mandates cost-benefit analyses of major federal actions. This section describes these other federal laws and policies that require analysis of federal actions and outlines which parts of this EIS address each of these requirements.

2.9.1 Endangered Species Act (ESA)

The Endangered Species Act of 1973 as amended (16 U.S.C. 1531 *et seq*; ESA), provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by NMFS for most marine mammal species, marine and anadromous fish species, and marine plants species and by the USFWS for bird species, and terrestrial and freshwater wildlife and plant species.

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. 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. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

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, 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 (Rohlf 1989). One assurance of this is 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 Act 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. 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 as to whether the proposed action poses "jeopardy" or "no jeopardy" of extinction to the listed species. If the determination is that the action proposed (or ongoing) will cause jeopardy, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction to 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 may contain a series of management 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 a likelihood exists of any taking[2] 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.

Twenty-four species occurring in the GOA and/or BSAI groundfish management areas are currently listed as endangered or threatened under the ESA (Table 2.9.1). The group includes seven great whales, one pinniped, twelve Pacific salmon, two seabirds, one albatross, and one sea turtle.

Table 2.9.1 Species currently listed as endangered or threatened under the ESA and occurring in the GOA and/or BSAI groundfish management areas.

Common Name	Scientific Name	ESA Status
Northern Right Whale	*Balaena glacialis*	Endangered
Bowhead Whale [3]	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Steller Sea Lion	*Eumetopias jubatus*	Endangered and Threatened [4]
Snake River Sockeye Salmon	*Onchorynchus nerka*	Endangered
Snake River Fall Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Snake River Spring/Summer Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Puget Sound Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Lower Columbia River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Willamette River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Columbia River Spring Chinook Salmon	*Onchorynchus tshawytscha*	Endangered
Upper Columbia River Steelhead	*Onchorynchus mykiss*	Endangered
Snake River Basin Steelhead	*Onchorynchus mykiss*	Threatened
Lower Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Upper Willamette River Steelhead	*Onchorynchus mykiss*	Threatened
Middle Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Short-tailed Albatross	*Phoebaotria albatrus*	Endangered
Spectacled Eider	*Somateria fishcheri*	Threatened
Steller Eider	*Polysticta stelleri*	Threatened

In summary, species listed under the ESA are present in the action area and, as detailed below, some are negatively affected by the EIS subject federal activity, implementation of Amendments 61/61/13/8. NMFS is the expert agency for ESA listed marine mammals. The USFWS is the expert agency for ESA listed seabirds. The proposed action, implementation of AFA Amendments 61/61/13/8, must be in compliance with the ESA.

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[2] 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)].

[3] The bowhead whale is present in the Bering Sea area only.

[4] Steller sea lion are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.

The material presented below further explains the ESA, listed species present in the action area, and Section 7 Consultations that have occurred to prior to preparation of the Draft EIS.

Section 7 Consultations - Introduction

Because the BSAI pollock fishery and is a federally regulated activity, any negative effects of the fishery on listed species or critical habitat and any takings that may occur are subject to ESA Section 7 consultation. NMFS initiates the consultation with itself in the case of marine mammals and anadromous species and with the USFWS for the bird species. The resulting letters of concurrence and biological opinions are issued to NMFS. The Council may be invited to participate in the compilation, review, and analysis of data used in the consultations. The determination of whether the action "is likely to jeopardize the continued existence of" endangered or threatened species or to result in the destruction or modification of critical habitat, however, is the responsibility of the appropriate agency (NMFS or USFWS). If the action is determined to result in jeopardy, the opinion includes reasonable and prudent measures that are necessary to alter the action so that jeopardy is avoided. If an incidental take of a listed species is expected to occur under normal promulgation of the action, an incidental take statement is appended to the biological opinion.

For all ESA listed species, Section 7 consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded; new information reveals effects of the action that may affect listed species in a way not previously considered; the action is subsequently modified in a manner that causes an effect to listed species that was not considered in the biological opinion; or a new species is listed or critical habitat is designated that may be affected by the action.

Section 7 consultations have been done for all the above listed species: some individually and some as groups. Below are summaries of the current status of consultations on ESA listed species in the management area. Because NMFS has determined that the proposed action would not affect listed species in any way not previously considered in previous biological opinions, consultation has not been reinitiated for Amendments 61/61/13/8.

Cetaceans

Seven great whale species, the northern right whale, bowhead whale, sei whale, blue whale, sei whale, fin whale, humpback whale, and sperm whale, were originally listed under the ESA when the law was enacted in 1973. All of these species were known to be present in BSAI and/or GOA, however potential impacts of the groundfish fisheries on listed cetaceans were not well documented. Cetaceans were included in the most recent biological opinion issued November 30, 2000 (NMFS 2000a) which analyzed the BSAI pollock fishery, and BSAI and GOA groundfish fisheries generally, in the context of the AFA. The opinion concluded:

> *"Measuring the potential effects of the groundfish fisheries on the marine ecosystem of the action area is extremely difficult and realistically cannot be achieved with the available information. We cannot dismiss any effects that might have occurred in the past and may continue to occur. Based on the information available, it is also reasonable to consider that the groundfish fisheries and non-human members of the marine ecosystem may compete with listed whales for a limited resource. However, the direct or indirect effects of commercial fisheries in the BSAI and GOA, based on the limited information available on the status, trends, distribution, and abundance of endangered whale species in the action area and interactions between these whales and commercial fisheries, does not appear to be significant. Although we do not have the information that would be necessary to determine how endangered whales in the action area would be affected by cascade effects of these groundfish fisheries or competition, we do know that recent*

information on humpback [the species most likely to compete with fisheries given their dietary preferences and distribution], blue and bowhead whales suggest that these species are increasing and do not appear to be experiencing these effects to a level that would inhibit recovery or survival."

This most recent biological opinion contained no conservation recommendations specific to large cetaceans. Because this biological opinion considered the effects of the groundfish fisheries of the BSAI and GOA under the context of the AFA and the preferred alternative, consultation was not reinitiated for Amendments 61/61/13/8.

Steller sea lion

In 1990, NMFS designated the Steller sea lion as a threatened species under the ESA. The designation followed severe declines throughout much of the GOA and Aleutian Islands region. In 1993, NMFS defined critical habitat for the species to include (among other areas), the marine areas within 20 nautical miles (nm) of major rookeries and haulouts of the species west of 144° W longitude. In 1997, NMFS recognized two separate populations, and reclassified the western population (west of 144° W longitude) as endangered.

NMFS first began collecting information on the abundance of Steller sea lions during the 1950s and 1960s. However, the first counts based on reliable data were not available until the late 1970s; these counts reported approximately 109,800 animals. During the 1980s, a precipitous decline of Steller sea lions was observed. By 1996, the population had declined by 80 percent from the late 1970s. Counts of adult and juvenile Steller sea lions have continued to decline over the last few years, but at a lower rate.

NMFS believes that multiple factors have contributed to the decline, but considerable evidence indicates that lack of available prey is a significant factor. Foraging studies confirm that Steller sea lions depend on pollock, Pacific cod, and Atka mackerel as major prey sources, and that they may be particularly sensitive to reduced availability of prey during the winter. The significance of pollock, Pacific cod, and Atka mackerel in the diet of sea lions may have increased since the 1970s due to shifts in the Bering Sea ecosystem related to atmospheric and oceanographic changes.

1998 Biological Opinion. In accordance with the requirements of the ESA, the NMFS Office of Protected Resources issued a biological opinion (BiOp) on the pollock fisheries of the BSAI and GOA and the Atka mackerel fishery of the Aleutian Islands subarea, dated December 3, 1998, and revised December 16, 1998 (NMFS 1998e). The 1998 BiOp concluded that the BSAI and GOA pollock trawl fisheries, as projected for 1999 through 2002, were likely to jeopardize the endangered western population of Steller sea lions and adversely modify critical habitat designated for this population.

The 1998 BiOp did not prescribe a single RPA for the BSAI and GOA pollock fisheries, but rather established a framework to avoid the likelihood of jeopardizing the continued existence of the western population of Steller sea lions or adversely modifying their critical habitat. The framework consisted of three principles: (1) temporal dispersion of fishing effort, (2) spatial dispersion of fishing effort, and (3) protection from fisheries competition for Steller sea lion prey in waters adjacent to rookeries and important haulouts. For each of these principles, the 1998 BiOp provided guidance on the development of management measures to meet the objectives and, ultimately, to avoid jeopardy and adverse modification. The 1998 BiOp stated that certain conservation measures could be phased in over a 2-year period.

In December 1998, NMFS staff briefed the Council on the 1998 BiOp. The Council then prepared recommendations for alternative management measures based on the RPA guidelines to avoid jeopardy and adverse modification. NMFS determined these recommendations to be acceptable as part of a 2-year phase-in strategy, in which equivalent or better protections would be extended for those areas for 2000 and beyond. On December 16, 1998, NMFS adopted the measures recommended by the Council (with modifications) into the 1998 BiOp as part of the reasonable and prudent alternatives for the Alaska pollock fisheries. NMFS published an emergency interim rule implementing these measures in the *Federal Register* on January 22, 1999 (64 FR 3437) and extended those measures for an additional 180 days in July 1999.

Legal challenges to the 1998 BiOp. Greenpeace, the American Oceans Campaign, and the Sierra Club challenged the 1998 BiOp in the U.S. District Court for the Western District of Washington (*Greenpeace v. NMFS*, Civ. No. C98-0492Z (W.D. Wash.)). In an Order issued on July 9, 1999 (and amended on July 13, 1999), the Court upheld the no-jeopardy conclusion for the Atka mackerel fishery and the jeopardy conclusion for the pollock fisheries. However, the Court also found that "the Reasonable and Prudent Alternatives ... were arbitrary and capricious ... because they were not justified under the prevailing legal standards and because the record does not support a finding that they were reasonably likely to avoid jeopardy." On August 6, 1999, the Court remanded the 1998-1 BiOp back to NMFS for further analysis and explanation.

To comply with the Court's Order, NMFS conducted additional analyses and completed the Revised Final Reasonable and Prudent Alternatives (RFRPAs) on October 15, 1999. The RFRPAs describe management measures that will avoid the likelihood that the pollock fisheries authorized by regulations will jeopardize the continued existence of the endangered western population of Steller sea lions or adversely modify their critical habitat.

NMFS evaluated the measures recommended by the Council in June 1999 as part of the RFRPA analyses, and determined that these measures (with modification to season dates, haulout protections, and spatial dispersion in the Bering Sea) achieved the principles identified in the 1998-1 BiOp and the RFRPAs, and these were subsequently incorporated into the October 15, 1999, RFRPAs mentioned above. NMFS implemented the modified measures (then the RFRPAs) by emergency interim rule for the 2000 groundfish fisheries (65 FR 3892, January 25, 2000, and 65 FR 36795, June 12, 2000). Greenpeace, the American Oceans Campaign, the Sierra Club, and fishing industry representatives have challenged the adequacy of the RFRPAs in the U.S. District Court for the Western District of Washington. That judicial challenge is still pending.

Injunction prohibiting trawling in critical habitat. In December 1998, NMFS also issued an additional biological opinion evaluating the effects of the 1999 Federal groundfish fisheries in the BSAI and the GOA on endangered and threatened species and their critical habitat (1998-2 BiOp). Greenpeace, the American Oceans Campaign, and the Sierra Club also challenged the legal adequacy of the 1998-2 BiOp, resulting in a Court Order finding it too narrow in scope. (*Greenpeace v. NMFS*, 80 F. Supp. 2d 1137 (W.D. Wash. 2000)). On July 19, 2000, the Court issued an injunction prohibiting fishing for groundfish with trawl gear in the exclusive economic zone within Steller sea lion critical habitat west of 144° W longitude until NMFS issued a comprehensive biological opinion adequately analyzing the full scope of the FMPs. (*Greenpeace v. NMFS*, 106 F. Supp. 2d 1066 (W.D. Wash. 2000)). The critical habitat areas closed by the Court's injunction were defined in regulations codified at 50 CFR 226.202, and in Tables 1 and 2 of 50 CFR part 226. Pursuant to the injunction, NMFS issued an interim final rule prohibiting fishing for groundfish with trawl gear in Steller sea lion critical habitat specified in the Court's injunction (65 FR 49766, August 15, 2000).

2000 Comprehensive BiOp. In response to the Court's Order that found the 1998 BiOp inadequate, NMFS issued the Comprehensive BiOp on November 30, (NMFS 2000a) . The Comprehensive BiOp evaluates all authorized federal groundfish fisheries and the overall management framework established by the GOA and BSAI FMPs. After analyzing the cumulative, direct, and indirect effects of the groundfish fisheries authorized by the GOA and BSAI FMPs on listed species, NMFS concluded in the Comprehensive BiOp that the Alaska groundfish fisheries, as currently prosecuted, jeopardize the continued existence of the western population of Steller sea lions and adversely modify its critical habitat. This conclusion was reached based on information that pollock, Pacific cod, and Atka mackerel are the main prey species for which Steller sea lions compete with the fisheries; that this competition causes reduced availability of prey, an effect of particular concern within Steller sea lion critical habitat, that reduced availability of prey leads to nutritional stress; and that nutritional stress, especially of juveniles and to a lesser extent adult females, is the leading hypothesis to explain the continued decline of the western population of Steller sea lions. The Comprehensive BiOp included an RPA that would allow a modified fishery to occur in a manner that would avoid jeopardy to the continued existence of Steller sea lions and adverse modification to their critical habitat.

Congressional action and RPA implementation timetable. After publication of the 2000 Comprehensive BiOp, Congress intervened prior to the start of the 2001 fisheries by passing Public Law (P.L.) 106-554 which was signed into law by the President on December 21, 2000. This law contained a one-year timetable for implementing the RPA as well as provisions affecting its implementation. Section 209 of P.L. 106-554, paragraph (c)(3) also required that "[t]he 2001 Bering Sea/Aleutian Islands and Gulf of Alaska groundfish fisheries shall be managed in accordance with the fishery management plan and federal regulations in effect for such fisheries prior to July 15, 2000 . . . and said regulations are hereby restored to full force and effect." NMFS implemented the provisions of P.L 106-554 by emergency interim rule published on January 22, 2001 (66 FR 7276). In addition, NMFS determined that this statutory provision extended through 2001 the interim emergency regulations promulgated in 2000 to implement the AFA.

Under the timetable prescribed in P.L 106-554, the Council has formed an RPA committee composed of representatives from industry, environmental groups, and agencies to develop recommendations to implement the Comprehensive BiOp for 2002 and beyond. To date, the RPA committee has conducted a series of meetings in Alaska and Seattle but has not yet formed recommendations for 2002 and beyond.

Reinitiation of consultation. Consultation was reinitiated on July 26, 2001, due to significant new information on the biology of Steller sea lions and subsequent proposed changes to the fishery including Amendments 70/70 and Amendments 61/61/13/8. This consultation considers whether the effects of these actions are likely to jeopardize the continued existence of two populations of Steller sea lions or cause the distruction or adverse modification of their critical habitat. For all other listed species in the action area, NMFS Office of Sustainable Fisheries has made a determination of either "no effect" or "not likely to adversely affect." In August 2001 NMFS prepared a draft BiOp on the effects of the BSAI and GOA groundfish fisheries as modified by proposed AFA amendments 61/61 and proposed Steller sea lion amendments 70/70. The draft BiOp concluded:

> *After reviewing the current status of the endangered western population of Steller sea lions, the environmental baseline for the action area, the proposed action for Alaska groundfish in the Bering Sea and Aleutian Islands and Gulf of Alaska, and the cumulative effects, it is NMFS' biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the western population of Steller sea lions.*
>
> *After reviewing the current status of critical habitat that has been designated for the western population of Steller sea lions, the environmental baseline for the action area, the proposed action for Alaska groundfish in the Bering Sea and Aleutian Islands and Gulf of Alaska, and the cumulative effects, it is NMFS' biological opinion that the action, as proposed, is not likely to adversely modify its critical habitat.*

A final BiOp on the effects of proposed Amendments 61/61/13/8 and Amendments 70/70 will be completed prior to the finalization of this EIS.

Pacific salmon

No stocks of Pacific salmon originating from freshwater habitat in Alaska are listed under the ESA. The ESA listed species or evolutionarily significant units (ESUs) that migrate into marine waters off Alaska, originate in freshwater habitat in Washington, Oregon, Idaho, and California. In the marine waters off Alaska, the ESA listed salmon stocks are mixed with hundreds to thousands of other stocks originating from the Columbia River, Willamette River, British Columbia, Alaska, and Asia. The ESA listed fish are not visually distinguishable from the other, unlisted, stocks. Mortal take of them in the salmon bycatch portion of the fisheries is assumed based on limited abundance, timing, and migration pattern information gleaned from recovery locations of coded-wire-tagged surrogate stocks (closely related hatchery stocks that are tagged with coded wire tags).

The summary of ESA listed salmon species is in Table 2.9.2. Those ESUs that are likely to migrate into marine waters off Alaska are highlighted, and are either chinook salmon or steelhead (Snake River fall chinook, Snake River spring/summer chinook, Puget Sound chinook, Upper Columbia River spring chinook, Upper Willamette River chinook, Lower Columbia River chinook, Upper Columbia River steelhead, Upper Willamette River steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, and Snake River Basin steelhead).

NMFS designated critical habitat in 1993 (57 FR 57051) for the Snake River sockeye, Snake River spring/summer chinook, and Snake River fall chinook salmon. The designations did not include any marine waters and, therefore, does not include any of the habitat where the Alaska groundfish fisheries are conducted.

The 2000 Comprehensive BiOp examined the effects of the BSAI and GOA groundfish fisheries on listed salmon species. After reviewing the status of listed Chinook salmon, and steelhead stocks listed in Table 2.9.2, the environmental baseline for the action area, the effects of the proposed fishery and the cumulative effects, NMFS determined that the BSAI and GOA groundfish fisheries, as proposed was not likely to jeopardize the continued existence of any listed salmon or steelhead or result in the distruction or adverse modification of designated critical habitat for these species.

The biological opinion contained three reasonable and prudent measures under the incidental take statement.

1. *The NPFMC and NMFS, Alaska Region shall ensure there is sufficient NMFS-certified observer coverage such that the bycatch of chinook salmon and "other" salmon in the BSAI and GOA groundfish fisheries can be monitored on an inseason basis.*

2. *The NPFMC and NMFS, Alaska Region shall monitor bycatch reports inseason to ensure that the bycatch of chinook salmon does not exceed 55,000 fish per year in the BSAI fisheries and 40,000 fish per year in the GOA fisheries.*

3. *The NPFMC and NMFS, Alaska Region shall monitor bycatch reports of Chinook salmon in the Bering Sea Subarea, inseason so that the Chinook Salmon Savings Area can be closed to directed fishing for pollock with trawl gear before the limit is exceeded.*

The incidental take statement appended to the biological opinion allowed for take of 55,000 chinook salmon in the BSAI and 40,000 chinook salmon in the GOA. Since it is not technically possible to know if any have been taken, the biological opinion estimated the amount of various ESUs which would be taken given these maximum bycatch amounts based on historical information and current literature. No incidental take statement is given for either chum, coho, sockeye, steelhead, or cutthroat trout given their extremely limited occurrence off Alaska.

Table 2.9.2 Summary of salmon species listed and proposed for listing under the ESA. ESUS in italic represent those likely to range into Alaskan waters.

Species	Evolutionarily Significant Unit (ESU)	Present Status	Federal Register Notice	
Chinook Salmon (*O. tshawytscha*)	Sacramento River Winter-Run	Endangered	54 FR 32085	8/1/89
	Snake River Fall	Threatened	57 FR 14653	4/22/92
	Snake River Spring/Summer	Threatened	57 FR 14653	4/22/92
	Puget Sound	Threatened	64 FR 14308	3/24/99
	Lower Columbia River	Threatened	64 FR 14308	3/24/99
	Upper Willamette River	Threatened	64 FR 14308	3/24/99
	Upper Columbia River Spring	Endangered	64 FR 14308	3/24/99
	Central Valley Spring-Run	Threatened	64 FR 50393	9/16/99
	California Coast	Threatened	64 FR 50393	9/16/99
Chum Salmon (*O. keta*)	Hood Canal Summer-Run	Threatened	64 FR 14570	3/25/99
	Columbia River	Threatened	64 FR 14570	3/25/99
Coho Salmon (*O. kisutch*)	Central California Coast	Threatened	61 FR 56138	10/31/96
	S. Oregon/ N. California Coast	Threatened	62 FR 24588	5/6/97
	Oregon Coast	Threatened	63 FR 42587	8/10/98
Sockeye Salmon (*O. nerka*)	Snake River	Endangered	56 FR 58619	11/20/91
	Ozette Lake	Threatened	64 FR 14528	3/25/99
Steelhead (*O. mykiss*)	Southern California	Endangered	62 FR 43937	8/18/97
	South-Central California	Threatened	62 FR 43937	8/18/97
	Central California Coast	Threatened	62 FR 43937	8/18/97
	Upper Columbia River	Endangered	62 FR 43937	8/18/97
	Snake River Basin	Threatened	62 FR 43937	8/18/97
	Lower Columbia River	Threatened	63 FR 13347	3/19/98
	Central Valley California	Threatened	63 FR 13347	3/19/98
	Upper Willamette River	Threatened	64 FR 14517	3/25/99
	Middle Columbia River	Threatened	64 FR 14517	3/25/99
Cutthroat Trout Sea-Run (*O. clarki clarki*)	Umpqua River	Endangered	61 FR 41514	8/9/96
	Southwest Washington/Columbia River	Proposed Threatened	64 FR 16397	4/5/99

The 2000 Comprehensive BiOp examined the proposed 2001 BSAI and GOA groundfish fisheries in the context of the regulations in place in 2000 which included emergency interim regulations to implement the major provisions of the AFA. As a consequence, proposed 2001 fisheries that were the subject of the Comprehensive BiOp closely resembled the action proposed under Amendments 61/61/13/8 which would make these regulations permanent for the duration of the AFA. NMFS has, therefore, determined that the proposed action falls within the 2000 Comprehensive BiOp and, consultation on the effects of the BSAI pollock fishery on listed salmon was not reinitiated for Amendments 61/61/13/8.

Short-tailed albatross.

Current population status. The short-tailed albatross (*Phoebastria albatrus*) is a large pelagic bird whose current range includes the Bering Sea and the Gulf of Alaska, it once ranged throughout most of the North Pacific Ocean. Originally numbering in the millions, the worldwide population of breeding age birds is currently approximately 600 individuals and the worldwide total population is approximately

1300 individuals[5] ; the population was estimated at 400 in 1988, 700 in 1994). The population is increasing at an approximate annual rate of 7 to 8 percent, based on egg counts from 1980 to 1998[6]. As the population increases, the potential for interactions with commercial fisheries increases. However, the short-tailed albatross population is steadily increasing due to its protection on the breeding grounds (two islands in Japan and a recent report on Midway Island). Preliminary information from a population model indicates that the short-tailed albatross population could have realized a 0.2 percent higher survival rate if incidental takes in the fisheries had not occurred from 1980 to 1989[7].

ESA listing. The short-tailed albatross was originally designated as endangered under the Endangered Species Conservation Act of 1969 on the list of foreign-listed species. When the ESA replaced the 1969 Act in 1973, it was included as a foreign species but not as a native species, thus the current listing notes the short-tailed albatross as endangered except in the United States. The USFWS corrected this error by extending the endangered status for the short-tailed albatross to include the species' range within the United States (65 FR 46643). Despite the listing oversight, the short-tailed albatross has always been protected in the EEZ since its 1970 listing. In its final rule extending the endangered status of the short-tailed albatross, USFWS identified the following factors as potential threats to the species conservation and recovery:

- *Small population size*
- *Damage or injury related to oil contamination*
- *Consumption of plastics*
- *Incidental mortality in longline fisheries in the North Pacific and Bering Sea*
- *Entanglement in derelict fishing gear*
- *Collisions with airplanes at Midway Atoll*

In this same rule, USFWS identified activities that are not expected to result in any take of short-tailed albatrosses:

- *Fishing activities in Alaska and Hawaii other than longline fishing*
- *Lawfully conducted vessel operations such as transport, tankering, and barging*
- *Harbor operations or improvements*

Section 7 Consultations. In 1996, NMFS reinitiated consultation on the 1997 GOA and BSAI fisheries TAC specifications. That consultation was concluded February 19, 1997, when USFWS issued an amendment to its previous 1989 biological opinion (USFWS 1997c). The biological opinion limited the scope of future Section 7 consultations on short-tailed albatross to the hook-and-line fisheries which are likely to adversely affect short-tailed albatrosses. Because the USFWS has limited future consultations on short-tailed albatross to hook-and-line fisheries, consultation was not reinitiated for Amendments 61/61/13/8 which affect trawl fisheries primarily and pot fisheries for crab secondarily.

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[5] Hasegawa, H., Professor, Biology Department, Toho University, Miyama 2-2-1, Funabashi, Chiba 274-8510 Japan, personal communication.

[6] Cochrane Ph.D, Jean, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, P.O. Box 1326, Grand Marais, MN 55604-1326, personal communication.

[7] Cochrane Ph.D., Jean, personal communication.

Spectacled Eider

Current population status. Spectacled eiders (*Somateria fischeri*) are large diving sea ducks that spend most of the year in marine waters where they primarily feed on bottom-dwelling molluscs and crustaceans. Besides breeding and molting in some Alaska coastal areas, spectacled eiders congregate during the winter in exceedingly large and dense flocks in openings in the pack ice in the central Bering Sea between St. Lawrence and St. Matthew Islands. Spectacled eiders from all three known breeding areas (in Alaska and Russia) use this wintering area. While at sea, spectacled eiders appear to be primarily bottom feeders, eating molluscs and crustaceans at depths of up to 70 m in the wintering area (USFWS 1999a). Because nearly all individuals of this species may spend each winter occupying an area of ocean less than 50 km (31 mi) in diameter, they may be particularly vulnerable to chance events during this time (USFWS 2000a). Between the 1970s and 1990s, spectacled eiders on the Yukon-Kuskokwim Delta (an Alaska breeding area) declined by 96 percent, from 48,000 pairs to fewer than 2,500 pairs in 1992. Based upon surveys conducted during the past few years, the Yukon-Kuskowkim Delta breeding population is estimated to be about 4,000 pairs(USFWS 2000a). Biologists estimate that about 9,000 pairs currently next on Alaska's arctic coastal plain, and at least 40,000 pairs nest in arctic Russia. The current worldwide population estimate is 360,000 birds, which is derived from winter surveys in the Bering Sea and includes non-breeding birds (USFWS 1999b).

Causes of the decline of spectacled eiders are not well understood. Besides known and plausible land-based causes (lead poisoning from spent lead shot; predation by foxes, gulls and ravens on breeding grounds; and hunting), marine-based causes are even less clear. Complex changes in fish and invertebrate populations in the Bering Sea may be affecting food availability for spectacled eiders during the eight to ten month non-breeding season (USFWS 1999b). Environmental contaminants at sea and competition with bottom-feeding walruses and gray whales for food may also affect spectacled eider (USFWS 1999b).

ESA listing. The spectacled eider was listed as a threatened species throughout its range in Alaska and Russia in 1993 (USFWS 1993a). The action was taken because the species had declined by as much as 94-98 percent on its principal breeding range in Alaska and breeding birds in Alaska continued to decline by about 14 percent per year. Critical habitat was not designated at the time. At the time of the listing, USFWS noted that the marine habitat requirements of spectacled eiders were poorly understood and that past and present threats to suspected marine habitats could include: 1) toxic contaminants transported from Russian or North American sites, 2) indirect impacts of shifting populations of species with overlapping food habits, and 3) secondary effects of commercial fish and invertebrate harvests in the Bering Sea (USFWS 1993a). USFWS had not found evidence that these generalized threats had actually occurred, although minimal information was available on long-term changes in the Bering Sea ecosystem.

At the time of the listing, very little was known about the spectacled eider's marine range. Recent satellite telemetry data and 3 years of late winter aerial surveys indicate that spectacled eiders spend the winter in exposed waters between St. Matthew and St. Lawrence Islands, or in open leads slightly west of the inter-island area (USFWS 1998c). Other sightings in U.S. waters occur in August through September when they molt in Ledyard Bay and northeast Norton Sound and in migration near St. Lawrence Island. Most studies of spectacled eiders have been within their breeding grounds. It's suggested that they feed primarily on benthic mollusks and crustaceans in shallow waters (less than 30 m) (Dau and Kitchinski 1977) and may also forage on pelagic amphipods that are concentrated along the sea water pack ice interface (Kessel 1989). While at sea, spectacled eiders appear to be primarily bottom feeders, eating molluscs and crustaceans at depths of up to 70 m in the wintering area (USFWS 1999a). On their coastal breeding grounds, these eiders feed on aquatic crustaceans, aquatic insects, and plant materials (Dau 1974). Although the species is noted as occurring in the GOA and BSAI management areas, no evidence that they interact with these groundfish fisheries exists.

Regarding the protection of spectacled eiders at sea, the USFWS has suggested the following measures to avoid harm to eiders in their molting and wintering areas (USFWS 1999a):

- *Comply with the ESA section 7 regulations.*
- *Prevent oil spills.*
- *Always use absorbent booms when transferring fuel to shore-based facilities.*
- *Store adequate oil and fuel clean-up equipment on-site at fuel transfer locations.*
- *Do not discharge oily bilge water near molting areas during summer or fall.*
- *Avoid disturbing or harvesting benthic communities in eider molting and wintering areas during any time of year.*

ESA Section 7 consultations. NMFS has been consulting with the USFWS on potential impacts of the groundfish fisheries in the BSAI and the GOA on listed seabird species since 1989 (USFWS 1989a). Beginning in 1992, the ESA section 7 consultations referenced two eider species: the spectacled eider and the Steller's eider (*Polysticta stelleri*), both ESA candidate species. Based on the best available information, the USFWS determined that the 1992 groundfish fishery TAC specifications would not adversely affect either of the eider species (USFWS 1992). The USFWS made the same determination (not likely to adversely affect) for the 1993 and 1994 groundfish fishery TAC specifications (USFWS 1993b; USFWS 1994a). This determination was primarily based on the lack of overlap between the marine ranges of the eider species and the harvest areas of the groundfish fisheries.

Since 1995, the Section 7 consultations on seabirds have more specifically addressed the endangered short-tailed albatross (USFWS 1995a) and since 1997 these consultations have been limited to the hook-and-line groundfish fisheries (USFWS 1997a).

In November 1999, NMFS requested that the USFWS affirm its determination that the ongoing groundfish fisheries (all gear types) of the BSAI and GOA do not adversely affect the spectacled eider or the Steller's eider (NMFS 1999f). This determination is consistent with the best available information on the groundfish fisheries and on the two eider species that was presented within the Final Supplemental Environmental Impact Statement for the 1998 Groundfish TAC Specifications (NMFS 1998c).

Steller's eider

Current population status. Steller's eiders (*Polysticta stelleri)* are seaducks that spend the majority of the year in shallow, near-shore marine waters where they feed by diving and dabbling for molluscs and crustaceans. Primary foods in marine areas include bivalves, crustaceans, polychaete worms, and molluscs (USFWS 1997b). Three breeding populations of Steller's eiders are recognized, two in Arctic Russia and one in Alaska. Actual numbers nesting in Alaska and Russia are unknown but the majority of Steller's eiders nest in arctic Russia (USFWS 1997b). After the nesting season, Steller's eiders return to marine habitats where they molt. Concentrations of molting Steller's eiders have been noted in Russia, near St. Lawrence Island in the Bering Sea, and along the northern shore of the Alaska Peninsula. Whereas the Russian Atlantic populations winters in the Barents and Baltic seas, the Russian Pacific population winters in the southern Bering Sea and northern Pacific Ocean, where it presumably intermixes with the Alaska-breeding population. During winter, most of the world's Steller's eiders concentrate along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet in shallow, near-shore marine waters. In spring, large numbers concentrate in Bristol Bay before migration. Along open coastline, Steller's eiders usually remain within about 400 m of shore normally in water less than 10 m deep but can be found well offshore in shallow bays and lagoons or near reefs (USFWS 1997b). Whereas the Russian Atlantic population is believed to contain 30-50,000 individuals, and the Russian Atlantic population likely numbers 100-150,000, the threatened Alaska-breeding population is thought to include hundreds or low thousands on the Arctic Coastal Plain, and possibly tens or hundreds on the Yukon-Kuskokwim Delta. Overall numbers have likely declined from historical population sizes.

ESA listing. The Alaska breeding population of the Steller's eider was listed as a threatened species in 1997 (USFWS 1997b). This determination was based upon a substantial decrease in the species' nesting range in Alaska, a reduction in the number of Steller's eiders nesting in Alaska, and the resulting increased vulnerability of the remaining breeding population to extirpation (USFWS 1997b). Critical habitat was not designated at the time of the listing. Steller's eiders occupy a vast expanse of marine habitat during the non-nesting season. Within the marine distribution of the Steller's eider the environment has likely been affect by any number of human activities, including marine transport, commercial fishing, and environmental pollutants. Another possible threat is changes in the Bering Sea ecosystem affecting food availability to the eiders. However, no evidence exists that modifications of the marine environment have cause d the decline of the Alaska breeding population of Steller's eiders (USFWS 1997b).

ESA Section 7 consultations. Section 7 consultations for both listed eider species are covered above.

Leatherback sea turtle

Current population status. The leatherback is the largest living turtle. Leatherback sea turtles are widely distributed throughout the oceans of the world, and are found throughout waters of the Atlantic Ocean, Pacific Ocean, Caribbean Sea, and the Gulf of Mexico. In the Pacific Ocean, they range as far north as Alaska and the Bering Sea and as far south as Chile and New Zealand. In Alaska, leatherback turtles are found as far north as 60°34'N, 145°38'W and as far west as the Aleutian Islands (Hodge 1979). Leatherback turtles have been found in the Bering Sea along the coast of Russia (Bannikov et al. 1971).

Globally, leatherback turtle populations have been decimated. The global leatherback turtle population was estimated to number approximately 115,000 adult females in 1980, but only 34,500 in 1995. The decline can be attributed to many factors including fisheries and intense exploitation of eggs. On some beaches, nearly 100 percent of the eggs laid have been harvested.

The Pacific leatherback population appears to be in a critical state of decline. The eastern Pacific leatherback population was estimated to be over 91,000 adults in 1980, but is now estimated to number less than 3,000 total adult and subadult animals. Leatherback turtles have experienced major declines at all major Pacific basin rookeries. At Mexiquillo, Michoacan, Mexico, Sarti et al., (Sarti et al. 1996) reported an average annual decline in nesting of about 23 percent between 1984 and 1996. The total number of females nesting on the Pacific coast of Mexico during the 1995–1996 season was estimated at fewer than 1,000; fewer than 700 females are estimated for Central America. In the western Pacific, the decline is equally severe.

ESA listing. The leatherback was listed as endangered on June 2, 1970 and a recovery plan was issued in 1998. Leatherback turtles are included in Appendix H of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which effectively bans trade. Critical habitat has not been designated for leatherback turtles in the U.S. Pacific, largely because nesting is not known to occur in U.S. territory and important foraging areas have not been identified.

Consultation history. The 2000 comprehensive BiOp on the groundfish fisheries of the BSAI and GOA examined the effects of groundfish fishing on leatherback sea turtles. The BiOP concluded that leatherbacks are not abundant in the areas of greatest commercial fishing in the GOA and are not found in the BSAI at all. NMFS does not have record of any reported takes of leatherback sea turtles in the commercial fisheries of the BSAI and GOA and there is no commercial fishery targeting the prey species for leatherbacks (salps and jellyfish). Therefore, the BiOp concluded that the direct and indirect effects of commercial fisheries in the BSAI and GOA on this species are negligible and not likely to jeopardize its survival or recovery.

2.9.2 Marine Mammal Protection Act (MMPA)

The MMPA of 1972 (16 U.S.C. 1361 *et seq.*), as amended through 1996, establishes a federal responsibility to conserve marine mammals with management responsibility for cetaceans (whales) and pinnipeds (seals) other than walrus vested with the Department of Commerce, NMFS. The Department of Interior, U.S. Fish and Wildlife Service, 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, and should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management.

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 Endangered Species Act. 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, then the potential impacts of the fishery must be analyzed in the appropriate EA or EIS, and the Council or NMFS may be requested to consider regulations to mitigate adverse impacts.

2.9.3 Essential fish habitat (EFH) considerations

Magnuson-Stevens Act and Interim Final Rule mandates

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996, Public Law 104-267, emphasizes the need to protect fish habitat. Under the law, regional fishery management councils prepared amendments identifying as "essential fish habitat" those areas necessary to managed 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.

NMFS is conducting a programmatic EFH consultation in conjunction with the draft programmatic SEIS that will be included as an appendix of the FEIS. In addition, the effects of proposed Amendments 61/61/13/8 are examined in section 3.1.9 of this EIS.

Determining the extent of potential adverse impacts for any action is not a simple task. The Technical Guidance on EFH issued by NMFS (NMFS 1998c) to aid regional fishery management councils in implementing the EFH requirements of the Magnuson-Stevens Act advises focusing assessments on whether "anthropogenic factors reduce habitat suitability for marine resources." The manual notes that defining a healthy ecosystem is "difficult and controversial," but tries to clarify the term in the context of EFH by identifying criteria that characterize healthy ecosystems, which are summed up in a rule that has been developed to make the concept of a healthy ecosystem more workable (Regier 1990). Using these criteria, a healthy ecosystem should be capable of the following three functions:

- Maintaining its ecological productive capacity

- Preserving its floral and faunal diversity
- Retaining its ability to regulate itself.

The manual advises the fishery management councils to investigate the ways in which an action might interfere with these function in both overt and subtle ways in assessing adverse effects to EFH.

Specifically, the manual addresses potential adverse effects to EFH from fishing activities as follows (NMFS 1998c):

> *"Adverse impacts from fishing may include direct, large-scale substrate damage that reduces habitat quality or quantity through alteration of sediment types, flattening of bottom structure, removal or mortality of biological communities or benthic organisms. FMPs should include management options that minimize adverse impacts, to the extent practicable, and identify potential conservation and enhancement measures. Because fishing activities fall within the regulatory control of the Councils and the Secretary, it is incumbent upon NMFS and the Councils to gather the best available information to evaluate management options.*
>
> *Fishing activities, including gear effects, vessel operations, and processing activities, have the potential to impact habitat on a discrete, as well as on a cumulative basis – fishery by fishery, one fishery interacting with another fishery, as well as fishing activities interacting with non-fishing activities (e.g., trawling interactions with channel dredging). These types of cumulative activities should be addressed by Councils in their EFH amendments."*

The action under examination in this EIS is Amendments 61/61/13/8 to implement the AFA. 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 assessment must include the following elements, which are listed in the Interim Final Rule:

1. *A description of the proposed action*
2. *An analysis of the effects, including cumulative effects, of the proposed action on EFH, the managed species, and associated species, such as major prey species, including affected life history stages;*
3. *The federal agency's view of the action on EFH; and*
4. *Proposed mitigation, if applicable.*

In terms of these requirements, Chapter 1 of this EIS includes a description of the proposed action. Chapter 3 includes a description of the environment in which the NMFS groundfish fisheries occur (Sections 3.1 and 3.2), a description of the life cycles and stock status of managed species (Section 3.2), and an analysis of the impacts of fishing gear impacts on that environment (Section 4.2). NMFS' views of the effects of the BSAI pollock fishery on essential fish habitat are contained in Section 4.2.

2.9.4 Coastal Zone Management Act (CZMA)

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) of the CZMA requires that any federal activity affecting the land or water uses or 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 CZM responsibility with a consistency determination for review at least 90 days before final action of NMFS.

2.9.5 Administrative Procedure Act (APA)

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, what is 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, NOAA subscribes to 30 days as a reasonable period for the public to be informed and submit comments on proposed fishery management regulations. Exceptions to 30-day prior notice protocol include (a) proposed rules that would implement FMP amendments, in which case the Magnuson-Stevens Act indicates a 45-day period, and (b) emergency regulations that often require immediate implementation.

Some regulations (e.g., emergency or interim) may be implemented immediately under the APA when the agency, for good cause, finds that prior notice and opportunity for public comment are impractical, unnecessary, or contrary to the public interest. The "good cause" reason for waiving normal public procedure must be fully explained in the *Federal Register* notice. The Magnuson-Stevens Act (at Section 305(c)) places further conditions and restrictions on the use of emergency or interim fishery regulations. For example, an emergency or interim fishery management measure may remain in effect for not more than 180 days and may be extended, by notice in the *Federal Register* only once for an additional period.

On August 21, 1997 (62 FR 44421), NOAA published further policy guidelines in the form of criteria and justification standards for using emergency rule authority to address marine fishery management issues. These criteria define the phrase in section 305(c) of the Magnuson-Stevens Act, "an emergency exists involving any fishery," as

> *"...a situation that:*
>
> 1. *Results from recent, unforeseen events or recently discovered circumstances; and*
> 2. *Presents serious conservation or management problems in the fishery; and*
> 3. *Can be addressed through emergency regulations for which the immediate benefits outweigh the value of advanced notice, public comment, and deliberative consideration of the impacts on participants to the same extent as would be expected under normal rulemaking process."* (62 FR 44422)

The emergency rule guidelines also state that the normal public rulemaking process may be waived in an emergency if the

> *"...emergency action might be justified under one or more of the following situations:*
>
> 1. *Ecological -- (A) to prevent overfishing as defined in an FMP, or as defined by the Secretary in the absence of an FMP, or (B) to prevent other serious damage to the fishery resource or habitat; or*
> 2. *Economic – to prevent significant direct economic loss or to preserve a significant economic opportunity that otherwise might be forgone; or*
> 3. *Social – to prevent significant community impacts or conflict between user groups; or*

4. *Public health – to prevent significant adverse effects to health of participants in a fishery or to the consumers of seafood products."* (62 FR 44422)

Except for the emergency or interim rule provisions, a proposed rule is designed to give interested or affected persons opportunity to submit written data, views or arguments for or against the proposed action. After the end of a 30- or 45-day comment period, the APA requires comments received to be summarized and responded to in the final rule notice. Further, the APA requires the effective date of a final rule to be 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. The 30-day delayed effectiveness period can be waived for a final rule only if it relieves a restriction, merely interprets an existing rule, or provides a statement of policy, or it must be made effective earlier than 30 days after publication for good cause. For fishery management regulations, the primary effect of the APA is to provide for public participation which, in combination with the Magnuson-Stevens Act, NEPA, and other statutes, limits the speed with which NMFS can implement non-emergency fishery regulations.

2.9.6 Regulatory Flexibility Act (RFA).

The RFA (5 U.S.C. 601 *et seq.*) requires federal agencies to assess the impacts of their proposed regulations on small entities and to seek ways to minimize economic effects on small entities that would be disproportionately or unnecessarily adverse. The most recent amendments to the RFA were enacted on March 29, 1996, with the Contract with America Advancement Act of 1996 (Public Law 104-121). Title II of that law, the Small Business Regulatory Enforcement Fairness Act (SBREFA), amended the RFA to require federal agencies to determine whether a proposed regulatory action would have a significant economic impact on a substantial number of small entities. For a federal agency, the most significant effect of SBREFA is that it made compliance with the RFA judicially reviewable.

The assessment requirement of the RFA is satisfied by a regulatory flexibility analysis, which applies only to regulatory actions for which prior notice and comment is required under the APA. Hence, emergency or interim rules that waive notice and comment are not required to have regulatory flexibility analyses. Further, regulatory flexibility analyses are required only when an agency cannot certify that an action will not have a "significant economic impact" on a "substantial number of small entities".

For purposes of these analyses, "small entities" include (a) small businesses which, for commercial fishing or fish processing, are firms with receipts of up to $3 million annually or up to 500 employees, respectively, (b) small non-profit organizations, and (c) small governmental jurisdictions with a population of up to 50,000 persons. For Alaska fisheries, these criteria include most fishing firms except for the large catcher/process vessels and most coastal communities except for Anchorage. NMFS has published guidelines for RFA analysis; they include criteria for determining if the action would have a significant impact on a substantial number of small entities.

An initial regulatory flexibility analysis (IRFA) is prepared for any proposed regulatory action that meets the above criteria for having an anticipated "significant economic impact" on a "substantial number of small entities." Section 4.6 of this EIS contains the regulatory flexibility analysis prepared for Amendments 61/61/13/8.

If, following public comments on the proposed rule, the action is still considered to meet the criteria for requiring RFA analysis, then a final regulatory flexibility analysis (FRFA) must be prepared. The FRFA contains most of the same information presented in the IRFA, but also must include (a) a summary of significant issues raised in public comment on the IRFA and the agency's response to those comments, and (b) a description of the steps the agency has taken to minimize the significant economic impacts on small entities, including a statement of factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why all other alternatives considered were rejected. Finally, the FRFA or a summary of it must be published in the *Federal Register* with the final rule.

In addition, SBREFA established two new requirements on agencies that publish rules. First, for each rule or group of related rules for which an agency is required to publish an FRFA, the agency is required to publish one or more guides to assist small entities in complying with the rule. These guides, called "small entity compliance guides," must explain what a small entity is required to do to comply with the rule(s). The second new requirement directs each agency regulating the activities of small entities to establish a program for responding to inquiries from small entities concerning information on, advice about, and compliance with statutes and regulations, as well as interpreting and applying law to specific sets of facts supplied by small entities. Guidance given by an agency applying law to facts provided by a small entity may be considered as evidence of the reasonableness of any proposed fines, penalties, or damages sought against the small entity in any civil or administrative action.

2.9.7 Paperwork Reduction Act of 1995 (PRA)

The PRA (44 U.S.C. 3501 *et seq.*, and 5 CFR part 1320) is designed "to minimize the paperwork burden for individuals, small businesses, educational and nonprofit institutions, federal contractors, state, local and tribal governments, and other persons resulting from the collection of information by or for the Federal Government." In brief, this law is intended to ensure that the government is not overly burdening the public with requests for information. This is accomplished through an information collection budget (ICB). The ICB for each agency is in terms of the total estimated time burden of responding to official inquiries. The President's Office of Management and Budget (OMB) oversees the ICB of each agency. Agencies must annually identify and obtain clearance from OMB for new or significant revisions to reporting and record keeping requirements.

Procedurally, the PRA requirements constrain what, how, and how frequently information will be collected from the public affected by a rule that requires reporting (e.g., harvested fish). New collections of information must be submitted to OMB for clearance before a final rule may take effect. For each rule that requires a collection of information, the agency must describe in detail what data will be collected, how it will be collected and how often, from whom it will be collected, how much time will be spent by each affected person in complying with the information requirements, why the information is necessary and how it will be used. OMB can take 60 days to review and clear a proposed information collection; hence, to avoid a PRA delay of a rule, NMFS tries to start the PRA review and clearance process at least 30 days before submission of a proposed rule for review in NMFS' central office. Information collections approved by OMB have a maximum effectiveness of three years. To be extended beyond that time requires another submission for OMB clearance. Required collections of information from the public can not be enforced without being included in an approved ICB.

Amendments 61/61/13/8 contain collection of information requirements subject to the PRA. These include permit requirements for vessels and processors, reporting requirements for vessels and processors, and recordkeeping requirements for vessels and processors. These collection of information requirements have been submitted to OMB for review and clearance and will not be discussed further in this EIS.

2.9.8 Executive Order 12866: Regulatory Planning and Review

Executive Order (EO) 12866 was signed by the President on September 30, 1993, published October 4, 1993 (58 FR 51735), and replaced EO 12291 and EO 12498. Its purpose, among other things, is to enhance planning and coordination with respect to new and existing regulations, and to make the regulatory process more accessible and open to the public. In addition, EO 12866 requires agencies to take a deliberative, analytical approach to rule making, including assessment of costs and benefits of the intended regulations. For fisheries management purposes, it requires NMFS to prepare (a) a regulatory impact review (RIR) for all regulatory actions, (b) a unified regulatory agenda twice a year to inform the public of the agency's expected regulatory actions, and (c) conduct a periodic review of existing regulations. Section 4.5 of this EIS contains a RIR for Amendments 61/61/13/8.

The purpose of an RIR is to assess the potential economic impacts of a proposed regulatory action. As such, it can be used to satisfy NEPA requirements and as a basis for determining whether a proposed rule will have a significant impact on a substantial number of small entities which would trigger the completion of an IRFA under the RFA. For this reason, the RIR is frequently combined with an EA and an IRFA in a single EA/RIR/IRFA document that satisfies the analytical requirements of NEPA, RFA and EO 12866 for any proposed rule. Criteria for determining "significance" for EO 12866 purposes, however, are different than those for determining "significance" for RFA purposes. A "significant" rule under EO 12866 is one that is likely to:

- *Have an annual effect on the economy (of the nation) of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;*

- *Create serious inconsistency or otherwise interfere with an action taken or planned by another agency;*

- *Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or*

- *Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in EO 12866.*

Although fisheries management actions rarely have an annual effect on the national economy of $100 million or more or trigger any of the other criteria, OMB makes the ultimate determination of significance under this EO based in large measure on the analysis in the RIR. However, Amendments 61/61/13/8 has been determined to be significant. Amendments 61/61/13/8 raise novel legal or policy issues arising out of legal mandates. An action determined to be significant is subject to OMB review and clearance before its publication and implementation.

An initial determination of significance, frequently without benefit of an RIR, is made for each proposed regulatory action by NMFS through a "listing document." The listing document is a brief description of a proposed regulatory action, including a regulatory identifier number (RIN), and the expected schedule for rule making. Listing documents are prepared by NMFS and submitted through NOAA General Counsel and Department of Commerce Office of General Counsel to OMB. If OMB concurs in a determination of "not significant" under EO 12866, then OMB will not need to review the rule. In practice, NMFS attempts to submit a listing document at least three months before submission of the proposed rule.

The regulatory planning function of EO 12866 is served by the unified regulatory agenda which is prepared twice a year to inform the public of the agency's expected regulatory actions and provide brief descriptions and timelines. In addition, a regulatory plan is prepared annually to report on the most significant regulatory actions that the agency reasonably expects to issue in proposed or final form in that fiscal year or later.

2.9.9 Executive Order 13084: Consultation and Coordination with Indian Tribal Governments

This EO on Consultation and Coordination with Indian Tribal Governments was signed on May 14, 1998, and published May 19, 1998 (63 FR 27655). The purpose of this EO 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 EO 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. The groundfish fisheries in the EEZ off Alaska are largely prosecuted from 3 to 200 miles offshore. Therefore, regulatory policies governing these fisheries rarely concern Indian tribal governments such that this EO becomes an issue in the normal Council regulatory process in Alaska. However, in conjunction with the preparation of this programmatic SEIS, NMFS has initiated a government-to-government consultation process.

2.9.10 Executive Order 12898: Environmental Justice

Executive Order 12898, issued in 1994, 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. While there exists a significant native population in Alaska, few are impacted by federal management of resources in the EEZ. However, a growing number of Alaska natives participate in the fisheries as a result of the Federal Community Development Quota Program and, as a result, more of the economic benefits derived from federal groundfish fisheries are found in coastal native communities.

2.9.11 Executive Order 13132: Federalism

This is the “Federalism” EO. It was signed by the President on August 4, 1999, and published August 10, 1999 (64 FR 43255). This EO superceded the previous “Federalism” EOs (12612 and 13083) but supplements EOs 12372, 12866, and 12988. This EO is intended to guide federal agencies in the formulation and implementation of “policies that have federalism implications.” Such policies are regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

The EO establishes fundamental federalism principles based on the U.S. Constitution, specifies federalism policy making criteria, and special requirements for preemption of state law. For example, a federal action that limits the policy making discretion of a state is to be taken only where there is constitutional and statutory authority for the action and it is appropriate in light of the presence of a problem of national significance. Also, where a federal statute does not have expressed provisions for preemption of state law, such a preemption by federal rule making may be done only when the exercise of state authority directly conflicts with the exercise of federal authority. Conflict between state and federal law is possible on fishery management issues; however, the Magnuson-Stevens Act (at Sec. 306) explicitly establishes conditions for federal preemption of state regulations (and extension of state fishery management authority into the EEZ). This EO also requires consultation between federal and state officials and requires a federalism impact statement for rules that have federalism implications. Federalism impact statements are rarely needed for federal Alaska groundfish regulations because of close state-federal consultation provided by the Council process.

Chapter 3: Affected Environment

The purpose of this chapter is to describe the Bering Sea and Aleutian Islands (BSAI) environment, and, to a lesser extent, the Gulf of Alaska (GOA) environment. The descriptions focus on the physical and oceanographic features, major living marine resources, their biology, habitat, current status of the resource, and the social-economic conditions associated with the pollock fishery.

The BSAI and GOA ecosystems are a complex system. Although there is much that is known, there remains much that is still unknown about the systems. A section on regime shifts is provided in this chapter to add insight about the long-term dynamics of the physical environment. This is important because there have been major climatic regime shifts occurring in the North Pacific ocean environment that appear to affect the dynamics of living marine resources in the BSAI and GOA. Studies of this marine ecosystem are ongoing. This chapter is intended to provide a detailed overview of the environment, referencing scientific literature and traditional knowledge where possible.

3.1 Physical environment

3.1.1 The North Pacific Ocean: Bering Sea and Gulf Alaska ecosystems

Two large marine ecosystems have been identified off Alaska, the eastern BSAI and the GOA. Their continental shelf areas make up about 74 percent of the total area (2,900,785 square kilometers [km^2]) of all U.S. continental shelves.

The Bering Sea is a semi-enclosed high-latitude sea. Of its total area of 2.3 million km^2, 44 percent is continental shelf, 13 percent is continental slope, and 43 percent is deepwater basin. Its broad continental shelf is biologically one of the most productive areas of the world. A special feature of the Bering Sea is the pack ice that covers most of its eastern and northern continental shelf during winter and spring. The dominant circulation of the water (Figure 3.1.1) begins with the passage of North Pacific water (the Alaskan Stream) into the Bering Sea through the major passes in the Aleutian Islands (Favorite et al. 1976). There is net water transport eastward along the north side of the Aleutian chain, and a turn northward at the continental shelf break and at the eastern perimeter of Bristol Bay. Eventually Bering Sea water exits northward through the Bering Strait, or westward and south along the Russian coast, entering the western North Pacific via the Kamchatka Strait. Some resident water joins new North Pacific water entering Near Strait, which sustains a permanent gyre around the deep basin in the central Bering Sea.

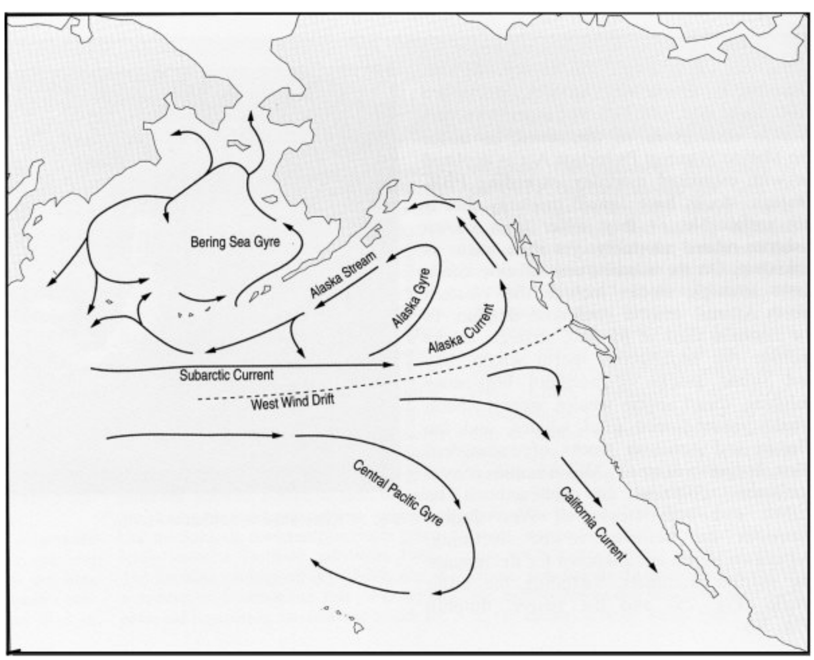

Figure 3.1.1 General circulation and major current systems of the North Pacific Ocean. Source: NMFS

The dominant circulation in the GOA (Musgrave et al. 1992) is characterized by the cyclonic flow of the Alaska Gyre. The circulation consists of the eastward-flowing Subarctic Current System at about 50°N and the Alaska Current System along the northern GOA. Large seasonal variations in the wind-stress curl in the GOA affect the meanders of the Alaska Stream and eddies of nearshore areas. It is the variations in these flows and eddies of the nearshore environment that affect a large part of the biological variability of the region. The GOA has about 160,000 km^2 of continental shelf, which is less than 25 percent of the eastern Bering Sea shelf.

3.1.2 Substrate

Eastern Bering Sea. The Eastern Bering Sea (EBS) sediments are a mixture of the major grades representing the full range of potential grain sizes, of mud (sub-grades clay and silt), sand, and gravel. Relative composition by such constituents determines the type of sediment at any one location (Smith and McConnaughey 1999). Sand and silt are the primary components over most of the sea floor, with sand predominating the sediment in waters shallower than 60 m. Overall, there is often a tendency of increase in the fraction of the sediment constituted by the finer grades (and decrease in average grain size) with increasing depth and distance from shore. This grading is particularly noticeable on the southeastern Bering Sea continental shelf in Bristol Bay and immediately westward (Figure 3.1.2). The condition occurs because settling velocity of particles decreases with particle size (Stokes Law), as does the minimum energy necessary to resuspend or tumble them. Since the kinetic energy of sea waves reaching the bottom decreases with increasing depth, terrigenous grains entering coastal shallows drift with water movement until they are deposited according to size at that depth where water speed is no longer sufficient for further transport. However, there is considerable fine-scale deviation from the graded pattern, especially in shallower coastal waters and offshore of major rivers, due to local variations in the effects of waves, currents, and river input (Johnson 1983).

Figure 3.1.3 shows the sediment type at locations over the southern and a portion of the central EBS shelf. Considerable local variability is indicated in areas along the shores of Bristol Bay and the north coast of the Alaskan Peninsula, as well as west and north of Bristol Bay, especially near the Pribilof Islands. Nonetheless, there is a general pattern whereby nearshore sediments in the east and southeast on the inner shelf (0-50 m depth) often are sandy gravel and gravelly sand. These give way to plain sand farther offshore and west. On the middle shelf (50-100 m), sand gives way to muddy sand and sandy mud, which continue over much of the outer shelf (100-200 m) to the start of the continental slope. Sediments on the central and northeastern shelf (including Norton Sound) have not been so extensively sampled, but Sharma (Sharma 1979) reports that while sand is dominant in places here as it is in the southeast, there are concentrations of silt both in shallow nearshore waters and in deep areas near the shelf slope. In addition, there are areas of exposed relict gravel possibly resulting from glacial deposits. These departures from a classic seaward fining of grain size are attributed to the large input of fluvial silt from the Yukon River and to flushing and scouring of sediment through the Bering Strait by the net northerly current.

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Gulf of Alaska and Aleutian Islands regions. Compared to the Bering Sea, the GOA has relatively weaker currents and tidal action near the sea floor and, therefore, a variety of seabed types such as gravely-sand, silty-mud, and muddy to sandy gravel, as well as areas of hard-rock (Hampton et al. 1986).

Investigations of the northeast GOA shelf (<200 m) have been conducted between Cape Cleare (148°W) and Cape Fairweather (138°W) (Feder and Jewett 1987). The shelf in this portion of the GOA is relatively wide (up to 100 km). The dominant shelf sediment is clay silt that comes primarily from either the Copper River or from the Bering and the Malaspina Glaciers. When the sediments enter the Gulf, they are generally transported to the west. Sand predominates nearshore, especially near the Copper River and the Malaspina Glacier.

Most of the western GOA shelf (west of Cape Igvak) consists of slopes characterized by marked dissection and steepness. The shelf consists of many banks, and reefs with numerous coarse, clastic, or rocky bottoms, and patchy bottom sediments. In contrast, in the vicinity of Kodiak Island, the shelf consists of flat, relatively shallow banks cut by transverse troughs.

The substrate in the area from Near Strait and the vicinity of Buldir Island, Amchitka, and Amukta Passes is mainly bedrock outcrops and coarsely fragmented sediment interspersed with sand bottoms.

3.1.3 Water column

Eastern Bering Sea. Important water column properties over the EBS include temperature, salinity, and density. These properties remain constant with depth in the near surface mixed-layer which varies from about 10-30 m in summer to about 30-60 m in winter (Reed 1984). The Inner Shelf (<50 m) is, therefore, one layer and well mixed most of the time. In the Middle Shelf (50-100 m) a two-layer temperature and salinity structure exists because of the downward mixing of wind and the upward mixing due to relatively strong tidal currents (Kinder and Schumacher 1981). On the Outer Shelf (100-200 m) a three-layer temperature and salinity structure exists due to the downward mixing by wind, horizontal mixing with oceanic water, and the upward mixing from the bottom friction due to relatively strong tidal currents. Oceanic water structure is present year-round beyond the 200 m isobath.

Overall, surface temperatures in winter vary from about -1° C in the north to about 3° C in the south, then increase to a maximum in August between 8˚C and 12˚C with the higher temperatures near shore. In the well mixed Inner Shelf, temperatures are isothermal and vary with the annual cycle. On the Middle Shelf, surface temperatures warm with the season but the lower layer remains <2° C year-round. The temperature changes in the Outer Shelf show the seasonal mixed layer above but stay about 3°-4° C year-round in the two lower layers due to oceanic influences and the warm advection from the south.

Surface salinities range from about 31.4 practical salinity units (psu) inshore to about 32.4 psu in the Outer Shelf to about 33.1 psu in the oceanic water. Lower salinities may be found close inshore near river mouths and the patterns of the isohalines show low salinity water from the GOA entering the Bering Sea at Unimak Pass and proceeding along the north side of the Alaska Peninsula to Bristol Bay (Royer 1981; Schumacher et al. 1982). The bottom salinities on the Inner Shelf also show this low salinity feature north of the Alaska Peninsula. Bottom salinities over the entire shelf range typically from 31.4 psu to 32.8 psu, slightly larger than at the surface. The highest bottom salinities are present west of Unimak Pass in summer, possibly from enhanced inflow of oceanic water to the inner slope.

Gulf of Alaska and Aleutian Islands regions. The density structure of the water column is described by the changes in physical properties versus depth, primarily temperature and salinity. Because of the plentiful coastal runoff in the eastern GOA and the general excess of precipitation over evaporation, the salinity changes dominate over temperature changes in controlling water density and thus water structure. Reed (Reed 1995) describes the latest available historical measurements of these properties, their horizontal and vertical distributions, and the resulting density structure of the water column in the GOA. For older, classic works detailing the characteristics of the Subarctic water mass, see Dodimead *et al.* (Dodimead et al. 1963) and Favorite *et al.* (Favorite et al. 1976).

Fundamentally, density increases with depth, but the greatest increase occurs in the permanent pycnocline from 25.0 σ_t at 30 m to 26.8 σ_t at 200 m. Above this pycnocline lies a 30 m deep, constant density (25.0 σ_t) surface mixed layer and below this pycnocline slowly increasing values 26.8-27.7 σ_t from 200 to 1500 m. The density structure closely follows the salinity structure with the permanent halocline marked by a rapid increase with depth from 32.0 psu to 33.8 psu. This halocline, is typically located between 30 and 200 m, underneath the surface mixed layer. Below the halocline salinity values slowly increase to 34.4 psu down to 1500 m. Temperature in the mixed layer varies between 3° and 12° C winter to summer. The temperatures within the halocline diminish from 5° to 3° C between 30 and 200 m, then slowly decrease to about 2.5° C near 1500 m. These are the relatively permanent physical properties in the GOA and Aleutian Islands areas. Significant changes only occur rarely with large scale changes in circulation (Reed 1984).

Small horizontal changes in water properties do occur as the flow proceeds westward between the GOA and the Aleutian Island areas, but mainly in the mixed layer. Salinities next to shore on the shelf in the eastern and northern GOA can be as low as 26.0 psu in the Alaskan Coastal Current (ACC) in the fall when precipitation peaks. Along the edge of the shelf in the Alaskan Stream a low salinity (< 32.0 psu) tongue-like feature protrudes westward. In Shelikof Strait and to the east, the range of temperatures from 0°C to 15°C can be substantially greater than those farther west. On the south side of the central Aleutian Islands near shore surface salinities can reach as high as 33.3 psu as the higher salinity Bering Sea surface water occasionally mixes southward through the Aleutian Islands. A minimum of about 32.2 psu is usually present over the slope in the Alaskan Stream; then values rise to >32.6 psu in the oceanic water offshore. Whereas surface salinity increases toward the west as its source of fresh water from the land decreases, salinity values near 1500 m decrease very slightly. Temperature values at all depth levels decrease toward the west.

3.1.4 Temperature/nutrient regimes

Bering Sea. Three fronts, the outer-shelf, mid-shelf, and inner-shelf, follow along the 200-, 100-, and 50-m bathymetric contours, respectively, and thus, separate four oceanographic domains that appear as bands along the broad EBS shelf. The oceanographic domains are: the deep water (>200 m), the outer-shelf (200-100 m), the mid-shelf (100-50 m), and the inner-shelf (<50 m). Water structure and properties are described by Reed (Reed 1995); Hattori and Goering (Hattori and Goering 1986) summarize the available data on the distribution of salinity, temperature, phosphate-phosphorus, silicic acid, nitrate-nitrogen, nitrite-nitrogen, and ammonia-nitrogen and characterize the four domains according to nutrients. Inorganic nutrient nitrogen distribution and dynamics were also described by Whitledge *et al.* (Whitledge et al. 1986). Because the fronts inhibit lateral fluxes of water and dissolved materials between the four domains, nutrient zones are consistent with the physical domains.

The vertical physical system also regulates the biological processes which lead to separate cycles of nutrient regeneration. The source of nutrients for the outer-shelf is the deep oceanic water and for the mid-shelf, it is the shelf-bottom water. Starting in winter, surface waters across the shelf are high in nutrients. Spring surface heating stabilizes the water column, then the spring bloom commences and consumes the nutrients. Steep seasonal thermoclines over the deep Bering Sea (30-50 m), the outer-shelf (20-50 m), and the mid-shelf (10-50 m) restrict vertical mixing of water between the upper and lower layers. Below these seasonal thermoclines nutrient concentrations in the outer-shelf water are invariably higher than those in the deep Bering Sea water with the same salinity. Winter values for nitrate-N/phosphate-P are similar to the summer ratios which suggests that even in winter the mixing of water between the mid-shelf and outer-shelf domains is substantially restricted (Hattori and Goering 1986).

Spring and summer storms can increase the total seasonal productivity by mixing to depths sufficient to resupply nutrients to the euphotic zone, but by the end of summer nutrient depletion in the euphotic zone is common all across the shelf. Year-to-year consistency of the trends between the summer nutrient distributions in 1975 and 1978 was shown by Hattori (Hattori 1979).

Gulf of Alaska and Aleutian Islands regions. Although little is known about nutrients in the Aleutian Islands, some chemical properties of GOA water make it unique in the world ocean. The deep oceanic water is distinctive because it has among the highest oceanic silicate, phosphate, and nitrate concentrations and the best-developed oxygen minimum compared to other ocean waters at similar latitudes. The oxygen and phosphate distributions result from the decomposition of particulate organic matter sinking from the surface, as elsewhere, but the higher concentrations arise because of accumulation from the poor circulation of the deep water. Reeburgh and Kipphut (Reeburgh and Kipphut 1986) examined GOA chemical profiles for dissolved oxygen, silicate, phosphate, and nitrate and summarized available historical data in three distinct oceanographic domains; 1) the deep sea, 2) the shelf, and 3) the fjords and estuaries. Of the three, the shelf domain has the least data.

Deep sea domain profiles show temperature decreases continuously with depth, first in the main thermocline from 10° C at the surface to 6° C at 100 m, then to a lesser degree to 4° C at 350 m and even more slowly to 1.8° C at 2500 m (Reeburgh and Kipphut 1986). Dissolved oxygen decreasing from about 300 µM O_2/kg at the surface to less than 50 µM O_2/kg at 400 m followed by a minimum near 900 m then a gradual rise to about 120 µM O_2/kg at 4000 m. Phosphate increased from 0.5 µM H_3PO_4-P/kg at the surface to a maximum of almost 3 µM H_3PO_4-P/kg from 500-1500 m, then decreased slightly to about 2.6 µM H_3PO_4-P/kg near 2500 m. Nitrate increased from about 0.3 µM NO_3-N/kg at the surface to a maximum of about 40 µM NO_3-N/kg from 500-1500 m, then decreased only slightly to about 35 µM NO_3-N/kg near 2500 m. Silicate increased from about 5 µM $Si(OH)_4$-Si/kg to 150 µM $Si(OH)_4$-Si/kg at 500 m, then continued to increase slightly to 175 µM $Si(OH)_4$-Si/kg at 2500 m. The dissolved oxygen minimum and the phosphate and nitrate maxima occupy similar depth zones. Some studies have investigated long-term variability in the deep sea using Ocean Station P data. Surface nitrate was never less than 10 µM even during peak uptake (Anderson et al. 1997). Hokkaido University (Hokkaido University 1981) confirmed measurable nitrate was always present and probably does not limit surface productivity. A well-established population of pelagic grazers appears to be responsible for the relatively high surface-nutrient concentrations (Miller et al. 1984).

The nutrients in the shelf waters, the second domain, interact horizontally and thus have similar properties to the shallow portion (<250 m) of the oceanic water described above. Seasonal changes depend upon the seasonal changes in the meteorological regime (Royer 1975). In the winter, easterly winds bring convergence and downwelling (Royer 1981) along with the winter cooling and replacement of warm, high-saline bottom waters. In the summer, the wind field reverses bringing relatively warm, high-saline, low-oxygen, high-nutrient waters from the central GOA back onto the shelf at depths of 100-200 m. Nitrate profiles near the mouth of Resurrection Bay show values increasing from 20 to 40 µM between 0 and 250 m during winter and values increasing from 1 to 30 µM between 0 and 250 m in summer.

Few nutrient studies have been done in the fjord and estuaries, the third domain, but exchange with the shelf water has been determined from a few localized intensive studies to be a function of sill depth. No anoxic conditions were observed in Alaskan fjords indicating at least annual bottom water renewal

(Muench and Heggie 1978). Shallow-silled fjords renewed between February and April when surface waters were most dense. Intermediate-sill depth (~150 m) fjords followed shelf-water density changes and led to fairly continuous flushing. Deep or unrestricted sill fjords are flushed between July and October when warm, saline, higher-nutrient water returns to the shelf after the relaxation of convergence.

3.1.5 Currents

The GOA and Aleutian Islands compose the eastern and northern boundaries of the main counterclockwise gyral circulation of the Subarctic Pacific Region. The smaller counterclockwise gyral circulation in the Bering Sea is a northern offshoot from the western part of the Region. Figure 3.1.1 shows the climatological mean circulation patterns of the Subarctic Pacific Region based on geostrophic flow (e.g., (Reed et al. 1993; Reed and Stabeno 1994)), and direct current measurements (Schumacher and Kendall Jr. 1995; Schumacher and Stabeno 1998; Stabeno and Reed 1994). The values of velocity given are estimates of typical flow. Speeds can vary substantially on daily time scales due to wind action on surface mixed layer waters, as shown by simulated surface current trajectories calculated throughout the region with REFM's (Resource Ecology and Fisheries Management Division) Ocean Surface Current Simulations (OSCURS) model. Mixing upward from the bottom due to tidal currents may be important on many time scales due to their recirculating of nutrients important for maintaining standing stocks of lower trophic levels which feed the higher portion of the ecosystem (Parker et al. 1995).

3.1.6 Sea ice

Oceanic conditions in the Bering Sea are influenced by the extent of ice cover (Figure 3.1.4). During extreme conditions, ice covers the entire eastern shelf; however, interannual variability of coverage can be as great as 40% (Niebauer 1988). The buoyancy flux from melting ice initiates both baroclinic transport along the marginal ice zone (~0.3 x 10^6 m^3 s^{-1}) (Muench and Schumacher 1985) and stratification. The ensuing ice edge bloom of phytoplankton accounts for between 10% and 65% of the total annual primary production (Niebauer et al. 1990). The nutrient-rich slope waters combine with summer solar radiation to create one of the world's most productive ecosystems (Walsh et al. 1989). Annual primary production varies from >200 gC $^{-2}$ over the southeastern shelf to >800 gC $^{-2}$ north of St. Lawrence Island. Over the western shelf, ice cover extends southwestward to Cape Kamchatka and seaward over the slope (Khen 1989).

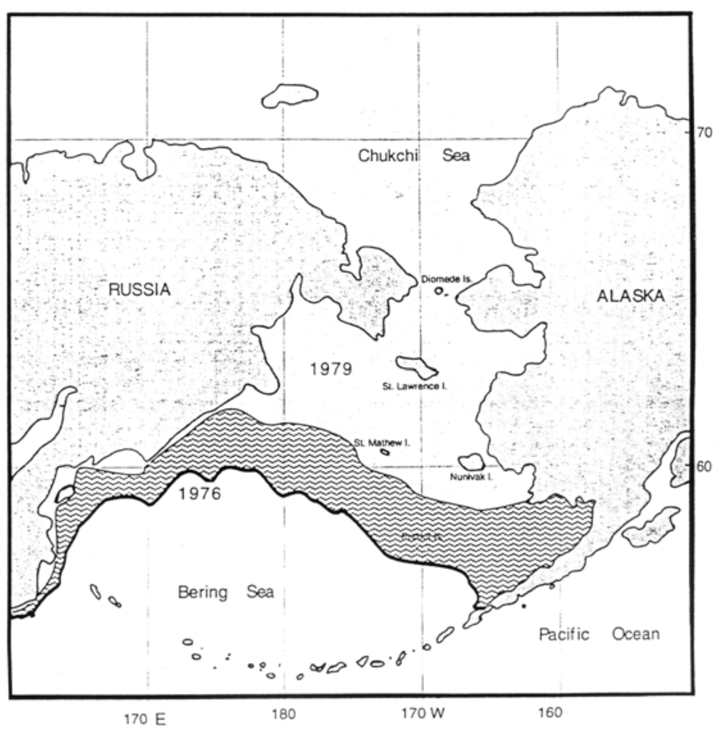

Figure 3.1.4 Maximum (1976) and minimum (1979) extent of sea ice in the Bering Sea.

Ice production and cold bottom water exert an important influence on distributions of biota over both the western (Radchenko and Sobolevskiy 1993) and eastern (Ohtani and Azumaya 1995; Wyllie-Echeverria 1995) shelves. The production of dense water has a marked impact on the halocline of the Arctic Ocean (Cavalieri and Martin 1994), with water from the Anadyr and Anadyr Strait polynyas providing a substantial fraction of the total dense water. From 9 to 25 m of ice formation occurs depending on the location and duration of a given season (Cavalieri and Martin 1994), but the average thickness of ice over most of the eastern shelf is only about 0.5 m (Coachman 1986).

3.1.7 Environmental regime shifts

The BSAI and GOA lie on the northern and eastern edges, respectively, of a larger regime north of about 42° N called the Subarctic Pacific Region. Physical features in this regime are primarily driven by the winter atmospheric circulation, in particular the Aleutian low which nearly covers this entire regime. Year-to-year, decadal, and longer-term changes in the shape of the Aleutian low determine the nature of the regime.

Regime shifts imply shifts in a characteristic behavior of a natural phenomenon like the major spatial and temporal features in the distributions of sea level pressure, wind, sea surface temperature, ice, or ocean currents. Minobe (Minobe 1997; Minobe 1999) studied changes in the Aleutian low over the last century whereas Hare and Mantua (Hare and Mantua 2000) studied changes in the eastern North Pacific from 1065-1997 to give the best assessment of recent regime shifts in the BSAI and GOA. Being on the fringe areas of the main pattern, the areas of interest may vary with more complexity, and as the latter analysis has shown, they may even be out of sync occasionally.

North Pacific pressure regime changes. The chronology of interdecadal climatic changes effecting the North Pacific Ocean was compiled from available measured atmospheric pressure data 1899-1997 by Minobe, (Minobe 1997). A climatic regime shift was defined as a transition from one climatic state to another within a period substantially shorter than the lengths of the individual epochs of each of the (two) climate states. Data used included the North Pacific Index (NPI), the area- and time-averaged sea level pressure anomalies in the region 160°E-140°W, 30°-60°N for winter-spring (Dec.-May) which illustrated rapid strength changes in the Aleutian low in winter and spring seasons. Bidecadal pressure averages during 1899-1924 (dashed line in Figure 3.1.5) showed that the Aleutian low was about 1 millibars (mb) weaker than average then strengthened to 1 mb below normal during 1925-47. Similar behavior occurred in the later part of this century as the Aleutian low shifted back to 1 mb above normal from 1948 to 1976 then strengthened back to 1 mb below normal during 1977-1997. Using late eighteenth century data for spring air temperature in western North America Minobe (Minobe 1997) found 1890 to be the first regime shift. This extended the length of the first period to 34 years in comparison to the 22, 26, and 20+ year regimes to follow. The 50-70 year interdecadal variability (a 2-regime cycle) has been prevalent from the eighteenth century to the present in North America and the likely cause is essentially an internal oscillation in the coupled atmosphere-ocean system. This suggests that the next climatic regime shift is most likely to occur in the coming decade between 2000 and 2007.

Long-term changes in fish populations around the North Pacific have apparently been influenced by climatic change of the same 50-70 year variability. Alaska salmon decreased in the 1940s and increased in the 1970s. Larger Japanese sardine catches occurred in the regimes with the deepened Aleutian low.

Bering Sea, Aleutian Islands and Gulf of Alaska regime changes. Although it took about 10 to 15 years to recognize the patterns, the regime shift of 1976/1977 is now widely recognized as well as its associated far reaching consequences for the large marine ecosystems of the North Pacific. The most recent regime shift (of 1989) has received in-depth study by data Hare and Mantua (Hare and Mantua 2000). Hare and Mantua assembled and examined 100 environmental time series (31 climatic and 69 biological) of indices as evidence of regime shift signals (Hare and Mantua 2000). A few of these examples are presented to illustrate that such signals are evident in the BSAI and GOA data.

The environmental regime of BSAI area does appear to have shifted. Evidence comes from sea surface temperature anomalies at the Pribilof Islands. The dominance of positive (warm) anomalies from 1977-1988 switched rapidly to negative (cold) anomalies in 1989 and were still dominating as late as 1997. Further evidence of a shift is seen in the time series of the southern extent of sea ice along 167°W (Figure 3.1.6), but the shift is less pronounced and more of a broad trend to cooler conditions with more ice. Controversy exists concerning 1989 being a complete or localized regime shift.

The GOA environment does not appear to have shifted, although it does appear to have returned to near normal with less year-to-year variability. As sea surface temperature is traced from the BSAI toward and clockwise around the GOA the anomalies stabilize around zero then remain positive in the southern GOA with no change in 1989. The unusual part of the controversy is that many biological time series in both areas show the shift in 1989 with relative clarity while the shift is less clear in the indices of Pacific climate (Hare and Mantua 2000).

A particularly striking example of biological changes was from a time series of quantitative catches of large medusae from bottom trawl surveys on the EBS shelf from 1979-1997 (Brodeur et al. 1999). The dramatic increase was in the 1990s where the median biomass increased tenfold between the 1982-1989 and 1990-1997 periods. Several large-scale winter/spring atmospheric and oceanographic variables in the Bering Sea also changed around 1990.

3.1.8 Distant forcing parameters that influence the North Pacific ecosystem

The coming era could be unique because there has been a new long-term global force applied to the climate of planet earth in the twentieth century that may superimpose a warming trend upon the ongoing large regime shift effects. The effects of feeding greenhouse gasses into the atmosphere during the twentieth century is beginning to manifest as a small rise in average global temperature that is expected to continue even as the input of gasses is diminished, thus, the coming effect in the twenty-first century. Based on the relatively crude predictions of climate change scenarios by the climate community experiments were performed at a U.S. GLOBEC workshop (U.S. GLOBEC 1996) to estimate changes for the Subarctic North Pacific in general. Based on these thought experiments coming changes can be estimated for BSAI and GOA. However, these are only speculations.

Climatologists start with the assumption of a secular warming of the atmosphere over the North Pacific Ocean, especially at higher latitudes. The more rapid rate of warming to the north would serve to decrease the meridional thermal gradient and cause a more sluggish atmospheric circulation. Major overall weather effects would be an increase in absolute humidity, a decrease in storm intensity, and a northward shift in the storm track. The humidity increase would increase coastal precipitation. Major ocean circulation effects that would follow the northward shift in the average line of zero wind stress curl which separates the subarctic and subtropic gyres are the weakening and northward shift of the core of the eastward flowing West Wind Drift and the northward shift of its bifurcation into the Alaska and California Currents. Changes in these features imply the changes for GOA and BSAI.

Gulf of Alaska. In the GOA previous studies have suggested the currents that with the northward shift of the West Wind Drift could result in an intensification of currents of the Alaska gyre. However, this was not clearly defined. With the winter decrease in storm intensity and the corresponding decrease in the input of positive vorticity (which drives the total flow) could consequently diminish both the average northward transport in the Alaska Coastal Current (ACC) and the westward transport in the Alaskan Stream. Other consequences in the central Gulf are less upwelling and less mixing resulting in shallower but warmer mixed layer tending to increase stratification.

Near the coast the added precipitation and glacial melt induced runoff would increase the stratification even more. As temperatures warm, more of the increased winter precipitation would fall as rain shifting the present fall maximum in river runoff earlier in the year closer to the time of maximum wind stress. Although the increased freshwater would add to the baroclinic structure, the decrease in wind stress along the coast would weaken the confinement of fresh water along the coast, thus weakening the baroclinic gradient and the ACC.

Reduction in strength of the ACC would effect the transport of nutrients along the shelf, and diminished downwelling on the shelf would tend to reduce the cross-shelf flux of nutrient-poor water at upper levels. This mechanism would be counteracted by less wind mixing, thus, there would be an unknown net effect on nutrient concentrations over the shelf. The timing of the spring bloom would probably be earlier since the water would be warmer, and the formation of the spring mixed layer could be earlier.

Bering Sea and Aleutian Islands. Effects of a global warming climate change scenario should be greater in BSAI than those in the GOA. This is because the BSAI is farther north where warming is expected to be greater due to the positive feedback from less snow cover and sea ice, hence a lower albedo. Changes in the atmosphere which drive the speculated changes in the ocean include increases in air temperature, storm intensities, storm frequencies, southerly wind, humidity, and precipitation. The increase precipitation plus snow and ice melt lead to an increase in fresh water runoff. The only decrease is in sea level pressure which is associated with the northward shift in the storm track. Although the location of the maximum in the mean wind stress curl will probably shift poleward, how the curl is likely to change is unknown. It is the net effect of the storms that largely determines the curl and there is likely to be compensation between changes in storm frequency and intensity.

Ocean circulation decreases are likely to occur in the major current systems; Alaskan Stream, Near Strait Inflow, Bering Slope Current, and Kamchatka Current. Competing effects make changes in the Unimak Pass inflow, the shelf coastal current, and the Bering Strait outflow unknown. Changes in hydrography should include increases in sea level, sea surface temperature, shelf bottom temperature and basin stratification. Decreases should occur in mixing energy and shelf break nutrient supply while competing effects make changes in shelf stratification and eddy activity unknown. Ice extent, thickness, and brine rejection are all expected to decrease.

Decadal and basin-scale climate variability can impact fish production and ecosystem dynamics. Sudden basin wide shifts in climate regime have been observed in the North Pacific (Mantua et al. 1997). These shifts appear to result from changes in atmospheric forcing. A climatology of the wind forcing shows that eastward and northward-propagating storm systems dominate the surface wind stress at short periods (<1 month), which serves principally to mix the upper ocean (Bond et al. 1994).

A large scale shift in atmospheric forcing occurred in the late 1970s. North Pacific winter sea level pressure averaged in the area between 30°N and 65°N and 160°E and 140°W showed a mean pressure of about 1010 mb from 1946 to 1977, changing to about 1007 mb from 1977 to 1988 when it changed back to about 1010 mb (Trenberth and Hurrell 1994). The timing of blocking marine ridges has changed from being primarily in winter in the early 1970s to primarily in fall in the late 1970s (Salmon 1992). Ingraham and Ebbesmeyer (Ingraham Jr. et al. 1998) used the Ocean Surface Current Simulations (OSCURS) model to generate wind driven surface drift trajectories initiated during winter months (Dec. - Feb.) for the period 1946 to the present. The endpoints of these 3-month drift trajectories shifted in a bimodal pattern to the north and south around the mean. The winter flow during each year is persistent enough to result in a large displacement of surface mixed layer water. The displacement also varies in a decadal pattern. Using the rule that the present mode is maintained until 3 years in a row of the opposite mode occur, four mode shifts were suggested; a south mode from 1946 to 1956, a north mode from 1957 to 1963, a south mode from 1964-1974, and a north mode 1975 to 1994.

Atmospheric forcing impacts sea surface temperatures. Two principal modes of remotely forced sea surface temperature anomalies include: shorter term El Niño /Southern Oscillation (ENSO) events and longer term Pacific Decadal Oscillations (PDO) (Mantua et al. 1997) . Temperature anomalies in the GOA and Bering Sea illustrate a relative warm period in the late 1950s followed by cooling especially in the early 1970s followed by a rapid temperature increase in the latter part of that decade. Since 1983, the GOA and Bering Sea have undergone different temperature changes. The sea surface temperatures in the GOA were generally above normal and those in the Bering Sea were below normal. The temperature differences between the two bodies of water have jumped from about 1.1° C to about 1.9° C (U.S. GLOBEC 1996). Subsurface temperature anomalies for the coastal GOA (GAK1, 60°N, 149°W) also show a change from the early 1970s into the 1980s similar to that observed in the sea surface (U.S. GLOBEC 1996). In addition, high latitude temperature responses to ENSO events can be seen especially at depth, in 1977, 1982, 1983, 1987 and in the 1990s. The 1997-1998 ENSO event, one of the strongest recorded this century, has significantly changed the distribution of fish stocks off California, Oregon, Washington, and Alaska, and the longer-term impacts of this event remain to be seen.

Francis et al. (Francis et al. 1999) reviewed the impacts of the most recent regime shift through lower, secondary and top trophic levels of the North Pacific marine ecosystem. Some of the following impacts on higher trophic levels are based on this review. Parker et al. (Parker et al. 1995) show marked similarities between time series of the lunar nodal tidal cycle, and recruitment patterns of Pacific halibut. Hollowed and Wooster (Hollowed and Wooster 1995) examined time series of marine fish recruitment and observed that some marine fish stocks exhibited an apparent preference (measured by the probability of strong year classes and average production of recruits during the period) for a given climatic regime. Hare and Francis (Hare and Francis 1995) found a striking similarity between large scale atmospheric conditions and salmon production in Alaska. Quinn and Niebauer (Quinn II and Niebauer 1995) studied the Bering Sea pollock population and found that high recruitment coincided with years of warm ocean conditions (above normal air and bottom temperatures and reduced ice cover). This fit was improved by accounting for density dependent processes.

Piatt and Anderson (Piatt and Anderson 1996) provide evidence of possible changes in prey abundance due to decadal scale climate shifts. These authors examine relationships between significant declines in marine birds in the northern GOA during the past 20 years and found significant declines in common murre populations occurred between the mid to late 1970s and the early 1990s. Piatt and Anderson (Piatt and Anderson 1996) found marked changes in diet composition of five seabird species collected in the GOA between 1975 to 1978 and 1988 to 1991. A shift in diet from one dominated by capelin in the late 1970s to one where capelin was virtually absent occurred in the later period.

On a larger scale, evidence of biological responses to decadal scale changes in climate are also found in the coincidence of global fishery expansions or collapses of similar species complexes. Sudden climate shifts in 1923, 1947 and 1976 in the North Pacific substantially altered marine ecosystems off Japan, Hawaii, Alaska, California, and Peru. Sardine stocks off Japan, California and Peru exhibit synchronous shifts in abundance which appear to be the result of climate teleconnections (Kawasaki 1991). These historical 60-yr cycles are seen in paleoceanographic records of scales of anchovies, sardines and hake as well. Other examples are salmon stocks in the GOA and the California Current System (CCS), whose cycles are out of phase – when salmon stocks do well in the GOA they do poorly in the CCS and vice versa (Hare and Francis 1995; Mantua et al. 1997).

In addition to decadal-scale shifts, interannual events such as the ENSO can have significant impacts on fish distribution and survival, and affect reproduction, recruitment and other processes in ways which are not yet understood. This is particularly true for the extra-tropical regions such as the northern CCS and GOA. The 1997-1998 ENSO event, one of the strongest recorded this century, has significantly changed the distribution of fish stocks off California, Oregon, Washington and Alaska, and the longer-term impacts of this event remain to be seen. Fisheries predictions are not possible in part because ENSO signals propagate to high-latitudes both through the ocean as well as through the atmosphere. Sufficient information on the dynamics of North Pacific climate and how this is linked to equatorial El Niño events does not exist to adjust our fisheries predictions for such abrupt, far-reaching and persistent changes. Warm ocean conditions observed in the California Current during the present regime may be due in large part to increased frequency of El Niño-like conditions.

3.1.9 Essential fish habitat (EFH)

EFH is defined in the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.” (16 U.S.C. 1802 § 3, 104-297). By definition, the area affected by this action, that is to say the entire North Pacific EEZ including the BSAI and the GOA, includes EFH for all species managed under the Council’s FMPs. EFH for these species is described and identified in five FMP amendments which were approved January 20, 1999 (Amendments 55/55/8/5/5). The EFH amendments describe EFH in text and with tables that provide information on the biological requirements for each life history stage of each managed species. They summarize all available information on environmental and habitat variables that control or limit distribution, abundance, reproduction, growth, survival, and productivity of the managed species.

In these amendments, species at different life stages were divided into five levels according to how much data were available for some or all portions of the geographic range of the species. For many species at different life stages, very little information was available. The EFH amendments will be updated as research fills in the gaps in our knowledge. A description of EFH as it has been identified for each species at different life stages is included in Section 3.2, which describes the life history of each managed species.

Table 3.1.1 lists all species which are managed by the Council by FMP. These species all have EFH within the area affected by this action, which, in effect, encompasses the entire EEZ. In the FMPs, species at different life stages were divided into five levels according to the amount of available data on some or all portions of the geographic range of the species. For many species at different life stages, very little information was available. A description of EFH as it has been identified for each species listed in Table 3.1.1 at different life stages, which describe the life history of each managed species. For more information, please consult the groundfish FMPs for the BSAI and GOA, which includes life stage descriptions for all FMP-managed species and includes tables on habitat associations, biological attributes, and reproductive traits for these species.

Table 3.1.1 FMP-managed species.

BSAI Groundfish	***GOA Groundfish***	***BSAI King and Tanner Crabs***	***High Seas Salmon***	***Scallops***
Arrowtooth flounder Alaska plaice Dusky rockfish Flathead sole Pacific cod Pacific ocean perch Rock sole Sablefish Atka mackerel Shortraker rockfish Rougheye rockfish Skates, sculpins, sharks, octopus, squid Thornyhead rockfish Walleye pollock Yellowfin sole Forage fish: eulachon, capelin, sand lance, sand fish, myctophids, euphausiids, pholids, stichaeids, bathylagidae, gonostomatidae	Arrowtooth flounder Atka mackerel Dover sole Dusky rockfish Flathead sole Pacific ocean perch Rex sole Rock sole Sablefish Shortraker rockfish Rougheye rockfish Skates, sculpins, sharks, octopus, squid Thornyhead rockfish Walleye pollock Yelloweye rockfish Forage fish: eulachon, capelin, sand lance, sand fish, myctophids, euphausiids, pholids, stichaeids, bathylagidae, gonostomatidae Yellowfin sole	Red king crab Blue king crab Golden king crab Scarlet king crab Tanner crab Snow crab Triangle Tanner crab Grooved Tanner crab	Chinook salmon Coho salmon Sockeye salmon Pink salmon Chum salmon	Weathervane scallops Pink scallops Spiny scallops Rock scallops

3.1.10 Contaminants

The Bering Sea, Aleutian Islands, and Gulf of Alaska ecosystems are not pristine. They have been subject to environmental contamination by radioactive wastes, chlorinated pesticides, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and trace elements. Scientific information on environmental contamination in the North Pacific Ocean is derived from data, reports and information products of multi-disciplinary environmental research, assessment and monitoring programs, such as the OCSEAP, the Environmental Studies Program (ESP) of the Minerals Management Service, and a program of long-term ecological research of ecosystems of the Bering and Chukchi seas and the Pacific Ocean called BERPAC, and NOAA's National Status and Trends (NS&T) Program. Additional incidental data on contaminant levels in the air, surface waters and biota can be obtained from results of multi-year cruises in the Indian and North Pacific Ocean during the period 1975 to 1982. The recently published "Arctic Monitoring and Assessment Program (AMAP) Assessment Report: Arctic Pollution Issues" and its separate summary report entitled "Arctic Pollution Issues: A State of the Arctic Environmental Report" provide a limited amount of data from the EBS.

Gulf of Alaska. The Mussel Watch Project determines concentrations of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, several pesticides, butyltins, and certain toxic elements in sediment and mollusks, in particular mussels or oysters, samples from U.S. coastal waters. In Alaska, the Mussel Watch sites are located only in the GOA, including Cook Inlet. Data and results of chemical analyses from these sites have recently been summarized. The contaminant concentrations are generally low, except for some metals. In a few instances, metal concentrations approach or exceed the 85th percentile values of the nationwide database: chromium at Homer Spit and Siwash Bay; nickel at Sheep Bay, Siwash Bay, and Mineral Creek Flats; and selenium at all sites in Prince William Sound and southeastern Alaska.

Statewide. From 1984 through 1993, the Benthic Surveillance Project measured the levels of contaminants and their metabolites in bottom-dwelling fish and in sediment samples, and measurements of pathological conditions, such as incidence of neoplasia and tumors, and physiological responses to contaminant exposure. Of the 120 sites nation wide, 13 sites were located in Alaska, extending from Ketchikan in southeastern Alaska to Prudhoe Bay on the North Slope. The Benthic Surveillance Project data have been compiled and reported. However, data from sites in Alaska are extremely limited. This fact, together with an inherently high variability in biological responses to contaminant exposure, precludes any conclusions pertaining to the northern North Pacific and Bering Sea fauna.

Bering Sea and Arctic. In 1993, the Arctic Regional Assessment was initiated in the U.S. Arctic responding to public concerns about widespread dumping of radioactive wastes, reactors and other vessels in the Arctic seas by the former Soviet Union. It was also recognized that there was a general lack of information on the levels and likely sources of radionuclides and contaminants in the region. The radioactivity component of the study was performed as a collaborative effort with the Office of Naval Research, United States Navy, as part of its Arctic Nuclear Waste Assessment Program. The study is nearing completion with all samples having been analyzed. Recent reports on this study have provided data and results from the Beaufort Sea. Preliminary results from the EBS samples have also been reported and additional reports are forthcoming.

In general, the anthropogenic radionuclide activity in the U.S. Arctic is low but quite pervasive, indicating that global fallout is the predominant and, perhaps, the only source. There are sub-regional differences in the radionuclide activity: the mean activity level of cesium-137 in the Beaufort Sea sediment samples (5.6 Bq/kg dry weight) is considerably higher than in the EBS (1.93 Bq/kg dry weight). In the EBS, Norton Sound samples had higher mean activity levels than the Bristol Bay samples. Similarly, the mean activity levels of plutonium239+240 in the Beaufort Sea sediment were higher than in the Bering Sea.

Among the species used for subsistence by communities in the North Slope Borough, radioactivity levels differ markedly between the terrestrial and marine species with the highest activity levels in the caribou tissues. In comparison, subsistence foods derived from marine food chains, for example, seals and bowhead whales, pose a much smaller, and nearly negligible, radiation dose. A follow-up study, using age-dependent dose coefficients, has demonstrated that the North Slope Borough communities that rely on traditional food resources would incur larger radiation doses, but all committed dose estimates were well within dosage from natural background and atmospheric fall-out.

There is an increasing concern about the adverse health effects in fish and wildlife in the U.S. Arctic, both at individual and population levels, from exposure to toxic elements. In certain instances, the body burden of metals in the tissues of species collected in western Alaska exceeds the levels at which physiological dysfunction or impaired reproduction is known to occur. Examples include cadmium in walrus kidneys, selenium in emperor geese blood, and lead in spectacled eiders and common eiders. As noted in the Mussel Watch data, concentration of some metals in the sediment and mussels from the GOA are high in comparison with the nationwide median. Historic data, as well as data based on chemical analyses of samples collected in 1993 and 1994, show generally elevated levels (approaching or exceeding the nationwide median value) of arsenic, chromium, copper and nickel in the EBS and Beaufort Sea sediment, with higher values generally found in the Beaufort Sea. Considering the lack of anthropogenic sources of toxic metals in the U.S. Arctic, that is, large urban areas or manufacturing industries, such elevated levels may be due to enriched source rocks and regional mineralogy. The Red Dog Mine off the coast of Chukchi Sea is an example of highly enriched source rocks forming one of the world's largest deposits of zinc, lead and associated minerals. Nonetheless, there is little scientific data on the environmental pathways, including food chain transfers, and biological effects of toxic elements on the fish and wildlife resources of the Arctic.

The levels of organic contaminants are generally very low and are among the lowest recorded by the NS&T Program. Several specific compounds or groups of compounds are undetectable both in the sediment biological samples (invertebrate and fish samples). Total chlordanes (the sum of cis-chlordane, trans-nonachlor, heptachlor, and heptachlor epoxide) levels were somewhat higher than the sum of DDT isomers and metabolites. Still, total chlordanes in EBS varied from below detection level to 0.46 ng/g in sediment, and between 0.4 and 7 in biological samples. Endosulfan II was measurable in only two sediment samples with values ranging 0.07 to 0.11 ng/g. Total PCB concentration (sum of 18 congeners in sediment was low but rather pervasive and uniformly distributed. It varied between 3 and 8 ng/g suggesting atmospheric deposition as the principal source. In the few biological samples analyzed for PCBs, the total PCB concentration ranged from 2 (in starfish) to 11 (in flatfish).

In contrast, the PAH distribution in Alaska shows marked regional differences. The coastal waters along the North Slope Borough are very rich in PAHs, with mean values often exceeding 300 ng/g dry weight in sediment. Off the Colville River in East Harrison Bay, the values are much higher, ca. 2,500 ng/g dry weight. The presence of certain biogenic markers in the hydrocarbon samples, (such as steranes and triterpanes), source diagnostic ratios of certain PAHs, alkanes and cycloalkanes, and hydrocarbon composition in the riverine sediment, suggest that extensive coastal erosion and discharge from rivers are the primary hydrocarbon sources in the region.

Many samples from Norton Sound contained relatively high amounts of perylene, whose presence in coastal marine sediments is usually attributable to terrigenous plant residues. Off the Yukon River Delta, perylene concentration was as much as 40 ng/g and contributed ca. 28 percent of the total PAHs. Previous studies in the region, conducted under OCSEAP, have shown a strong correlation between the terrigenous flux and perylene content in Norton Sound and Cook Inlet. In Bristol Bay, the lower PAH values are perhaps indicative of a lack of fine-grained sediment, riverine input or industrial activities; the 1994 data ranged between 18 and 73 ng/g. Low as these levels are, detailed examination of composition and source diagnostic ratios of certain PAH compounds suggest that a major source of PAHs in the area is diesel fuel. In comparison with the Norton Sound samples, the Bristol Bay samples lacked chrysenes, had relatively high amounts of alky-substituted naphthalenes and phenanthrenes, and contained small amounts of dibenzothiophenes in all samples. Perylene was not detected at several of the of Bristol Bay stations. Further, the fossil fuel pollution index values for Bristol Bay samples was general higher, occasionally exceeding 70. This index can range between 100 for fossil fuel [as computed, the index value can exceed 100 under certain circumstances] to nearly zero for pyrogenic PAHs; values for Prudhoe Bay crude oil, Cook Inlet crude oil, and Alaska diesel fuel are about 95. Data on other petroleum hydrocarbons, such as n-alkanes, isoalkanes, and cycloalkanes, are not available to further examine the likely sources of hydrocarbons in the EBS.

3.2 Biological resources

3.2.1 Groundfish species

This section presents descriptions of major target species summarizing important life history traits, their habitat environment, prey base, and status of the stocks. Additional information on life history (in table format) and habitat features (in mappings) for each major groundfish species are described in the following three documents: (1) Environmental Assessment for essential fish habitat (NPFMC 1999a), (2) Essential fish habitat assessment report for the groundfish resources of the BSAI region (NPFMC 1998a), (3) Essential fish habitat assessment report for the groundfish resources of the GOA region (NPFMC 1998b). Harvest specifications, including allowable biological catch, total allowable catch, and the overfishing levels are detailed in the annual Stock Assessment and Fishery Evaluation (SAFE) documents produced by the Council. The SAFE documents also detail the stock assessment conducted for each species.

Pollock

Stock Description and Life History. Pollock (*Theragra chalcogramma)* is the most abundant species within the EBS and the second most abundant groundfish stock in the GOA . It is widely distributed throughout the North Pacific in temperate and subarctic waters (Wolotira Jr. et al. 1993). Pollock is a semidemersal schooling fish, which becomes increasingly demersal with age. Approximately 50 percent of female pollock reach maturity at age four, at a length of approximately 40 cm. Pollock spawning is pelagic and takes place in the early spring on the outer continental shelf. In the EBS, the largest concentrations occur in the southeastern portion of the EBS, north of Unimak Pass. In the GOA, the largest spawning concentrations occur in Shelikof Strait and the Shumagin Islands (Kendall et al. 1996). Juvenile pollock are pelagic and feed primarily on copepods and euphausiids. As they age, pollock become increasingly piscivorus and can be highly cannibalistic, with smaller pollock being a major food item (Livingston 1991b). Pollock are comparatively short lived, with a fairly high natural mortality rate estimated at 0.3 (Hollowed et al. 1997; Wespestad and Terry 1984) and maximum recorded age of around 22 years.

Although stock structure of Bering Sea pollock is not well defined (Wespestad 1993), three stocks of pollock are recognized in the BSAI for management purposes: EBS, Aleutian Islands and Aleutian Basin (NPFMC 1999c). Pollock in the GOA are thought to be a single stock (Alton and Megrey 1986) originating from springtime spawning in Shelikof Strait (Brodeur and Wilson 1996).

Trophic Interactions. The diet of pollock in the EBS has been studied extensively (Dwyer 1984; Lang and Livingston 1996; Livingston 1991b; Livingston 1993; Livingston and DeReynier 1996). These studies have shown that juvenile pollock is the dominant fish prey in the EBS; other fish are also consumed by pollock including juveniles of Pacific herring (*Clupea pallasii*), Pacific cod, arrowtooth flounder (*Atheresthes stomias*), flathead sole (*Hippoglossus elassodon*), rock sole, yellowfin sole, Greenland turbot, Pacific halibut and Alaska plaice (*Pleuronectes quadrituberculatus*). On the shelf area of the EBS, the contribution of these other fish prey to the diet of pollock tends to be very low (i.e., usually less than 2 percent by weight of the diet; (Livingston 1991b; Livingston 1993; Livingston and DeReynier 1996). However, in the deeper slope waters, deep-sea fish (myctophids and bathylagids) are a relatively important diet component (12 percent by weight), along with euphausiids, pollock, pandalid shrimp and squid (Lang and Livingston 1996).

The cannibalistic nature of pollock, particularly adults feeding on juveniles, is well-documented by field studies in the EBS (Bailey 1989a; Dwyer et al. 1987; Livingston 1989b; Livingston 1991b; Livingston

1993; Livingston and DeReynier 1996; Livingston and Lang 1997). As mentioned previously, cannibalism by pollock in the Aleutian Islands region has not yet been documented (Yang 1996).

Cannibalism rates in the EBS vary depending on year, season, area, and predator size (Dwyer et al. 1987; Livingston 1989b; Livingston and Lang 1997). Cannibalism rates are highest in autumn, next highest in summer, and lowest in spring. Cannibalism rates by pollock larger than 40cm are higher than those by pollock less than 40cm. Most pollock cannibalized are age-0 and age-1 fish, with most age-1 pollock being consumed northwest of the Pribilof Islands where most age-1 pollock are found. Pollock larger than 50 cm tend to consume most of the age-1 fish. Smaller pollock consume mostly age-0 fish. Although age-2 and age-3 pollock are sometimes cannibalized, the frequency of occurrence of these age groups in the stomach contents is quite low. Laboratory studies have shown the possibility of cannibalism among age-0 pollock (Sogard and Olla 1993b). Field samples have confirmed this interaction, but so far this interaction appears not to be very important.

Field and laboratory studies on juvenile pollock have examined behavioral and physical factors that may influence vulnerability of juveniles to cannibalism (Bailey 1989a; Olla et al. 1995; Sogard and Olla 1993a; Sogard and Olla 1993b). Although it had previously been hypothesized that cannibalism occurred only in areas with no thermal stratification, these recent studies show that age-0 pollock do move below the thermocline into waters inhabited by adults. Larger age-0 fish tend to move below the thermocline during the day, and all age-0 fish tend to inhabit surface waters at night for feeding. Most cannibalism may occur during the day. If food availability is high, all sizes tend to stay above the thermocline, but when food resources are low then even small age-0 fish do move towards the colder waters as an energy-conserving mechanism. Thus, prediction of cannibalism rates may require knowledge of the thermal gradient and food availability to juveniles in an area.

Various studies have modeled pollock cannibalism in either a static or dynamic fashion (Dwyer 1984; Honkalehto 1989; Knechtel and Bledsoe 1981; Knechtel and Bledsoe 1983; Laevastu and Larkins 1981; Livingston 1991a; Livingston 1994b; Livingston et al. 1993). The Knechtel and Bledsoe (Knechtel and Bledsoe 1983) size-structured simulations produced several conclusions regarding cannibalism. Under conditions simulating the current fishing mortality rate ($F=0.3yr^{-1}$) the population tended toward equilibrium. They also found that cannibalism is a stabilizing influence, with the population showing less variation compared to simulations in which cannibalism was not included. Zooplankton populations were also simulated in the model, and Knechtel and Bledsoe concluded that food was limiting, particularly for adult pollock. Maximization of average catch occurred at an extremely high F value ($F=3.0\ yr^{-1}$) that is about ten times higher than the actual fishing mortality rates in the EBS. However, the interannual variation in catches under this hypothetical scenario were extremely large.

The trend in more recent modeling efforts (Honkalehto 1989; Livingston 1994a; Livingston 1994b; Livingston et al. 1993) has been to examine cannibalism using more standard stock assessment procedures such as virtual population analysis or integrated catch-age models such as Methot's (Methot 1990) synthesis model. The purpose is to obtain better estimates of juvenile pollock abundance and mortality rates, which can improve our knowledge of factors affecting recruitment of pollock into the commercial fishery at age 3. Results from Livingston (Livingston 1994a; Livingston 1994b; Livingston et al. 1993) highlight several points with regard to cannibalism. In the current state of the EBS, cannibalism appears to be the most important source of predation mortality for age-0 and age-1 pollock. Predation mortality rates for juvenile pollock are not constant, as assumed in most population assessment models, but vary across time mainly due to changes in predator abundance but perhaps also due to predators feeding more heavily on more abundant year classes. The decline in pollock recruitment observed at high pollock spawning biomasses appears to be due to cannibalism. There also appears to be an environmental component to juvenile pollock survival, wherein surface currents during the first 3 months of life may transport larvae to areas more favorable to survival (e.g., away from adult predators or in areas more favorable for feeding). Estimates of total amount of pollock consumed by important groundfish predators show that cannibalism is the largest source of removal of juvenile pollock by groundfish predation (Livingston 1991a; Livingston 1993; Livingston and DeReynier 1996).

Other groundfish predators of pollock include Greenland turbot, arrowtooth flounder, Pacific cod, Pacific halibut, and flathead sole (Livingston 1991a; Livingston and DeReynier 1996; Livingston et al. 1993). These species are some of the more abundant groundfish in the EBS, and pollock constitutes a large proportion of the diet for many of them. Other less abundant species that consume pollock include Alaska skate (*Bathyraja parmifera*), sablefish (*Anoplopoma fimbria*), Pacific sandfish (*Trichodon trichodon*), and various sculpins (Livingston 1989a; Livingston and DeReynier 1996). Small amounts of juvenile pollock are even eaten by small-mouthed flounders such as yellowfin sole and rock sole (Livingston 1991a; Livingston 1993; Livingston and DeReynier 1996). Age-0 and age-1 pollock are the targets of most of these groundfish predators, with the exception of Pacific cod, Pacific halibut, and Alaska skate, which may consume pollock ranging in age from age-0 to greater than age-6 depending on predator size.

Pollock is a significant prey item of marine mammals and birds in the EBS and has been the focus of many studies. Studies suggest that pollock is a primary prey item of northern fur seals when feeding on the shelf during summer (Sinclair et al. 1997; Sinclair et al. 1994). Squid and other small pelagic fish are also eaten by northern fur seals in slope areas or in other seasons. The main sizes of pollock consumed by fur seals range from 3-20 cm or age-0 and age-1 fish. Older age classes of pollock may appear in the diet, during years of lower abundances of young pollock (Sinclair et al. 1997). Pollock has been noted as a prey item for other marine mammals including northern fur seals, harbor seals (*Phocoena phocoena*), fin whales (*Balaenoptera physalus*), minke whales (*B. Acutorostrata*), and humpback whales (*Megaptera novapangliae*) but stomach samples from these species in the EBS have been very limited, so the importance of pollock in the diets has not been well-defined (Kajimura and Fowler 1984). Pollock are one of the most common prey in the diet of spotted seals (*Phoca larqha*) and ribbon seals (*P. Fasciata*), which feed on pollock in the winter and spring in the areas of drifting ice (Lowry et al. 1979).

Five species of piscivorus birds are dominant in the avifauna of the EBS: northern fulmar (*Fulmarus glacialus*), red-legged kittiwake (*Rissa brevirostris*), black-legged kittiwake (*R. Tridactyla*), common murre (*Uria aalgae*), and thick-billed murre (*U. Iomvia*) (Kajimura and Fowler 1984; Schneider and Shuntov 1993). Pollock is sometimes the dominant component in the diets of northern fulmar, black-legged kittiwake, common murre and thick-billed murre, while red-legged kittiwakes tend to rely more heavily on myctophids (Hunt Jr. et al. 1981a; Kajimura and Fowler 1984; Springer et al. 1986). Age-0 and age-1 pollock are consumed by these bird species, and the dominance of a particular pollock age-class in the diet varies by year and season. Fluctuations in chick production by kittiwakes have been linked to the availability of fatty fishes such as myctophids, capelin (*Mallotus villosus*) and Pacific sand lance (*Ammodytes hexapteras*) (Hunt Jr. et al. 1995). Changes in the availability of prey, including pollock, to surface-feeding seabirds may be due to changes in sea surface temperatures and the locations of oceanographic features such as fronts which could influence the horizontal or vertical distribution of prey (Decker et al. 1995; Springer 1992). See Section 3.2.4 for more information.

The diet of pollock, particularly adults, in the GOA has not been studied as thoroughly as in the EBS. Larvae, 5-20 mm in length, consume larval and juvenile copepods and copepod eggs (Canino 1994; Kendall Jr. et al. 1987). Early juveniles (25-100 mm) of pollock in the GOA primarily eat juvenile and adult copepods, larvaceans, and euphausiids while late juveniles (100-150 mm) eat mostly euphausiids, chaetognaths, amphipods, and mysids (Brodeur and Wilson 1996; Grover 1990a; Krieger 1985; Livingston 1985; Merati and Brodeur 1997; Walline 1983). Juvenile and adult pollock in southeast

Alaska rely heavily on euphausiids, mysids, shrimp and fish as prey (Clausen 1983). Euphausiids and mysids are important to smaller pollock and shrimp and fish are more important to larger pollock in that area. Copepods are not a dominant prey item of pollock in the embayments of southeast Alaska but appear mostly in the summer diet. Similarly, the summer diet of pollock in the central and western GOA does not contain as much copepods (Yang 1993). Euphausiids are the dominant prey, constituting a relatively constant proportion of the diet by weight across pollock sizes groups. Shrimp and fish are the next two important prey items.

Fish prey become an increasing fraction of the pollock diet with increasing pollock size in the GOA. Over 20 different species of fish have been identified in the stomach contents of pollock from this area but the dominant fish consumed is capelin (Yang 1993). A high diversity of prey fish were also found in pollock stomachs. Commercially important fish prey included: Pacific cod, pollock, arrowtooth flounder, flathead sole , Dover sole (*Microstomus pacificus*), and Greenland halibut. Forage fish such as capelin, eulachon (*Thaleichthys pacificus*) and Pacific sand lance, were also found in pollock stomach contents.

Dominant populations of groundfish in the GOA that prey on pollock include arrowtooth flounder, sablefish, Pacific cod, and Pacific halibut (Albers and Anderson 1985; Best and St-Pierre 1986; Jewett 1978; Yang 1993). Pollock is one of the top five prey items (by weight) for Pacific cod, arrowtooth flounder, and Pacific halibut. Other prey fish of these species include Pacific herring and capelin (an osmerid fish). Other predators of pollock include great sculpins (Carlson 1995) and shortspined thornyheads (*Sebastes alascanus*) (Yang 1993). As found in the EBS, Pacific halibut and Pacific cod tend to consume larger pollock, and arrowtooth flounder consumes pollock that are mostly less than age-3. Unlike the EBS, however, the main source of predation mortality on pollock at present appears to be from the arrowtooth flounder (Livingston 1994b). Stock assessment authors have attempted to incorporate predation mortality by arrowtooth flounder, Pacific halibut, and sea lions in the stock assessment for pollock in the GOA (Hollowed et al. 1997).

Research on the diets of marine mammals and birds in the GOA was less intensive for the Bering Sea, but recently has been greatly accelerated (Brodeur and Wilson 1996; Calkins 1987; DeGange and Sanger 1986; Hatch and Sanger 1992; Lowry et al. 1989; Merrick and Calkins 1996; Pitcher 1980a; Pitcher 1980b; Pitcher 1981). Brodeur and Wilson's (Brodeur and Wilson 1996) review summarized both bird and mammal predation on juvenile pollock. The main piscivorus birds that consume pollock in the GOA are black-legged kittiwakes, common murre, thick-billed murre, tufted puffin (*Fratercula cirrhata*), horned puffin (*F. Corniculata*), and probably marbled murrelet (*Brachyramphus marmoratus*). The diets of common murres have been shown to contain around 5 percent to 15 percent age-0 pollock by weight depending on season. The tufted puffin diet is more diverse and tends to contain more pollock than that of the horned puffin (Hatch and Sanger 1992). Both horned puffins and tufted puffins consume age-0 pollock. The amount of pollock in the diet of tufted puffin varied by region in the years studied, with very low amounts in the north-central GOA and Kodiak Island areas, intermediate (5-20 percent) amounts in the Semidi and Shumagin Islands, and large amounts (25-75 percent) in the Sandman Reefs and eastern Aleutian Islands. The proportion of juvenile pollock in the diet of tufted puffin at the Semidi Islands varied by year and was related to pollock year-class abundance.

Pollock is a major prey of Steller sea lions and harbor seals in the GOA (Merrick and Calkins 1996; Pitcher 1980a; Pitcher 1980b; Pitcher 1981). Harbor seals tend to have a more diverse diet, and the occurrence of pollock in the diet is lower than in sea lions. Pollock is a major prey of both juvenile and adult Steller sea lions in the GOA. It appears that the proportion of animals consuming pollock increased from the 1970s to the 1980s, and this increase was most pronounced for juvenile Steller sea lions. Sizes of pollock consumed by Steller sea lions range from 5-56 cm and the size composition of pollock consumed appears to be related to the size composition of the pollock population. However, juvenile

Steller sea lions consume smaller pollock on average than adults. Age-1 pollock was dominant in the diet of juvenile Steller sea lions in 1985, possibly a reflection of the abundant 1984 year class of pollock available to Steller sea lions in that year.

Habitat. Pollock are widely distributed in temperate and subarctic waters throughout the North Pacific (Wolotira Jr. et al. 1993). Pollock are semi-demersal schooling fish, which become increasingly demersal with age. Approximately fifty percent of female pollock reach maturity at age four, at a length of approximately 40 cm. Springer (Springer 1992) described the spawning season in the eastern Bering Sea: "Spawning usually begins in February over the southeastern continental slope and progresses onto the shelf north of Unimak Pass, where most eggs are released in March-April. Spawning continues, and generally declines, along the outer shelf to the northwest, with eggs being released in the vicinity of the Pribilof Islands in April-May and south and west of St. Matthew Island in May-June." In the GOA, the largest spawning concentrations are the Shumagin Islands (early March) Shelikof Strait (late March), the east side of Kodiak Island and near Prince William Sound (Kendall et al. 1996).

Pollock eggs (duration 14-21 days) are dispersed in pelagic waters of the outer continental shelf and upper slope of the eastern Bering Sea from Unimak Island northwest to Zhenchug Canyon in 200-400 m of depth over basin and lower slope areas in the Aleutian Islands and the Aleutian Basin. They are found at depths below 150m in Shelikof Strait in the GOA.

Pollock larvae (duration 14-60 days) are found in epipelagic waters on the inner, middle, and outer continental shelf and upper slope of the eastern Bering Sea, eastern portions of the Aleutian Basin, and throughout the Aleutians Islands. They are found in the GOA along the middle and outer continental shelf from Dixon Entrance to 170˚ W. They eat copepod, nauplii and small euphausiids, and survival is enhanced where these organisms are concentrated, such as along semi-permanent fronts (mid-shelf front near the 100 m isobath), within ephemeral gyres, and possibly in association with jellyfish.

First-year pollock are found along the bottom and in midwater. They have no known substrate preferences. At ages two and three years, pollock are mostly found off the bottom within the water column, often associated with fronts and thermoclines. In the BSAI, ranges of juveniles of strong year-classes have varied from throughout the eastern Bering Sea (1978 year-class) to almost exclusively north of Zhenchug Canyon (1989 year-class). In the GOA, juveniles range throughout pelagic waters along the inner, mid and outer continental shelf in the from Dixon Entrance to 170˚ W. The younger ones feed primarily on pelagic crustaceans--copepods and euphausiids. As they age, pollock become increasingly piscivorus and can be highly cannibalistic in certain seasons (Livingston 1991a; Livingston 1991b), particularly in the eastern Bering Sea. In the GOA, shrimp are an important diet component, in addition to other crustaceans and small fish.

Adult pollock (four years and over) are found in Melo-pelagic and semi-demersal habitats along the middle and outer continental shelf in the eastern Bering Sea from the U.S. Russia Convention Line to Unimak Pass and northeast along the Alaska Peninsula and throughout the Aleutian Islands. They also live pelagically over deep Aleutian Basin waters. In the GOA, they range in waters from 70 to 200m along the outer continental shelf from Dixon Entrance to 170˚ W. They feed on pelagic crustaceans and small fish--primarily juvenile pollock, myctophids and bathylagids on the eastern Bering Sea shelf and slope, and capelin and juvenile pollock in the GOA. Concentrations of these prey species are found in upwellings along the shelf break or fronts on the middle shelf.

Stock assessment. Currently, information on pollock in the EBS comes from NMFS observers aboard commercial fishing vessels, annual trawl surveys, and triennial echo integration (hydroacoustic) trawl surveys. In the Aleutian Islands, information comes from observer data and triennial bottom trawl surveys. In the GOA, stock assessment information is based on observer and port sampling data, annual hydroacoustic surveys in the Shelikof Straits area, and triennial bottom trawl surveys. These different data sets are analyzed simultaneously to obtain an overall view of each stock's condition. The bottom trawl data may not provide an accurate view of pollock distribution because a significant portion of the pollock biomass may be pelagic and not available to bottom trawls and much of the Aleutian Islands shelf is untrawlable due to rough bottom.

In the EBS pollock are assessed with an age-structured model incorporating fishery data and two types of survey catch data and age compositions. Bottom trawl surveys are conducted annually during June through August and provide a consistent time series of adult population abundance from 1982-1997. Echo-integrated trawl surveys are run every three years (typically) and provide an abundance index on more pelagic (typically younger) segments of the stock. Both surveys dispose their catches into their relative age compositions prior to analyses. Fishery data include estimates of the total catch by area/time strata and also the average body weight-at-age and relative age composition of the catch within each stratum. The results of the statistical model applied to these data are updated annually and presented in the BSAI pollock chapter of the Council's BSAI SAFE report. Also included are separate analyses on pollock stocks in the Aleutian Islands and Bogoslof areas. These analyses are constrained by data limitations and are presented relative to the status of the EBS stock. This analysis focused specifically on the EBS stock with the view that extensions to these other areas are equally applicable. The stock assessment is reviewed by the Plan Team, and by the Scientific and Statistical Committee, before being presented to the Council.

The age composition of pollock has been dominated by strong year classes—most recently there appears to be higher than average 1992 year class, and prior to that the 1989 year class was very high. The abundance of these year classes is evident from the Echo Integration Trawl (EIT) and bottom trawl surveys in addition to the extensive fishery age-composition data that have been collected. The selectivity of the fishery has cumulative impacts on the age composition due to fishing mortality. The fishery has tended to exhibit variable selectivity over time, but generally targets fish aged 5 years and older.

GOA pollock are also assessed with an age-structured model incorporating fishery and survey data. The data used in this analysis consist of estimates of total catch biomass, bottom trawl biomass estimates, EIT survey estimates of the spawning biomass in Shelikof Strait, egg production estimates of spawning biomass in Shelikof Strait, and fisheries catch at age and survey size and age compositions. Fishery catch statistics (including discards) are estimated by the NMFS Alaska Regional Office. These estimates are based on the best blend of observer-reported catch and weekly production reports. Age composition data are obtained from several sources including catch at age aggregated over all seasons, nations, vessel classes and International North Pacific Fisheries Commission (INPFC) statistical areas for the years, and numbers at age from the spring EIT survey and the bottom trawl surveys. An additional estimate of the age composition of the population in 1973 was available from a bottom trawl survey of the GOA. Length frequency data collected from the EIT survey are also included in the model, as is historical information on pollock size composition obtained from the Japanese Pacific ocean perch fishery from the period 1964-1975 (Hollowed et al. 1991). Recent assessments have explored the impact of predation mortality by arrowtooth flounder, Pacific halibut and Steller sea lions by incorporating time series of estimated predator biomass, the age composition of pollock consumed by predators, and estimated consumption rates (Hollowed et al. 1997).

The current age and size distributions of GOA pollock are discussed in Hollowed *et al.* (Hollowed et al. 1997). Ages 3 through 15 represent the recruited population, although reliable estimates of abundance for ages 2 and above exist. The age composition is dominated by a recent strong 1994 year class; large numbers from the strong 1988 year class are still in the population. The estimated mean age of the recruited portion of the population in 1999 was 4 years.

Over the last 15 years, NOAA's Fisheries Oceanography Coordinated Investigations (FOCI) targeted much of their research on understanding processes influencing recruitment of pollock in the GOA. These investigations led to the development of a conceptual model of factors influencing pollock recruitment (for complete review collection of papers (Kendall et al. 1996). Bailey *et al.* (Bailey et al. 1996) reviewed 10 years of data for evidence of density dependent mortality at early life stages. Their study revealed evidence of density dependent mortality only at the late larval to early juvenile stages of development. Bailey *et al.* (Bailey et al. 1996) hypothesize that pollock recruitment levels can be established at any early life stage (egg, larval or juvenile) depending on sufficient supply from prior stages. He labeled this hypothesis the supply dependent multiple life stage control model. In a parallel study, Megrey *et al.* (Megrey et al. 1996) reviewed data from FOCI studies and identified several events that are important to survival of pollock during the early life history period. These events are climatic events (Hollowed and Wooster 1995; Stabeno et al. 1995), preconditioning of the environment prior to spawning (Hermann et al. 1996), the ability of the physical environment to retain the planktonic life stages of pollock on the continental shelf (Bograd et al. 1994; Schumacher et al. 1993), and the abundance and distribution of prey and predators on the shelf (Bailey and Macklin 1994; Canino 1994; Theilacker et al. 1996). Thus, the best available data suggest that pollock year-class strength is controlled by sequences of biotic and abiotic events and that population density is only one of several factors influencing pollock production.

In both the BSAI and GOA, cumulative impacts of fishing mortality on the age composition are influenced by the selectivity of the fishery. The current age compositions of the stocks reflect a fished population with a long catch history. In any given year, the age composition of the stock is influenced by previous year-class strength. The reproductive potential of the stock in a given year is dependent on the biomass of spawners as modified by abiotic and biotic conditions. Thus, it is likely that the average age of unfished populations would have varied inter-annually due to the history of oceanic and climate conditions. NMFS's FOCI and the Coastal Ocean Program's Southeast Bering Sea Carrying Capacity (SEBSCC) regional study focuses research on improving our understanding of mechanisms underlying annual production of pollock stocks in the GOA and EBS. NOAA's long-term goal is to improve our ability to assess quantitatively the long term impact of commercial removals of adult pollock on future recruitment by combining the findings of process-oriented research programs such as FOCI and SEBSCC with NMFS's on-going studies of species interactions, fish distributions, and abundance trends. This supplemental environmental impact statement, does not seek to evaluate the range of mean ages that could have occurred in the absence of fishing.

Pacific Cod

Pacific cod (*Gadus macrocephalus*) is a demersal species that occurs on the continental shelf and upper slope from Santa Monica Bay, California through the GOA, Aleutian Islands, and EBS to Norton Sound (Bakkala 1984). The Bering Sea represents the center of greatest abundance, although Pacific cod are also abundant in the Gulf and Aleutian Islands (Outer Continental Shelf Environmental Assessment Program 1987). In 2000, the estimated spawning biomass for Pacific cod in the EBS was 355,000 tons. The 2000 estimated spawning biomass in the GOA was 111,000 tons.

GOA and BSAI cod stocks are genetically indistinguishable (Grant et al. 1987), and tagging studies show that cod migrate seasonally over large areas (Shimada and Kimura 1994). In the late winter, Pacific cod converge in large spawning masses over relatively small areas. Major aggregations occur between Unalaska and Unimak Islands, southwest of the Pribilof Islands and near the Shumagin group in the western Gulf (Shimada and Kimura 1994). Spawning takes place in the sublittoral-bathyal zone (the area of the continental shelf and slope [40-290 m]) near the bottom. The eggs sink to the bottom and are somewhat adhesive (Hirschberger and Smith 1983). Pacific cod reach a maximum recorded age of 19.

Pacific cod are omnivorous. Livingston (Livingston 1991b) characterized the diet of Pacific cod in the BSAI and GOA as follows: In terms of percent occurrence, the most important items were polychaetes, amphipods, and crangonid shrimp; in terms of numbers of individual organisms consumed, the most important items were euphausiids, miscellaneous fishes, and amphipods; and in terms of weight of organisms consumed, the most important items were pollock, fishery offal, and yellowfin sole. Small Pacific cod were found to feed mostly on invertebrates, while large Pacific cod are mainly piscivorus. Predators of Pacific cod include halibut, salmon shark, northern fur seals, Steller sea lions, harbor porpoises (*Phocoena phocoena*), various whale species, and tufted puffin (Westrheim 1996).

Flathead Sole

Flathead sole (*Hippoglossus elassodon*) is distributed from northern California northward throughout Alaska (Wolotira Jr. et al. 1993). In the northern part of its range, it overlaps with the related and very similar Bering flounder (*Hippoglossoides robustus*) (Hart 1973). Because it is difficult to separate these two species at sea, they are currently managed as a single stock (Walters and Wilderbuer 1997). Adults are benthic and occupy separate winter spawning and summer feeding distributions. From over-wintering grounds near the continental shelf margin, adults begin a migration onto the mid and outer continental shelf in April or May. The spawning period occurs in the spring, primarily in deeper waters near the margins of the continental shelf (Walters and Wilderbuer 1997). Eggs are large and pelagic. Upon hatching, the larvae are planktonic and usually inhabit shallow areas (Waldron and Vinter 1978). Exact age and size at maturity are unknown, but recruitment to the fishery begins at age 3. The maximum age for flathead sole is approximately 20 years. Flathead sole feed primarily on invertebrates such as amphipods and decapods. In the EBS, other fish species represented 5-25 percent of the diet (Livingston 1993).

Rock Sole

Rock sole are distributed from southern California northward through Alaska (Wolotira Jr. et al. 1993). Two species of rock sole occur in the North Pacific ocean, a northern rock sole (*Lepidopsetta* sp. cf. *bilineata*) and a southern rock sole (*L. bileneata*). These species have an overlapping distribution in the GOA, but the northern species primarily comprise the BSAI populations, where they are managed as a single stock (Wilderbuer and Walters 1997b). Adults are benthic and, in the EBS, occupy separate winter (spawning) and summertime feeding distributions on the continental shelf. Spawning takes place during the late winter-early spring, near the edge of the continental shelf at depths of 125 to 250 m. Eggs are demersal and adhesive (Forrester 1964). The estimated age at 50 percent maturity for female rock sole is 9-10 years at a length of 35 cm (Wilderbuer and Walters 1997b). Rock sole are important as the target of a high value bottom trawl roe fishery occurring in February and March, which accounts for the majority of the BSAI catch. Although female rock sole are highly desirable when in spawning condition, large amounts are discarded in other trawl fisheries during the rest of the year. Commercial harvest occurs primarily on the EBS continental shelf and in lesser amounts in the Aleutian Islands region. Northern and southern rock sole are managed as a single unit in the BSAI. Rock sole are abundant on the EBS shelf and to a lesser extent in the Aleutian Islands.

Greenland Turbot

Greenland turbot (*Reinhardtius hippoglossoides*) are distributed from Baja California northward throughout Alaska, although it is rare south of Alaska and is primarily distributed in the eastern BSAI region (Hubbs and Wilimovsky 1964). Juveniles are believed to spend the first three or four years of life on the continental shelf and then move to the continental slope as adults (Alton et al. 1988; Templeman 1973). Greenland turbot are demersal to semi-pelagic. Unlike most flatfish, the migrating eye of Greenland turbot does not move completely to one side, but stops at the top of the head, which presumably results in a greater field of vision and helps to explain this species' tendency to feed off the sea bottom (de Groot 1970). Spawning occurs in winter and may be protracted, starting as early as September and continuing until March (Bulatov 1983). The eggs are benthypelagic (suspended in the water column near the bottom) (D'yakov 1982). Juveniles are absent in the Aleutian Islands region, suggesting that populations in that area originate from elsewhere (Alton et al. 1988). Greenland turbot are a moderately long-lived species, with a maximum recorded age of 21 years (Ianelli and Wilderbuer 1995) Pelagic fish are the main prey of Greenland turbot, with pollock often a major species in the diet (Livingston 1991b). Greenland turbot also feed on squid, euphausiids and shrimp.

Yellowfin Sole

Yellowfin sole (*Limanda aspera*) is distributed from British Columbia to the Chukchi Sea (Hart 1973). In the Bering Sea, it is the most abundant flatfish species and is the target of the largest flatfish fishery in the United States. While also found in the Aleutian Islands and GOA, the stock is of much smaller size in those areas. Adults are benthic and occupy separate winter and spring/summer spawning/feeding grounds. Adults overwinter near the shelf-slope break at approximately 200 m and move into nearshore spawning areas as the shelf ice recedes (Nichol 1997). Spawning is protracted and variable, beginning as early as May and continuing through August, occurring primarily in shallow water at depths less than 30 m (Wilderbuer et al. 1992). Eggs, larvae and juveniles are pelagic and usually are found in shallow areas (Nichol 1994). The estimated age at 50 percent maturity is 10.5 years at a length of approximately 29 cm (Nichol 1994), with a maximum recorded age of 33 years (Wilderbuer 1997). Yellowfin sole feed primarily on benthic invertebrates, with polychaetes, amphipods, decapods and clams dominating the diet in the EBS (Livingston 1993).

Yellowfin sole stocks were over-exploited by foreign fisheries in 1959-1962. Since that time, indices of relative abundance have shown major increases in abundance during the late 1970s. Since 1981, abundance has fluctuated widely but biomass estimates indicate that the yellowfin sole population remains at a high, stable level. Information on yellowfin sole stock conditions in the BSAI comes primarily from the annual EBS trawl survey. Estimates of yellowfin sole biomass derived from these surveys have been more variable than would be expected for a comparatively long-lived and lightly exploited species (Wilderbuer 1997). The reason for this variability is not known. However, Nichol (Nichol 1997) hypothesized that much of the yellowfin sole resource is found at depths less than 30 m during the summer when bottom trawl surveys are conducted. This could cause the survey to underestimate the abundance of yellowfin sole.

Arrowtooth Flounder

Arrowtooth flounder (*Atheresthes stomias*) is common from Oregon through the EBS (Allen and Smith 1988). The very similar Kamchatka flounder (*A. evermanni*) also occurs in the Bering Sea. Because it is not usually distinguished from arrowtooth flounder in commercial catches, both species are managed as a group. Arrowtooth flounder is a relatively large flatfish that occupies continental shelf waters almost exclusively until age 4, but at older ages occupies both shelf and slope waters, with concentrations at depths between 100 and 200 m (Martin and Clausen 1995). Spawning is protracted and variable and probably occurs from September through March (Zimmermann 1997). For female arrowtooth flounder collected off the Washington coast, the estimated age at 50 percent maturity was 5 years with an average length of 37 cm. Males matured at 4 years and 28 cm (Rickey 1995). Values of 50 percent maturity for the Bering Sea stock are 42.2 cm and 46.9 cm for males and females, respectively (Zimmermann 1997). The maximum reported ages are 16 years in the Bering Sea, 18 years in the Aleutian Islands and 23 years in the GOA.

Arrowtooth flounder are important as a large and abundant predator of other groundfish species. Adults are almost exclusively piscivorus and over half their diet can consist of pollock (Livingston 1991b). Currently, arrowtooth flounder have a low perceived commercial value because the flesh softens soon after capture due to protease enzyme activity (Greene and Babbitt 1990). Enzyme inhibitors such as beef plasma have been found to counteract this flesh-softening activity, but suitable markets have not been established to support increased harvests. Thus, they are primarily caught by bottom trawls as bycatch in other high value fisheries. Stocks are lightly exploited and appear to be increasing in both the GOA and the BSAI. Information on arrowtooth flounder stock conditions in the BSAI comes primarily from the annual EBS shelf trawl survey. Limited information is also available from past slope surveys (1981-91) and catch sampling of the commercial fishery.

Other Flatfish

In the Bering Sea, eight other flatfish species are managed under the FMPs. Alaska plaice (*Pleuronectes quadriterculatus*), rex sole (*Glyptocephalus zachirus*), Dover sole (*Microstomus pacificus*), starry flounder (*Platichthys stellatus*), English sole (*Parophrys vetulus*), butter sole (*Isopsetta isolepis*), sand sole (*Psettichthys melanostictus*) and deep sea sole (*Embassichthys bathybius*). Adults of all species are benthic and occupy separate winter spawning and summer feeding grounds. Adults overwinter in deeper water and move into nearshore spawning areas in the late winter and spring. Spawning takes place as early as November for Dover sole (Hagerman 1952) but occurs from February through April for most species (Hart 1973). All flatfish eggs are pelagic and sink to the bottom shortly before hatching (Alderdice and Forrester 1968; Hagerman 1952; Orcutt 1950; Zhang 1987), except for butter sole, which has demersal eggs (Levings 1968).

In the Bering Sea, Alaska plaice is the most abundant and commercially important of the other flatfish species. It is a comparatively long-lived species, and has frequently been aged as high as 25 years. Alaska plaice appear to feed primarily on polychaetes, marine worms and other benthic invertebrates (Livingston 1993; Livingston and DeReynier 1996). For the other seven species in the BSAI “other flatfish” management category, little is known of their feeding habits, spawning, growth characteristics or seasonal movements and population age/size structure.

In general, other flatfish are taken as bycatch in bottom trawl fisheries for other groundfish. Alaska plaice are also taken in directed bottom trawl fisheries in the EBS. Because other flatfish are generally not targeted, commercial catch data is of limited use for stock assessment purposes. The principal source of information for evaluating the condition of other flatfish stocks in the BSAI is the annual EBS shelf trawl survey.

Sablefish

Sablefish (*Anoplopoma fimbria*) is found from northern Mexico to the GOA, westward to the Aleutian Islands, and in gullies and deep fjords, generally at depths greater than 200 m. Sablefish observed from a manned submersible were found on or within 1 m of the bottom (Krieger 1997). Several studies have shown sablefish to be highly migratory for at least part of their life cycle (Heifetz and Fujioka 1991; Maloney and Heifetz 1997), and substantial movement between the BSAI and the GOA has been documented (Heifetz and Fujioka 1991). Thus sablefish in Alaskan waters are assessed as a single stock (Sigler et al. 1999). Adults reach maturity at 4 to 5 years and a length of 51 to 54 cm (McFarlane and Beamish 1990). Spawning is pelagic at depths of 300-500 m near the edges of the continental slope (McFarlane and Nagata 1988). Juveniles are pelagic and appear to move into comparatively shallow near-shore areas where they spend the first 1 to 2 years (Rutecki and Varosi 1997). Sablefish are long-lived, with a maximum recorded age in Alaska of 62 years. It appears that sablefish are opportunistic feeders. Feeding studies conducted in Oregon and California, found that fish made up 76 percent of the diet (Laidig et al. 1997). Other studies, however, have found a diet dominated by euphausiids (Tanasichuk 1997).

Recent important year classes are 1997, 1995, and 1990, although the abundance estimate for the 1997 cohort is uncertain because it is based on only one year of data. Abundance has fallen in recent years because recent recruitment is insufficient to replace strong year classes from the later 1970s which are dying off. The estimated mean age of the recruited portion of the population is 7.3 years. The dominating factor determining the age composition is the magnitude of the recruiting year classes. The selectivity of the fishery has cumulative impacts on the age composition due to fishing mortality, and the current composition is also the result of a fished population with a several-decade catch history. How the current age composition of the population compares with the unfished population is unknown.

Larval sablefish feed on a variety of small zooplankton ranging from copepod nauplii to small amphipods. The epipelagic juveniles feed primarily on macrozooplankton and micronekton (i.e., euphausiids). The older demersal juveniles and adults appear to be opportunistic feeders, with food ranging from variety of benthic invertebrates, benthic fishes, as well as squid, mesopelagic fishes, jellyfish, and fishery discards. Gadid fish (mainly pollock) comprise a large part of the sablefish diet. Nearshore residence during their second year provides the opportunity to feed on salmon fry and smolts during the summer months. Young-of-the-year sablefish are commonly found in the stomachs of salmon taken in the southeast troll fishery during the late summer.

Rockfish

At least 32 rockfish species of the genus *Sebastes* and *Sebastolobus* have been reported to occur in the GOA and BSAI (Eschmeyer et al. 1984), and several are of commercial importance. Pacific ocean perch (*S. alutus*) has historically been the most abundant rockfish species in the region and has contributed most to the commercial rockfish catch. Other species such as northern rockfish (*S. polyspinis),* rougheye rockfish (*S. aleutianus*), shortraker rockfish (*S. borealis*), shortspine thornyheads (*S. alascanus*), yelloweye rockfish (*S. ruberrimus*), and dusky rockfish (*S. ciliatus*) are also important to the overall rockfish catches.

Rockfish in the GOA is currently managed as four assemblages: 1) slope rockfish, 2) pelagic shelf rockfish, 3) demersal shelf rockfish, and 4) thornyheads. Slope rockfish which is further subdivided into four subgroups 1) Pacific ocean perch, 2) shortraker and rougheye rockfish, 3) northern rockfish, and 4) "other slope rockfish".

Rockfish in the BSAI are currently managed as two assemblages; 1) Pacific ocean perch complex and 2) other rockfish. The Pacific ocean perch complex includes Pacific ocean perch, rougheye rockfish, shortraker rockfish, sharpchin rockfish, and northern rockfish. For the EBS region, the Pacific ocean perch complex is divided into two subgroups with: 1) Pacific ocean perch, and 2) shortraker, rougheye, sharpchin, and northern rockfish combined. For the Aleutian Islands region, the Pacific ocean perch complex is divided into three subgroups: 1) Pacific ocean perch, 2) shortraker and rougheye rockfish, and 3) sharpchin and northern rockfish. Other rockfish includes all *Sebastes* and *Sebastolobus* species in the BSAI region other than the Pacific ocean perch complex. Shortspine thornyheads account for more than 90 percent of the estimated biomass of the other rockfish assemblage in the BSAI.

Pacific ocean perch

Pacific ocean perch (*Sebastes alutus*) (POP) is primarily a demersal species which inhabits the outer continental shelf and slope regions of the North Pacific and Bering Sea, from southern California to Japan (Allen and Smith 1988). As adults, they live on or near the sea floor, generally in areas with smooth bottoms (Krieger 1993), generally at depths ranging from 180 to 420 m. The diet of POP appears to consist primarily of plankton (Brodeur and Percy 1984); euphausiids are the single most important prey item (Yang 1996).

Though more is known about the life history of POP than about other rockfish species (Kendall and Lenarz 1986), much uncertainty still exists about its life history. POP are viviparous, with internal fertilization and the release of live young (Hart 1973). Insemination occurs in the fall, and release of larvae occurs in April or May. POP larvae are thought to be pelagic and drift with the current. Juveniles seem to inhabit rockier, higher relief areas than adults (Carlson and Straty 1981; Krieger 1993). POP is a slow growing species that, in the Gulf, reaches maturity at approximately 10 years, or 36 cm in length (Heifetz et al. 1997) and has a maximum life span of 90 years (Chilton and Beamish 1982).

The current age and size distributions of POP in the GOA are discussed in Heifetz *et al.* (Heifetz et al. 1999). Information is available from the 1984, 1987, 1990, 1993, and 1996 surveys. The dominating factor determining the age composition is the magnitude of the recruiting year classes which are highly variable. The first three surveys show a strong 1976 year-class, and the 1980 year-class appears strong in the 1987 survey and average in the 1990 survey. The 1986 year-class appears strong in the 1990 survey, and exceptionally strong in the 1993 and 1996 surveys. The selectivity of the fishery has cumulative impacts on the age composition due to fishing mortality, and it is not certain how the current age composition of the population would compare to an unfished population.

An analysis of the diets of commercially important groundfish species in the GOA during the summer of 1990 found that about 98 percent of the total stomach content weight of POP in the study was made up of invertebrates and 2 percent of fish (Yang 1993). Euphausiids (mainly *Thysanoessa inermis*) were the most important prey item. Euphausiids comprised 87 percent by weight of the total stomach contents. Calanoid copepods, amphipods, arrow worms, and shrimp were frequently eaten by POP. Documented predators of POP include Pacific halibut and sablefish, and it likely that Pacific cod and arrowtooth flounder also prey on POP. Pelagic juveniles are consumed by salmon, and benthic juveniles are eaten by lingcod and other demersal fish (NMFS 1997b).

Shortraker and Rougheye rockfish

Shortraker and rougheye rockfish inhabit the outer continental shelf of the north Pacific from the EBS as far south as southern California (Kramer and O'Connell 1988). Adults of both species are semi-demersal and are usually found in deeper waters (from 50 to 800 m) and over rougher bottoms (Kreiger and Ito 1999) than POP. Little is known about the biology and life history of these species, but they appear to be long-lived, with late maturation and slow growth. Shortraker rockfish have been estimated to reach ages in excess of 120 years and rougheye rockfish in excess of 140 years. Like other members of the genus *Sebastes*, they are viviparous (bear live young) and birth occurs in the early spring through summer (McDermott 1994). Food habit studies conducted by Yang (Yang 1993) indicate that the diet of rougheye rockfish is dominated by shrimp. The diet of shortraker rockfish is not well known, based on a small number of samples, the diet appears to be dominated by squid. Because shortraker rockfish have large mouths and short gill rakers, it is possible that they are potential predators of other fish species (Yang 1993). Both species are associated with a variety of habitats from soft to rocky habitats, although boulders and sloping terrain appear also to be desirable habitat. Age at recruitment is uncertain, but is probably on the order of 20+ years for both species. Length at 50 percent sexual maturity is about 45 cm for shortraker rockfish and about 44 cm for rougheye rockfish (McDermott 1994).

Northern rockfish

Northern rockfish inhabit the outer continental shelf from the EBS, throughout the Aleutian Islands and the GOA (Kramer and O'Connell 1988). This species is semi-demersal and is usually found in comparatively shallower waters of the outer continental slope (from 50 to 600 m). Little is known about the biology and life history of northern rockfish. However, they appear to be long lived, with late maturation and slow growth. Like other members of the genus *Sebastes*, they bear live young, and birth occurs in the early spring through summer (McDermott 1994).

Food habit studies indicate that the diet of northern rockfish is dominated by euphausiids (Yang 1993). Northern rockfish are generally planktivorous (feed on plankton) with euphausiids being the predominant prey item (Yang 1993). Copepods, hermit crabs, and shrimp have also been noted as prey items in much smaller quantities. Predators of northern rockfish are not well documented but likely include larger fish such as Pacific halibut that are known to prey on other rockfish species.

Pelagic shelf rockfish

In the GOA, pelagic shelf rockfish consist of dusky rockfish, yellowtail rockfish (*S. flavidus*), and widow rockfish (*S. entomelys*). Black rockfish (*Sebastes melanops)* were formerly in this group, but were removed in April, 1998, from both the pelagic shelf group and the GOA groundfish FMP. Dusky rockfish is by far the most important species in the group, both in terms of abundance and commercial value. Trophic interactions of dusky rockfish are not well known. Food habits information is available from just one study with a relatively small sample size for dusky rockfish (Yang 1993). This study indicated that adult dusky rockfish consume primarily euphausiids, followed by larvaceans, cephalopods, and pandalid shrimp. Predators of dusky rockfish have not been documented, but likely include species that are known to consume rockfish in Alaska, such as Pacific halibut, sablefish, Pacific cod, and arrowtooth founder.

Demersal shelf rockfish

Demersal shelf rockfish include seven species of nearshore, bottom-dwelling 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)*, and yelloweye rockfish. Demersal shelf rockfish are managed by the Council as a distinct assemblage only off Southeast Alaska Outside (SEO) east of 140°W, an area which is further divided into four management units along the outer coast: the South SEO (SSEO), central SEO (CSEO), North SEO (NSEO), and East Yakatat (EYKT). Yelloweye rockfish comprise 90 percent of the catch and will be the focus of this section.

Yelloweye rockfish occur on the continental shelf from northern Baja California to the EBS, commonly in depths less than 200 m (Kramer and O'Connell 1988). They are long-lived, slow growing, and late maturing. Yelloweye have been estimated to reach 118 years and their natural mortality rate is estimated at 0.20 (O'Connell and Funk 1987). They are viviparous (live bearing) with parturition (birth) occurring primarily in late spring through mid-summer (O'Connell 1987). Yelloweye inhabit areas of rugged, rocky relief and adults appear to prefer complex bottoms with the presence of "refuge spaces" (O'Connell and Carlile 1993). Demersal shelf rockfish are highly valued and a directed longline fishery is held for these species. Estimated length and age at 50 percent maturity for yelloweye collected in CSEO in 1988 are 45 cm and 21 years for females and 50 cm and 23 years for males.

Yelloweye are a large, predatory fish that usually feeds close to the bottom. Food habit studies indicate that the diet of yelloweye rockfish is dominated by fish remains, which comprised 95 percent, by volume, of the stomachs analyzed. Herring, sandlance and Puget Sound rockfish (*S. empheaus*) were particularly dominant. Shrimp are also an important prey item (Rosenthal et al. 1988).

Thornyheads

Thornyheads in Alaskan waters are comprised of two species, the shortspine thornyhead and the longspine thornyhead. Only the shortspine thornyhead is of commercial importance. It is a demersal species found in deep water from 93 to 1,460 m from the Bering Sea to Baja California (Ianelli and Gaichas 1999). Little is known about thornyhead life history. Like other rockfish, they are long lived and slow growing. The maximum recorded age is probably in excess of 50 years, and females do not become sexually mature until an average age of 12 to 13 at a length of about 21 cm. Thornyheads spawn large masses of buoyant eggs during the late winter and early spring (Pearcy 1962). Juveniles are pelagic for the first year. Shrimp were the top prey item for shortspine thornyheads in the GOA; while cottids were the most important prey item in the Aleutian Islands region (Yang 1993; Yang 1996).

Biologically, the biggest area of uncertainty for this species is in their longevity and natural mortality rate. Currently, NMFS scientists believe they are slow-growing and long-lived fish that are relatively sedentary on the ocean floor. Survey and fishery catch rates indicate that they are relatively evenly distributed within their habitat and do not tend to form dense aggregations like many other groundfish species.

Other rockfish species

Numerous other rockfish species of the genus *Sebastes* have been reported in the GOA and BSAI (Eschmeyer et al. 1984), and several are of commercial importance. Most are demersal or semi-demersal with different species occupying different depth strata (Kramer and O'Connell 1988). All are viviparous (Hart 1973). Life history attributes of most of these rockfish are poorly known or virtually unknown. Because they are long lived and slow growing, natural mortality rates are probably low. The diet of species for which dietary information exists seems to consist primarily of planktonic invertebrates (Yang 1993; Yang 1996). Other rockfish species are taken both in directed fisheries and as bycatch in trawl and longline fisheries.

In the GOA, although the "other slope rockfish" management group comprises 17 species, six species alone make up 95 percent of the catch and estimated abundance. These six species are sharpchin, redstripe, harlequin, yellowstripe, silvergrey, and redbanded rockfish.

Prey of "other slope rockfish" is not documented for the GOA. Predators of "other slope rockfish" are also not well documented, but likely include larger fish such as Pacific halibut that are known to prey on other rockfish species.

Atka mackerel

Bering Sea/Aleutian Islands. Atka mackerel (*Pleurogrammus monopterygius*) are distributed from the east coast of the Kamchatka Peninsula, throughout the Aleutian Islands and the EBS, and eastward through the GOA to southeast Alaska (Wolotira Jr. et al. 1993). Their current center of abundance is in the Aleutian Islands, with marginal distributions extending into the southern Bering Sea and into the western GOA (Lowe and Fritz 1999a). Atka mackerel are one of the most abundant groundfish species in the Aleutian Islands where they are the target of a directed trawl fishery (Lowe and Fritz 1999a). Adults are semi-pelagic and spend most of the year over the continental shelf in depths generally less than 200 m. Adults migrate annually to shallow coastal waters during spawning, forming dense aggregations near the bottom (Morris 1981; Musienko 1970). In Russian waters, spawning peaks in mid-June (Zolotov 1993) and in Alaskan waters in July through October (McDermott and Lowe 1997). Females deposit adhesive eggs in nests or rocky crevices. The nests are guarded by males until hatching occurs (Zolotov 1993). The first *in situ* observations of spawning habitat in Seguam Pass were recently (August, 1999) documented[1]. Genetic studies indicate that Atka mackerel form a single stock in Alaskan waters (Lowe et al. 1998). However, growth rates can vary extensively among different areas (Kimura and Ronholt 1988; Lowe and Fritz 1999a; Lowe et al. 1998). Age and size at 50 percent maturity has been estimated at 3.6 years and 33 to 38 cm, respectively (McDermott and Lowe 1997). Atka mackerel are a relatively short-lived groundfish species. A maximum age of 15 years has been noted, however most of the population is probably less than 10 years old.

Atka mackerel are an important component in the diet of other commercial groundfish, mainly arrowtooth flounder, Pacific halibut, and Pacific cod; seabirds, mainly tufted puffins; and marine mammals, mainly northern fur seals and Steller sea lions (Byrd et al. 1992; Fritz et al. 1995; Livingston 1993; Yang 1996). Atka mackerel are also components in the diets of the following marine mammals and seabirds: harbor seals, Dall's porpoise, thick-billed murre, and horned puffins (Yang 1996). An analysis of the diets of commercially important groundfish species in the Aleutian Islands during the summer of 1991 were analyzed by found that more than 90 percent of the total stomach contents weight of Atka mackerel in the study was made up of invertebrates, with less than 10 percent made up of fish (Yang 1996). Euphausiids (mainly *Thysanoessa inermis* and *Thysanoessa rachii*) were the most important prey item, followed by calanoid copepods. The two species of euphausiids comprised 55 percent by weight of the total stomach contents, and copepods comprised 17 percent of the total stomach contents weight. Larvaceans and hyperiid amphipods had high frequencies of occurrence (81 percent and 68 percent, respectively), but comprised less than 8 percent of the total stomach contents weight. Squid was another item in the diet of Atka mackerel; it had a frequency of occurrence of 31 percent, but only comprised 8 percent of the total stomach contents weight. Atka mackerel are known to eat their own eggs. Atka mackerel eggs comprised 3 percent of the total stomach contents weight and occurred in 9 percent of the Atka mackerel stomachs analyzed (Yang 1996). Walleye pollock were the second most important prey fish of Atka mackerel, comprising about 2 percent of the total stomach contents weight. Myctophids, bathylagids, zoarcids, cottids, stichaeids, and pleuronectids were minor components of the Atka mackerel diet; each category comprised less than 1 percent of the total stomach contents.

Atka mackerel are a difficult species to survey because they do not have a swim bladder, and therefore are poor targets for hydroacoustic surveys. They prefer rough and rocky bottoms that are difficult to sample with the current survey gear, and their schooling behavior and patchy distribution result in survey estimates with large variances. Complicating the difficulty in surveying Atka mackerel is the low probability of encountering schools in the GOA where the abundance is lower and their distribution is

[1] Lauth, R., Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115, personal communication.

patchier relative to the BSAI. Because of this, it has not been possible to estimate trends in population for the species in the GOA. The stock assessment in the Aleutian Islands is based on the triennial trawl survey as well as total catch and catch at age data from the commercial fishery.

The age composition of Atka mackerel is dominated by a recent strong 1992 year class (6-year- olds), and there is still evidence of the strong 1988 year class (10-year- olds) in the population. The estimated mean age of the 1998 fishery age composition is six years. The current fishery tends to select fish ages 3 to 12 years old (Lowe and Fritz 1999a). It is not known how the age composition of the population would look in an unfished population.

Gulf of Alaska. No reliable estimate exists of current Atka mackerel biomass in the GOA. Atka mackerel have not been commonly caught in each of the GOA triennial trawl surveys. It has been determined that the general GOA groundfish bottom trawl survey does not assess the Gulf portion of the Atka mackerel stock well, and the resulting biomass estimates have little value as absolute estimates of abundance or as indices of trend (Lowe and Fritz 1999a). Because of this lack of fundamental abundance information GOA Atka mackerel are not assessed with a model and the assessment does not utilize abundance estimates from the trawl survey. The stock assessment for GOA Atka mackerel consists of descriptions of catch history, length and age distributions from the fishery during 1990 to 1994, and length and age distributions from the trawl surveys (1990, 1993, and 1996).

The most recent size and age distributions are from the 1996 and 1993 trawl surveys, respectively. Male and female size distributions had mean lengths of 45 and 47 cm, respectively. A mode of fish from 45 to 47 cm represented the 1988 year class. It appears as though little recent recruitment has occurred in the GOA population. Currently, no directed fishery for GOA Atka mackerel occurs. Atka mackerel are caught as bycatch, and the selectivity of Atka mackerel by the other fisheries is unknown. As such, Atka mackerel in the GOA are currently managed as a bycatch fishery. They are caught as bycatch in the pollock, Pacific cod, Pacific ocean perch, and northern rockfish fisheries.

The diets of commercially important groundfish species in the GOA during the summer of 1990 were analyzed by Yang (Yang 1993). Atka mackerel were not sampled as a predator species. However, it is probably a reasonable assumption that the major prey items of GOA Atka mackerel would likely be euphasiids and copepods as was found in Aleutian Islands Atka mackerel (Yang 1996). The abundance of Atka mackerel in the GOA is much lower compared to the Aleutian Islands. Atka mackerel only showed up as a minor component in the diet of arrowtooth flounder in the GOA (Yang 1993).

Ecological relationships between target species and other species in the Eastern Bering Sea and Aleutian Islands

This section summarizes information on the ecological relationships between target species and other species of the groundfish communities in the BSAI and GOA areas using data from the AFSC Food Habits data base. This is the primary data source for most target species and published reports for other species. The trophic relationships between the species that form the food webs in the groundfish communities are described. In each ecosystem, the target species were categorized into six groups: benthic invertebrate feeders, benthic mixed fish/invertebrate feeders, benthic piscivores, pelagic zooplanktivores, pelagic mixed zooplankton/fish feeders, and pelagic piscivores. It should be noted that these categories are somewhat artificial since individual fish species may exhibit size-related, seasonal, geographic, or interannual diet changes that may change them from one category to another. The categories are to be considered illustrative of the general feeding strategy for adults of each species.

The generalized EBS food web (Figure 3.2.1) is based upon diet data from the EBS shelf (< 200m) during the primary feeding season for these predators (May - September). Figure 3.2.2 represents the trophic relationships of the groundfish in the Aleutian Islands.

Benthic invertebrate feeders. In the EBS groundfish species fit into each of the benthic groups. Yellowfin sole, Alaska plaice, and rock sole are primarily invertebrate feeders. The largest dietary components of these species are benthic invertebrates such as polychaete and other marine worms, bivalves and gammarid amphipods. Pacific sand lance appear as a substantial component of the rock sole diet, however this predation primarily occurs in large rock sole at limited areas and time (Lang et al. 1995). Therefore, rock sole are not grouped as a piscivorus species in this analysis.

Other EBS flatfish species that fall into this category include rex sole and starry flounder. Amphipods, clams, and polychaetes account for 90 percent of the diet of rex sole in the EBS (Brodeur and Livingston 1988). The diet of starry flounder is primarily (95 percent by weight) clams (Brodeur and Livingston 1988).

Three species of eelpouts also fall into this category, although their diets are quite dissimilar from each

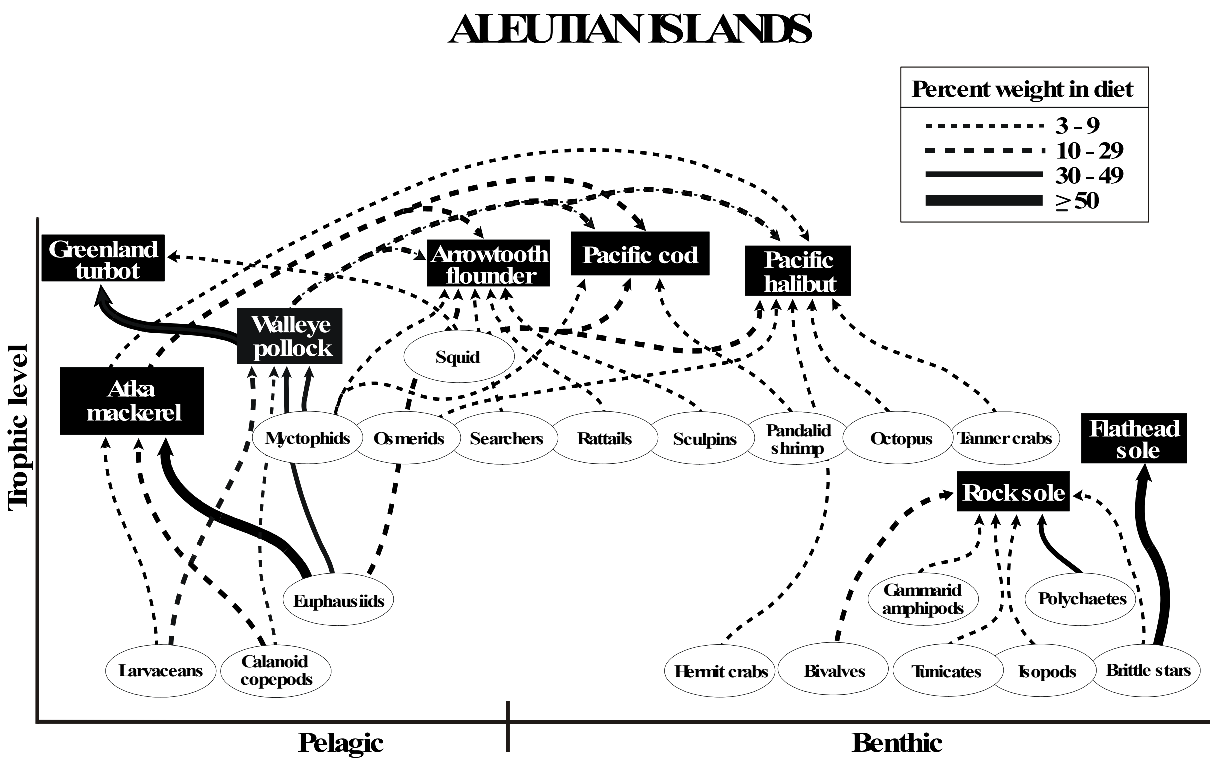

Figure 3.2.2 Trophic relationships of the groundfishes of the Aleutian Islands.

other. Twoline eelpouts (*Bothrocara brunneum*) primarily consume amphipods and other benthic crustacea (Brodeur and Livingston 1988). Shortfin eelpouts (*Lycodes brevipes*) consume up to 90 percent of their diet in the form of brittle stars (Brodeur and Livingston 1988). Wattled eelpouts (*Lycodes* *palearis*) consume a mixture of Tanner and snow crabs, gammarid amphipods, and polychaete worms (Brodeur and Livingston 1988).

Red Irish lords (*Hemilepidotus hemilepidotus*), sturgeon poachers (*Agonus acipenserinus*), and gunnels (Pholidae) are also characterized as benthic invertebrate feeders. The primary prey (75 percent by weight) of red Irish lords in the EBS are hermit crabs, followed by Tanner and snow crabs (Brodeur and Livingston 1988). Sturgeon poachers consume benthic amphipods (80 percent of the diet by weight) and decapod crustacea (Brodeur and Livingston 1988). Gunnels consume a wide range of benthic invertebrate prey (NPFMC 1999c).

In the Aleutian Islands, rock sole is the main component of this category. They mainly feed on benthic and epibenthic invertebrates like polychaetes, bivalves, hermit crab, gammarid amphipods, brittle stars, and gastropods, etc. Simenstad *et al.* (Simenstad et al. 1977) reported that polychaetes was the most frequently occurring (53 percent) prey of rock sole in the Amchitka Island area. Other prey of rock sole in his study included gammarid amphipods (29 percent), brittle stars (6 percent), bivalves (6 percent), gastropods (6 percent), and hermit crab (6 percent). In the EBS and GOA, yellowfin sole and flathead sole were also included in the primary invertebrate feeders group. Trophic information for these two species in the Aleutian Islands area is lacking but it is assumed they feed similarly in the Aleutian Islands.

Non-target species like rock greenling and armorhead sculpins (*Gymnocanthus galeatus*) can be categorized in this group of benthic primary invertebrate feeders. Simenstad *et. al.*(Simenstad et al. 1977) reported that rock greenlings fed on gastropod, bivalve mollusks, amphipods, isopods, and polychaetes. They also reported that armorhead sculpins rely on benthic amphipods, isopods, and polychaetes as their food.

Benthic mixed fish/invertebrate feeders. Pacific cod, Pacific halibut, skates and flathead sole are both characterized as having a mixed fish and invertebrate diet. Flathead sole receives this characterization due to the presence of pollock, brittle stars, crangon shrimp, mysids and bivalves in their diet. Fish are a relatively small portion of small (< 20 cm) flathead sole diets, but are increasingly important with size (Livingston and DeReynier 1996) and warrant their placement in this category. Although Pacific cod are not as obviously benthic as many of the flatfishes, they are considered a benthic predator. Pacific cod consume a wide variety of benthic invertebrate prey as well as walleye pollock and pleuronectids such as yellowfin sole. While Pacific cod of all sizes prey heavily on benthic invertebrates, especially Tanner and snow crab, fish prey become increasingly important with size (Livingston and DeReynier 1996). Pacific halibut and skates are benthic species that consume invertebrates more at smaller sizes but have a large fish component to their diet. This fish component is dominant at the larger sizes of these fish. Pollock are the primary prey of these species, although Pacific halibut consume other fish prey as well (i.e., eelpouts). Hermit, Tanner, and snow crabs are also important prey of these two species.

Two large sculpins are also characterized as having a mixed fish and invertebrate diet. Plain sculpins (*Myoxocephalus jaok*) in the EBS consume fish (pleuronectids) and crab species (Tanner and hermit) almost exclusively (Brodeur and Livingston 1988). Great sculpins (*Myoxocephalus polyacanthocephalus*) rely upon pollock (20 percent by weight) and Tanner and snow crabs (50 percent by weight) as their main dietary components (Brodeur and Livingston 1988).

Grenadier that inhabit the upper continental slope generally prey on locally abundant fish and invertebrates and scavenge for carcasses (Drazen et al. In Press; Okamura 1970; Pearcy and Ambler 1974). The popeye grenadier (*Coryphaenoides cinereus*) is the most numerically abundant grenadier in this region (Bohle 1988) and it likely has this type of feeding strategy. The giant grenadier (*Albatrossia pectoralis*) feeds on myctophids, squid and a variety of benthic and mesopelagic animals in the EBS

(Novikov 1970). Eelpouts, other fish, and shrimp were identified as dominant prey of the giant grenadier in the EBS from samples taken in the 1980s (Brodeur and Livingston 1988).

Non-target species like the large, demersal Pacific sleeper shark can be categorized in this group. Yang and Page (Yang and Page 1999) reported that arrowtooth flounder was the most important prey of sleeper shark in the GOA, representing 67 percent of the total stomach content weight. Other prey in the GOA included pollock, rockfish, Pacific salmon, *Oncorhynchus* sp., flathead sole, and *Octopus dofleini*. Other studies have reported flatfish, salmon, rockfish, octopus and squids, crabs, seals, and carrion (Hart 1973) as prey items of this species. Sleeper sharks are likely to consume similar types of prey in the EBS.

In the Aleutian Islands, Pacific cod, Pacific halibut, rougheye rockfish, shortraker rockfish, and shortspine thornyhead are categorized in benthic mixed fish/invertebrate feeders group. They feed mainly on the bottom but also in the water column. Because of the high diversities in their diets, they are subdivided into two groups: 1) the Pacific cod and Pacific halibut group, and 2) the rougheye rockfish, shortraker rockfish, and short spine thornyhead group. The diets of the Pacific cod and Pacific halibut include high proportions of fish and crabs whereas the diets of the rougheye rockfish, shortraker rockfish, and shortspine thornyhead consist of large amounts of shrimp (pandalids and crangonids). Yang (Yang 1996) showed that Pacific cod and Pacific halibut had a high diet overlap value of 62 percent by weight of the total stomach contents. Shortraker rockfish and shortspine thornyhead had high diet overlap value (56 percent) (Yang 1996).

Yang (Yang 1996) found that the prey fish of Pacific cod consisted of 27 percent (by weight) Atka mackerel, 17 percent pollock, 7 percent cottids, and small amounts (≤3 percent) myctophids, flatfish, rockfish, Pacific herring, snailfish, bathylagids, Pacific sand lance, stichaeids, searchers, and viperfish. Invertebrates consumed by Pacific cod included 9 percent squids, 6 percent pandalid shrimp, 4 percent octopus, and small amounts (≤3 percent) Tanner crab, Korean horse-hair crab (*Erimacrus isenbeckii*), hermit crab, euphausiids, calanoid copepods, polychaetes.

The diet of Pacific halibut is very similar to that of Pacific cod except that Pacific halibut consumed more cephalopods and less Atka mackerel than Pacific cod (Yang 1996). Yang's (Yang 1996) study showed that the stomach contents of Pacific halibut consisted of 19 percent pollock, 12 percent Atka mackerel, 17 percent squids, 10 percent octopus, 7 percent Tanner crab, 5 percent capelin, and small amounts (≤3 percent) sablefish, flatfish, Pacific herring, sculpins, Pacific cod, rockfish, searchers, hermit crab, lyre crab, and gastropods.

Rougheye rockfish, shortraker rockfish, and shortspine thornyhead are included in this category. This group of fish feeds mainly on shrimps (pandalids and hippolytids). They also feed on certain amounts of fish like myctophids, cottids, and snailfish. Yang (Yang 1996) found that shrimp, comprising 45 percent of the total stomach contents weight, was the primary invertebrate prey of the rougheye rockfish. Snailfish were the most important prey fish; they also comprised 45 percent of the stomach contents weight. Rougheye rockfish also consumed some myctophids (4 percent). Other food items included polychaetes, amphipods, mysids, euphausiids, and isopods. Shrimp (32 percent) were the most important food of shortraker rockfish. Fish prey comprised 37 percent of the total stomach contents weight, of which myctophids and cottids comprised 15 percent and 19 percent , respectively (Yang 1996). Cottids were the most important prey fish of shortspine thornyhead, comprising 51 percent of the total stomach contents weight. Pandalid shrimp, at 18 percent of the total stomach contents weight, were the most important invertebrate prey. Shortspine thornyhead also consumed Korean horsehair crab, and scarlet king crab.

Non-target species like great sculpin, blackfin sculpin (*Malacocottus kincaidi*), and red Irish lord can be categorized in this group. Simenstad *et. al.* (Simenstad et al. 1977) found that the horsehair crab and *Chionoecetes sp*. were the main food of the great sculpin while fish, amphipods, polychaetes were the most important food for the blackfin sculpin. They also reported that red Irish lord fed mainly on horsehair crab, shrimp, amphipods, and polychaetes.

Grenadier generally prey on locally abundant fish and invertebrates and scavenge for carcasses (Buckley et al. 1999; Drazen et al. In Press; Pearcy and Ambler 1974). Giant grenadier feed on squid, bryozoans, fish, and shrimp around the Aleutian Islands (Novikov 1970). Pacific grenadier are most commonly caught and feed near the bottom (Buckley et al. 1999; Drazen et al. In Press; Pearcy and Ambler 1974), but the diet of five specimens caught in a mesopelagic trawl in this region contained myctophids, other mesopelagic fishes, mysids, isopods and euphausiids (Simenstad et al. 1977).

Benthic piscivores. Pacific sandfish and bigmouth sculpins (*Hemitripterus bolini*) fall into this category, as over 90 percent of their diets are comprised of fish, especially gadids (Brodeur and Livingston 1988).

Pelagic zooplankton feeders. Pacific herring are an example of pelagic zooplanktivores; as copepods and euphausiids make up 95 percent of their diet by weight (Brodeur and Livingston 1988). The most important prey in the diet of Pacific ocean perch from the EBS are euphausiids, which make up 45 percent of the diet (Brodeur and Livingston 1988), placing them in this group of zooplankton feeders. Unspecified caridean shrimp are their second most important prey. Many forage fish species also fit into this category. Capelin, eulachon, myctophids, bathylagids, and stichaeids are all pelagic predators of zooplankton prey (NPFMC 1999c). Euphausiids, and copepods are the primary prey of these species, although many other pelagic prey (i.e. pteropods, ctenophores, jellyfish, chaetognaths) are also found in their diets.

In the Aleutian Islands, Atka mackerel and northern rockfish are categorized in this group. They feed mainly in the water column and zooplankton (euphausiids, calanoid copepods, larvaceans, and hyperiid amphipods) comprised more than 60 percent of the total stomach contents weight of each of these species. High dietary overlap was found between Atka mackerel, Pacific ocean perch, and northern rockfish since they all consumed large amount of euphausiids and calanoid copepods (Yang 1996)

Euphausiids were the most important prey of Atka mackerel in the Aleutian Islands area (Yang 1996). They comprised 55 percent (by weight) of the total stomach contents. Other zooplankton consumed by Atka mackerel included 17 percent calanoid copepods, and 5 percent larvaceans (pelagic tunicates). Squid was another invertebrate prey of Atka mackerel; they comprised 8 percent of the total stomach contents weight.

Euphausiids were the most important prey of the northern rockfish, comprising 50 percent of the total stomach contents weight. Calanoid copepods comprised 17 percent of the total stomach contents weight. Other food included polychaetes, pteropods, amphipods, shrimp, hermit crab, and larvaceans.

Non-target species that are pelagic zooplanktivores includes mesopelagic fishes like myctophids and bathylagids. (Simenstad et al. 1977) reported that calanoid copepods and hyperiid amphipods constitute the major food sources of myctophids with euphausiids, chaetognaths, pteropods, and shrimp as the secondary food. They also found that California smoothtongue (*Bathylagus stilbius*) fed on chaetognaths and calanoid copepods with a secondary contribution from euphausiids.

Pelagic mixed fish/zooplankton feeders. Pollock appear to be primarily zooplanktivores, consuming calanoid copepods and euphausiids as their primary prey. However, pollock also exhibit some piscivory, primarily in the form of cannibalism, placing them in the group of mixed fish and zooplankton consumers. Pollock also have a small benthic component to their diet.

Northern rockfish consume fish and euphausiids as the two most important prey by weight (Brodeur and Livingston 1988) placing them in the group of pelagic predators with a diet of mixed fish and zooplankton. Atka mackerel are also members of this group due to the reliance on pollock and euphausiids as the two most important prey in their diet as well (Brodeur and Livingston 1988). In the GOA, these two species are categorized as primarily zooplanktivorous.

In the Aleutian Islands, Yang (Yang 1996) found that pollock fed mainly on euphausiids (43 percent by weight). Myctophids (37 percent by weight) were the most important prey fish of pollock in the Aleutian Islands area. Less important prey of pollock included calanoid copepods, shrimp, capelin, bathylagids, and Pacific sand lance. Although Pacific ocean perch is primarily zooplanktivorous in the GOA, it has a significant fraction of fish in its diet in the Aleutian Islands. Therefore, it is placed in the mixed zooplankton/fish feeders group here. Euphausiids are the most important prey of Pacific ocean perch, comprising 51 percent (by weight) of the diet (Yang 1996). The next important zooplankton prey was calanoid copepods. They comprised 7 percent of the stomach contents weight. Myctophids were the most important prey fish consumed by Pacific ocean perch. They comprised 34 percent of the total stomach contents weight.

Non-target species like sockeye (*Oncorhynchus nerka*) and chum (*Oncorhynchus keta*) salmon can be categorized in this group. (Simenstad et al. 1977) reported that they fed on forage fish like Pacific sand lance and myctophids. Hyperiid amphipods and calanoid copepods also contributed to the diets of both salmon species.

Pelagic piscivores. Arrowtooth flounder and Greenland turbot are primarily piscivorus in the EBS and Aleutian Islands. Non-target species like great sculpin can also be categorized in this group. (Simenstad et al. 1977) found that this species was completely piscivorus with red Irish lords, sturgeon poachers (*Podothecus acipenserinus*), and searchers as their favorite prey.

Arrowtooth flounder primarily consume walleye pollock and eelpouts on the EBS shelf. However, euphausiids are a large portion of the diet of smaller (<20 cm) arrowtooth flounder (Livingston and DeReynier 1996). In the deeper slope waters of the EBS, squid also become an important part of the diet of arrowtooth flounder (Lang and Livingston 1996). Greenland turbot are almost exclusively piscivorus on the EBS shelf. The dominant prey of Greenland turbot is pollock. However, eelpouts also contribute to their diet. Very small (<20 cm) Greenland turbot have a large euphausiid component to their diet (Livingston and DeReynier 1996). In the deeper slope region of the EBS, Greenland turbot consume squid as well as pollock (Lang and Livingston 1996). Sablefish are primarily piscivorus in the EBS on species such as pollock (Brodeur and Livingston 1988). However cephalopods are their most important prey behind fish. Salmon sharks are opportunistic pelagic predators of many species of fish and squid as well as benthic invertebrates.

In the Aleutian Islands area, prey fish comprised 89 percent (by weight) of the diet of arrowtooth flounder (Yang 1996). Yang (Yang 1996) reported that Atka mackerel was the most important prey of arrowtooth flounder. They comprised 44 percent by weight of the total stomach contents. Other prey fish included 13 percent of walleye pollock, 7 percent of myctophids, and small amounts (≤3 percent) of cottids, sablefish, rockfish, stichaeids, Pacific herring, snailfish, flatfish, Pacific sand lance, and viperfish. Invertebrate prey of arrowtooth flounder included small amounts (≤5 percent) of euphausiids, squids. In general, the diet of Greenland turbot had high percentages of both fish and squids (Yang 1996). Yang

(Yang 1996) reported that the diet of Greenland turbot included 46 percent (by weight) of squids, 28 percent of walleye pollock, 13 percent of bathylagids, 4 percent of octopus, and 3 percent of viperfish.

Benthic invertebrate feeders. Smaller flatfish like flathead sole, rock sole, yellowfin sole are included in this category. They mainly feed on benthic and epibenthic invertebrates like shrimps, crab, polychaetes, bivalves, hermit crab, gammarid amphipods.

Yang and Nelson (Yang and Nelson 2000) found that pandalid shrimp was the most important prey of flathead sole in the GOA in 1993. It comprised 32 percent of the total stomach contents weight. Brittle stars were the second most important food of flathead sole in GOA. Flathead sole also fed on other benthic or epibenthic invertebrates like hermit crabs, crangonid shrimp, Tanner crab and gammarid amphipods.

Rogers *et al.* (Rogers et al. 1987) showed that rock sole and yellowfin sole had generalized diets. They fed mainly on polychaetes. However, rock sole took mainly motile forms of polychaetes (errantiates), whereas the yellowfin sole consumed more non-motile forms of polychaetes (sedentariates). Most of the crab they consumed (e.g. *Telmessus cheiragonu*s, *Pugettia gracilis*, and *Cancer oregonensis*) were not commercially important. They also consumed clams and gammarid amphipods.

Non-target species like starry flounder rock greenling (*Hexagrammos lagocephalus*), kelp greenling (*Hexagrammos decagrammus*), masked greenling (*Hexagrammos octogrammus*), and white spotted greenling (*Hexagrammos stelleri*) can also be categorized in this group of benthic primary invertebrate feeders. Rogers *et al.* (Rogers et al. 1987) and Rosenthal (Rosenthal 1983) found that these greenlings fed mainly on gammarids, crab (most non-commercially important), shrimp, caprellids, mysids, and small amounts of fish. Rosenthal (Rosenthal 1983) reported that starry flounder fed on clam siphons, cancrid crab, brittle stars and polychaetes.

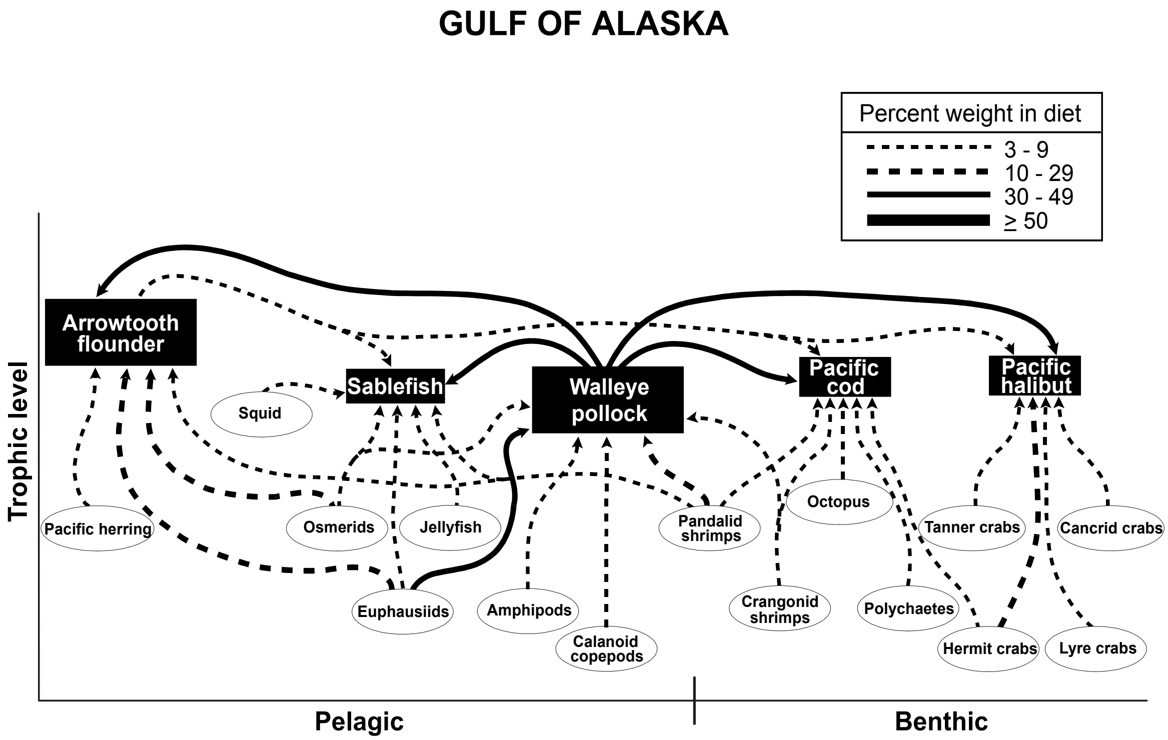

Figure 3.2.3 Trophic relationships of the groundfishes in the Gulf of Alaska.

Benthic mixed fish/invertebrate feeders. Pacific cod, Pacific halibut, rougheye rockfish, shortraker rockfish, and shortspine thornyhead are categorized in this group. They feed mainly on the bottom but also in the water column. Because of the high diversities in their diets, they are subdivided into two groups: 1) the Pacific cod and Pacific halibut group, and 2) the rougheye rockfish, shortraker rockfish, and shortspine thornyhead group. The diets of Pacific cod and Pacific halibut include high proportions of fish and crab whereas the diets of rougheye rockfish, shortraker rockfish, and shortspine thornyhead consist of large amounts (≥44 percent by weight) of shrimp (pandalids and crangonids). Yang and Nelson (Yang and Nelson 2000) showed that Pacific cod and Pacific halibut had high diet overlap value of 64 percent by weight of the total stomach contents. Diet overlaps between the three rockfishes in this group were >50 percent .

The prey fish in the Pacific cod diet in 1996 consisted of 23 percent (by weight) pollock, 4 percent Atka mackerel, and small amounts (≤1 percent each) of zoarcids, cottids, searchers (*Bathymaster signatus*), stichaeids, capelin, rock sole, and arrowtooth flounder (Yang and Nelson 2000). The invertebrates that Pacific cod consumed included 11 percent Tanner crab, 11 percent hermit crab, 6 percent lyre crab, 11 percent pandalid shrimp, 5 percent crangonid shrimp, and 6 percent polychaetes.

Compared to Pacific cod, Pacific halibut consumed more fish and crab but very little shrimp. Because of the large size attained by Pacific halibut, they also feed on more different kinds of fish like rock sole, yellowfin sole, Dover sole, and Pacific cod. Yang and Nelson (Yang and Nelson 2000) reported that pollock (32 percent by weight) was the most important prey of Pacific halibut in the GOA area in 1996. Other prey fish of the Pacific halibut consumed included 6 percent of Atka mackerel, 4 percent capelin, and small amounts (≤3 percent) of Pacific sand lance, rock sole, yellowfin sole, zoarcids, cottids, searchers, stichaeids, arrowtooth flounder, Dover sole, and Pacific cod. The important invertebrates consumed by Pacific halibut included Tanner crab (9 percent), hermit crab (15 percent), lyre crab (6 percent), and small amounts (≤3 percent) of decorator crab, cancrid crab, and octopus.

Yang and Nelson (Yang and Nelson 2000) found that the diet of rougheye rockfish in 1993 comprised 50 percent (by weight) of pandalid shrimp, 10 percent of crangonid shrimp, 11 percent of euphausiids, and 5 percent of eulachon (*Thaleichthys pacificus*). Other prey fish consumed by rougheye rockfish included walleye pollock, Pacific herring, Pacific sand lance, myctophids, zoarcids, cottids, snailfish, and flatfish. The commercially important Tanner crab was also consumed by rougheye rockfish; it comprised 1 percent of the total stomach contents weight in 1993.

Shrimp (mainly pandalids) were the most important food of the thornyhead (61 percent by weight in 1993). Tanner crab comprised 7 percent of the food of thornyheads. Fish (pollock, zoarcids, and sculpins) comprised 12 percent of the food of the thornyhead in 1993. Other prey items included polychaetes, mysids, amphipods, and other crab (mainly decorator crab).

Compared to rougheye rockfish and shortspine thornyhead, shortraker rockfish eat fewer prey items. Yang and Nelson's (Yang and Nelson 2000) study showed that pandalid shrimp, comprising 50 percent of the total stomach contents weight, was the most important food of shortraker rockfish in 1993. Their study also showed that squid was the second important prey of shortraker rockfish. It comprised 35 percent of the total stomach contents weight.

Non-target species like great sculpins and red Irish lord can also be categorized in this group of mixed fish/invertebrate feeder. Rogers *et al.* (Rogers et al. 1987) found that fish and crab comprised about 50 percent of the total stomach contents weight of the great sculpins. Rosenthal (Rosenthal 1983) reported that red Irish lord fed on kelp greenling, brittle stars, octopus, hermit crab, gastropods, and sipunculid worm.

The giant grenadier, popeye grenadier and Pacific grenadier (*Coryphaenoides acrolepis*) are common in the GOA. Studies of the feeding habits of giant and Pacific grenadiers in other areas indicate that they prey on and scavenge carcasses of locally abundant fish, squid and other benthic and mesopelagic animals (Buckley et al. 1999; Drazen et al. In Press; Novikov 1970; Pearcy and Ambler 1974) and it is likely that grenadier in the GOA have a similar diet.

Non-target species like Pacific sleeper shark can be categorized in this group. Yang and Page (Yang and Page 1999) reported that arrowtooth flounder was the most important prey of sleeper shark, representing 67% of the total stomach content weight. Other prey included pollock, rockfish, Pacific salmon, *Oncorhynchus* sp., flathead sole, and *Octopus dofleini*.

Pelagic piscivores. Arrowtooth flounder is categorized in the group of pelagic primary piscivores. They feed mainly on fish in the water column. Compared to Pacific cod and Pacific halibut (the mixed fish/invertebrate feeders), arrowtooth flounder had a high percentage (about 60 percent) of prey fish and almost no crab in their diet. However, arrowtooth flounder did consume more euphausiids than Pacific cod and Pacific halibut did. In general, arrowtooth flounder consumed more pandalid shrimp than Pacific halibut did (Yang and Nelson 2000). Yang and Nelson (Yang and Nelson 2000) found that the diet of the arrowtooth flounder in the GOA in 1996 comprised 53 percent (by weight) pollock, 10 percent capelin, and small percentages (≤2 percent) stichaeids, bathylagids, salmonids, zoarcids, cottids, searchers, eulachon, rock sole, and Pacific cod. Although arrowtooth flounder fed mainly on fish, the diet of smaller-sized fish also included euphausiids, pandalid shrimp, and crangonid shrimp in their diet.

Lingcod (*Ophiodon elongatus*) is also categorized in the group of pelagic primary piscivores. Rosenthal (Rosenthal 1983) found that Pacific sand lance was the most important food of lingcod. Other prey fish included black rockfish, dusky rockfish, and kelp greenling.

Non-target species like salmon shark and spiny dogfish can be categorized in this group. The diet of salmon sharks includes salmonids, rockfish, lancetfish (*Alepisaurus* sp), daggertooth (*Anotopterus* sp), sablefish, spiny dogfish, lumpfishes (Cyclopteridae), myctophids, sculpins, pollock, Pacific herring, Pacific halibut, and squid. The main food of spiny dogfish includes Pacific herring, Pacific sand lance, smelts (Osmeridae) and euphausiids (NPFMC 1999c).

Pelagic zooplanktivores. Atka mackerel, Pacific ocean perch, northern rockfish, and dusky rockfish are categorized in the pelagic primary zooplanktivores group. They feed mainly in the upper water column. Zooplankton (including euphausiids, calanoid copepods, larvaceans, chaetognaths, and hyperiid amphipods) and gelatinous invertebrates (jellyfish) comprised more than 80 percent of the stomach contents of each of these species (Yang and Nelson 2000). Pacific ocean perch and northern rockfish had high diet overlap since they all fed largely ($\geq$ 60 percent) on euphausiids. Compared to Pacific ocean perch and northern rockfish, Atka mackerel consumed a high percentage (64 percent) of calanoid copepods but a low percentage (4 percent) of euphausiids. However, in the Aleutian Islands, euphausiids dominated (55 percent) the diet of Atka mackerel (Yang 1996).

Yang and Nelson (Yang and Nelson 2000) reported that the diet of Atka mackerel in the GOA consisted of 64 percent (by weight) calanoid copepods, 19 percent jellyfish, 12 percent gastropods, 4 percent euphausiids, and 1 percent hyperiid amphipods. The diet of Pacific ocean perch in 1990 comprised 60 percent euphausiids, 11 percent amphipods, 7 percent calanoid copepods, 5 percent pandalid shrimp, and 4 percent chaetognaths (Yang and Nelson 2000). The diet of northern rockfish in 1990 also contained a high percentage (88 percent) of euphausiids. Other prey items of northern rockfish included chaetognaths, calanoid copepods, and hyperiid amphipods. Yang and Nelson (Yang and Nelson 2000) found that euphausiids were the most important food (61percent by weight) of dusky rockfish. Larvaceans were the second most important prey of dusky rockfish; they comprised 14 percent of the total stomach contents weight. Dusky rockfish also consumed 8 percent chaetognaths, 8 percent hermit crab, and small amounts (<5 percent) of pandalids, hippolytids, gammarid amphipods, and calanoid copepods.

Forage species such as bathylagids, myctophids, eulachon, Pacific sand lance, and capelin can be categorized in this group. Bathylagids consume plankton (euphausiids, calanoid copepods, pteropods, appendicularia, chaetognath, and gelatinous animals such as ctenophores and jellyfish). Myctophids consumed mostly calanoid copepods and euphausiids. Eulachon mainly feed on euphausiids, calanoid copepods, and cumaceans. Pacific sand lance prey upon chaetognaths, amphipods, calanoid copepods and fish larvae. Euphausiids and calanoid copepods are common to the diet of capelin, although marine worms and small fish are also part of their diet (NPFMC 1999c).

Pelagic mixed zooplankton/fish feeders. Pollock and sablefish are categorized in this group. This group of fish feeds not only on zooplankton but also on fish and shrimp. Compared to the primary zooplanktivores (80 percent of their diets were zooplankton), the zooplankton/fish feeders, consume less zooplankton (no more than 60 percent of their diets). On the other hand, the combination of the fish and shrimp consumed by the zooplankton/fish feeders can be as high as 40 percent (Yang and Nelson 2000).

Pollock plays an important trophic role in the GOA. They are important prey of many groundfish species: Pacific halibut, Pacific cod, arrowtooth flounder, and sablefish. Pollock also consume their young. Yang and Nelson (Yang and Nelson 2000) reported that the diet of walleye pollock in the GOA in

1993 comprised 41 percent euphausiids, 20 percent pandalid shrimp, 6 percent larvaceans (pelagic tunicates), 4 percent calanoid copepods, and small amounts (≤3 percent) of capelin, Pacific sand lance, eulachon, zoarcids, cottids, stichaeids, squids, and amphipods.

Compared to pollock, sablefish consumed more fish (mainly juvenile pollock) but less euphausiids and shrimp. It is worth noting that sablefish was the only groundfish that consumed a high percentage (32 percent by weight in 1996) of fish offal (fish carcasses) in the GOA area. Another special prey for sablefish was jellyfish. Yang and Nelson (Yang and Nelson 2000) found that sablefish in 1996 fed mainly on euphausiids (10 percent of the total stomach contents weight), amphipods (11 percent), jellyfish (14 percent), pollock (10 percent), pandalid shrimp (5 percent), and small amounts (≤3 percent) of squids, polychaetes and hermit crab.

3.2.2 Other fish species

Forage Fish

Forage fishes, as a group, occupy a nodal or central position in the North Pacific food web, being consumed by a wide variety of fish, marine mammals and seabirds. Many species undergo large, seemingly unexplainable, fluctuations in abundance. Most of these are R-selected species (e.g., pollock, herring, Atka mackerel, capelin, sand lance), which generally have higher reproductive rates, are shorter-lived, attain sexual maturity at younger ages, and have faster individual growth rates than K-selected species (e.g., rockfish, many flatfish which are generally long-lived, reach sexual maturity at an older age, and grow slowly). Predators which utilize R-selected fish species as prey (marine mammals, birds, and other fish) have evolved in an ecosystem in which fluctuations and changes in relative abundances of these species have occurred. Consequently, most of them, to some degree, are generalists who are not dependent on the availability of a single species to sustain them, but on a suite of species, any one (or more) of which is likely to be abundant each year. However, differences in energy content exist between forage species, with herring, sand lance, and capelin containing higher energy content per unit mass than other forage species such as juvenile pollock (Payne et al. 1997). It is possible that changes in availability of higher energy content forage may influence growth and survival of the upper-trophic level species reliant on forage species as their main prey.

Some evidence exists, that osmerid abundances, particularly capelin and eulachon, have declined significantly since the mid-1970s. Evidence for this comes from marine mammal food habits data from the GOA (Calkins and Goodwin 1988), as well as from data collected in biological surveys of the GOA [not designed to sample capelin; (Anderson et al. 1997)] and commercial fisheries bycatch from the EBS (Fritz et al. 1993). It is not known, however, whether smelt abundances have declined or whether their populations have redistributed vertically, due presumably to warming surface waters in the region beginning in the late 1970s. This conclusion could also be drawn from the data presented by Yang (Yang 1993), who documented considerable consumption of capelin by arrowtooth flounder, a demersal lower-water column feeder, in the GOA.

Distribution, species associations, and biomass trends of various forage fishes in the Bering Sea were recently summarized by Brodeur *et al.* (Brodeur et al. 1999). Spatial distributions of some forage species in the EBS (age-1 pollock, age-1 cod, Pacific herring, capelin and eulachon) showed some spatial separation of the groups and some changes in distribution in a cold versus a warm year. Capelin were associated with colder temperatures in the northern part of the study area while age-0 pollock were associated with warmer temperatures than the overall measured temperature. Eulachon was found only in the warmer temperatures at the southern part of the sampling area. Although this study did not find any long-term trends in forage fish abundance in the Bering Sea, the study period began in 1982, which is generally considered to be a warmer period in the Bering Sea. Analysis of 36 years of Russian pelagic trawl data indicates different periods of fish abundance, depending on environmental conditions. In the western Bering Sea and Okhotsk Sea, herring and capelin appear to alternate in abundance with pollock. Such a pattern has not been definitively identified for the EBS.

Smelts (capelin, rainbow smelt and eulachon). Smelts (family Osmeridae) are slender schooling fishes that can be either marine (such as capelin) or anadromous (rainbow smelt and eulachon).

Capelin (*Mallotus villosus*) are distributed along the entire coastline of Alaska and south along British Columbia to the Strait of Juan de Fuca. In the North Pacific, capelin can grow to a maximum of 25 cm at age 4. Most capelin spawn at age 2-3, when they are only 11-17 cm (Pahlke 1985). Spawning occurs in spring in intertidal zones of coarse sand and fine gravel--especially in Norton Sound, northern Bristol Bay and Kodiak. Very few capelin survive spawning. The age of maturity of capelin in the Barents Sea has been shown to be a function of growth rate, with fast-growing cohorts reaching maturity at an earlier age than slow-growing cohorts. Thus, it is possible to have slow and fast-growing cohorts mature in the same year, resulting in large spawning biomasses one year preceded and potentially followed by small spawning biomasses.

In the Bering Sea, adult capelin are only found near-shore during the months surrounding the spawning run. During other times of the year, capelin are found far offshore in the vicinity of the Pribilof Islands and the continental shelf break. The seasonal migration may be associated with the advancing and retreating polar ice front, as it is in the Barents Sea. In the EBS, winter ice completely withdraws during the summer months. If migration follows the ice edge, the bulk of the capelin biomass in the Bering Sea could be located in the northern Bering Sea, beyond the area worked by the groundfish fisheries and surveys. Very few capelin are found in surveys, yet they are a major component of the diets of marine mammals feeding along the winter ice edge (Wespestad 1987), and of marine birds, especially in the spring. In the GOA, which remains ice free year round, capelin overwinter in the bays of Kodiak Island and in Kachemak Bay.

Capelin have shown abrupt declines in occurrence in small-mesh trawl survey samples in the GOA (Anderson and Piatt 1999; Piatt and Anderson 1996) In both NMFS and ADF&G survey data capelin first declined along the east side of Kodiak Island and bays along the Alaska peninsula. Subsequent declines took place in the bays along the west side of Shelikof Strait. These declines happened quickly, and low abundance has persisted for over a decade. The decline was coincident with increases in water temperature of the order of 2⌒ C which began in the late 1970's. Capelin have fairly narrow temperature preferences, and probably were very susceptible to the increase in water column temperatures (Piatt and Anderson 1996; Piatt et al. 1997). Mapping of relative densities of capelin showed defined areas of relative high abundance. The Shelikof region showed relative high catches in Kujulik, Alitak, and Olga bays. Most catches of capelin were closely associated with bays with the exception of high catches offshore of Cape Ikolik at the southwest end of Kodiak Island. Isolated offshore areas east of Kodiak Island showed some high catches, with most of the high catches associated with Ugak and Kazakof Bays. Only isolated catches of less than 50 kilograms were evident in the database from Prince William Sound, Kenai Coast, and Lower Cook Inlet regions.

The diet of capelin in the north Pacific as summarized by Hart (Hart 1973) and Trumble (Trumble 1973) is primarily planktivorous. Small crustaceans such as euphausiids and copepods are common to the diet of capelin, although marine worms and small fish are also part of their diet. In the Bering Sea, adult capelin consume copepods, mysids, euphausiids, and chaetognaths. Juveniles primarily consume only copepods (Naumenko 1984). The largest capelin (>13cm) consume euphausiids nearly exclusively.

Capelin feed throughout the year in the Bering Sea. However, the diet exhibits seasonal variation that is due in part to spawning migration and behavior.

The primarily planktivorous diets of eulachon, sand lance, and capelin reduce the potential for dietary competition with the piscivorus and benthic diets of most groundfish. However, the potential for dietary competition is greater between pollock and forage fish due to the importance of planktonic prey such as euphausiids and copepods in their diets.

Rainbow smelt ascend rivers to spawn in spring shortly after the breakup of the ice. After spawning, they return to the sea to feed. Surveys have found concentrations of rainbow smelt off Kuskokwim Bay, Togiak Bay and off Port Heiden, but they also probably occur in many nearshore areas near river mouths. Rainbow smelt mature at ages 2-3 (19-23 cm), but can live to be as old as 9 years and as large as 30 cm. Little is known about trends in abundance of this species.

Eulachon (*Thaleichthys pacificus*) also spawn in spring in rivers of the Alaska Peninsula, and possibly other rivers draining into the southeastern Bering Sea. Eulachon live to age 5 (and grow to 25 cm), but most die following first spawning at age 3. Eulachon are consistently found by groundfish fisheries and surveys between Unimak Island and the Pribilof Islands in the Bering Sea, and in Shelikof Strait in the GOA. Evidence from fishery observer and survey data suggests that eulachon abundances declined in the 1980s (Fritz et al. 1993). These data should be interpreted with caution because surveys were not designed to sample small pelagic fishes such as eulachon, and fishery data was collected primarily for total catch estimation of target groundfish. Causes of the decline, if real, are unknown, but may be related to variability in year-class strength as noted for capelin. Small-mesh shrimp trawl surveys in the coastal areas of the GOA suggest that eulachon has remained at a low level of relative abundance since 1987. Eulachon are currently at the lowest recorded level in the survey series (1972-97) at 0.01 kg/km.

The diet of eulachon in the North Pacific generally consists of planktonic prey (Hart 1973; Macy et al. 1978) As larvae they primarily consume copepod larvae; post-larvae consume a wider variety of prey that includes phytoplankton, copepod eggs, copepods, mysids, ostracods, barnacle larvae, cladocerans worm larvae and larval eulachon. Juvenile and adult eulachon feed almost exclusively on euphausiids, with copepods and cumaceans occasionally in the diet.

Pacific sand lance (Ammodytidae). Pacific sand lance (family name Ammodytidae) are usually found on the bottom, at depths between 0-100 m except when feeding (pelagically) on crustaceans and zooplankton. Spawning is believed to occur in winter. Sand lance mature at ages 2-3 years and lengths of 10-15 cm. Little is known of their distribution and abundance; they are rarely caught by trawls. In the Bering Sea, sand lance are common prey of salmon, northern fur seals and many species of marine birds. Thus, they may be abundant in Bristol Bay, along the Aleutian Islands and Alaska Peninsula. In the GOA, sand lance are prey of harbor seals, northern fur seals and marine birds, especially in the Kodiak area and along the southern Alaska Peninsula. Given the sand lance's short life span and the large number of species which prey on it, mortality, fecundity and growth rates of Pacific sand lance are probably high.

Sand lance in the Kodiak region undergo an extensive migration that is counter to the normal pattern found with many inshore species. Spawning takes place in the late fall and winter, and usually completed in January. Hatching of larvae continues over an extended period of time until March and perhaps April (Blackburn et al. 1983; Blackburn and Anderson 1997) and some larval fish may spend up to several months in beach sediments. Newly hatched larval sand lance and adults start migrating offshore in the early spring and spend some time in offshore bank areas where they can often be abundant. Offshore ichthyoplankton surveys in the GOA indicate high larval abundance first appearing in early March and remained high until early July, but then disappeared after that. In the late summer, massive schools of fish start migrating inshore to suitable beach habitat for spawning and overwintering. These inshore migrating schools provide important forage for species such as offshore migrating sea birds during late summer and early fall. Hence, sand lance are among one of the few fish which migrate inshore during the late summer months to overwinter near-shore while most other fish migrate offshore prior to winter months.

Hart (Hart 1973) and Trumble (Trumble 1973) summarized the diet of sand lance in the North Pacific as primarily planktivorous; their primary prey changing with ontogeny. Larval sand lance consume diatoms (microscopic one-celled or colonial algae) and dinoflagellates (photosynthetic marine organisms); post-larvae prey upon copepods and copepod nauplii (larvae). More recent information on the food habits of age-0 and age-1 sand lance show a dominance of calanoid copepods in the diet with barnacle nauplii, larvaceans, and shrimp larvae as other important prey (Blackburn and Anderson 1997). Adult sand lance prey upon chaetognaths, fish larvae, amphipods, annelids and common copepods. Sand lance exhibit seasonal and diurnal variation in feeding activity and are opportunistic feeders upon abundant plankton blooms.

Lantrenfish and Deep-sea Smelts (Myctophids). Lanternfishes (family Myctophids) and deep-sea smelts (family bathylagids) are distributed pelagically in the deep sea throughout the world's oceans. Most species in both families occur at depth during the day and migrate to near the surface to feed (and be fed upon) at night. A common myctophid in the Bering Sea and GOA is the northern lampfish (*Stenobrachius leucopsarus*), which has a maximum length of approximately 13 cm. Deep-sea smelts of the North Pacific include blacksmelts (*Bathylagus* spp.) and northern smoothtongue (*Leuroglossus stilbius schmidti*) ,each of which have maximum lengths of between 12-25 cm. Lanternfish and deep-sea smelts are important forage fishes for marine birds and marine mammals. Because they are rarely caught in survey or fishery trawls, nothing is known of recent trends in their abundance.

Because of their large mouth, relatively sparse and denticulate gill rakers, well developed stomach and short intestine, lantern fishes mostly consume actively swimming animals like copepods and euphausiids (Balanov et al. 1995). Because deep-sea smelts have a small mouth, dense flat gill rakers, a small stomach and long intestine, they consume weak swimming soft-bodied animals (pteropods, appendicularia, ctenophores, chaetognath, polychaete, jellyfish, etc.). Deep-sea smelts in the epipelagic zone can also feed on euphausiids and copepods at night when they are abundant (Balanov et al. 1995; Gorelova and Kobylyanskiy 1985).

Pacific Sandfish (Trichodontidae). The Pacific sandfish (*Trichodon trichodon*) (family Trichodontidae) lives in shallow inshore waters to about 50 m depth and grows to a maximum length of 30 cm. Some evidence shows sand fish exhibit burrowing behavior in which they bury themselves in the sand and come to rest with only their dorsal surface showing. Nothing is known of trends in their abundance. They are fed upon by salmon and other fish, as well as pinnipeds. The diet of sandfish consists of small crustaceans such as mysids, amphipods, and cumaceans (Kenyon 1956; Mineva 1955). More recent information from the GOA shows that sandfish consume sand lance, several types of shrimps, crab larvae, cumaceans and polychaetes (Paul et al. 1997). In the EBS, the diet of Pacific sandfish is primarily (95 percent by weight) fish, especially gadids (Brodeur and Livingston 1988).

Euphausiids. The species comprising the euphausiid group occupy a position of considerable importance within the North Pacific food web. Euphausiids are fed upon by almost all other major taxa inhabiting the pelagic realm. Along with many copepod species, the euphausiids form a critical zooplanktonic link between the primary producers (phytoplankton) and all upper pelagic trophic levels. These crustaceans, also known as krill, occur in large swarms in both neritic (nearshore) and oceanic (offshore) waters. Members of at least 11 genera of euphausiids are known from the North Pacific, the most important (in terms of numbers of species) being *Thysanopoda, Euphausia, Thysanoëssa* and *Stylocheiron* (Boden et al. 1955; Ponomareva 1963). Euphausiids are generally thought to make diurnal vertical migrations, remaining at depth (usually below 500 m) during the day and ascending at night to 100 m or less. However, this is complicated by the fact that as euphausiids grow they are found at deeper depths, except during spawning, which occurs in surface waters. Spawning occurs in spring to take advantage of the spring phytoplankton bloom, and the hatched nauplii larvae live near the surface (down to about 25 m). By fall and winter, the young crustaceans are found mainly at depths of 100 m or less, and make diurnal vertical migrations. Sexual maturity is reached the following spring at age 1. After spawning, adult euphausiids gradually descend to deeper depths until fall and winter, when they no longer migrate daily to near-surface waters. In their second spring, they again rise to the surface to spawn; euphausiids older than 2 years are very rarely found. This classical view of euphausiid life history and longevity was recently questioned by Nicol (Nichol 1990), who reported that Antarctic euphausiids may live as long as 6-10 years; annual euphausiid production, then, would be much lower than if they lived only 2 years.

While euphausiids are found throughout oceanic and neritic waters, their swarms are most commonly encountered in areas where nutrients are available for phytoplankton growth. This occurs primarily in areas where upwelling of waters from depths into the surface region is a consistent oceanographic feature. Areas with such features are at the edges of the various domains on the shelf or at the shelf-break, at the heads of submarine canyons, on the edges of gullies on the continental shelf (e.g., Shumagin, Barnabus, Shelikof gullies in the GOA), in island passes (on certain tides) in the Aleutian Islands (e.g., Seguam Pass, Tanaga Pass), and around submerged seamounts (e.g. , west of Kiska Island). It is no coincidence that these are also prime fishing locations used by commercial fishing vessels seeking zooplanktivorous groundfish, such as pollock, Atka mackerel, sablefish, and many species of rockfish and flatfish (Fritz et al. 1993; Livingston and Goiney 1983; Yang 1993).

The diet of many species of fish other than the groundfish, including salmon, smelts (capelin, eulachon, and other osmerids), Arctic cod (*Boreogadus saida*) and Pacific tomcod (gadids), and Pacific herring is composed, to varying degrees, by euphausiids (Livingston and Goiney 1983), while euphausiids are the principal item in the diet of most baleen whales [e.g. minke, fin, sei), humpback, right, and bowhead whales (Perez 1990)]. While copepods generally constitute the major portion of the diet of planktivorous birds (e.g. auklets), euphausiids are prominent in the diets of some predominately piscivorus birds in some areas [e.g. kittiwakes on Buldir Island in the Aleutian Islands, Middleton Island in the GOA, and Saint Matthew Island in the Bering Sea (Hatch et al. 1990)].

The diets of euphausiids in the North Pacific consist of planktonic prey. Species of the genus Euphausia consume diatoms, dinoflagellates, tintinnids, chaetognaths, echinoderm larvae, amphipods, crustacean larvae, ommatidians, and detritus (Mauchline 1980). Species of the genus *Thysanoessa* consume diatoms, dinoflagellates, tintinnids, radiolarians, foraminiferans, chaetognaths, echinoderm larvae, molluscs, crustacean larvae, ommatidians and detritus (Mauchline 1980). Several species of *Thysanoessa* also consume walleye pollock eggs in the GOA (Brodeur and Merati 1993).

Euphausiids represent a significant portion of the diet of walleye pollock in the EBS shelf region (Livingston 1991a). Euphausiids represent as much as 70 percent of the diet in the winter and spring and are generally more important to larger pollock than smaller ones. Euphausiids are also the primary prey of small (<35 cm) Greenland turbot in the EBS shelf, but are of little importance to larger fish (Livingston and DeReynier 1996). Small (< 35 cm) arrowtooth flounder also consume euphausiids as a large (50 percent by weight) portion of their diet; euphausiids are of little importance to the larger ones (Livingston and DeReynier 1996). Euphausiids were not found as a significant component of the diet of any other EBS shelf groundfish. In the EBS slope region euphausiids were found in the diets of several groundfish species. Euphausiids represent 26 percent of the overall diet by weight of walleye pollock but are more important seasonally (80 percent by weight in winter) and are more important to smaller (<50 cm) fish (Lang and Livingston 1996). Euphausiids also play a small role (<1 percent by weight) in the diets of Pacific cod, flathead sole, and arrowtooth flounder (Lang and Livingston 1996).

Euphausiids are an important food item of many groundfish species in the GOA and Aleutian Islands areas. Yang (Yang 1993) showed that the diets of plankton feeding groundfish in the GOA such as dusky rockfish, POP, and northern rockfish had large percentages (more than 65 percent) of euphausiids. Euphausiids also comprised 39 percent of the diet of walleye pollock in the GOA. In the Aleutian Islands, euphausiids also comprised 43, 55, 51, and 50 percent of the stomach contents of walleye pollock, Atka mackerel, Pacific ocean perch, and northern rockfish, respectively. Euphausiids were also a constituent of the diets of arrowtooth flounder (5 percent), rougheye rockfish (2 percent), shortspine thornyhead (1 percent), and shortraker rockfish (1 percent) in the Aleutian Islands. (Yang 1996).

Gunnels (Pholidae) and Pricklebacks, Warbonnets, Eelblennys, Cockscombs and Shannys (Stichaeidae). Gunnels (family Pholidae) and pricklebacks (family Stichaeidae) are long, compressed, eel-like fishes with long dorsal fins often joined with the caudal fin. Pricklebacks are so named because all rays in the dorsal fin are spinous in most species (while some may have soft rays at the rear of the dorsal fins). Gunnels have flexible dorsal fin rays, and differ from pricklebacks in that the anal fin is smaller (the distance from the tip of the snout to the front of the anal fin is shorter than the length of the anal fin). Most species of both families live in shallow nearshore waters among seaweed and under rocks and are mostly less than 45 cm in length. Approximately 14 species of Stichaeidae and five species of Pholidae occur in Alaska. Nothing is known about absolute or trends in their abundance, and little about their growth rates, maturity schedules, and trophic relationships. They feed mostly on small crustacea and arthropods, and are thought to grow quickly. Some cockscombs in British Columbia attain sexual maturity at age 2 years.

These species are in the Family Stichaeidae; a family with long, slender, compressed bodies. Some of the diets of the stichaeids are described below. The longsnout prickleback *(Lumpenella longirostris*) eats copepods almost exclusively (Barraclough 1967). Young ribbon pricklebacks eat copepods and oikopleura (Robinson et al. 1968). The food of the adults of this species includes crustaceans and red and green algae. Black prickleback consume copepods, copepod nauplii and clam larvae (Barraclough et al. 1968). It has also been reported that an important food of high cockscomb was green algae. Other food of this species included polychaete worms, amphipods, molluscs, and crustaceans.

The diets of gunnels (family Pholidae) consists primarily of benthic and epibenthic prey. Amphipods, isopods, polychaete worms, harpacticoid copepods, cumaceans, munid crabs, insects, mysids, algae, ostracods, bivalves, crustacean larvae, and tunicates have been described as their main prey (Simenstad et al. 1979; Williams 1994). Juvenile fish prey (English sole, and sand lance) have also been described as infrequent components of its diet in Puget Sound, Washington (Simenstad et al. 1977).

Stichaeids represent a minimal portion of the diets of several groundfish species in the EBS shelf region. Pacific cod (Livingston 1991b), arrowtooth flounder (Yang and Nelson 2000), and flathead sole (Pacunski 1991) consume unidentified stichaeids as < 1percent of their diets by weight. Greenland turbot consume a combination of unidentified stichaeids and daubed shanny (*Lumpenus maculatus*) as a small portion (<1 percent) of their diet.

Stichaeids represent a small portion (<1 percent by weight) of the diet of Pacific cod, arrowtooth flounder, and Greenland turbot in the EBS slope region (Lang and Livingston 1996). Yang (Yang 1993) studied the diets of the groundfish in the GOA area during summer. Yang also found that stichaeids comprised about 1percent of the stomach content weight of arrowtooth flounder, Pacific cod, and walleye pollock, respectively. Pacific halibut, sablefish, and Pacific ocean perch also consumed stichaeids, but their contribution to the diets was small (<1 percent). Yang (Yang 1996) also studied the diet of the groundfish in the Aleutian Islands area. He found that stichaeids comprised 2 percent of the stomach contents weight of arrowtooth flounder. Stichaeids comprised <1 percent of the diets of Pacific cod, walleye pollock, and Atka mackerel.

Pholids. Pholids (saddleback gunnel) were found in the Pacific cod stomachs in the Aleutian Islands area; their contribution was less than 1percent of the total stomach contents weight. Pholids were not found as a significant portion of the diets of EBS shelf or slope groundfish. Pholids are probably not important prey of the groundfish in the GOA area because they were not found in a recent study of groundfish diets in that area (Yang 1993).

Bristlemouths, Lightfishes, Anglemouths (Gonostomatidae). This is a large and diverse family, Gonostomatidae, of small (to about 8 cm), bathypelagic fish that are rarely observed except by researchers. They can be abundant at depths of up to 5000 m. As many as six species may occur in the North Pacific Ocean and Bering Sea. Bristleworms, Lightfishes, and Angelmouths have large gill openings and well-developed gill rakers, characteristics of a zooplankton feeder. The primary zooplankton prey of gonostomatids are calanoid copepods. The other food includes ostracods and euphausiids. Some larger gonostomatids also consume some fish (Gorelova 1980).

Gonostomatids were not found as a significant portion of the diets of EBS shelf or slope groundfish (Livingston and DeReynier 1996). Gonostomatids are probably not important prey of the groundfish in the GOA area because they were not found in a recent study of groundfish diets in that area (Yang 1993). Gonostomatids were found in pollock stomachs in the Aleutian Islands area; however, they contributed less than 1percent of the total stomach contents weight (Yang 1996).

Significance of forage fish in the diet of BSAI groundfish.

Forage fish, as defined here, are found in the diets of walleye pollock, Pacific cod, arrowtooth flounder, Pacific halibut, Greenland halibut, yellowfin sole, rock sole, Alaska plaice, flathead sole, and skates in the EBS region. However, forage fish do not represent a large portion of the diet by weight of these predators with the exception of shelf rock sole (14.3 percent) and slope pollock (12.6 percent). The groundfish food habits database compiled by AFCS, REFM, contains groundfish diet data, including important prey by weight in the diets of groundfish.

Eastern Bering Sea shelf. Despite the generally piscivorus diet of cod, arrowtooth flounder, Pacific halibut, Greenland turbot and skates, forage fish are not principal components in the diet by weight. Sand lance are the most prevalent forage fish in the diet of cod (0.8 percent) while capelin, Osmeridae, Bathylagidae, Myctophidae, and eulachon each represent 0.1 percent or less of the diet by weight. In the diet of arrowtooth flounder, capelin and eulachon each represent 0.2 percent of the diet by weight, while Osmeridae, Myctophidae, and sand lance each constitute 0.1 percent or less. The diet of Pacific halibut contains 2.2 percent sand lance and 1.8 percent capelin; Osmeridae and eulachon each represent 0.1 percent or less. Myctophidae represent 0.2 percent of the diet of Greenland turbot; Bathylagidae, Osmeridae, and sand lance represent 0.1 percent or less. Sand lance are the most important forage fish in the diet of skates (0.7 percent); capelin, sandfish, and Myctophidae each represent 0.1 percent or less.

Sand lance is the most prevalent forage fish species in the diet of walleye pollock (0.5 percent); Osmeridae, Bathylagidae, Myctophidae, and eulachon each represent <0.1 percent of the diet by weight. The total contribution (0.6 percent) of forage fishes to the diet of yellowfin sole is primarily due to sand lance; Bathylagidae and capelin each represent <0.1 percent by weight. Sand lance are the second most important prey in the diet of rock sole, 14.3 percent by weight; Osmeridae are the only other forage fish present in the diet (<0.1 percent). Sand lance are the only forage fish found in the diet of Alaska plaice, representing 0.5 percent of the diet. Flathead sole consumes capelin (1.3 percent), sand lance (0.5 percent), Osmeridae (0.1 percent) and Myctophidae (<0.1 percent).

Eastern Bering Sea slope. Lang and Livingston (Lang and Livingston 1996) studied the diets of groundfish in the EBS slope region. In this region, forage fish are relatively unimportant in the diets of Greenland halibut, flathead sole, arrowtooth flounder, and cod. However, 12.6 percent of the diet of pollock on the slope consists of forage fishes. Greenland halibut consume Bathylagidae (0.4 percent) and Myctophidae (0.4 percent) as the only forage fish in their diet. Flathead sole also consumed Bathylagidae (0.3 percent) and Myctophidae (0.1 percent). Myctophidae (0.2 percent) is the only forage fish found in the diet of arrowtooth flounder. Pollock consume Bathylagidae (7.0 percent), Myctophidae (5.5 percent), Osmeridae (0.1 percent), and sand lance (<0.1 percent). Forage fish are negligible in the diet of cod; Bathylagidae represent <0.1 percent of the diet by weight.

Aleutian Islands. Yang (Yang 1996) studied the diets of groundfish in the Aleutian Islands during summer. He found that main fish prey of groundfish in the Aleutian Islands included Atka mackerel, walleye pollock, Pacific herring, capelin, myctophids, bathylagids, Pacific sand lance, and eulachon. Although Atka mackerel and walleye pollock were important fish prey of arrowtooth flounder, Pacific halibut, and Pacific cod, other forage fish species comprised from 1-37 percent of the diet of groundfish. Most of the Atka mackerel consumed by the groundfish were located near Attu, Agattu, Amchitka, Tanaga, Atka, and Unalaska Islands. Myctophids were an important forage fish. Large amounts of myctophids were found in the diets of Greenland turbot, walleye pollock, Pacific ocean perch, and shortraker rockfish. They were also found in arrowtooth flounder, Pacific cod, rougheye rockfish, Atka mackerel, and northern rockfish. Most myctophids consumed by the groundfish were located near Kiska, Adak, Seguam, and Yunaska Islands. It is notable that most groundfish species studied consume myctophids as food. If the abundance of the myctophids declines dramatically, it could impact the growth of groundfish in the Aleutian Islands area which depend on myctophids for a main food resource. Bathylagids were found in the diets of Greenland turbot and walleye pollock. Capelin were found in the diet of Pacific halibut and walleye pollock collected in the Akutan Island area, but they contributed only 5 percent and less than 1 percent of the diets of Pacific halibut and walleye pollock, respectively. Pacific sand lance were food of arrowtooth flounder, Pacific halibut, Pacific cod, and walleye pollock, but they contributed less than 1 percent of the diets. Only a small amount (less than 1 percent) of eulachon was found in the diet of walleye pollock. Pacific sandfish was not found in the diets of the groundfish in the Aleutian Islands area.

Significance of forage fish in the diet of GOA groundfish

Yang and Nelson (Yang and Nelson 2000) studied the diets of groundfish in the GOA shelf during summer. They found that the main fish prey of groundfish in the GOA included pollock, Pacific herring, capelin, Pacific sand lance, eulachon, Atka mackerel, bathylagids, and myctophids (Figure 3.2.4). Although walleye pollock was the most important fish prey of arrowtooth flounder, Pacific halibut, sablefish, Pacific cod, and walleye pollock in the GOA area, other forage fish species comprised 1-23 percent of the diet of groundfish. Capelin was important food of arrowtooth flounder and pollock, comprising 23 percent and 7 percent of the diet of arrowtooth flounder and walleye pollock in 1990, respectively. The consumption of the capelin by walleye pollock gradually decreased to 3 percent in 1993; to 0 percent in 1996. Comparing to 1990, arrowtooth flounder also consumed less capelin in 1993 (4 percent) and in 1996 (10 percent). The capelin consumed by these groundfish were mainly located in the northeast and southwest of Kodiak Island. Eulachon comprised 6 percent of the food of sablefish.

Myctophids were important forage fish for shortraker rockfish, comprising 18 percent of the diet of shortraker rockfish. Pacific sand lance were found in the stomachs of arrowtooth flounder, Pacific halibut, sablefish, Pacific cod, and walleye pollock, but its contribution to the diet was small (≤1 percent).

Bathylagids were only found in the diet of walleye pollock, they contributed less than 1 percent of the diet of walleye pollock. Pacific sandfish was not found in the diet of the groundfish in the GOA area. In the Atlantic, strong interactions between cod and capelin have been recorded (Akenhead et al. 1982). Even though Pacific cod did not feed so heavily on capelin in the GOA, capelin was one of the important fish prey of several groundfish species. The distributions and the abundances of the forage fish in the GOA are not well known. However, a series of years with poor forage fish recruitment, which decreases the availability of small fish, may have greater impact on piscivorus groundfishes.

Significance of forage fish to seabirds. Capelin and sandlance are crucial to many bird species; other forage fish include myctophids, herring, Pacific saury, and pollock. Many seabirds can subsist on a variety of invertebrates and fish during nonbreeding months but can only raise their nestlings on forage fish (Sanger 1987a; Vermeer et al. 1987).

Seabird population trends throughout the Arctic and subarctic are largely determined by forage fish availability (Birkhead and Furness 1985). Lack of prey usually causes population declines through breeding failure rather than adult mortality. Although seabirds can adapt to occasional years of poor food and reproduction, a long-term scarcity of forage fish leads to population declines. Reproductive success in Alaskan seabirds is strongly linked to the availability of appropriate fish. Breeding failure as a result of forage fish scarcity has been documented in Alaska for black-legged kittiwakes, glaucous-winged gulls (*Larus glacescens*), pigeon guillemots (*Cepphus columba*), and murres (Baird 1990; Kuletz 1983; Murphy et al. 1987; Murphy et al. 1984; Springer 1991a). Similar observations have been made for seabirds in British Columbia (Vermeer et al. 1979; Vermeer and Westerheim 1984) and the North Atlantic (Barrett et al. 1987; Brown and Nettleship 1984; Harris and Hislop 1978; Monaghan et al. 1989; Vader et al. 1990). Breeding failure can result when adults lack sufficient energy reserves to complete a nest, lay eggs, or complete incubation, or when they cannot feed the nestlings adequately.

Seabirds depend on forage fish that are small, high in energy content, and form schools within efficient foraging range of the breeding colony. Fish 5 to 20 cm long are easily captured and handled by seabirds. Schools must be available near the breeding colony, within 20 km or less for inshore

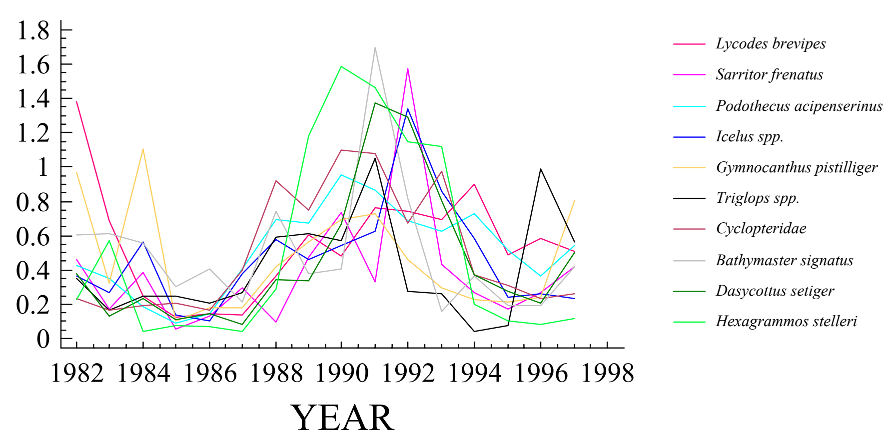

Figure 3.2.4 Changes in population estimates for a variety of non-commercial fish species in the eastern Bering Sea, showing a similarity in trends. Species include sculpins, eelpouts, poachers, snailfish, ronquils, and greenlings.

feeders such as terns, guillemots, and cormorants, but up to 60 km or farther for kittiwakes and murres (Schneider and Hunt Jr 1984). Seabirds such as kittiwakes and terns can take prey only when they are concentrated at the surface; these species are affected more frequently by food shortage than are diving seabirds such as murres, murrelets, puffins, and cormorants (Furness and Ainley 1984; Uttley et al. 1994).

Although Alaskan seabirds consume several species of fish, only one or two forage species are available near most colonies. If an important fish stock is depleted locally, birds may have no alternative that can support successful breeding. Regional variations in dominant forage fish include sand lance along most of the Aleutian Islands and the coast and northern islands of the Bering Sea (Springer 1991a; Springer et al. 1996); capelin and pollock on most of the Alaska Peninsula (Hatch and Sanger 1992; Springer 1991a); and pollock on St. Matthew Island and the Pribilof Islands (Hunt Jr. et al. 1981a; Springer et al. 1986).

The preferred forage species in each area usually is essential for successful seabird reproduction. Black-legged kittiwakes bred successfully in the northern Bering Sea when sand lance were available, but not in years when they had to rely on cods (Springer et al. 1987). After capelin declined in the GOA in the late 1970s, black-legged kittiwakes switched to pollock and sand lance, but this diet did not prevent breeding failure (Baird 1990; Piatt and Anderson 1996). Capelin have increased again near some GOA colonies since 1994, and kittiwake breeding success has improved in those areas recently.

Theories have attributed reductions in the forage fish of seabirds to both commercial fisheries and climatic cycles. However, recent studies have concluded that both factors probably are significant (National Research Council 1996). Climate has been recognized as the dominant factor in fluctuations of pelagic fish stocks (Wooster 1993). Climate in the GOA and Bering Sea undergoes cycles of varying lengths (Royer 1993), which influences the numbers and distribution of forage fish and hence avian productivity (National Research Council 1996; Piatt and Anderson 1996). The same has been found in eastern Canada and northern Britain (Bailey 1989b; Carscadden 1984).

However, directed fisheries on forage fish can deepen and prolong their natural population cycles (Duffy 1983; Steele 1991). In other nations with directed forage fish fisheries, several stocks have "crashed" due to a combination of climatic and fishery pressures, which has led to local population declines in seabirds. Examples include fisheries on anchoveta (*Engraulis ringens*) in Peru ((Duffy 1983; Schaefer 1970), herring in Norway (Anker-Nilssen and Barrett 1991; Lid 1981), and pilchard (*Sardinops oscellata*) in South Africa (Crawford and Shelton 1978). In northwestern Russia, where several forage species (capelin, herring, and Arctic cod) were overfished, sand lance are still available to seabirds, but the birds appear to compete for them more intensely than before (Krasnov et al. 1995).

Significance of forage fish to marine mammals

In general, small forage fish such as capelin, herring, sand lance, and eulachon have been recognized as important prey items for a variety of marine mammal species. Among these are northern fur seals, Steller sea lions, harbor seals, spotted seals, and bearded seals, as well as humpback whales and fin whales. Northern fur seals, Steller sea lions, and harbor seals have been declining in abundance for a number of years, and some theories attribute these declines to the lack of availability of prey species.

Largely due to the variable nature of the food habits data on different predators with respect to sampling method, timing and location, and lack of survey data on non-commercial prey species, the relative importance of forage species can appear uncertain. However, taken in aggregate, the available data suggest that forage fish species are important to marine mammals when and where they are available. Table 3.2.1 shows the relative rank of forage fish species in the diets of northern fur seals, Steller sea lions, and harbor seals in the GOA. Capelin are an important component of the diet of all three species. In addition, of those species forming the forage fish category, Bathylagids and sand lance contribute to the diet of the fur seal, with eulachon as another important component of the harbor seal diet (Table 3.2.1). A summary of capelin and other forage fish use by selected marine mammal species in Alaska follows (data for pinnipeds from Alaska Fisheries Science Center).

Northern fur seal. Examination of 3,530 stomachs collected from seals taken at sea from 1960, 1962 to 1964, 1968, 1973 and 1974 indicated that capelin was the third most prevalent prey item, after pollock and Pacific herring. Available information on fur seal feeding habits prior (1892 to 1950s) to these pelagic collections also describe capelin and bathylagid smelt as primary prey in seal spewings and stomachs. Pacific herring and capelin were absent from stomach samples collected in the 1980s and 1990s. Absence of forage fish in the samples was thought to be related to fluctuations in the abundance and availability of these fish, environmental changes in the Bering Sea, or exclusion by the existence of large populations of pollock.

Steller sea lion. Few opportunities exist to collect food habits data for Steller sea lions in offshore waters of the Bering Sea. Stomach samples collected by ADF&G in 1981, and 1985 to 1986 did not indicate the presence of forage fish species, but rather contained predominantly pollock and yellowfin sole. However, samples collected in the GOA during summer 1975 to 1978 (n=37) showed that capelin comprised about 60 percent of the stomach contents identified.

Table 3.2.1 Rank of prey species in the diets of northern fur seals, Steller sea lions, and harbor seals in the Gulf of Alaska and Bering Sea.

Ranking	Northern fur seal[1]	Steller sea lion[2]	Harbor seal[3]
1	Squids (33.3)	Pollock (58.3)	Pollock (21.4)
2	Capelin (30.6)	Herring (20.6)	Octopus (18.3)
3	Pollock (25.1)	Capelin (7.4)	Eulachon (11.6)
4	Atka mackerel (3.5)	Salmon (5.1)	Capelin (10.4)
5	Herring (2.9)	Squid (4.2)	Herring (6.4)
6	Bathylagidae (2.9)	Sculpins (1.3)	Salmon (4.4)
7	Salmon (1.1)	Pacific cod (0.9)	Shrimps (3.3)
8	Flatfishes (0.6)	Rockfishes (0.8)	Pacific cod (3.2)
9	Sablefish (0.2)	Flatfishes (0.3)	Flatfishes (2.6)
10	Sand lance (0.2)	Octopus (<0.1)	Squids (1.6)

[1]Rankings based on modified volume, numbers in parentheses are modified volumes; from (Perez and Bigg 1981).
[2]Rankings based on combination rank index, numbers in parentheses are percent of total sample volume; from (Pitcher 1981)).
[3]Rankings based on modified index of relative importance, numbers in parentheses are percent of total sample volume; from (Pitcher 1980a; Pitcher 1980b).

Harbor seal. Analyses of harbor seal stomach contents from collections made by ADF&G during 1973 to 1978 in the GOA indicated the presence of several forage fish species, including capelin, eulachon, Pacific herring and Pacific sand lance. In particular, capelin, eulachon and Pacific herring ranked 3rd, 4th and 5th respectively out of 15 species compared using the Index of Relative Importance (IRI) method. Seasonal and area differences were pronounced; capelin were most common in collections from the Kodiak Island area, but were absent in samples from the south side of the Alaska Peninsula. Similarly, eulachon comprised 95 percent of the contents volume for collections in the Copper River Delta, 30 percent in Lower Cook Inlet, and 4.6 percent around Kodiak Island.

Spotted seal. Collections of spotted seal stomachs (n=14) during March - June 1976 to 1978 in the southeastern Bering Sea indicated that capelin was the predominant prey item. Similar collections from the northern Bering Sea (n=12) in 1976 to 1978 contained predominantly Arctic cod, capelin and saffron cod. In March - June 1972 and 1973 spotted seal collections from the Gulf of Anadyr contained predominantly Arctic cod, but pollock and sand lance were present as well.

Bearded seal. Pelagic collections of bearded seal stomachs near Saint Matthew Island in the Bering Sea in spring 1981 indicated a very high occurrence of capelin in the diet, 82 percent, based on 16,940 individual capelin remains recovered. The authors suggest that the high occurrence was related to the presence of dense schools of capelin that rise in the water column and move toward shore in the early spring. This prey species, like the other forage fishes, therefore, may be very important in specific areas and times of year, but would not necessarily appear as important prey if sampling were to occur elsewhere, at different times.

Humpback whale. The major prey species of humpback whales are small schooling fishes and large zooplankton, mainly euphausiids. Important prey species in southeastern Alaska are capelin, herring, pollock and krill. Shifts in distribution of humpback whales in southeastern Alaska have also been documented in apparent response to changes in prey abundance.

Fin whale. Fin whales are seasonally associated with coastal and continental shelf habitats and food resources. In the North Pacific, fin whales compete with commercial fisheries for common prey species such as herring, northern anchovy, pollock, capelin, sand lance and lanternfish. Data compiled over the past 25 years suggest that these whales feed in eastern North Pacific waters (e.g., Shelikof Strait and the GOA).

Commercially important crab species in the BSAI

The commercially important crab species in the BSAI are: red king crab (*Paralithodes camtschaticus*), blue king crab (*P. platypus*), golden or brown king crab (*Lithodes aequispinus*), Tanner crab (*Chionoecetes bairdi*), and snow crab (*C. opilio*). Scarlet king crab (*L. couesi*), grooved Tanner crab (*C. tanneri*), triangle Tanner crab (*C. angulatus*) are also found in the BSAI, but their abundance is considered too low to support commercial fisheries. Annual trawl surveys for crab stock assessments are conducted by NMFS in the BSAI. A length-based analysis, developed by ADF&G, incorporates survey and commercial catch and observer data into more precise abundance estimates (Zheng et al. 1998a; Zheng et al. 1995b).

Life history and stock status. King, Tanner, and snow crab share a similar life cycle, although particular life cycle traits are distinct for each species. After males and females mate, the female carries the eggs for approximately a year at which time the eggs hatch into free swimming larvae. After drifting with the currents and tides, and undergoing several development changes, the larvae settle to the ocean bottom and molt into non-swimmers, looking very much like miniature adult crab. The juvenile crab settle on preferred habitat, where they continue to molt and grow for several years until they become sexually mature. Each life stage for stocks of BSAI crab is concentrated at some combination of depth, habitat, geographic area, and time of year.

In the trophic structure, crab are members of the inshore benthic infauna consumers guild (NPFMC 1994). During each life stage, crab consume different prey and are consumed by different predators. Planktonic larval crab consume phytoplankton and zooplankton and are prey for pelagic fish, such as salmon and herring. Post-settlement juveniles feed on diatoms, protozoa, hydroids, crab, and other benthic organisms. Food eaten by king crab varies with their size, depth inhabited, and species, but includes a wide assortment of worms, clams, mussels, snails, brittle stars, sea stars, sea urchins, sand dollars, barnacles, fish parts and algae. King crab fall prey to a wide variety of species including Pacific cod, rock sole, yellowfin sole, pollock, octopus, and other king crab (Livingston 1993). Snow and Tanner crab feed on an extensive variety of benthic organisms including bivalves, brittle stars, other crustaceans, polychaetes and other worms, gastropods, and fish (Lovrich and Sainte-Marie 1997). In turn, they are consumed by a wide variety of predators including groundfish, bearded seals, sea otters, octopus, Pacific cod, halibut and other flatfish, eel pouts, and sculpins (Tyler and Kruse 1997). Snow crab comprise a large portion of the diet of many species of skates (Orlov 1998).

Crab, being benthic organisms, depend on specific habitat types throughout their life stages. Settlement on habitat with adequate shelter, food, and temperature is imperative to the survival of first settling crab. Young of the year red and blue king crab require nearshore shallow habitat with significant protective cover (e.g., sea stars, anemones, micro algae, shell hash, cobble, shale) (Stevens and Kittaka 1998). Early juvenile stage Tanner and snow crab also occupy shallow waters and are found on mud habitat ((Tyler and Kruse 1997).

Red king crab. Red king crab are widely distributed throughout the BSAI, GOA, Sea of Okhotsk, and along the Kamchatka shelf up to depths of 250 meters. King crab molt several times per year through age 3 after which molting is annual. At larger sizes, king crab may skip molt as growth slows. Females grow more slowly and do not get as large as males. In Bristol Bay, males attain fifty percent maturity at 120 mm carapace length and females at 90 mm carapace length (about 7 years). Mean age at recruitment into the fishery is 8-9 years. Natural mortality of adult king crab is estimated at 0.2. Red king crab in the Norton Sound area mature at smaller sizes and do not attain the maximum sizes found in other areas. In Bristol Bay, red king crab mate when they enter shallower waters (<50 m), generally beginning in January and continuing through June. Males grasp females just prior to female molting, after which the eggs (43,000 to 500,000 eggs) are fertilized and extruded on the female's abdomen. The females carry the eggs for 11 months before they hatch, generally in April. Red king crab spend two to three months in larval stages before settling to the benthic life stage. Young-of-the-year crab occur at depths less than 50 m. They are solitary and need high relief habitat or coarse substrate such as boulders, cobble, shell hash, and living substrates such as bryozoans and stalked ascidians (Stevens and Kittaka 1998). At 1.5 to 2 years, crab form pods consisting of thousands of crab and migrate to deeper water. Podding generally continues until 4 years (about 65 mm), when the crab join adults in the spring migration to shallow water for spawning and the summer-fall feeding migration to deep water.

Based on analysis of the 2000 NMFS survey results, large female crab and legal males decreased in abundance and the abundance of pre-recruits did not change from 1999 (NPFMC 1999c). Legal males decreased from an estimated 9.4 million crab in 1997 to 7.4 million crab in 1998, and then increased to 11.0 million crab in 1999, and decreased to 8.7 million crab in 2000. Large females (>89 mm carapace length) increased from 25.3 million crab in 1997 to 35.3 million crab in 1998, then decreased to 14.5 million crab in 1999, and increased to 17.4 million crab in 2000 (NPFMC 1999c). The Bristol Bay red king crab stock remains depressed compared to past abundance levels. Survey and fishery data indicate a long term decline of Pribilof Islands red king crab. Localized, high concentrations of Pribilof Islands red king crabs were found by the 2000 survey (NPFMC 1999c); however, survey and fishery data indicate a long-term decline in the stock. The combined red and blue king crab Pribilof Islands fishery was closed in 1999 and 2000.

Blue king crab. Blue king crab have a discontinuous distribution throughout their range (Hokkaido Japan to southeast Alaska). In the Bering Sea, discrete populations exist around the Pribilof Islands, St. Matthew Island, and St. Lawrence Island. Smaller populations have been found around Nunivak and King Island. Adult male blue king crab occur at an average depth of 70 m and an average water temperature of 0.6ºC. Blue king crab molt multiple times as juveniles. Skip molting occurs with increasing probability for those males larger than 100 mm carapace length. In the Pribilof area, males attain 50 percent maturity at 108 mm carapace length and females attain 50 percent maturity at 96 mm carapace length (about 5 years) (Somerton and MacIntosh 1983). Blue king crab in the St. Matthew Island area mature at smaller sizes (50 percent maturity at 77 mm carapace length for males and 81 mm carapace length for females) and do not get as large overall. Blue king crab have a biennial ovarian cycle and a 14 month embryonic period before hatching in late spring. Juveniles require cobble habitat with shell hash. These habitat areas have been found at 40-60 m around the Pribilofs Islands. Unlike red king crab, juvenile blue king crab do not form pods, instead relying on cryptic coloration for protection from predators.

The blue king crab population in the Pribilof district is low, and population trends are not easily detectable (NMFS 1998d). The 2000 NMFS survey estimated legal male abundance in the Pribilof district at 0.5 million crab, a slight increase from the 1999 survey, but still a significant decrease from the 1998 survey. Blue king crab in the St. Matthew Island area were estimated to be below the minimum stock size threshold, with an estimated abundance of 0.8 million legal sized males crab (NPFMC 1999c). The St. Matthew blue king crab stock was declared overfished and the fishery closed in 1999. A rebuilding plan is being developed. Blue king crab female abundance is considered imprecise because trawling does a poor job of sampling the inshore, rocky substrate preferred by females (Morrison et al. 1998).

Golden king crab. Golden king crab, also called brown king crab, range from Japan to British Columbia. In the BSAI, golden king crab are found at depths from 200 m to 1,000 m, generally in high relief habitat such as inter-island passes. Size at sexual maturity depends on latitude, with crabs in the northern areas maturing at smaller sizes. In the St. Matthew Island area, males attain 50 percent maturity at 92 mm carapace length and females at 98 mm carapace length. In the Pribilof and western Aleutian islands area, males attain 50 percent maturity at 107 mm carapace length and females at 100 mm carapace length. Further south, in the eastern Aleutian Islands, males attain 50 percent maturity at 130 mm carapace length and females at 111 mm carapace length. ADF&G and NMFS do not make annual abundance estimates for Bering Sea golden king crab and commercial harvest is allowed by ADF&G permit (Morrison et al. 1998). Catches have declined from the early years of the fishery as the initial stock was exploited and recruitment was unable to sustain the fishery at its initial harvest levels (Morrison et al. 1998).

Tanner crab. Tanner crab are distributed on the continental shelf of the North Pacific Ocean and Bering Sea from Kamchatka to Oregon. Off Alaska, Tanner crab are concentrated around the Pribilof Islands and immediately north of the Alaska Peninsula, and are found in lower abundance in the GOA. After molting many times as juveniles, Tanner crab reach sexually maturity at about age 6 with an average carapace width of 110-115 mm for males and 80-110 mm for females (Tyler and Kruse 1997). At maturity, most males undergo terminal molt; however, some male crab may molt after maturity (Zheng et al. 1998a). Male Tanner crab reach a maximum size of 190 mm carapace width and live up to 14 years (Donaldson et al. 1981). Males of commercial size usually range between 7 and 11 years old and vary in weight 1 to 2 kg (Adams 1979). Natural mortality of adult Tanner crab is estimated at 0.3. Tanner crab females are known to form high-density mating aggregations, or pods, consisting of hundreds of crabs per mound. These mounds may provide protection from predators and also attract males for mating. Research shows the female Tanner crab prefer mating with large, old shell males (Paul and Paul 1996; Paul et al. 1995). Mating occurs from January through June. Some females can retain viable sperm in spermathecae for up to two years. Females carry clutches of 50,000 to 400,000 eggs for one year after fertilization. Hatching occurs between April and June (Tyler and Kruse 1997).

The Tanner crab fishery was closed in 1997, 1998, and 1999 due to low abundance. The 1998 survey abundance estimates for large males (135 mm carapace width) and large females is the lowest on record for the survey (NMFS 1998d). Most legal males encountered were in the Eastern District, with the highest abundance in central Bristol Bay. The cohort which began recruiting into the fishery in 1988-1992 has declined as a result of natural mortality and fishery removals. During the 1997 survey, 95 percent of legal males encountered were old shelled and not expected to molt again, and few young males in the 50-115 mm carapace width were surveyed. Tanner crab abundance increase in the 2000 survey. Legal male abundance is estimated at 4.9 million crabs, a 147 percent increase from 1999. Since 1999, pre-recruits males increased 24 percent to 18.1 million crabs and large females increased 15 percent to 13.7 million crabs. The NPFMC considers the stock overfished and the NPFMC's Crab Plan Team has developed a rebuilding plan (NMFS 1999a).

Snow crab. Snow crab are distributed on the continental shelf of the Bering Sea, the Arctic Ocean, and in the western Atlantic Ocean as far south as Maine. Snow crab are not present in the GOA. In the Bering Sea, snow crab are common at depths of ≤200 meters. The EBS population within U.S. waters is managed as a single stock; however, the distribution of the population extends into Russian waters to an unknown degree. Snow crab reach sexual maturity at age 4, with an average carapace width of 65 mm for males and 50 mm for females. The mean size of mature females varies from year to year over a range of 63 mm to 72 mm carapace width. Females cease growing with a terminal molt upon reaching maturity, and rarely exceed 80 mm carapace width. Males similarly cease growing upon reaching a terminal molt when they acquire the large claw characteristic of maturity. Male snow crab reach a maximum size of 150 mm carapace width and live up to 14 years. Large, hard-shelled males out compete adolescent and small adults in mating with females (Sainte-Marie et al. 1997). Males of commercial size usually range between 7 and 11 years old and vary in weight from .5 to 1 kg (Adams 1979). Female snow crab are able to store spermatophores in seminal vesicles and fertilize subsequent egg clutches without mating. At least two groups of eggs can be fertilized from stored spermatophores, but the frequency of this occurring in nature is not known (Sainte-Marie et al. 1997).

In 2000, large male snow crab were estimated at 76.1 million crabs, a 20 percent decline from 1999. In 1999, the mature biomass declined below the minimum stock size threshold of 460 million lbs and the stock was declared overfished (NPFMC 1999c). A rebuilding plan is being developed by the NPFMC crab plan team. A harvest of 33.5 million pounds was landed in 2000 based on a reduced harvest rate from past years. Little recruitment is apparent from the 1999 or 2000 survey.

Pacific halibut

Pacific halibut (*Hippoglossus stenolepis*) range from the Bering Sea to Oregon, with the center of abundance in the GOA. Spawning takes place in the winter months from December through February. Most spawning takes place off the edge of the continental shelf at depths of 400 to 600 m. Male halibut become sexually mature at 7 or 8 years of age, females mature at ages of 8 to 12 years. In the 1970s, at 10 years of age, males averaged 9.1 kg and females averaged 16.8 kg. A few males grow to exceed 36 kg and live up to 27 years. Females can grow to over 225 kg and can live up to 42 years. Females can produce up to 3 million eggs annually. Fertilized eggs float free for about 15 days before hatching; the larvae drift free for up to another six months and can traverse great distances. During this time, halibut rise to the surface and are carried to shallower waters by prevailing currents. In the shallower waters, young halibut begin life as bottom dwellers at a length of about 35 mm. Most young halibut spend five to seven years in shallow waters. Younger halibut (up to 10 years of age) are highly migratory and generally migrate in a clockwise direction east and south throughout the GOA. Older halibut tend to be much less migratory. Halibut prey on a wide variety of fish, crab, and shrimp. Halibut will sometimes leave the ocean bottom to feed on pelagic fish such as herring and sand lance (International Pacific Halibut Commission 1987).

The halibut resource is healthy, and the total catch has been near record levels. The 1999 coastwide catch totaled 58,026 mt round weight. The breakdown by fishery was: commercial fisheries (43,270 mt, or 75 percent), recreational fisheries (5,502 mt, or 9 percent), personal use (440 mt, or 1 percent), bycatch in other fisheries (7,779 mt, or 13 percent), and wasted mortality due to fishing by lost gear and discards (1,035 mt, or 2 percent).

The assessment of the Pacific halibut stock status was revised in 1996 due to the observed changes in individual growth rates that affected fishing selectivity by the gear. The new analyses showed that the exploitable portion of the Pacific halibut stocks apparently peaked at 326,520 mt in 1988 (Sullivan and Parma 1998). The population has since declined slightly and has maintained a biomass in the range of 270,000-277,000 mt for the past 5 years. The long-term average reproductive biomass for the Pacific halibut resource was estimated at 118,000 mt (Parma 1998). Long-term average yield was estimated at 26,980 mt, round weight (Parma 1998).

Pacific salmon

Five species of Pacific salmon, pink *(Oncorhynchus gorbuscha)*, chum *(O. keta)*, sockeye *(O. nerka)*, coho *(O. kisutch)*, and chinook salmon *(O. tshawytscha)* as well as steelhead trout (*O. mykiss*), occur in Alaska. With some important variations, all species have a similar appearance and anadromous life history. Salmonids spawn in freshwater, their eggs hatch and go through several developmental stages in fresh water until they outmigrate to the ocean as fry or smolt. The young salmon feed and grow to maturity, ranging widely over the North Pacific Ocean, Bering and Chukchi seas. They return to freshwater, often migrating tremendous distances to reach their natal streams, where they spawn and then die. This adaptation to spawning in freshwater has resulted in the tremendous seasonal abundance of spawning salmon, relatively easily harvested, and sustaining large human populations for a millennia. Adult salmon do not compete directly with juveniles for the relatively scarce food resources found in freshwater environments. Carcasses left in the streams after spawning fertilize the freshwater environment, ultimately providing food for their developing young.

Pink salmon. Pink salmon occur from northern California to Russia and Korea; and are the most common species in Alaska. Pink salmon are the smallest species; adults average 1.6 to 2 kg with an average length of 50 to 65 cm. In Alaska, adult pink salmon enter spawning steams between June and mid-October. Most pink salmon spawn within a few miles of the coast, and spawning within the intertidal zone or stream terminuses is very common. The female carries 1,500 to 2,000 eggs and digs a nest, or redd, with her tail and releases the eggs into the nest. Eggs are immediately fertilized by one or more males. After spawning, both males and females die, usually within two weeks. The eggs hatch sometime in early to mid-winter. In late winter or spring, the fry emerge from the gravel and outmigrate to the ocean, usually during the darkness. By late fall, the juvenile pink salmon average 10 to 15 cm in length and grow rapidly (Groot and Margolis 1991)

Chum salmon. Chum salmon have the widest distribution, ranging from California to Japan. In the Arctic Ocean, they range from the Mackenzie River in Canada to the Lena River in Siberia. Chum salmon are the most important commercial and subsistence species in the Arctic, northwest, and interior of Alaska. Chum salmon vary in size from 2 to over 13 kg, but usually range from 3 to 8 kg, with females usually smaller than males. Like pink salmon, chum salmon outmigrate as fry in the spring after emerging from the gravel. Chum salmon may spend three to five years feeding and growing to maturity in the ocean before returning to spawn (Groot and Margolis 1991)

Sockeye salmon. Sockeye salmon occur widely through the North Pacific Ocean and Bering and Chukchi seas, from California to northern Hokkaido in the Pacific, and from Bathurst Inlet in Canada to the Anadyr River in Siberia. Sockeye are the most important commercial species in Alaska. Adults average from 2 to 3.6 kg. After hatching, juvenile sockeye may spend one to four years in freshwater before outmigrating to the ocean as smolt weighing only about 5 gm. Sockeye grow quickly and spend one to four years at sea before returning to spawn. Those fish returning to spawn after only one year in the ocean are almost all males and are called jacks. Although sexually mature, they are much smaller in size (often less than 25 cm in length and 250 g in weight) than adult males that have spent several more years feeding in the ocean. Jacks are also common in chinook and coho salmon populations (Groot and Margolis 1991)

Coho salmon. Coho salmon occur from California through the North Pacific and southern Bering Sea to Siberia, Japan, and Korea. Adults average between 3.6 and 5.4 kg but may reach as much as 13.6 kg. Spawning coho are the last salmon to arrive and enter freshwater from July to November. The fry remain in the gravel utilizing the yolk sac until they emerge in May or June. Coho spend from one to five years in freshwater streams and lakes before outmigrating to the sea. The amount of time spent at sea varies greatly, but most coho spend 18 months feeding and growing before returning as full size adults (Groot and Margolis 1991)

Chinook salmon. Chinook salmon occur from California through the North Pacific, Bering and Chukchi seas to the Anadyr River in Siberia and Hokkaido, Japan. These are the largest salmon, often exceeding 14 kg. The largest sport- caught chinook salmon was a 44 kg fish taken from the Kenai River. Some chinook salmon outmigrate to the ocean soon after hatching in late winter or early spring, while others remain in fresh water for over one year before outmigrating to the ocean as smolts. Chinook salmon become sexually mature in two to seven years, females tend to be older than males at maturity. Fish in any spawning run vary greatly in size, a mature 3-year-old will weigh less than 2 kg while a mature 7-year-old may exceed 23 kg. Chinook salmon often make extensive fresh water migrations to their natal steams in some of the larger river systems. Yukon River chinook salmon bound for the headwaters in the Yukon Territory, Canada, will travel more than 2,000 miles in a 60-day period (Groot and Margolis 1991)

Steelhead trout. Steelhead trout range in Alaskan waters extends from Dixon Entrance in southeast Alaska through the GOA to Cold Bay, Alaska. Steelhead trout are similar to rainbow trout; the greatest difference is their anadromous life history. Rainbow trout spend their entire lives in freshwater. In the spring, steelhead smolt leave their natal streams and enter the ocean when they are about 15 cm in length. Steelhead spend from one to three years feeding and growing until returning to spawn. Some populations return in spring, summer, or fall. Some rivers have more than one run of steelhead each year. Spawning occurs from April through June. Unlike salmon, steelhead commonly spawn more than once, and fish over 70 cm in length are commonly repeat spawners. Spent spawners slowly return to the ocean where they usually spend at least one winter before returning. The eggs quickly hatch and emerge from the stream beds as fry in mid-summer, and by fall the steelhead are 5 to 8 cm in length. Juvenile steelhead remain in the stream about 3 years before outmigrating to the ocean (Groot and Margolis 1991; Hart 1973). Steelhead populations are generally stable throughout Alaska.

All five species of Alaska salmon are fully utilized, and stocks in most regions of the state generally have rebuilt to or beyond previous high levels. The unprecedented high abundance of Alaska salmon up to 1995 should not be interpreted as an absence of some of the same factors affecting declines of salmon in the Pacific Northwest. Issues and problems associated with salmon management include the potential for overfishing, bycatch in other fisheries, loss of freshwater spawning and rearing habitats, and important nearshore marine areas.

A number of factors have contributed to the current high abundance of Alaska salmon. These include: 1) pristine habitats with minimal impacts from extensive development; 2) favorable ocean conditions that allow high survival of juveniles; 3) improved management of the fisheries by State and Federal agencies; 4) elimination of high-seas drift-net fisheries by foreign nations; 5) hatchery production; and 6) reduction of bycatch in fisheries for other species. Unspoiled habitats, favorable oceanic conditions, and adequate numbers of spawning salmon are likely the paramount issues affecting current Alaska salmon abundance. Alaska salmon management continues to focus on maintaining pristine habitats and ensuring adequate escapements. Ocean conditions, however, that have favored high marine survivals in recent years, fluctuate due to interdecadal climate oscillations (Mantua et al. 1997). Recent evidence exists that a change in ocean conditions in the North Pacific Ocean and GOA may be underway, possibly reflecting the downturn in abundance of Alaska salmon runs in 1996 and 1997.

The well being of salmon in Alaska is also directly influenced by land management practices. The quality of freshwater habitats determines the success of reproduction and initial rearing of juveniles. Several agencies, entities, and groups have significant influence on the quality of freshwater spawning and rearing habitats for salmon throughout Alaska. Included among these are U.S. Department of Agriculture Forest Service, U.S. Department of the Interior Bureau of Land Management and National Park Service, federally designated National Wildlife Refuges, State of Alaska designated State Parks and Forest, Alaska Native Regional and Village Corporations, plus various municipalities, boroughs and other private land owners that exert some control over watersheds used by salmon.

Pacific herring

Pacific herring (*Clupea pallasii)* occur from California through the GOA and Bering Sea to Japan. Pacific herring may grow to a length of 45 cm with a weight of over 500 gm but average 23 cm and about 225 gm. Pacific herring migrate in schools. In Alaska, Pacific herring begin spawning in mid-March in southeastern Alaska and as late as June in the Bering Sea. Spawning occurs in shallow, vegetated areas in intertidal and subtidal areas. The eggs are adhesive, and survival is greater for those eggs which stick to vegetation than for those which fall to the bottom. Milt released by the males drifts among the eggs, fertilizing them. The eggs hatch in about two weeks, depending upon water temperature. Herring spawn every year after reaching sexual maturity at 3 or 4 years of age. The average life span of herring is about 8 years in southeastern Alaska and 16 years in the Bering Sea. The young larvae drift and swim with the ocean currents. After developing to their juvenile form, they rear in sheltered bays and inlets and appear to remain segregated from adult populations until they mature. After spawning, most adults leave inshore waters and move offshore to feed primarily on zooplankton. They are seasonal feeders and accumulate fat reserves for periods of relative activity. Herring schools often follow a diel vertical migration pattern, spending daylight hours near the bottom and moving upward during the evening to feed (Hart 1973).

From catch records, it is evident that herring biomass fluctuates widely due to influences of strong and weak year-classes. The period since the mid-1970s seems to be one of low-to-moderate herring abundance. Abundance of the stocks depend mostly on highly variable year-class strengths. A strong 1988 year-class that dominated in the stock has declined rapidly in abundance. The 1988 year-class is being replaced by another strong year-class (the 1992 year-class) that should sustain abundance levels in the near future. In Prince William Sound, herring abundance is at an historical low following a disease outbreak in 1993.

Squid and other species

In the BSAI FMP squid are grouped in a “Squid and Other Species” group made up of squids, which are considered separately; and sculpins, skates, sharks, and octopi, which comprise the true “other species” category. Because insufficient data exists to manage each of the other species groups separately, they are considered collectively. Neither squid nor any of the species in the “other species” category are currently targeted by the groundfish fisheries in the BSAI and GOA. As such, they are only caught as bycatch by fisheries targeting groundfish.

Squid are found throughout the Pacific Ocean. Squid are taken as bycatch in trawl fisheries for pollock and rockfish. The red (magistrate) armhook squid is probably the best known species found in Alaskan waters. It is abundant over continental slopes throughout the North Pacific from Oregon to southern Japan (Nesis 1987). It is the basis of fisheries in both Russian and Japanese waters. Little is known about the reproductive biology of squid. Fertilization is internal and juveniles have no larval stage. Eggs of inshore species are often enveloped in a gelatinous matrix attached to substrate, while the eggs of offshore species are extruded as drifting masses. The red armhook squid appears to spawn in the spring and to live as long as 4 years, though most die after spawning at one year to 16 months old (Arkhipkin et al. 1996). Perez (Perez 1990) estimated that squids comprise over 80 percent of the diet of some whales. Seabirds and some salmon species are also known to feed heavily on squid at certain times of the year. Assessment data are not available for squid from AFSC surveys because of their mainly pelagic distribution over deep water. Information on the distribution, abundance, and biology of squid stocks in the EBS and Aleutian Islands region is generally lacking. Red armhook squid (*Berryteuthis magister*) predominates in commercial catches in the EBS and GOA, and *Onychoteuthis borealijaponicus* is the principal species encountered in the Aleutian Islands region.

Forty-one species of sculpins were identified in the EBS and 22 species in the Aleutian Islands region (Bakkala 1993; Bakkala et al. 1985; Ronholt et al. 1985). During these same surveys, 15 species of skates were identified but inadequate taxonomic keys for this family may have resulted in more species being identified than actually exist. Species that have been consistently identified during surveys are the Alaska skate (*Bathyraja parmifera*), big skate (*Raja binoculata*), longnose skate *(R. rhina*), starry skate (*R. stellulata)*, and Aleutian skate (*B. aleutica*). Biomass estimates of sculpins and skates from demersal trawl surveys serve as valuable indices of their relative abundance.

While biomass estimates have been made for sharks and octopi, the AFSC bottom trawl surveys are not designed to adequately sample the realms they inhabit. Sharks are rarely taken during demersal trawl surveys in the Bering Sea; however, spiny dogfish *(Squalus acanthias*) is the species usually caught, and the Pacific sleeper shark (*Somniosus pacificus*) has been taken on occasion. Two species of octopus have been recorded, with *Octopus dofleini*, the principal species, and *Opisthoteuthis california* appearing only intermittently.

Many species in the squid and other species assemblage are important as prey for marine mammals and birds as well as commercial groundfish species. Squid and octopus are consumed primarily by marine mammals, such as Steller sea lions ((Lowry 1982), northern fur seals ((Perez and Bigg 1986), harbor seals (Lowry 1982; Pitcher 1980b), sperm whales (Kawakami 1980), Dall's porpoise (Crawford 1981), and Pacific white-sided dolphins (Morris et al. 1983) and beaked whales (Loughlin and Perez 1985)). Sculpins have also been found in the diet of harbor seals (Lowry 1982).

Biomass estimates from AFSC surveys illustrate that sculpins were the major component of this group until 1986, after which the biomass of skates exceeded that of sculpins. The abundance of skates increased between 1985 and 1990, but has since declined in 1999. The abundance of sculpins remained relatively stable through 1998, but declined to the lowest biomass estimate since 1975 in 1999.

Trends in the biomass of GOA "other species" (sharks, skates, sculpins, smelts, octopi, and squids) were investigated using the NMFS triennial trawl survey data from 1984 through 1999. Any discussion of biomass trends should be viewed with the following caveats in mind: 1) Survey efficiency may have increased for a variety of reasons between 1984 and 1990, but should be stable after 1990, 2) Surveys in

1984, 1987, and 1999 included deeper strata than the 1990 - 1996 surveys. Therefore, the biomass estimates for deeper-dwelling components of the other species category are not comparable across all years.

The average biomass within the other species category using all six survey biomass estimates is 160,000 tons. The most recent estimate of other species biomass (1999) is 213,000 tons. Skates represent 30-40 percent of the other species biomass from all surveys and are the most common group in each year except 1984, when sculpin biomass was highest within the category. Total biomass for the other species category has increased between 1984 and 1999. This is the result of apparent increases in skate, shark, and smelt biomass, some of which may be difficult to resolve from changes in survey efficiency. Sculpin biomass appears relatively stable over this period.

Individual species biomass trends were evaluated for the more common and easily identified shark and sculpin species encountered by the triennial trawl survey. In general, the increasing biomass trend for the shark species group is as result of increases in spiny dogfish and sleeper shark biomass between 1990 and 1999. Salmon shark biomass has been stable to decreasing, according to this survey, but salmon sharks are unlikely to be well sampled by a bottom trawl (as evidenced by the high uncertainty in the biomass estimates). It should be noted that both salmon shark and Pacific sleeper shark biomass estimates may be based on a very small number of individual tows in a given survey. No salmon sharks were encountered in the 1999 survey, despite reports of their increased abundance in other areas of the GOA.

Individual sculpin species display divergent biomass trends between 1984 – 1999. While the biomass of bigmouth sculpins has decreased over the period of the survey, great sculpin biomass has remained relatively stable, and yellow Irish lord biomass has increased. The biomass of yellow Irish lords appears to have increased over time despite general stability in the number of hauls where they occurred, whereas bigmouth sculpins were encountered in fewer hauls each year. Uncertainty in these estimates varies between years.

In addition to sharks and sculpins, we examined available biomass estimates for grenadiers (Macrouridae), which are not included in the other species category. The species most commonly encountered in the triennial trawl surveys was the giant grenadier (*Albatrossia pectoralis*). The Pacific grenadier was present, but with much lower estimated biomass in all years. Survey coverage of deeper strata is particularly important to grenadier biomass estimates; therefore we consider the 1990–1996 survey estimates to be of little use for detecting trends in grenadier abundance

No reliable biomass estimates for squid exist, and no stock assessment *per se*. Sobolevsky (Sobolevsky 1996) cites an estimate of four million tons for the entire Bering Sea made by squid biologists at the Pacific Scientific Research Institute of Fisheries and Oceanography (in Vladivostok Russia) (Shuntov 1993), and an estimate of 2.3 million tons for the western and central Bering Sea (Radchenko 1992), but admits that squid stock abundance estimates have received little attention. AFSC bottom trawl surveys almost certainly underestimate squid abundance.

Reliable biomass estimates exist for two (skates and sculpins) of the groups that comprise the bulk of the biomass and fishery catches in the other species category. Survey biomass estimates for sharks, smelts, and octopi, while not reliable, represent the best data available on the abundance of these species.

Benthic infauna and epifauna

Historical work on benthic invertebrates was done as part of the Outer Continental Shelf Environmental Assessment Program (OCSEAP) and has been summarized in a variety of publications. In addition, small-mesh trawl surveys of NMFS and ADF&G in the inshore areas of the GOA provide information on abundance trends of a variety of species such as jellyfish, starfish, forage fish, and other fish in addition to shrimp (Anderson and Piatt 1999; Piatt and Anderson 1996; Piatt et al. 1997). Zooplankton sampling by Japanese and NMFS researchers is ongoing in the Bering Sea and GOA (Sugimoto and Tadokoro 1997). NMFS' Bering Sea bottom trawl surveys also provide information on abundance trends of jellyfish and a variety of non-target fish species (NPFMC 1999c).

Infauna is the term for the invertebrates that inhabit the sediment of the seafloor. Generally they are collected with benthic grab samples. Epifauna is the term for the invertebrates that live on top of the sediment of the seafloor. Both are generally collected with trawl gear. Feder and Jewett (Feder and Jewett 1987) and Jewett and Feder (Jewett and Feder 1981) described the benthic infauna and epifauna in the GOA and EBS areas, respectively. Recent work has also been done to describe the distribution and abundance of benthic invertebrates and other living substrates to recommend habitat areas of particular concern that may require further protection (NPFMC 1999c; NPFMC 2000c). Descriptions of benthos in embayments and fjords are not summarized here because they occur outside the fishery management units.

Eastern Bering Sea. An estimated 70 percent of the invertebrate epifaunal biomass in the EBS consists of red king crab, blue king crab, snow crab, Tanner crab, and four species of sea stars. The mean invertebrate epifaunal biomass in the southeastern Bering Sea is 4.1 grams per square meter (g/m^2). In southeastern Bering Sea, echinoderms, especially *Asteria amurensis* represent 84.4 percent (1.6 g/m^2) of the epifauna biomass in water less than 40 m deep. In 40-100m water *A. amurensis* represents 12.7 percent (0.6 g/m^2), the largest component of the biomass with the exception of red king crab and snow crab. The largest component of the invertebrate epifaunal biomass in water deeper than 100 m in the southeastern Bering Sea other than crabs of the genus *Chionoecetes* or *Paralithodes* is a basket star (*Gorgonocephalus caryi*), representing 7.3 percent (0.4 g/m^2) (Jewett and Feder 1981).

The average infaunal standing stock in the EBS has been estimated to be 300 g/m^2 with little seasonal or annual variation (Stoker 1981). A total of 472 infaunal species representing 292 genera and 16 phyla are present in the region (Stoker 1981). The most common of those are 143 species of polychaete annelids and 54 species of bivalve molluscs found in 95 percent of the benthic samples collected (Stoker 1981). Also common are 76 species of gastropod molluscs (epifaunal) and 76 species of amphipods. Echinoderms represent 80 percent of the total invertebrate infaunal biomass of the northeastern Bering Sea shelf. Mean epifaunal biomass estimates of the northern shelf are slightly less than those for the southern shelf (3.1 g/m^2). In shallow (<40 m) water, *A. amurensis* is the dominant (56 percent) component of the epifauna community, with several other species of sea stars representing 4-7 percent of the community biomass. In deeper (> 40m) water, a sea urchin (*Strongylocentrotus droebachiensis*) and a basket star are the two most prevalent (22.4 and 56.1 percent, respectively) invertebrate epifaunal species (Jewett and Feder 1981).

EBS invertebrate species assemblages exhibit spatial variation over the EBS Shelf coinciding with the frontal domains and substrate type (Haflinger 1981). Cluster analyses have shown seven (Haflinger 1981) and eight (Stoker 1981) major species assemblages. Haflinger's (Haflinger 1981) analyses further resulted in four faunal domains; Bristol Bay, <50 m, 50-100 m, and > 100 m depth. The species composition of the assemblages differ, but polychaetes, clams, amphipods and snails are the primary taxa represented in each group (Haflinger 1981; Stoker 1981). Bivalve molluscs are found throughout the southeastern Bering Sea, but their abundance is highest in the region between 40-100 m water depth (McDonald et al. 1981). In shallower water, the cockle (*Serripes groenlandicus*) is the dominant bivalve species, but is replaced by clams (*Tellina lutea*), and *Yoldia hyperborea* with increasing depth (Stoker 1981). Further offshore, *Astarte borealis* and *Macoma calcarea* become the most prevalent bivalve species (Stoker 1981). Similarly, polychaete annelids are found throughout the region, but the dominant species vary by location (Haflinger 1981; Stoker 1981). The dominant polychaetes nearshore are *Myriochele heeri* and *Sternapsis scutata*; farther offshore *Haploscoloplos elongatus*, *Maldane sarsi*, and *Chone duneri* are the predominant species (Stoker 1981). The whelks, *Neptunia ventricosa* and *N. heros*, were most dominant in the middle and outer shelf areas of the southeastern Bering Sea (Jewett and Feder 1981).

Recently, NMFS survey data were examined to determine distribution of many key invertebrate groups in the Bering Sea. Plots were generated using NMFS RACEBASE data for standard Bering Sea trawl stations, for historical (1984-1988) and contemporary (1994-1998) time periods. Maps of benthic infauna distribution and biological summaries of these invertebrates can be found in the draft Habitat Areas of Particular Concern Environmental Assessment/Regulatory Impact Review (NPFMC 2000c). Some data were not used in the analysis because invertebrates have not always been a priority item in the field and there are some irregularities in the data, namely inconsistent levels of taxonomic identification (*e.g.*, sea anemone, *Metridium* sp. and *Metridium senile*) across cruises (years), survey legs within a cruise and vessels within a leg. In some cases, problems could be resolved by grouping species/taxa. Cruises with serious systematic error (due to vessel/leg effects) were excluded from plots of multi-year averages, as were cruises when a taxon was never recorded. As such, the CPUE values (kg/ha) associated with the abundance labels in the figure legends may be useful for comparing apparent prevalence of the different taxa, if it is assumed catchabilities are equal. Invertebrate taxa were selected based on potential vulnerability to fishing gear. It should be noted that some of these taxa would not be considered as living substrate HAPC (including empty bivalve and gastropod shells). The following invertebrate groups were considered (years dropped from analysis are in parenthesis) and distributions plotted:

sea raspberries (*Eunepthya,* formerly *Gersemia*)
horny corals (Gorgonacea) (1985, 1986, 1987, 1988, 1994, 1995, 1997)
sea whips/sea pens (Pennatulacea)
anemones (Actiniaria)
mussels (incl. *Mytilus*, *Modiolus*, *Musculus* and 1 occurrence of *Crenella)*
sponges (Porifera)
bryozoans (incl. feathery, leafy, flattened, ribbed and coral varieties)
sea onions (*Boltenia*)
sea peaches (*Halocynthia*)
sea potatoes (*Styela rustica*) (1986)
polychaete tube worms (1985, 1987, 1988, 1994)
hydroids (Hydrozoa) (1994, 1996, 1997)
empty gastropod shells (1985)
empty bivalve shells (1984)

The survey data show that these key invertebrate groups are widely distributed in the Bering Sea. In general, invertebrates are concentrated in the existing no-trawl zones, which were designed to protect this type of habitat. Of interest, the early data set (1984-89) shows that these taxa were there in abundance prior to closure regulations. These data reaffirm that the trawl closure areas were situated in appropriate places to protect this habitat. For example, anemones are found in highest abundance near the Pribilof Islands, and sponges, sea onions (*Boltenia*), and miscellaneous bryozoans are concentrated in the Bristol Bay area. In addition, it appears that, for the most part, both the abundance and distribution of these taxa are quite similar between the two time periods.

Aleutian Islands region. Shevtsov (Shevtsov 1964b) investigated the benthos of the Aleutian Islands from Near Islands to Unimak Pass. Most of the samples were taken from Near Strait and in the vicinity of

Buldir Island, Amchitka, and Amukta Passes. The main fauna in this area were sessile suspension feeders. The biomass of this trophic level (sponges; barnacle, *Balanus rostratus*; and bryozoans) in Near Strait was 400 g/m^2, which was about 96 percent of the total benthic biomass in this area.

In Buldir Pass, the sessile suspension feeders were sponges, sea anemone, sabellid polychaetes, bivalves (Saxicavidae, *Pododesmus macroschisma*), and bryozoans. Their biomass was over 1.0 kg/m^2 and comprised 98 percent of the total biomass in this area. In Amukta Pass, the bottom fauna included sponges, hydroids, bryozoans, and ascidians; the biomass of this group was 400 g/m^2 and made up about 96 percent of the total biomass in this area. The selective deposit feeders were the dominant fauna at the entrance of all the straits, although they occurred more frequently in the sandy and muddy area that is deeper than 1,000 m (Shevtsov 1964b).

On the Pacific Ocean side of Buldir Island, ophiuroids and eunicid and onuphid polychaetes accounted for 78 percent of the total biomass (450 g/m^2) in this area. On the Pacific Ocean side of Amukta Pass, *Amphiura psilopora* and *Ophiura* spp. composed 50 percent of the total biomass (6 g/m^2) in this area; on the Bering Sea side, polychaetes, *Lysippe labiata* and *ophiuroids* made up 6 g/m^2, or 47 percent of the total biomass. Mobile suspension feeders accounted for 27 percent of the biomass in the Aleutian straits. Non-selective consumers were uncommon, and their biomass never exceeded 1.0 g/m^2 (Shevtsov 1964b)

Gulf of Alaska and Aleutian Islands. The continental shelf and upper slope between Unimak Pass and Graham Island (in southeast Alaska) were divided into western and northeastern regions. The boundary between these two regions is a line running to the southeast from the tip of the Kenai Peninsula. The two regions were separated based on the topography of the coast areas. The coastal area of the northeastern GOA is characterized topographically by a relatively straight coastline and by extensive coastal lowlands. This contrasts with the western region where the coastline is extremely irregular and the mountains rise abruptly from the shore.

Feder and Matheke (Feder and Matheke 1980) described over 400 invertebrate taxa representing eleven phyla inhabiting the northeast GOA continental shelf. Fifteen taxa (primarily annelids and mollusks) occurred at 50 percent or more of the stations sampled while 28 taxa (from eight phyla) represented 10 percent or more of the wet weight of infauna collected at one or more stations sampled. Infaunal abundance on the shelf for the period 1974 to 1976 ranged from 67 to 1,654 individuals/m^2; the biomass ranged from 7 to 776 g/m^2. After dividing the shelf area into different regions, the mean abundance and biomass were calculated. Mean diversity and species richness values were highest in the Tarr Bank and shelf break groups (Feder and Matheke 1980).

Mollusks are important components of the infauna. In this shelf region, three mollusk associations were described (Hickman and Nesbitt 1980): 1) shallow-water *Yoldia-Siliqua-Lyonsia* sand association, 2) shallow-to-intermediate depth *Cyclocardia* -boreal turrid mud association, and 3) deep-water *Cadulus* thin-shelled protobranch mud association. The 180 m isobath seemed to be the line separating the *Cyclocardia*-boreal turrid mud association from the *Cadulus* thin-shelled protobranch mud association (Hickman and Nesbitt 1980).

Shevtsov (Shevtsov 1964a; Shevtsov 1964b) found that, east of Kodiak Island, the biomass of the shelf benthos decreased abruptly. The biomass consisted mainly of deposit (detritus) feeders in the northeast GOA (67 percent of the total biomass) and suspension (filter) feeders (27 percent of the total biomass). Feder and Matheke (Feder and Matheke 1980) also found that the deposit feeders dominated the abundance and biomass in the northeastern shelf, whereas the suspension feeders (e.g., sea pen (*Ptilosarcus grneyi*)) were not common in the northeastern GOA shelf.

Mean infaunal production was 4.5 gC/m^2/y in the northeastern GOA shelf (Feder and Matheke 1980). Assuming that the microfloral/meiofaunal production rate is twice that of the macrofauna, and also assuming that epifaunal production on the shelf is 0.12 gC/$m^{2/}$y, the total benthic production for the northeastern GOA shelf may be estimated at 13.7 gC/m^2/y (Feder and Jewett 1987).

No discrete infaunal communities were found in the northeastern GOA shelf (Feder and Matheke 1980). These data suggested to Feder that species distribute themselves independently along environmental gradients. Feder also noted that as the amount of sand and gravel in the sediment increased, the diversity and the species richness increased. This indicated that the size of the sediment is the main factor controlling the species distribution. However, because of the variations in the distribution patterns of the individual species, it also indicates that other environmental factors besides the size of the grain and the deposition rate of the sediment affect the species distribution.

About 180 species (in 10 phyla) were found in the epifauna in the northeastern GOA shelf. Mollusks, arthropods, and echinoderms dominated in both the species representation and the biomass (Feder et al. 1981). The trend in biomass observed was epifauna decreased from the west to the east. Epifauna biomass calculated from survey samples taken between 144°30' and 140°W was 2.6 g/m^2 while biomass calculated from survey samples taken between 140° and 137°30' W was only 1.1 g/m^2 (Feder et al. 1981).

The highest epifauna biomass was found west of Kayak Island in an area composed of silt and clay (Feder et al. 1981). Tanner crab dominated the epifauna in all depths of this region. In the vicinity west of Kayak Island, other epifauna organisms that had high biomass were pink shrimp (*Pandalus borealis*) and mud star (*Ctenodiscus crispatus*) (Feder et al. 1981).

Mud stars occur mostly at depths greater than 100 m. This species of sea star is a non-selective deposit-feeding asteroid that feeds on the organic materials associated with the mud it ingests. It either dominated, or was second in total biomass, in the four canyons/troughs sampled: Kayak, Icy, Yakutat, and Alsek. Quantities of this small sea star are presumed to be underestimated when sampled by trawls (Feder et al. 1981).

Tanner crab, the ascidian *(Halocynthia hilgendorfi igaboja)*, and the green sea urchin (*S. droebachiensis*), were dominant species in samples taken from the northwest bank of Tarr Bank. *Halocynthia* was collected attached to the substrate of small, (about 4 cm diameter) , rounded rocks. In the eastern and southern parts of Tarr Bank, the dominant taxa were Tanner crab, pink shrimp, and the mud star (Feder et al. 1981).

The basket star, was one of the dominant epifauna species in Cape Cleare Ground, Middle Bank, and Icy Bank. This species accounted for 1.5, 2.0, and 5.6 percent of the epifauna biomass in those three areas, respectively (Feder et al. 1981).

The brittle star *(Ophiura sarsi)*, is an organism that can not be adequately sampled by trawls. However, when large aggregations occur, trawl sampling is useful for a gross estimate of the distribution and relative abundance. In this region, the largest biomass of this species was found on Middle Bank. This area yielded 0.2 g/m^2 of this brittle star. *Ophiura* is a deposit feeder or scavenger. Its main predators are the bottom-feeding species including species such as the sunflower sea star *(Pycnopodia helianthoides)*, and flathead sole.

Weathervane scallop *(Patinopecten caurinus)*, Tanner crab, Dungeness crabs, and sunflower sea stars are the dominant species in Cape Yakataga and Yakutat Bay areas. A dense bed of scallops was found seaward of Icy Bay and landward of Icy Canyon. The concentration of the scallop in this area was 11.6 g/m^2 (NMFS 1976).

The sunflower sea star is one of the large sea stars in the GOA. Individuals typically weigh about 0.5 kg. This species usually occurred in samples taken in the shallower (<100 m) areas between Kayak Island and Dry Bay. Deeper (113-182 m) areas, like Icy Bank, were also important habitat for this species. Sunflower sea star are scavengers, preying on brittle stars and mud stars. Other less important food included gastropods, *Colus halli*, *Mitrella gouldi*, *Solarieda obscura*, *Olenopota* sp., and *Natica clausa*, and bivalves, *Serripes groenlandicus* and *Clinocardium ciliatum*.

The sea anemone, (*Metridium senile*), as well as scallops, were dominant species in the area sampled between Dry Bay and Lituya Bay. Sea anemones feed on the organic materials suspended in the water column in this turbulent shallow region (Feder et al. 1981).

In areas deeper than 200 m, the epifauna biomass was considerably lower per square meter than the adjacent banks and grounds. In this deeper area, deposit feeders were usually the dominant species. However, in the Bering Canyon area, the sea urchin was the dominant species. It presumably feeds by a combination of browsing and scavenging. The highest density was only 37 individuals per kilometer (NMFS 1976).

Heart urchin, *Brisaster townsendi*, dominated the epifauna in the Yakutat and Alsek Canyons, and to a lesser extent in Bering Canyon. This species burrows into the substrate. It selects organic material deposited either on or within the sediment in which it burrows. Because of this burrowing behavior, trawl sampling usually underestimates the relative abundance. Nevertheless, they still accounted for 84 percent, 40 percent, and 16 percent of the biomass in Yakutat, Alsek, and Bering Canyons, respectively. Densities up to 7.5 g/m^2 were found in the Yakutat Canyon (Feder and Matheke 1980).

Benthic habitat in the western GOA was found to be dominated by the sessile filter feeding infauna and epifauna (e.g., sponges, sabellid and serpulid polychaetes, clams, barnacles, and the brachiopod). The biomass of this trophic group was 112 g/m^2 (62 percent of the total biomass) (Semenov 1965).

Mobile filter feeders (e.g., bivalves such as *Pectinidae*, *Carditidae*, *Glycymeridae*, *Astartidae*, *Serripes* sp., and *Cardium* sp.; the amphipods, *Ampelisca* spp.; and the sand dollar, *Echinarachnius parma*) also dominated in the western Gulf. The biomass of this trophic group was 26 g/m^2 (Semenov 1965).

Browsers and selective deposit-feeders (e.g., terebellid polychaetes and bivalve mollusks *Nucula tenuis*, *Nuculana fossa*, *Yoldia* spp., and *Macoma* spp.) were most common on bottoms with smooth relief and which were covered with fine-grained sand or muddy sediments at depths of from 52 to 158 meters. These trophic groups represented 8.4 percent of the total benthic biomass, with a biomass of 15.1 g/m^2. The third trophic group was non-selective deposit feeders. The substrate characteristics where this group was found consisted of fine-grained sand, sandy mud, and mud. These non-selective deposit feeders (e.g., the polychaetes, *Scoloplos armiger*, *Axiothella catenata*, *Sternaspis scutata*, and the mud star, occurred in the area 100 to 244 m deep and had a biomass of about 16 g/m^2 (8.9 percent of the total benthic biomass) (Semenov 1965).

Inshore small-mesh surveys in the GOA have abundance information on sea stars (Anderson and Piatt 1999). Sea-stars, order Asteroidea, is dominated by only a few species in this historic catch series. The dominant species by far, in the recent data from 1972 on, is the purple orange sea-star (*Asterias amurensis*). These sea-stars are predators on benthic invertebrates, primarily bivalves. This sea-star is also an important food source for crustacean predators such as shrimp and crabs. Catches of this abundant species have fluctuated wildly in recent years. The long-term average abundance of sea-stars in survey catches is 0.8 kg/km (n=6,812) for 1972-97. Since 1991 catches have been substantially over this long-term index averaging 2.8 kg/km. The highest average catch in a given year was 9.6 kg/km in 1994. Further studies need to address what impact a large increase in sea-star biomass may have on epibenthic populations. High king crab populations may have had a mediating effect (predation) on sea-star biomass during periods when crab populations were higher. These relationships between commercial and non-commercial species need to be more fully understood for effective management.

Zooplankton

NMFS Fisheries Oceanography Coordinated Investigations Program (FOCI) has conducted zooplankton monitoring in the GOA and collaborated with Japanese researchers in such research in the EBS. The FOCI cardinal sampling line (Line 8, seven stations across Shelikof Strait between Cape Kekurnoi and Kodiak Island) was routinely sampled for nutrients, chlorophyll, icthyo- and zooplankton several times during each year from March – June. Monitoring began in 1985, but not all sample types were collected in all years. Currently Line 8 is sampled for nutrients, chlorophyll, and zooplankton only once or twice a year (May), and broad-scale surveys for ichthyoplankton are conducted approximately twice a year. Every other year a process-oriented springtime cruise is conducted in Shelikof Strait to investigate a physical or biological process that contributes to recruitment variability of walleye pollock.

Bering Sea. As part of the FOCI monitoring program, fall surveys for age-0 pollock around the Pribilof Islands were begun in 1994. These surveys included hydrography, nutrients, chlorophyll, zooplankton, and juvenile fish along the four sampling transects. However, project that initiated these collections is not funded to continue sample collection past fall 1999. The SEBSCC Monitoring an-d Indices program began in 1997 and field collections will end in fiscal year 2000. In this program, nutrients, chlorophyll, and zooplankton are collected winter, spring, and fall at the shelf break, and around moorings in the Outer and Middle Shelf Domains. Sample collection around Unimak Pass is less frequent. Biological and chemical data from this project are currently being synthesized with physical environmental data to produce indices for predicting survival potential of juvenile pollock.

An extension of the published summer EBS zooplankton biomass time series collected by the Faculty of Fisheries, Hokkaido University, Japan was supplied by Japanese researchers collaborating with FOCI. The R/V *Oshoro Maru*, a training ship for undergraduate cadets has been in the EBS almost every summer since 1954. The biomass is the wet weight of plankton retained by a 333 micron mesh NORPAC net towed vertically from near bottom to the surface. Wet weight measurements are made on the preserved catch. Data from the time series (Sugimoto and Tadokoro 1997) and mean and standard domain were then derived. Determinations regarding whether the measurements before 1994 had equal coverage of the Outer and Middle Domain or whether this might be a source of bias still remains to be seen. If the measurements are unbiased and without error, then data collected suggest that recent levels of zooplankton biomass exceed those of the early 1990s and that some are comparable to values in the late 1960s.

Shrimp

Small-mesh surveys in the GOA provide information on shrimp abundance in nearshore waters (Anderson and Piatt 1999). Caridean shrimp of four major families; Pandalidae, Crangonidae, Hippolytidae, and Pasiphaeidae occupy an important niche in the pelagic realm in Alaskan waters. There is a long history of commercial harvesting of several species of Pandalidae in the Bering Sea and GOA, but no known harvests of members of the other families has occurred. Most of the available biological information in Alaskan waters relates to the commercially important shrimps in the family Pandalidae.

Commercially important pandalid shrimp first hatch as larvae in the spring, April through early June. Shrimp larvae remain in near-surface waters until undergoing metamorphosis to the juvenile phase and settle into a semi-benthic existence. Pandalid shrimp mature first as male and then undergoing a transformation to female, depending on growth rate of the individual (Charnov and Anderson 1989). Massive swarms of shrimp take part in the daily migration up into near-surface water at night to feed. During daylight shrimp are mostly near bottom. Females which have eggs on attachments to the pleopods after spawning do not actively migrate up in the water column until after eggs hatch.

Shrimp are a major food item for important commercial fish species, birds, and marine mammals. Albers and Anderson (Albers and Anderson 1985) found that pandalid shrimp were a dominant food item by frequency of occurrence (63 percent) in the Pacific cod diet in Pavlof Bay. Jewett (Jewett 1978) and Hunter (Hunter 1979) found significant amounts of shrimp in cod taken from offshore areas but not as high as that found in inshore populations. Shrimp are also important in the diet of almost all fishes where they co-occur. Shrimp larvae and juveniles are preyed on by pink, sockeye, and coho salmon, sand lance, pollock, longfin smelt, surf smelt, juvenile great sculpin, starry flounder, and rock sole taken from near-shore samples (Blackburn et al. 1983). MacDonald and Peterson (Mac Donald and Petersen 1976) report shrimp in the diet of beluga whales, Steller sea lions, and harbor seal. Hatch *et al.* (Hatch et al. 1978) reported that glaucous-winged gulls, kittiwakes, and tufted puffins preyed on shrimp. Shrimp, therefore, are a major forage species. In turn, shrimp also prey on other crustaceans, many demersal and pelagic invertebrates, larval and small fishes, and can feed on dead or decaying organic matter.

Pandalid shrimp have declined uniformly throughout all study areas in the GOA, with the most significant declines occurring after 1981. Total pandalid shrimp biomass averaged 179.3 kg/km in the 1972-81 period. In contrast, abundance has declined in all surveyed areas to only 10.1 kg/km in the recent 1990-97 time period. Of particular note is the humpy shrimp (*Pandalus goniurus*) that was formerly a significant part of the shrimp biomass but became nearly extinct; while the other species, primarily northern pink shrimp, (*P. borealis*) have declined, but not to near-extinction levels. Humpy shrimp averaged 19.26 kg/km during the period 1972-81 and declined to very low levels in recent surveys (0.09 kg/km in 1990-97). This observed change demonstrates that some pandalid species are vulnerable to being extinguished from the near-shore ecosystem. Humpy shrimp was not heavily targeted commercially, and declines continued after closure of commercial fisheries.

One hypothesis for the near-extinction of humpy shrimp is the sustained high winter temperature in the late 1970s (Royer 1989). This species is commonly found in relatively shallow water subject to high residual winter cooling. In contrast northern pink shrimp is found at deeper depths and is buffered from extreme temperature declines in winter. These distribution traits, along with abrupt changes in winter temperatures, may explain the region-wide mechanism that was responsible for shrimp population declines. Although adult populations were relatively high in 1976-1979, no strong year-classes were produced by any pandalid species during this period. The mechanism that affected reproductive and larval success occurred simultaneously with the climatic forcing event in the GOA (McGowan et al. 1998). The thermal history of Pandalid shrimp is an important factor in the production of viable larvae (Nunes 1984).

Side-stripe shrimp (*Pandalopsis dispar)*, have declined in abundance from near-shore sampling areas. This shrimp has a more pelagic characteristic and is found at the deepest locations sampled. It is possible that the distribution of this species has shifted to deeper depth intervals, outside sampling strata in response to GOA water column warming. *Pandalus hypsinotus*, known locally as the coonstripe shrimp, is typically identified with inshore habitats and a shallow depth range. Both of the above species have declined to near-extinction levels in our sampling areas, both less than 0.002 kg/km during recent surveys from higher levels in the early 1970s ~10 kg/km for each species. Declines in these shrimp species occurred after fishing was largely closed in the near-shore areas where stocks were once abundant (Orensanz et al. 1998).

Other fish

Eastern Bering Sea. Non-commercial species are a significant portion of the fish fauna occurring in the Bering Sea, but due to their small biomass or lack of marketability, are rarely harvested. These fishes may be valuable indicators of changes occurring to the Bering Sea ecosystem due to natural or man-made influences. Figure 3.2.4 shows the relative changes in population estimates from 1982 to 1997 of 12 non-commercial fish species common in the EBS shelf region based on NMFS bottom trawl survey (NPFMC 1999c).

Studies have shown that environmental temperatures and fish populations co-vary in a cyclical pattern. Some non-commercial fishes from the Bering Sea show similar cyclical fluctuations in population levels which may be linked to environmental changes such as temperature. However, specific mechanisms of how environmental changes can influence fish populations over long periods of time is often difficult to discern. For example, do environmental changes alter the fishes' habitat (substrate or structure) or does it act directly on some aspect of the fishes' biology (spawning time, egg viability, food availability).

The nature of future work in this regard will be to examine how environmental changes can influence fish population changes for non-commercial species in the EBS. Important aspects of the biology of each species such as length at age, and length frequencies provide important information on fish longevity, growth rates and recruitment. By comparing the ecology and biology between each species, common life history aspects can help determine vulnerabilities to changing environmental conditions.

Gulf of Alaska. Many epibenthic non-commercial species have undergone significant declines in abundance in near- shore areas sampled in small-mesh trawl surveys in the GOA. Since many of these species have no known commercial potential they have not always been identified in survey catches as discussed above. However, since 1970 most of these species have been identified, enumerated, and weighed in small-mesh trawl surveys.

Among these species, the most significant change since the early 1970s has been the decline of long-snout prickleback. Catches of pricklebacks averaged 2 to 3 kg/km in the early 1970s. Since 1981, catches have remained at relative low levels averaging substantially less than 1 kg/km. Spiny lumpsucker *(Eumicrotremus orbis)*, has completely disappeared from catches in recent years. In the early part of the 1970s, this fish was locally abundant in some of the bays along the Alaska peninsula.

Jellyfish

Eastern Bering Sea. Researchers at NMFS examined catches of large medusae from summer bottom trawl surveys that sampled virtually the same grid station on the EBS shelf and used the same methodology every year from 1979 to 1998. This series shows a gradual increase in biomass of medusae from 1979 to 1989, followed by a dramatic increase in the 1990s. The median biomass increased ten-fold between the 1981-89 and 1990-97 periods. Most of this biomass was found within the Middle Shelf Domain (depths between 50 and 100m). The greatest rate of increase occurred in the northwest portion of this domain. Whether this dramatic increase in biomass of gelatinous zooplankton has resulted from some anthropogenic perturbation of the Bering Sea environment or is a manifestation of natural ecosystem variability is unclear. However, several large-scale winter/spring atmospheric and oceanographic variables in the Bering Sea exhibited concomitant changes beginning around 1990, indicating that a possible regime change occurred at this time.

Gulf of Alaska. Jellyfish are not an expected target of the near-bottom small-mesh sampling trawl used in shrimp surveys in the GOA. Most jellyfish are probably caught somewhere in the water column when sampling gear is either set or retrieved, or during periods when jellyfish are swimming near the bottom. However small-mesh sampling gear does retain significant jellyfish and data collected over a long temporal scale since the early 1970s provides a rough index of the relative abundance of these organisms in survey areas (Anderson and Piatt 1999). Jellyfish in three generic groups are present in small-mesh trawl catches, Cyanea, Aurelia, and Aequorea. Cyanea appears to dominate in most of the catches along the south side of the Alaska peninsula . Average catches were 2.3 kg/km prior to 1980. In 1980 the highest average catch of total jellyfish biomass was observed in small-mesh survey samples averaging 58.2 kg/km (n=548), for that year. In the years 1981-97 catches have averaged 7.1 kg/km, well above the overall average for years prior to 1980. It appears that 1980 was a pivotal year in jellyfish abundance in the GOA. Future research should concentrate on the relationship between jellyfish primary productivity of the ecosystem and what their high abundance might mean in impacting year-class strength of commercial species.

3.2.3 Marine mammals

The BSAI and GOA support one of the richest assemblages of marine mammals in the world. Twenty-six species are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises) in areas fished by commercial groundfish fleets (Lowry and Frost 1985; Springer et al. 1999). Most species are resident throughout the year, while others migrate into or out of the management areas seasonally. Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry 1982). Below are brief descriptions of their range, habitat, diet, abundance, and population status. Incidental take estimates (where available) and management measures taken to address interactions with commercial fisheries are included where applicable.

Pinnipedia

Three families of pinnipeds are represented in the management areas: Otariidae, the eared seals (Steller sea lion and northern fur seals), Odobenidae, the Pacific walrus, and Phocidae, the true seals (harbor, spotted, bearded, ringed, ribbon and northern elephant seals).

Steller sea lion. The Steller sea lion (*Eumetopius jubatus*) ranges along the North Pacific Ocean rim from northern Japan to California (Loughlin et al. 1984), with centers of abundance and distribution in the GOA and Aleutian Islands, respectively. The northernmost breeding colony in the Bering Sea is on Walrus Island near the Pribilof Islands and in the GOA on Seal Rocks in Prince William Sound (Kenyon and Rice 1961).

Habitat includes both marine waters and terrestrial rookeries (breeding sites) and haulouts (resting sites). Pupping and breeding occur during mid-May through July in rookeries on relatively remote islands, rocks, and reefs. Females generally return to rookeries where they were born to give birth and mate (Alaska Sea Grant 1993; Calkins and Pitcher 1982; Loughlin et al. 1984). Although most often within the continental shelf region, they may be found in pelagic waters as well (Bonnell et al. 1983; Fiscus et al. 1976; Kajimura and Loughlin 1988; Kenyon and Rice 1961; Merrick et al. 1997).

Observations of Steller's sea lions at sea suggest that large groups usually consist of females of all ages and subadult males; adult males sometimes occur in those groups but are usually found individually. On land, all ages and both sexes occur in large aggregations during the nonbreeding season. Breeding season aggregations are segregated by sexual/territorial status. Steller's sea lions are not known to migrate, but they do disperse widely at times of the year other than the breeding season. For example, sea lions marked as pups in the Kuril Islands (Russia) have been sighted near Yokohama, Japan (more than 350 km away) and in China's Yellow Sea (over 750 km away), and pups marked near Kodiak, Alaska, have been sighted in British Columbia, Canada (about 1,700 km distant). Generally, animals up to about 4 years-of-age tend to disperse farther than adults. As they approach breeding age, they have a propensity to stay in the general vicinity of the breeding islands, and, as a general rule, return to their island of birth to breed as adults.

The foraging patterns of adult females varies seasonally. Trip duration for females with young pups in summer is approximately 18 to 25 hours. Trip length averages 17 km, and they dive approximately 4.7 hours per day. In winter, females may still have a dependent pup, but a mean trip duration is about 200 hours. During winter, a mean trip length is about 130 km, and dives total about 5.3 hours per day (Merrick et al. 1997). Yearling sea lions in winter exhibit foraging patterns intermediate between summer and winter females in trip distance (mean of 30 km), but shorter in duration (mean of 15 hours), and with less effort devoted to diving (mean of 1.9 hours per day). Estimated home ranges are 320 km^2 for adult females in summer, about 47,600 km^2 (with large variation) for adult females, and 9,200 km^2 for winter yearlings in winter (Merrick et al. 1997).

Compared to other pinnipeds, Steller sea lions tend to make relatively shallow dives, with few dives recorded to depths greater than 250 m. Maximum depths recorded for individual adult females in summer are in the range from 100 to 250 m; maximum depth in winter is greater than 250 m. The maximum depth measured for 5-9 month olds in winter was 72 m (Merrick et al. 1997; Swain and Calkins 1997). However, since these young of the year were likely still nursing, they were probably not representative of juvenile sea lion diving abilities. For example, Swain and Calkins (Swain and Calkins 1997) found that a 2 year old male dove to a maximum depth of 252 m, and 1-2 year olds regularly dove to depths over 100 m.

Steller sea lions give birth to a single pup each year; twinning is rare. Males establish territories in May in anticipation of the arrival of females (Pitcher 1981). Viable births begin in late May and continue through early July and the sex ratio at birth is slightly in favor of males. Females breed again about two weeks after giving birth. Copulations may occur in the water but most are on land (Gentry 1970; Gisiner 1985; Pitcher and Calkins 1981). The mother nurses the pup during the day. After staying with her pup for the first week, she goes to sea on nightly feeding trips. Pups generally are weaned before the next breeding season, but it is not unusual for a female to nurse her offspring for a year or more. Females reach sexual maturity between 3 and 8 years of age and may breed into their early 20s. Females can have a pup every year but may skip years as they get older, or when nutritionally stressed. Males also reach sexual maturity at about the same ages but do not have the physical size or skill to obtain and keep a breeding territory until they are 9 years of age or older. Males may return to the same territory for up to seven years, but most often no more than three years (Gisiner 1985). While on the territory during the breeding season, males may not eat for 1-2 months. The rigors of fighting to obtain and hold a territory and the physiological stress over the duration of the mating season reduces the life expectancy of these animals. They rarely live beyond their mid-teens, while females may live as long as 30 years.

In the Bering Sea and GOA, the Steller sea lion diet consists of a variety of schooling fishes (e.g., pollock, Atka mackerel, Pacific cod, flatfishes, sculpins, capelin, Pacific sand lance, rockfishes, Pacific herring, and salmon), as well as cephalopods (e.g., octopus and squid) (Calkins and Goodwin 1988; Lowry 1982; Merrick and Calkins 1995; Perez 1990). Recent analyses of fecal samples collected on Steller sea lion haulouts and rookeries in the GOA and Aleutian Islands suggest particular importance of Atka mackerel for Steller sea lions in the central and western Aleutian Islands. Over 70 percent of the Steller sea lion summer diet is composed of Atka mackerel in this area. Pollock represented over 60 percent of their diet in the central GOA, 29 percent in the western GOA and eastern Aleutian Islands, and over 35 percent in parts of the central Aleutian Islands (Merrick and Calkins 1995). Small pollock (those less than 20 cm) appear to be more commonly eaten by juvenile sea lions than by older animals (Merrick and Calkins 1995).

Seventy-six percent of the total estimated annual food consumption by the Steller sea lion population in the EBS is fish. Of the total annual fish consumption, commercial groundfish comprise 69 percent. The groundfish consumption by Steller sea lions represents 0.4 percent of the standing biomass consumed annually by all predators combined in the EBS (Perez and McAlister 1993).

Merrick *et al.* (Merrick et al. 1997) documented Steller sea lion's relative consumption of seven prey categories in the GOA: 66.5 percent are gadids (pollock, Pacific cod, Pacific hake and unidentified gadids), 20.3 percent Pacific salmon, 6.1 percent small schooling fish, 3.9 percent flatfish, 2.9 percent squid or octopus, and 0.3 percent Atka mackerel (Merrick et al. 1997). Merrick and Calkins (Merrick and Calkins 1996) determined 70 percent of stomachs collected from animals in the GOA during the 1970s and 1980s also contained gadids.

Daily consumption rates of herring by captive sea lions was estimated by Rosen and Trites (Rosen and Trites 1998) between 5.61 and 8.07 kg. In an attempt to predict the nutritional importance of pollock versus herring in the diet of the Steller sea lion, Fadely *et al.* (Fadely et al. 1994) reported daily consumption rates of these two prey items by captive California sea lions (*Zalophus californianus*). The daily food intake of herring was 5.2-8.2 kg; intake of pollock was from 7.8 to 12.0 kg.

The count of adult and juvenile Steller sea lions in Alaska during 1996/98 was 40,565 (Alaskan western stock = 29,658), with a total for the state of 52,602 if pups are included (Sease and Loughlin 1999). In the late 1950s and early 1960s, the total population in the North Pacific was estimated to be about 240,000 to 300,000 (Kenyon and Rice 1961). Steller sea lions are currently managed as two distinct stocks (i.e., eastern and western) (Loughlin 1997). Abundance of the U.S. eastern stock remained relatively stable from the 1960s to 1985 at around 13-15,000 nonpups, and has since increased to nearly 19,000 nonpups. The U.S. western stocks on the other hand have declined continuously since the 1960s, from around 177,000 nonpups in the 1960s to 33,600 nonpups in 1994. In the 1960s, the western stock included 92 percent of the U.S. population, but by 1994 this proportion had declined to 64 percent (Loughlin et al. 1992; Merrick et al. 1987).

In 1990, the Steller sea lion was listed as threatened under the ESA throughout its range (55 FR 12645, 55 FR 13488, 55 FR 49204, 55 FR 50005). A recovery plan was completed in 1992. In 1997, NMFS reclassified Steller sea lions as two distinct population segments under the ESA (62 FR 24345). The population segment west of 144°W, or approximately at Cape Suckling, was reclassified as endangered. The eastern stock remains listed as threatened.

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995 The minimum estimated mortality rate incidental to commercial fisheries is 30 Steller sea lions per year, based on observer data and self reported fisheries information, or stranding data where observer data were not available (Hill and DeMaster 1999).

Northern fur seal. The northern fur seal (*Callorhinus ursinus*) ranges throughout the North Pacific Ocean from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan. Breeding is restricted to only a few sites (i.e., the Commander and Pribilof Islands, Bogoslof Island, and the Channel Islands)(NMFS 1993a).

Pupping, mating, and weaning occur on land in isolated rookeries; the remainder of their lives is spent at sea. Lactating females at the Pribilof Islands usually forage within 160 km of the rookeries, but occasionally as far away as 430 km (Goebel et al. 1991). Pups are weaned in October and November, about 125 days after birth, and go to sea soon afterward (Gentry and Kooyman 1986). Most females, pups, and juveniles leave the Bering Sea by late November and migrate south as far as southern California in the eastern North Pacific and Japan in the western North Pacific. They remain pelagic offshore and along the continental shelf until March, when they begin returning to the rookeries. Adult males are believed to migrate only as far south as the GOA (Kajimura and Fowler 1984).

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 of food. Their diet consisted of 67 percent fish (34 percent pollock, 16 percent capelin, 6 percent Pacific herring, 4 percent deep-sea smelts and lanternfishes, 2 percent salmon, 2 percent Atka mackerel, and ≤1 percent of eulachon, Pacific cod, rockfishes, sablefish, sculpins, Pacific sand lance, flatfishes 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.

Based on diet studies conducted since the early pelagic collections (Antonelis et al. 1997; Sinclair et al. 1996; Sinclair et al. 1994), some prey items such as capelin have disappeared entirely from fur seal diet in the EBS and squid consumption has been markedly reduced. At the same time, pollock consumption has tripled while the age category of pollock eaten has decreased. Consumption of pollock, gonatid squid, and bathylagid smelt in the EBS has, however, remained consistently important in all diet studies, despite the wide variety of prey available to fur seals within their diving range.

Gastrointestinal contents of 73 northern fur seals collected from the Bering Sea in 1981 (n=7), 1982 (n=43), and 1985 (n=43) indicated consumption of nearly 100 percent fish (1981), 88 percent fish and 12 percent squid (1982), and 88 percent fish and 12 percent squid (1985) (Sinclair et al. 1994). Analysis of these data showed that pollock and squid were the most frequently eaten prey in the EBS, and that a positive correlation exists between pollock year-class strength and the frequency of pollock in fur seal diets (Sinclair et al. 1994). The same report concluded that northern fur seals are size-selective mid-water feeders during the summer and fall in the EBS. Since 1987, studies of northern fur seal diet have been based on fecal samples (scats). A comparative study of fur seal diet based on the current method of scat analysis vs. stomach content analysis from the 1980s collections (Sinclair et al. 1996) demonstrated that pollock represented 79 percent of all prey for all years combined in gastrointestinal tracts, and 78 percent of the total prey in fecal samples. The frequency of occurrence of pollock in all years averaged 82 percent in gastrointestinal tracts and 76 percent in fecal samples (Sinclair et al. 1996).

Based on the pelagic collections from the 1970s, annual food consumption by the northern fur seal population in the EBS was 432.4 x 10^3 mt, of which 289.7 x 10^3 mt represented fish species. Of the total annual fish consumption, commercial groundfish comprised 56 percent, which was an estimated 0.7 percent of the standing biomass of commercial groundfish consumed (i.e., by all predators combined) annually in the EBS (Perez and McAlister 1993). Based on data collected in the 1980s, consumption of groundfish has increased with a decrease in forage fishes (Sinclair et al. 1996; Sinclair et al. 1994). Trites (Trites 1992) estimated 133,000 mt of walleye pollock (ages 1-2) are consumed annually by northern fur seals in the EBS.

Abundance varies by season. During the breeding season, approximately 74 percent of the worldwide population is found on the Pribilof Islands with the remaining animals spread throughout the North

Pacific Ocean. Of the seals in U.S. waters outside of the Pribilof Islands, approximately one percent of the population is found on Bogoslof Island in the southern Bering Sea and San Miguel Island off southern California (Lloyd et al. 1981; NMFS 1993a). Two separate stocks of northern fur seals are recognized within U.S. waters: An eastern Pacific stock and a San Miguel Island stock. The most recent estimate for the number of fur seals in the eastern Pacific stock is approximately 1,019,192 (Hill and DeMaster 1999).

Northern fur seals were listed as depleted under the Marine Mammal Protection Act (MMPA) in 1988 because population levels had declined to less than 50 percent of levels observed in the late 1950s and no compelling evidence existed that carrying capacity had changed substantially since that time (NMFS 1993a). Under the MMPA, this stock remains listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60 percent of carrying capacity). A conservation plan for the northern fur seal was written to delineate reasonable actions to protect the species (NMFS 1993a). Following that, fisheries regulations were implemented in 1994 (50 CFR 679.22(a)(6)) to create a Pribilof Islands Area Habitat Conservation Zone, in part, to protect the northern fur seal.

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1996. Incidental mortality was observed only in the BSAI groundfish trawl, with a mean annual (total) rate of 2.2 animals (Hill and DeMaster 1999).

Pacific walrus. The Pacific walrus (*Odobenus rosmarus*) occur primarily in the shelf waters of the Bering and Chukchi Seas (Allen 1980; Smirnov 1929). Most of the population congregates during the summer in the southern edge of the Chukchi Sea pack ice between Long Strait, Wrangell Island and Point Barrow (Fay et al. 1984). The remainder of the population, primarily adult males, stays in the Bering Sea during summer (Brooks 1954; Burns 1965; Fay 1955; Fay 1982; Fay et al. 1984). Females and subadult males migrate toward Bering Strait in the autumn when the pack ice begins to re-form (Fay and Stoker 1982a). Walruses use terrestrial haulouts when suitable haulouts on ice are unavailable. The major haulouts are located along the northern, eastern, and southern coasts of the Chukchi Peninsula, on islands in the Bering Strait, on the Punuk Islands, on Round Island in Bristol Bay (Lentfer 1988) and at Cape Seniavan on the north side of the Alaska Peninsula.

Walrus feed almost exclusively on benthic invertebrates (bivalve molluscs) (Fay and Stoker 1982a; Fay and Stoker 1982b). Feeding occurs in depths of 10 to 50 m, with a maximum depth of about 80 m (Fay and Stoker 1982a; Vibe 1950). Some walrus, primarily males, occasionally feed on seals. Estimated dietary composition of walrus in the EBS is >97 percent invertebrates and <1 percent fish. Fay and Stoker (Fay and Stoker 1982b) report an incidental ingestion rate of 0.4 percent for fish in the diet of Pacific walruses taken near Nome, Alaska, an estimate considered high for the population.

Determining Pacific walrus population size is complicated by sampling problems and interpretation of survey results. The total initial estimate of 270,000-290,000 animals in 1980 was later adjusted to about 250,000 (Fay et al. 1984; Fedoseev 1984). Nonetheless, a dramatic increase in the size of the walrus population up to 1980 has been indicated by the survey results, and by range expansion (Fay et al. 1984; Sease 1986).

The species is not listed under the ESA and has no special status under the MMPA. Round Island, one of the most important terrestrial haulouts in the United States, is a State of Alaska preserve and federal regulations prohibit entry of fishing vessels inside 12 miles.

Walrus have been reported to be taken incidentally in domestic groundfish trawl fisheries of the EBS. NMFS observer data collected from 1992-1996 indicate that approximately 17 animals (range 8-25) were caught each year. In cases where sex could be identified, all were males. Most (80 percent) were already decomposed upon catch, indicating that at least a portion of the catch consisted of individuals whose mortality was unrelated to fisheries interactions, representing harvest loss or natural mortality. At 17 walrus per year, the mortality rate is well below 10 percent of the potential biological removal level and constitutes an "insignificant level approaching zero" (Gorbics et al. 1998).

Harbor seal. Harbor seals (*Phoca vitulina*) inhabit coastal and estuarine waters off Baja California, north along the western coasts of the U.S., British Columbia, and southeast Alaska, west through the GOA and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and, occasionally, fresh waters. Major food items vary by availability and include sand lance, smelt, sculpins, herring, capelin, shrimp, mysids, octopus, pollock, and flatfishes (Lowry 1982).

Based on an average of data for the BSAI area, harbor seal diet composition is approximately 75 percent fish (12 percent pollock, 9 percent Atka mackerel, 9 percent sculpins, 8 percent greenlings, 8 percent Pacific cod, 5 percent capelin, 5% Pacific herring, 4% eulachon, 4% Pacific sand lance, 3 percent flatfishes, 3 percent saffron cod, 2 percent other fishes, and ≤ 1 percent Arctic cod, eelpouts, rockfishes, and Pacific salmon) and 25 percent invertebrates (Perez 1990). The total estimated annual food consumption by the population in these areas is 43.3 x 10^3 mt, of which 32.5 x 10^3 mt is fish (Perez and McAlister 1993). Ashwell-Erickson and Elsner (Ashwell-Erickson and Elsner 1981) reported that annual fish consumption by harbor seals in the Bering Sea was 79.0 x 10^3 mt, assuming a population of 150,000 seals.

Daily prey consumption rates of 6-8 percent of total body weight have been estimated for captive harbor seals. Spaulding (Spaulding 1964) estimated an average daily consumption of 6 percent body weight per day from the stomach contents of wild pinnipeds (range 2-11 percent). Food consumption by captive subadult harbor and spotted seals, as reported by Ashwell-Erickson and Elsner (Ashwell-Erickson and Elsner 1981) was about 4 percent of body weight in March through August and increased to about 8 percent of body weight in the winter.

Mean daily per capita food requirements for harbor seals in the Strait of Georgia, British Columbia, were estimated to be 1.9 kg, or 4.3 percent of mean body mass (Olesiuk 1993). Total annual prey consumption of harbor seals in that area was estimated at 9,892 mt, which included 4,214 mt of hake, 3,206 mt of herring, 398 mt of salmon, 335 mt of plain-fin midshipman, and 294 mt of lingcod.

Three separate stocks of harbor seals are recognized in Alaska waters: (1) The southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, (2) the GOA stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and (3) the Bering Sea stock - including all waters north of Unimak Pass (Hill and DeMaster 1999). Population sizes and mortality rates in fisheries are calculated separately for each of these stocks.

The most recent comprehensive aerial surveys of the southeast Alaska stock were conducted during the autumn molt in 1997 and 1998. Uncorrected counts not accounting for animals not hauled out of the water during assessment surveys in the northern southeast Alaska region (from Kayak Island to Frederick Sound) for 1997 yielded 18,933 seals (Withrow and Cesarone 1998). Uncorrected counts for the southern southeast Alaska region (from Federick Sound to the US/Canada border), in 1998, was 26,106 animals (Withrow and Cesarone 1999). The development of appropriate correction factors to account for harbor seals in the water (i.e., not accounted for in aerial photographs) is presently underway, so reliable estimates of total abundance are not yet available. However it is likely that the actual abundance of harbor seals may be approximately just under twice as many as the uncorrected counts suggest. NMFS observers monitored harbor seal incidental take in the GOA groundfish trawl, longline, and pot fisheries during 1990-1996. Incidental takes within the range of the southeast Alaska stock of harbor seals occurred only in the longline fishery, with annual mortality estimated to be 4.0 seals (Hill and DeMaster 1999).

The Bering Sea stock was surveyed during the autumn molt of 1995 throughout northern Bristol Bay and along the north side of the Alaska Peninsula (Withrow and Loughlin 1996) and most recently in August 2000. According to the 1995 surveys, the uncorrected counts are 8,740. The results from the 2000 survey are currently being analyzed. NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries. The mean annual (total) mortality was 2.2 for the BSAI groundfish trawl fishery, 0.6 for the BSAI longline fishery, and 1.2 for the BSAI pot fishery, a total of 4 harbor seals (Hill and DeMaster 1999).

The GOA stock was surveyed in sections with photographic aerial surveys during the autumn molt in 1996 and 1999. The uncorrected counts of harbor seals are 14,813 (Willow and Loughlin, 1997, and Lopez and DeMaster, 2000). NMFS observers monitored incidental take in the GOA groundfish trawl, longline, and pot fisheries, and the Prince William Sound and Alaska Peninsula/Aleutian Islands salmon drift gillnet fisheries. The mean annual (total) mortality from fisheries with observers was estimated to be 24.6 harbor seals (Hill and DeMaster 1999).

Spotted seal. Spotted seals (*Phoca largha*) are distributed along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk Seas south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay 1977). They are known to occur around the Pribilof Islands, Bristol Bay, and the eastern Aleutian Islands. Of eight known breeding areas, three occur in the Bering Sea. Only one stock, the Alaska stock, is recognized in U.S. waters.

Preferred habitat for spotted seals is the “front zone” of pack ice, generally rectangular floes 10-20 m in diameter with brash ice or open water between (Burns 1970; Burns 1981a). When pack ice is absent, the habitat requirements of spotted seals are similar to those of harbor seals. Availability of food nearby and freedom from disturbance seem to be important criteria for coastal haulout sites. Adult spotted seals eat fish, crustaceans, and cephalopods. Diet varies regionally and with age and is thought to vary seasonally as well. However, most data have been collected in the spring and summer and little is known of winter food habits (Lowry et al. 1981a).

In the Bering Sea region, the estimated percent composition of the spotted seal diet is 96 percent fish and 4 percent invertebrates. This information was based on data from Lowry *et. al.* (Lowry 1982) and Bukhityarov *et al.* (Bukhtiyarov et al. 1984), and accounts for the relative seasonal abundance of the spotted seal population in the EBS (Perez 1990; Perez and McAlister 1993). The total estimated annual food consumption by the population (assumed to number 14,000 in summer and 140,000 in winter) in this area is 89.1 x 10^3 mt, of which 85.5 x 10^3 mt is fish that comprise 96 percent of their diet (Perez 1990; Perez and McAlister 1993). Ashwell-Erickson and Elsner (Ashwell-Erickson and Elsner 1981) reported estimates of annual food and fish consumption (in 10^3 mt) in the Bering Sea region as 118 and 92, respectively, assuming a population of 125,000 spotted seals in summer and 250,000 in winter. These estimates of prey consumption are directly dependent on estimates of population abundance, which as described below, are not currently available from reliable, systematic surveys.

Makhnyr and Perlov (Makhnyr and Perlov 1988) reported that the diet of spotted seals along the Sakhalin coast in Russia included pink salmon, kundzha *(Salvelinus leucomaenis)*, redfin (*Leuciscus brandti*), *Myoxocephalus* sp., pleuronectids, and crab (unknown sp.). Fedoseev and Bukhityarov (Fedoseev and Bukhtiyarov 1972) found that spotted seals in the Okhotsk Sea fed on pollock, navaga (*Eleginus navaga*), Pacific sand lance, euphausiids and decapods. Bukhityarov *et al.* (Bukhtiyarov et al. 1984) report that various prey were consumed in greater amounts depending on area: pollock in the Central Bering Sea and the Okhotsk Sea; capelin in the southeast Bering Sea; Arctic cod in the northern Bering Sea and the Gulf of Anadyr; Pacific sand lance in Karaginski Gulf; and herring and smelt in the southeastern Chukchi Sea and southwestern Seaward Peninsula.

A reliable estimate of spotted seal population abundance is currently not available (Rugh et al. 1995). Early estimates of the world population were in the range of 334,000-450,000 animals (Burns 1973). The population of the Bering Sea, including Russian waters, was estimated to be 200,000-250,000 based on the distribution of family groups on ice during the mating season (Burns 1973). However, comprehensive systematic surveys were not conducted to obtain these estimates. Reliable data on trends in population abundance for the Alaska stock of spotted seals are considered unavailable (Hill and DeMaster 1999). An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. A shift in regional weather patterns in the Arctic region has been observed over the last 10-15 years (Tynan and DeMaster 1996). Ice-associated seals, such as the spotted seal, are particularly sensitive to changes in weather and sea-surface temperatures in that these strongly affect their ice habitats. Data are insufficient to make reliable predictions of the effects of Arctic climate change on the Alaska spotted seal stock.

NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Observers did not report any mortality or serious injury of spotted seals incidental to these groundfish fisheries (Hill and DeMaster 1999).

Bearded seal. Bearded seal (*Erignathus barbatus*) are circumpolar in their distribution, extending from the Arctic Ocean south to Hokkaido in the western Pacific. In Alaskan waters, bearded seals occur on the continental shelves of the Bering, Chukchi, and Beaufort Seas (Burns 1981a; Ognev 1935). Only one stock, the Alaska stock, is recognized in U.S. waters. Early estimates of the Bering-Chukchi Sea population range from 250,000 to 300,000 (Burns 1981a; Burns 1981b; Burns et al. 1981; Popov 1976). Until additional surveys are conducted, reliable estimates of abundance are considered unavailable. Reliable data on trends in population abundance are likewise unavailable. The concern expressed above regarding regional weather patterns for spotted seals applies to bearded seals (Hill and DeMaster 1999).

Bearded seals feed on the benthos; therefore, their distribution appears to be strongly dictated by the occurrence of shallow water and high prey biomass. They appear to be limited to feeding depths of less than 150-200 m (Burns 1981a; Kosygin 1966) preferring depths of 25-50 m (Kingsley et al. 1985; Stirling et al. 1982). Decapod crustaceans and molluscs make up most of the diet though prey include a wide variety of invertebrates and fish (Burns and Frost 1983; Lowry et al. 1979; Lowry et al. 1980a; Lowry et al. 1981a; Lowry et al. 1981b; Smith 1981). Major prey in the Bering, Chukchi, and Beaufort seas include crab, clams, shrimps, and Arctic cod (Kosygin 1966; Kosygin 1971; Lowry et al. 1981a; Lowry et al. 1981b). In the Bering Sea region, the estimated percentage composition of the bearded seal diet is 23 percent fish and 77 percent invertebrates. This information was based on data in Kenyon (Kenyon 1962), Kosygin (Kosygin 1966; Kosygin 1971), and Lowry *et al.* (Lowry 1982; Lowry and Frost 1981; Lowry et al. 1980a), and accounts for the relative seasonal abundance of the bearded seal population in the EBS (Perez 1990; Perez and McAlister 1993). The total estimated annual food consumption by the population in this area is 265.2 x 10^3 mt, of which 61.0 x 10^3 mt is fish that comprise 23 percent of their diet, assuming a population of 5,000 bearded seals in summer and 150,000 in winter (Perez and McAlister 1993).

NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Observed incidental kills in the Bering Sea trawl fishery totaling 3 in 1991, and 4 in 1994 form the basis for an estimated annual mortality of 2.0 (Hill and DeMaster 1999).

Ringed seal. Ringed seals (*Phoca hispida*) have a circumpolar distribution in all Arctic Ocean waters (King 1983). In the eastern North Pacific, they are found in the southern Bering Sea and range as far south as the seas of Okhotsk and Japan. They have an affinity for ice-covered waters and are well adapted to occupying seasonal and permanent ice. They remain in contact with ice most of the year and pup on the ice in late winter, early spring (McLaren 1985). Only the Alaska stock is recognized in U.S. waters. A reliable abundance estimate for the Alaska stock is currently not available (Hill and DeMaster 1999). Crude estimates of the world population have ranged from 2.3 to 7 million, with 1 to 1.5 million in Alaskan waters (Kelly 1988). The most recent abundance estimates are based on aerial surveys conducted in 1985, 1986, and 1987 by Frost *et al.* (Frost et al. 1988) but for only a limited portion of the geographic range of the stock. Reliable data on trends in population abundance for the Alaska stock are also unavailable. The concern expressed above regarding regional weather patterns for spotted and bearded seals applies to ringed seals as well.

Ringed seals consume crustaceans (shrimps, amphipods, and euphausiids) and fish (Arctic cod, saffron cod, smelt, and herring) (Fedoseev 1984; Johnson et al. 1966; Lowry et al. 1980a; McLaren 1985). In the Bering Sea region, the estimated diet composition of ringed seals is 85 percent fish and 15 percent invertebrates (Kenyon 1962; Lowry 1982; Lowry and Frost 1981; Lowry et al. 1978; Lowry et al. 1980a). Eighty five percent of the total estimated annual food consumption is fish, assuming a population of 1,000 ringed seals in summer and 600,000 in winter (Perez and McAlister 1993).

NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. The observed incidental take in the Bering Sea trawl fishery in 1992 was 2 animals, representing the basis for an estimated mean annual (total) mortality of 0.6 (Hill and DeMaster 1999).

Ribbon seal. Ribbon seals (*Phoca fasciata*) inhabit the North Pacific Ocean and adjacent fringes of the Arctic Ocean. In Alaskan waters, ribbon seals are found in the open sea, on the pack ice, and on shorefast ice (Kelly 1988). They range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort Seas (Braham et al. 1984; Burns 1970; Burns 1981b). Only one stock, the Alaska stock, is recognized in U.S. waters. A reliable abundance estimate for the Alaska stock of ribbon seals is currently not available (Hill and DeMaster 1999). Burns (Burns 1981b) estimated the worldwide population of ribbon seals at 240,000 in the mid-1970s, with an estimate for the Bering Sea at 90,000-100,000. Reliable data on trends in population abundance for the Alaska stock of ribbon seals are unavailable. The concern expressed above regarding regional weather patterns for spotted, beared, and ringed seals applies as well to ribbon seals.

Very little is known about the habitat requirements of ribbon seals. They usually haul out on thick pack ice (Burns 1981b; Burns et al. 1981; Shustov 1965b; Tikhomirov 1966) and only rarely on shorefast ice (Bailey 1928; Kelly et al. In prep.). Seasonal redistribution occurs. For example, in April they have been found throughout the ice front but most abundantly over deep water south of the continental shelf (Braham et al. 1984). Ribbon seals eat crustaceans, cephalopods, and fish (Arsen'ev 1941; Burns et al. 1981; Frost and Lowry 1980; Shustov 1965a). Few data are available on seasonal variations in the diet; some regional variation has been described (Frost and Lowry 1980). Shustov (Shustov 1965a) states that the diet of the ribbon seal is intermediate between that of ringed and bearded seals. Thus, the percentage of fish (54 percent) in the diet of the EBS population was estimated in Perez (Perez 1990) as the average of values for ringed and bearded seals. Invertebrate consumption was estimated at 46 percent (Perez 1990). The total estimated annual food consumption by the population in this area is 70.7 x 10^3 mt, of which 38.2 x 10^3 mt (54 percent) is fish, assuming a population of 66,000 seals (Perez and McAlister 1993).

NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Two incidental kills observed in the Bering Sea trawl fishery during 1990 and 1991 form the basis for an estimated mean annual (total) mortality of 0.2 (Hill and DeMaster 1999).

Northern elephant seal. Northern elephant seals (*Mirounga angustirostris)* range throughout the northeast Pacific Ocean from central Baja California, Mexico to the GOA and eastern Aleutian Islands, with occasional sightings in the southern Bering Sea. Breeding occurs on islands from central Baja California north through central Oregon. Pupping and mating occurs on isolated island and mainland rookeries between December and March. Following breeding season, adults go to sea and forage until returning to rookery islands to molt. Females do so in May and males in July. Following the molt (which requires 4 to 6 weeks to complete) adults again return to foraging areas where they feed until returning for the following breeding season.

The animals complete two long distance migrations each year, with males traveling an average of 21,000 km and females 18,000 km (Stewart and DeLong 1995). Adult males and females occupy different foraging areas. Females forage in an area generally bounded by 42°N to 45°N, off the North American continental shelf, westward to the central Pacific Ocean. Adult males are distributed farther north than females, primarily occupying pelagic waters from British Columbia, through the GOA and westward to the eastern Aleutian Islands.

The majority of foraging activity recorded occurs off the continental shelf over very deep water. In these waters, elephant seals dive to average depths of 400 m, apparently feeding on organisms associated with the deep scattering layer. Some adult and subadult males occupy more coastal habitats, where dive records suggest feeding on or near the bottom. While the proportion of the population using coastal habitats is unknown, most adult males and females appear to feed in the water column over very deep water.

Existing information on northern elephant seal food habits is based on analysis of stomach contents obtained from either animals found dead on beaches or live animals lavaged on rookeries. Studies found that elephant seals eat cephalopods, Pacific hake (*Merluccius productus)* , spotted cusk-eel (*Chilara taylori*), ratfish (*Hydrolagus colliei*), plainfin midshipman, skates (*Raja* sp), swell shark (*Cephaloscyllium ventriosum*), and thornback (*Platyrhinoides triseriata*).

The food habits of elephant seals while they reside in Alaskan waters are unknown. The adults which are feeding in very deep water off the continental shelf are probably taking primarily squid, as they do in California. The degree to which the smaller fraction of the northern elephant seal population frequenting areas on the continental shelf seals feed on demersal teleost fishes is unknown.

The estimated population of 127,000 northern elephant seals (Stewart and DeLong 1995) existed in U.S. and Mexico waters in 1991 and some 84,000 animals were estimated to make up the U.S. population in 1996 (Barlow and Gerrodette 1996). In the decade of the 1990s, six elephant seals have been taken incidental to groundfish fisheries in Alaska: one in the BSAI trawl, two in the GOA trawl and three in GOA longline fisheries.

Carnivora

Only one marine member of the order Carnivora, the Sea otter (family Mustelidae), occurs in or near groundfish fishing areas in Alaskan waters. A second member of Carnivora also considered a marine mammal, the polar bear (Family Ursidae), inhabits Alaskan waters but is not included in this EIS because its range does not extend southward far enough to overlap with commercial groundfish fisheries.

Sea otter. The sea otter (*Enhydra lutris*) inhabits shallow coastal waters of the North Pacific Ocean and the southern Bering Sea (Estes 1980; Estes and Palmisano 1974; Estes and Van Blaricom 1985). Habitat is generally shallow (less than 34 m) nearshore marine waters with sandy or rocky bottoms supporting substantial populations of benthic invertebrates. In some areas, large numbers of sea otters occur offshore. For example, in the Copper River Delta and inside Prince William Sound, sea otters are often present more than 8 km from shore (Garshelis and Garshelis 1984). Large aggregations have been observed more than 30 km north of Unimak Island in the Bering Sea (Kenyon 1969).

Sea otters use beds of canopy-forming kelps for resting and foraging (Reidman 1987). Sea otters also occur in areas where kelp is not present, though the absence of kelp may affect distribution and survival (Reidman 1987). Sea otters regularly haul out in the Aleutian and Shumagin Islands (Kenyon 1969) and other areas throughout their current range. Sea otters eat a wide variety of sessile and slow-moving benthic invertebrates, including sea urchins, abalone, clams, mussels, basket cockles, rock scallops (*Crassadoma gigantea*), Dungeness crab (*Cancer magister*), rock crab (*Cancer* spp.), kelp crab (*Pugettia* spp.), spiny lobsters (*Panulirus interruptus*), and turban snails (Kenyon 1969). Sea otters also eat octopus and squid, and, in some parts of Alaska, sluggish epibenthic fishes (Estes and Van Blaricom 1985; Reidman 1987).

Using data in Kenyon (Kenyon 1969; Kenyon 1981) and Lowry *et al.* (Lowry 1982), the sea otter's diet consists of an estimated 82 percent invertebrates and 18 percent fish. The fish component included lumpsuckers, sculpins, rock greenling, Atka mackerel, rockfishes, sablefish, Pacific cod, and pollock. The estimated total annual food consumption by the population in the EBS is 157.1 x 10^3 mt, of which 28.3 x 10^3 mt is fish. Of the total annual fish consumption, commercial groundfish comprise 8 percent, which is considered a trace amount of the standing biomass of commercial groundfish consumed annually (by all predators) in the EBS (Perez and McAlister 1993).

Commercial exploitation for pelts from the mid-1700s to the late 1800s caused sea otters to become nearly extinct (Bancroft 1959; Lensink 1962). Protection in this century has allowed remnant groups to increase and reoccupy much of the historic sea otter range in Alaska (Estes 1980; Kenyon 1969). Three stocks of sea otters separated by genetic differences and geographic isolation are presently considered to occur in Alaska. They include: the southeast Alaska stock which extends from the southern boundary of Alaska north to Cape Yakataga; the south central stock which extends from Cape Yakataga to the east coast of Cook Inlet; and the southwest Alaska stock which extends from the western shore of Cook Inlet south and east to the Alaska-Russia border (Gorbics and Bodkin In press). The USFWS estimates that the total sea otter population size in Alaska at 100,000 to 150,000 animals (USFWS 1994b). NMFS observers monitored incidental take in the groundfish trawl, longline, and pot fisheries during 1990-1995. No mortality or serious injuries to sea otters were observed incidental to these groundfish fisheries. USGS/BRD has recently placed sea otters on the candidate species list under the ESA. Recent surveys show a decline of 70 percent in the past 8 years. (65 FR 67343, November 9, 2000)

Cetacea

Large cetaceans with ranges (or historical occurrences) in the fisheries management areas include humpback, grey, sei, fin, blue, right, sperm, beaked (several species), minke, and northern right whales. Bowhead whales are also present seasonally, extending as far south as St. Matthew Island during some winters (Moore and Reeves 1993). Small cetaceans include beluga whales, killer whales, Pacific white-sided dolphins, harbor porpoises, and Dall's porpoises.

Beluga whale. Beluga whales (*Delphinapterus leucas*) are distributed throughout seasonally ice-covered Arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980) and some stocks are closely associated with open leads and polynyas (nonlinear openings in the sea ice) in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal Alaskan waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Beaufort Sea (Hazard 1988). Most beluga whales from these summering areas are assumed to overwinter in the Bering Sea, excluding those found in the northern GOA, but few data exist to support this conclusion (O'Corry-Crowe and Lowry 1997; O'Corry-Crowe et al. 1997). Five stocks of beluga whales are recognized within U.S. waters: Cook Inlet, Bristol Bay, EBS, Eastern Chukchi Sea, and Beaufort Sea (Hill et al. 1997). The two stocks within the BSAI and GOA groundfish management areas are those in Bristol Bay and the EBS. The total corrected population abundance estimate for Bristol Bay is 1,316; and 7,986 are estimated for the EBS stock (Hill et al. 1997). The EBS population is thought to be stable or increasing (Hill et al. 1997); the Bristol Bay stock is considered stable (Frost and Lowry 1990).

Alaskan belugas feed primarily on fish (e.g., herring, capelin, smelt, eulachon, cod, and salmon) during the spring and summer; fall and winter diets are not known (Frost and Lowry 1981; Lowry and Frost 1985). The total estimated annual food consumption by the population in the EBS is 143.3 x 10^3 mt, of which 133.5 x 10^3 mt (93 percent) is fish assuming: a) EBS beluga whale average abundance is 3,500 in May-October and 18,000 in November-April, b) the average adult body mass is 800 kg, and c) diet composition remains the same year-round (Perez 1990; Perez and McAlister 1993). In captivity, beluga whale food consumption rates were found to vary with age, sex and season. On average, the larger the animal the smaller the relative food intake, therefore belugas at 200 kg consumed about 4.5 percent of their body weight per day while belugas at 1400 kg needed only 1.2 percent (Kastelein et al. 1994).

NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1998. No mortality or serious injuries to belugas were observed incidental to these groundfish fisheries (Hill and DeMaster 1999).

Killer whale. Killer whales (*Orcinus orca*) have been observed in all oceans and seas of the world (Leatherwood et al. 1982). In Alaska waters, killer whales occur along the coast from the Chukchi Sea, into the Bering Sea, along the Aleutian Islands, GOA, and into southeast Alaska (Braham and Dahlheim 1982). They occur primarily in coastal waters, although they have been sighted well offshore (Heyning and Dalheim 1988). Seasonal movements in polar regions may be influenced by ice cover and in other areas primarily by availability of food. Prey include marine mammals, birds, fish, and squid (Jefferson et al. 1991). The total estimated annual prey consumption by the population in the EBS is 16.1 x 10^3 mt, of which 10.5 x 10^3 mt (65 percent) is fish (Perez and McAlister 1993). Interactions with commercial longline fisheries are well-documented throughout the BSAI. Depredation rates of bottomfish by killer whales on longline catches, based on four different methods of calculation, suggested that whales took 14-60 percent of the sablefish, 39-69 percent of the Greenland turbot, and 6-42 percent of the arrowtooth flounder caught in commercial gear (Yano and Dahlheim 1995).

Four killer whale stocks are recognized along the west coast of North America from California to Alaska. Two of them occur in Alaska, the Eastern North Pacific Northern Resident stock and the Eastern North Pacific Transient stock (Hill and DeMaster 1999). The combined counts of resident and transient killer whales are 717 and 336, respectively (Dahlheim 1994; Dahlheim et al. 1996; Dahlheim and Waite 1993). Reliable data on trends in population abundance for either stock are not available (Hill and DeMaster 1999).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1998. Observed incidental mortality of killer whale occurred in the BSAI groundfish trawl and longline fisheries with a mean annual (total) mortality of 1.0 for BSAI trawl and 0.4 for BSAI longline. No killer whale mortality was observed in the pot fisheries (Hill and DeMaster 1999). Killer whales interact with longline fisheries in the southeastern Bering Sea where predation on catch, especially sablefish and Greenland turbot, occurs periodically as gear is being retrieved (Dahlheim et al. 1996). Fishermen within the fixed gear Pacific halibut and sablefish fisheries are allowed to use longline pot gear to reduce interactions with killer whales (61 FR 49076, September 18, 1996).

Pacific white-sided dolphin. Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) are found throughout the temperate North Pacific Ocean. In the eastern North Pacific the species occurs from the southern Gulf of California, north to the GOA, west to Amchitka in the Aleutian Islands, but is rarely encountered in the southern Bering Sea. They are mostly pelagic but also occur occasionally on the continental shelf (Dahlheim 1994; Hobbs and Jones 1993). Prey include a variety of small schooling fish and squid (Walker and Jones 1993).

Of two stocks recognized in the North Pacific Ocean, the North Pacific stock is present in the BSAI and GOA management areas (Hill and DeMaster 1999). The most complete population abundance estimate for Pacific white-sided dolphins was calculated from line transect analyses applied to the 1987-90 central North Pacific marine mammal sightings survey data (Buckland et al. 1993). The Buckland *et al.*(Buckland et al. 1993) abundance estimate, 931,000 animals, more closely reflects a range-wide estimate rather than one that can be applied to either of the two management stocks off the west coast of North America. However, the portion of the Buckland *et al.* (Buckland et al. 1993) estimate derived from sightings north of 45°N in the GOA can be used as the population estimate for this area (26,880).

Between 1978 and 1991, thousands of Pacific white-sided dolphins were killed annually incidental to high seas fisheries. However, these fisheries have not operated in the central North Pacific since 1991. Six different commercial fisheries in Alaska that could have interacted with Pacific white-sided dolphins were monitored for incidental take by NMFS observers from 1990 to 1998: BSAI and GOA groundfish trawl, longline, and pot fisheries. The mean annual (total) mortality was 0 in the Bering Sea groundfish trawl fishery and 0.8 in the Bering Sea groundfish longline fishery (Hill and DeMaster 1999).

Harbor porpoise. Harbor porpoises (*Phocoena phocoena*) are found in the eastern North Pacific Ocean from Point Barrow, along the Alaskan coast, and down the west coast of North America to Point Conception, California (Dahlheim et al. 2000; Gaskin 1984; Suydam and George 1992). They occur primarily in coastal waters, but are also found in offshore regions where the shelf extends offshore (Dahlheim et al. 2000; Gaskin 1984). Harbor porpoise occur continuously along the North American coast, with regions of higher concentrations in some locations, such as Puget Sound and Glacier Bay (Gaskin 1984; Raum-Suryan and Harvey 1998; Taylor and Dawson 1984). Significant differences found in genetic samples from California, Washington, British Columbia, and Alaska (Rosel 1992; Rosel et al. 1995) and studies of contaminant levels from California to Washington (Calambokidis and Barlow 1991) show that harbor porpoise along the west coast of North America are not panmictic (random mating within a breeding population) and do not move great distances. However, available data are insufficient to separate biological stocks of harbor porpoise in Alaska. But because regional populations are believed to exist, it was considered prudent to establish management units (Hill and DeMaster 1999; Rosel et al. 1995; Taylor and Dawson 1984). Three separate management units are recognized in Alaska: Southeast Alaska, GOA, and Bering Sea stocks. Aerial surveys conducted in 1991-1993 (Dahlheim et al. 2000) produced an uncorrected abundance estimate of 8,940 for the three stock areas combined. Hill and DeMaster (Hill and DeMaster 1999) split the overall estimate into the three stock ranges and applied a correction factor to produce the following three abundance estimates: 10,301 for the Southeast Alaska stock, 8,497 for the GOA stock, and 10,946 for the Bering Sea stock. No reliable information on trends in abundance exists.

No prey studies have been conducted in Alaska. However, prey studies in Washington and British Columbia found the diet of harbor porpoise to include cephalopods and a wide variety of fish including Pacific herring, smelt, eelpout, eulachon, pollock, Pacific sand lance and gadids (Gearin et al. 1994; Walker et al. 1998). The total estimated annual food consumption by the population during summer in the EBS is 1.0 x 10^3 mt, of which 0.8 x 10^3 mt (80 percent) is fish (based on the estimated average pelagic abundance of 1500 animals) (Perez and McAlister 1993). Captive, non-lactating harbor porpoise of various age and sex classes were found to consume between 750 and 3,250 g of fish per day (equivalent to 4-9.5 percent of their body weight) (Kastelein et al. 1997). Rates of consumption depended on the caloric content of the fish as well as the age, body weight, exercise level, and individual basal metabolic rates. Wild harbor porpoise are expected to need more energy for thermoregulation and locomotion than the animals in this study.

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. During this period, 21-31 percent of the GOA longline catch occurred within the range of the Southeast Alaska harbor porpoise stock (Hill and DeMaster 1999). No incidental mortalities were recorded by observers, but an annual mean of 3.25 mortalities was documented from log book records from the Southeast Alaska salmon drift gillnet fishery (1990 - 1993). The estimated minimum annual mortality rate incidental to commercial fisheries is four animals for the Southeast Alaska stock. For the GOA and Bering Sea harbor porpoise stocks, an estimated minimum annual mortality rate incidental to commercial fisheries was calculated to be 25 and 2, respectively, based on observer and logbook data (Hill and DeMaster 1999). For all three stocks, a reliable mortality estimate rate incidental to commercial fisheries was considered unavailable because of the absence of observer placements in several fisheries.

Dall's porpoise. Dall’s porpoises (*Phocoenoides dalli*) are endemic to the northern North Pacific Ocean region and adjoining seas, inhabiting both pelagic and near shore habitats. The species is common along the entire coast of North America as far south as 32°N (Morejohn 1979). In the Bering Sea, sightings are infrequent north of 62°N (Nishiwaki 1966). Food habits data from the western Aleutian Islands suggests a diet composed primarily of cephalopods and myctophid fishes (Crawford 1981). The total estimated annual food consumption by the population during summer in the EBS is 169 x 10^3 mt, of which 84.5 x 10^3 mt (50 percent) is fish (Perez and McAlister 1993).

One stock of Dall's porpoise is recognized in Alaska waters (Hill et al. 1997), although a separate Bering Sea stock has been suggested, based on differences in reproductive timing and parasite associations (Amino and Miyazaki 1992; Kasuya and Ogi 1987; Walker 1990; Walker and Sinclair 1990) and preliminary genetics analyses Winans and Jones (Winans and Jones 1988) . The Alaska stock of Dall's porpoise is estimated at 417,000. This number, however, may be overestimated by as much as five-fold because of vessel attraction behavior (Hill et al. 1997; Turnock and Quinn 1991).

Six different commercial fisheries operating within the range of the Alaska stock of Dall's porpoise were monitored for incidental take by NMFS observers during 1990-98. The mean annual (total) mortality was 6.0 for the Bering Sea groundfish trawl fishery,1.2 for the GOA groundfish trawl fishery (Hill and DeMaster 1999).

Sperm whale. Sperm whales (*Physeter macrocephalus*) are distributed widely in the North Pacific Ocean, as far north as the Pribilof Islands in the Bering Sea (Leatherwood et al. 1982; Omura et al. 1955). They are a pelagic species, known to dive deeper than 1,000 m and remain submerged for periods of an hour or more. They feed primarily on medium- to large-sized squids (Gosho et al. 1984) but may occasionally take octopus and a variety of fish, including salmon, rockfish, lingcod, and skates. The total estimated annual food consumption by the population in the EBS is 952.8 x 10^3 mt, of which 171.5 x 10^3 mt (18 percent) is fish (Perez and McAlister 1993).

One stock is recognized in Alaska, the North Pacific stock (Hill and DeMaster 1999). The number of sperm whales occurring within Alaskan waters is unknown. Reliable information on trends in abundance are not available. NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1998.

Beaked whales (three species). Beaked whales present in the GOA and Bering Sea include the Baird's, (*Berardius bairdii*), Cuvier's, (*Ziphius cavirostris*), and Stejneger's (*Mesoplodon stejnegeri*) beaked whales.

Baird's beaked whales inhabit the North Pacific Ocean and adjacent seas (Bering Sea, Okhotsk Sea, Sea of Japan, and the Sea of Cortez in the southern Gulf of California and Mexico)(Balcomb 1989). Populations harvested in the coastal waters of Japan have been studied extensively, but little is known about this species in the rest of its range (Balcomb 1989; Kasuya et al. 1997). In the North Pacific Ocean, Baird's beaked whales have been sighted in all areas north of 35°N, particularly in areas with submarine escarpments and seamounts (Kasuya and Ohsumi 1984; Ohsumi 1983). In the eastern North Pacific, the range of this species extends north into the Bering Sea at least as far as St. Matthew Island and the Pribilof Islands, where stranded individuals have been found (Hanna 1920; Rice 1986). An apparent break in distribution occurs in the eastern GOA, but there are sighting records from the mid-Gulf to the Aleutian Islands and in the southern Bering Sea (Kasuya and Ohsumi 1984). According to Tomilin (Tomilin 1957), Baird's beaked whales arrive in the Okhotsk and Bering seas in April-May and are especially numerous in summer months. Baird's beaked whales are migratory, arriving in continental slope waters during summer and fall months when surface water temperatures are the highest (Dohl et al. 1983; Kasuya 1986).

Baird's beaked whales are the most commonly observed beaked whales in their range, perhaps because they are relatively large and gregarious, traveling in schools of a few animals to several dozen (Balcomb 1989). The abundance of Baird's beaked whales off the Pacific coast of Japan is about 5,000 animals (Kasuya et al. 1997; Miyashita 1986; Miyashita and Kato 1993). In U.S. waters in the North Pacific, Baird's beaked whales are found in two non-contiguous areas (Alaska and California/Oregon/ Washington) and are considered two separate stocks. Based on 1991 and 1993 survey data, Barlow and Gerrodette (Barlow and Gerrodette 1996) estimated there were 382 (CV=0.53) animals in the California/Oregon/Washington stock of Baird's beaked whale (Barlow et al. 1997). There are currently no reliable estimates of stock size for the Alaska stock of Baird's beaked whales (Hill and DeMaster 1999).

Prey species of Baird's beaked whales include benthic and epibenthic creatures such as squid, skates, rattail, rockfish, and octopus (Pike 1953; Tomilin 1957), as well as pelagic species such as mackerel, sardine, and saury (*Cololabis saira*) (Nishiwaki and Oguro 1971). Judging by the benthic habits of their prey species, these whales routinely dive to depths of 1,000 m; typical dives are 25-35 minutes in length, and dives of 45 minutes are not unusual (Balcomb 1989).

NMFS observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1997, but no mortalities or serious injuries of Baird's beaked whales were observed (Hill and DeMaster 1999). The Alaska stock of Baird's beaked whales is not listed as threatened or endangered under the ESA, nor is it considered depleted or strategic under the MMPA (Hill and DeMaster 1999).

Cuvier's beaked whales are distributed in all oceans and most seas, except in high polar waters (Moore 1963). Off the U.S. west coast, this species is the most commonly encountered beaked whale (Barlow et al. 1997). No seasonal changes in distribution are apparent from stranding records, and morphological evidence is consistent with a single panmitic population from Baja California, Mexico, to Alaska (Barlow et al. 1997; Mitchell 1968), with animals ranging as far north as the Aleutian Islands and the Commander Islands (Rice 1986).

Cuvier's beaked whales are found in three non-contiguous areas within U.S. waters in the North Pacific (Alaska, California/Oregon/ Washington, and Hawaii), and are considered to be three separate stocks (Hill and DeMaster 1999). The 1996 abundance estimate for the California/Oregon/ Washington stock of Cuvier's whale was 9,163 (CV=0.52) animals; but, no information exists regarding trends in abundance (Barlow et al. 1997). Reliable abundance estimates for the Alaska stock are not currently available (Hill and DeMaster 1999).

Cuvier's beaked whales have a low, diffuse blow that is directed forward (Backus and Schevill 1961; Norris and Prescott 1961) and there is some evidence that they dive to avoid vessels, which may explain the relatively small number of sightings of this species at sea (Heyning 1989). In the eastern tropical Pacific, Cuvier's whales are most often seen alone or in small groups of two to seven animals (Heyning 1989).

The average length of adult Cuvier's beaked whales is 6.13 m, with no significant differences in size between the sexes (Heyning 1989). Ross (Ross 1984) examined growth layers in the teeth of Cuvier's beaked whales and found a maximum of 36+ growth layers in males and 30 layers in females, while Perrin and Myrick (Perrin and Myrick 1980) found 62 growth layers in the tooth of an animal in which neither sex nor length were known (Heyning 1989).

Squid are considered to be the primary prey of Cuvier's beaked whales, although few stomach samples have been analyzed. In Japanese waters, Nishiwaki and Oguro (Nishiwaki and Oguro 1972) found that squid predominated in stomach samples of whales harvested in water depths up to 1,000 m; while fish were the main prey item found in whales harvested in deeper waters. Heyning (Heyning 1989) summarized prey items found in the stomachs of Cuvier's beaked whales from a wide range of areas and noted that most of the species were open ocean, mesopelagic, or deep-water benthic organisms--providing some evidence that Cuvier's beaked whales are an offshore deep-diving species. Fiscus (Fiscus 1997) reviewed the prey species identified in the stomach contents of animals found stranded on Amchitka Island (Fiscus 1997) and Kodiak Island (Foster and Hare 1990) and concluded that, in Alaskan waters, Cuvier's beaked whales feed mainly on cephalopod species that inhabit mesopelagic and deeper depths in the open ocean. However, he also noted that some of these species (mostly gonatids) have been taken in surface gillnets (Fiscus and Mercer 1982; Kubodera et al. 1983)

NMFS observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1997, but no mortalities or serious injuries of Cuvier's beaked whales were observed (Hill and DeMaster 1999). The Alaska stock of Cuvier's whales is not listed as threatened or endangered under the ESA, nor is it considered depleted or strategic under the MMPA.

Stegneger's beaked whales are rarely observed at sea and distribution has been inferred from stranded specimens (Loughlin and Perez 1985; Mead 1989). This species is also commonly known as the Bering Sea beaked whale. They are endemic to the cold-temperate waters of the North Pacific Ocean, Sea of Japan, and southwest Bering Sea. The range extends along the coast of North America from Cardiff, California, north through the GOA to the Aleutian Islands, into the Bering Sea as far as the Pribilof Islands and Commander Islands, and, off Asia, south to Akita Beach on Noto Peninsula, Honshu, in the Sea of Japan (Loughlin and Perez 1985). Stejneger's beaked whales are believed to inhabit deeper waters of the continental slope (Morris et al. 1983) and frequent the Aleutian Basin and Aleutian Trench rather than the shallow waters of the northern or EBS (Mead 1984). This species is not known to enter the Arctic Ocean and is the only species of *Mesoplodon* in Alaskan waters (Loughlin and Perez 1985).

Available evidence indicates that *Mesoplodon* species are usually seen in small groups (Mead 1984). Loughlin *et al.* (Loughlin et al. 1982) reported that Stejneger's beaked whales sighted in the central Aleutian Islands were in groups of 5-15 individuals. The animals usually formed tight groups and sometimes dove in unison. Blows, when visible, were often low and inconspicuous.

In U.S. waters of the North Pacific, there are three *Mesoplodon* stocks: an Alaska stock of Stejneger's whales, all *Mesoplodon* species off of California/Oregon/Washington, and a Hawaiian stock of Blainville's beaked whale, *Mesoplodon densirostris*. There are currently no reliable estimates of abundance for the Alaska stock of Stejneger's whales, nor any data on trends in abundance (Hill and DeMaster 1999).

The primary food of Stejneger's beaked whale is probably squid (Moore 1963; Tomilin 1957). Mead (Mead 1989) found trace quantities of squid beaks, but no fish, in the stomachs of two stranded animals.

NMFS observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1997, but no mortalities or serious injuries of Stejneger's beaked whales were observed (Hill and DeMaster 1999). The Alaska stock of Stejneger's whale is not listed as threatened or endangered under the ESA, nor is it considered depleted or strategic under the MMPA.

Gray whale. Gray whales (*Eschrichtius robustus*) occur across the coastal and shallow-water areas of both the eastern and western reaches of the North Pacific Ocean, Bering, Chukchi, and Beaufort Seas. Two stocks are recognized, the eastern North Pacific stock and the western Pacific or "Korean" stock; the latter stock is considered rare and endangered. The eastern North Pacific stock abundance estimate was 26,635 (CV = 10.06%) during the 1997/98 census (Hobbs and Rugh 1999). The population has been increasing over the past several decades at an estimated annual rate of 3.29% (Buckland et al. 1993). Gray whales were originally listed as endangered under the ESA but were delisted in 1994 (Rugh et al. 1999).

Only the eastern North Pacific stock is found in the BSAI and GOA groundfish management areas. This population migrates annually along the coast of North America from summer feeding areas in the Bering, Chukchi, and Beaufort Seas to winter grounds in sheltered waters along the Baja Peninsula (Rice and Wolman 1971). Prey include epibenthic and benthic invertebrates, though some pelagic feeding has been observed (Nerini 1984). The total estimated annual food consumption by the population in the EBS is 271.5×10^3 mt (assuming only 5,000 occur in the Bering Sea in summer), which included only a trace amount of fish (Perez and McAlister 1993). Previous studies have reported estimates of annual food consumption in the Bering Sea region as 850 x 10^3 mt (Zimushko and Lenskaya 1970), 2,700-3,240 x 10^3 mt (Frost and Lowry 1981), and 571-1,674 x 10^3 mt (Nerini 1984).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1998. No gray whale mortalities were observed (Hill and DeMaster 1999).

Humpback whale. Humpback whales (*Megaptera novaeangliae*) are common in Alaska waters (NMFS 1991c). Their historic summer range in the North Pacific encompasses coastal and inland waters around the Pacific Rim from Point Conception, California, north to the GOA and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Johnson and Wolman 1984; Nemoto 1957; Perry et al. 1999; Tomilin 1967). Through a variety of information sources (surveys, photo-identification, genetics), it has become evident that at least three relatively separate populations exist in the EEZ. Each population migrates between their respective summer/fall feeding areas and their winter/spring calving and mating areas (Baker et al. 1998; Calambokidis et al. 1997). These apparent populations have been assigned as “managements units” or stocks: the Western North Pacific stock, Central North Pacific stock, and the California/Oregon/Washington-Mexico stock. Two of these populations are seasonally distributed in Alaskan waters: the Central North Pacific and the Western North Pacific stocks. The Central North Pacific stock winters in Hawaiian waters and summers in northern British Columbia, Southeast Alaska, Prince William Sound and west to at least Kodiak Island (Baker et al. 1986; Baker et al. 1990; Calambokidis et al. 1997; Perry et al. 1990). The Western North Pacific stock winters in Japanese waters and probably migrates to the BSAI to feed in the summer (Berzin and Rovnin 1966; Darling 1991; Nishiwaki 1966).

As a result of intensive commercial exploitation during this century, the humpback whale population was considerably reduced throughout much of the range (Rice 1978). Baker and Herman (Baker and Herman 1987) estimated that the Central North Pacific Stock contained 1,407 animals between 1980-1983. The robustness of that estimate is questionable, however, due to the opportunistic nature of the survey methodology in conjunction with a small sample size. A more recent abundance estimate was produced based on data collected by nine independent research groups that conducted photo-identification studies in the three wintering areas (Mexico, Hawaii, and Japan). Using photographs from 1991 - 1993, abundance estimates for the Central North Pacific stock and the Western North Pacific stock were calculated to be 4,005 (CV=0.095) and 394 (CV=0.084), respectively. There is no trend information for the Western North Pacific stock. The Central North Pacific stock appears to be increasing, although the rate of increase is unknown due to the uncertainty of the earlier estimate (Baker and Herman 1987; Hill and DeMaster 1999). The species is listed as endangered under the ESA and a recovery plan has been written (NMFS 1991b).

Prey in the North Pacific and Bering Sea include euphausiids, mackerel, capelin , sand lance, pollock, and herring (Bryant et al. 1981; Dolphin and McSweeney 1983; Nemoto 1959). The total estimated annual food consumption by humpback whales in the EBS is 5.5 x 10^3 mt, of which 1.6 x 10^3 mt (29 percent) is fish (based on the estimated average pelagic abundance of 150 animals) (Perez and McAlister 1993).

NMFS observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1997. No humpback whale mortalities were observed. However, in 1997 a dead humpback whale was found entangled in netting and trailing orange buoys near the Bering Strait. The mortality was attributed to the Western North Pacific stock, although it is impossible to know with certainty which stock it came from. The annual mortality rate incidental to commercial fisheries of 0.2 was given to this stock, but is considered a minimum since mortality information is unavailable from Japanese, Russian or international waters (Hill and DeMaster 1999). For the Central North Pacific stock, data from observer placement in Hawaiian fisheries were included in addition to the Alaska observer data to estimate mortality. For this stock, the annual estimated minimum mortality rate incidental to commercial fisheries is 1, based on observer data (0), self-reported fisheries information (0.6), and stranding data (0.4). This estimate is also considered a minimum estimate since several fisheries known to interact with this stock did not have observers, and there was limited observer coverage in Canada (Hill and DeMaster 1999).

Fin whale. In the North Pacific, fin whales (*Balaenoptera physalus*) range from the Chukchi Sea to roughly 20°N (Leatherwood et al. 1982; Rice 1998). In U.S. waters, fin whales are distributed seasonally off the coast of North America and in Hawaiian waters (Barlow et al. 1995; McDonald et al. 1995). Acoustic detections of fin whale calls indicate that whales aggregate near the Aleutian Islands in summer (Moore et al. 1998) and near the Hawaiian Islands in winter (McDonald 1999), although some whale calls continue to be detected northern latitudes throughout the winter with no noticeable migratory movement south (Watkins et al. 2000). Prey includes planktonic Crustacea (euphausiids and copepods), squid, and fish (herring, cod, mackerel, pollock, capelin) and cephalopods (Gambell 1985). The total estimated annual food consumption by the population in the EBS is 57.5 x 10^3 mt, of which 9.2 x 10^3 mt (16 percent) is fish (Perez and McAlister 1993).

The fin whales present in the GOA and Bering Sea are considered part of the Alaska (Northeast Pacific) stock. Although reliable estimates of current and historical abundance or population trends for the Alaska stock are not available (Hill et al. 1997; Springer et al. 1999), provide a provisional estimate of 4,951 (95 percent C.I. = 2,833-8,653) fin whales for the central Bering Sea shelf.

Fin whales are listed as endangered under the ESA. NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No fin whale mortalities were observed (Hill and DeMaster 1999).

Minke whale. Minke whales (*Balaenoptera acutorostrata*) are distributed worldwide. In the eastern North Pacific, sightings range south from Point Barrow, Alaska, throughout the Bering Sea and Bristol Bay, and in coastal and offshore waters of the GOA (Stewart and Leatherwood 1985). Minke whales in Alaska are managed as a separate stock from those in California, Oregon, and Washington. However, little data is available on the migratory behavior and apparent "home ranges" of eastern North Pacific minke whales (Dorsey et al. 1990). No estimates have been made for the number of minke whales in the North Pacific or in Alaskan waters (Hill et al. 1997).

Prey preferences of eastern North Pacific minke whales are unknown. Depending on season and region, pelagic schooling fishes (in particular herring, pollock, mackerel, anchovy, and saury make up over 90 percent of the total prey weight ingested by western North Pacific minke whales (Kasamatsu and Hata 1985; Tamura et al. 1998). Perez and McAlister (Perez and McAlister 1993) estimated the total annual food consumption of EBS minke whales at 52.6 x 10^3 mt, of which 31.6 x 10^3 mt (60 percent) was comprised of fish. This estimate was based on the following assumptions: 1) an average abundance of minke whales in the EBS during May-October and November-April of 8,000 and 500, respectively, 2) an average body mass of 6,000 kg for an adult minke whale, and 3) a diet composition averaged from studies conducted in the North Atlantic and western North Pacific (Perez 1990).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities were observed during that time. One minke whale mortality was observed in 1989 in the Bering Sea and GOA joint-venture groundfish trawl fishery, the predecessor to the current Alaska groundfish trawl fishery (Hill and DeMaster 1999).

Bowhead whale. The Western Arctic stock of bowhead whales (*Balaena mysticetus*), the only stock found in U.S. waters, is widely distributed in the central and western Bering Sea in winter (November to April). Bowhead whales are generally associated with the marginal ice front and found near the polynyas of Saint Matthew and Saint Lawrence Islands and the Gulf of Anadyr (Moore and Reeves 1993). From April through June, these whales migrate north and east, following leads in the sea ice in the eastern Chukchi Sea until they pass Point Barrow, where they travel east toward the southeastern Beaufort Sea and most spend the summer (June through September) (Shelden and Rugh 1995). By early winter (late October and November) they arrive in the Bering Sea (Bessonov et al. 1990; Kibal'chich et al. 1986), where they remain until the following spring migration. Studies of stable isotope ratios in bowhead baleen suggest that the Bering and Chukchi seas are the preferred feeding habitats, rather than the Beaufort Sea (Lee and Schell 1999). Historically, there were many records of bowhead whales in the Bering and Chukchi Seas in summer (Townsend 1935), possibly of a sub-population that is now extinct or nearly so (Bockstoce 1986; Bogoslovskaya et al. 1982).

Prey species identified from bowhead whale stomach contents have included crustacean zooplankton, particularly euphausiids and copepods ranging in length from 3 to 30 mm; and epibenthic organisms, mostly mysids and gammarid amphipods. Benthic species were relatively rare in bowhead stomach contents (Lowry 1993). The total estimated annual food consumption by the population in the EBS was calculated to be 18.1 x 10^3 mt, which includes a trace amount of fish (Perez and McAlister 1993). However, this assumes that 200 bowheads are present in the EBS in the summer (May-October), which is remarkably high given the lack of any sightings in this area other than in winter or during the migrations compared with 1,600 individuals who are present in the winter (November-April) (which is an underestimate if it is assumed that the entire population enters the Bering Sea each winter). The Western Arctic stock is estimated at 8,200 animals (International Whaling Commission 1997) and is increasing at a rate of 3.1 percent from 1978 to 1993, when abundance rose from approximately 5,000 to 8,000 whales (Raftery et al. 1995). The species is listed as endangered under the ESA.

No observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska exist (Hill and DeMaster 1999). However, there have been several cases of entanglements recorded. This included three harvested bowheads that had scars attributed to rope entanglements, one bowhead found dead entangled in ropes similar to those used with fishing gear in the Bering Sea, and one bowhead with ropes on it that were attributed to rigging from a commercial offshore fishing pot, most likely a crab pot. There have been two other recent reports of bowheads with gear attached or marks that likely were from crab gear (J.C.D. George, North Slope Borough, pers. comm.) Aerial photographs in at least two cases have shown ropes trailing from the mouths of bowheads (NMFS unpayable. data). No observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska exist (Hill and DeMaster 1999).

Blue whale. Blue whales (*Balaenoptera musculus*) in the North Pacific presumably migrate to sub-polar feeding grounds in spring and summer and to low latitudes in winter (Perry et al. 1999; Rice 1978; Tomilin 1967) ; however, there is some evidence that some whales remain in low latitudes year-round (Reilly and Thayer 1980). During the spring and summer months, blue whales are found in the Northeast Pacific, the GOA, along the Aleutian Islands and near the Kuril Islands and the Kamchatka Peninsula (Berzin and Rovnin 1966; McDonald et al. 1995; Murie 1959; Tomilin 1967). Blue whale range does not extend north of the Aleutian Islands, except rarely in the far southeastern corner of the Bering Sea (Rice 1998). Prey are mostly euphausiids (Nemoto 1970). Blue whales also eat copepods (Nemoto 1970; Thompson 1940; Tomilin 1967) and less frequently amphipods and squid (Mizue 1951; Thompson 1940). Estimates of total prey consumption are not available for this species.

Blue whales are listed as endangered under the ESA, and have been protected since 1966. Estimates of abundance in the North Pacific Ocean have ranged from 1,400 to 1,900 individuals (Nishiwaki 1966; Omura and Ohsumi 1974; Rice 1978; Tillman 1975), although these estimates are now considered outdated (Perry et al. 1999). More blue whales are thought to be distributed on the east side of the North Pacific than on the west side (Omura et al. 1955; Tomilin 1967), and there is increasing evidence that more than one stock exists within the North Pacific ocean basin (Perry et al. 1999). For example, blue whales that occur in summer off California, and in winter off Baja California and in the Gulf of California, may be a separate population numbering close to 2,000 whales (Barlow et al. 1995). There are no reliable estimates for blue whales in the GOA or southeastern Bering Sea.

Sei whale. Sei whales (*Balaenoptera borealis*) are found in all oceans, but remain in more temperate waters than other balen whales. They migrate long distances from low latitude winter areas to higher latitude summer grounds, but infrequently venture into cold, polar waters (Gambell 1976; Gambell 1985; Rice 1998). In the North Pacific, the summer range extends from southern California to the GOA on the east; across the North Pacific south of the Aleutian Islands, extending into the Bering Sea only in the southeastern corner of the deep southwestern Aleutian Basin; south to Japan on the west; and across the central Pacific north of the Subarctic boundary (Gambell 1985; Rice 1998). In the North Pacific, sei whales winter in waters between 20°N and 23°N latitude and summer from 35°N to 40-50°N (Masaki 1976). There is evidence, from catch data, of differential migration by reproductive class, with pregnant females leading the migration into and out of the feeding grounds (Masaki 1976). There is also evidence of segregation by age, with a higher proportion of older and larger sei whales in the higher latitudes (Gambell 1985). Sei whales are usually seen alone or in small groups, and the species does not appear to have a well-defined social structure (Tomilin 1957).

Adult sei whales reach a maximum length of 18.6 m in the North Pacific Ocean and females are larger than males (Gambell 1985). A maximum age of 60 years was determined by examination of annual growth layers formed in the earplug (Lockyer 1974). Sei whales reach sexual maturity between 5 and 15 years of age, and the mating season occurs during a 5-month period in the winter. Calves, born after a 12-month gestation period, are about 4.4 m in length. Weaning occurs on the summer grounds, when the calf is 6-9 months old and about 9 m in length. Adult females bear a calf every 2-3 years (Lockyer and Martin 1983; Mizroch et al. 1984; Rice 1977).

In the northern North Pacific, sei whales feed primarily on copepods when available (*Calanus cristatus, C. plumchrus, and C. pacificus*), but also on euphausiids, such as *Thysanoessa inermis* and *T. longipes*, small schooling fish, such as saury, and squid (Nemoto 1959; Nemoto and Kawamura 1977). Sei whales use both engulfing and skimming feeding strategies, depending on the type of prey, unlike other balaenopterids which feed by engulfing their prey (Nemoto 1959; Nemoto 1970; Perry et al. 1999).

The International Whaling Commission considers only one stock of sei whales in the North Pacific (Donovan 1991) for management purposes, although there is evidence that more than one stock exists (Horwood 1987; Masaki 1977). Using catch history and catch per unit effort data, Tillman (Tillman 1977) estimated that the population of sei whales in the North Pacific declined from about 42,000 in 1963 to 8,600 in 1974. For MMPA stock assessments, sei whales in the eastern North Pacific (east of 180°) are considered a separate stock, however, there are no abundance estimates for sei whales along the west coast of the U.S. or in the eastern North Pacific (Barlow et al. 1997).

NMFS observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1997, but no mortalities or serious injuries of sei whales were observed (Hill and DeMaster 1999). Sei whales are listed as endangered under the ESA. The eastern North Pacific stock is also considered a depleted and strategic stock under the MMPA (Barlow et al. 1997).

Northern right whale. Northern right whales (*Eubalaena glacialis*) are believed to range in the North Pacific from about 25° to 60°N, and are thought to move from subpolar regions to lower latitudes with the onset of winter (Cumming 1985; Rice 1998; Scarff 1986). A small group of right whales (< 10 animals) has been seen consistently in the EBS since 1996 (Goddard and Rugh 1998; Tynan 1999), with an additional sighting just south of Kodiak Island in the GOA in July 1998. Right whales feed primarily on at least three species of calanoid copepods and to a lesser extent on euphausiids (Klumov 1962; Omura et al. 1969). Tynan (Tynan 1999) sampled zooplankton near right whales seen in the EBS in July 1997 and report copepod species typical of the middle-shelf assemblage: *Calanus marshallae*, *Pseudocalanus newmani* and *Acartia longiremis*, which are smaller species than those upon which right whales fed historically (i.e., *C. plumchrus* and *C. cristatus*) in outer-shelf waters.

The northern right whale population exceeded 11,000 animals before commercial exploitation (NMFS 1991d). Historically, large concentrations of right whales occurred in the GOA (50-58°N, 140-152°W) in summer, but there is no evidence of population recovery there (Scarff 1986). Rice (Rice 1974) stated that only a few individuals remained in the eastern North Pacific stock, and that for all practical purposes was extinct because no sightings of a cow with calf had been confirmed since 1900. A reliable estimate of abundance for the North Pacific right whale stock is not available nor is there any estimate of population trend (Hill and DeMaster 1999).

Right whales are listed as endangered under the ESA and a recovery plan has been written (NMFS 1991c). In 1983, a right whale was reported to be incidentally killed in a gillnet in Russian waters (NMFS 1991c). Gillnets were also possibly responsible for the death of another right whale off the Kamchatka Peninsula in October of 1989 (Kornev 1994). No other incidental takes of right whales have occurred in the North Pacific. Any mortality incidental to commercial fisheries would be considered significant (Hill and DeMaster 1999).

3.2.4 Seabirds

Seabirds spend the majority of their life at sea rather than on land. The group includes the albatrosses, shearwaters, and petrels (*Procellariiformes*), cormorants (*Pelecaniformes*), and two families of the *Charadriiformes*: gulls (*Laridae*), and auks, such as puffins, murres, auklets, and murrelets (*Alcidae*). Several species of sea ducks (*Merganini*) also spend much of their life in marine waters and are included in this section. Other bird groups contain pelagic members such as swimming shorebirds (*Phalaropodidae*), but they seldom interact with groundfish fisheries and, therefore, will not be discussed further in this EIS.

Thirty-eight species of seabirds breed in Alaska. More than 1600 colonies have been documented, ranging in size from a few pairs to 3.5 million birds. The USFWS is the lead Federal agency for managing and conserving seabirds and is responsible for monitoring populations, both distribution and abundance. Breeding populations are estimated to contain 36 million individuals in the Bering Sea and 12 million individuals in the GOA; total population size (including subadults and nonbreeders) is estimated to be approximately 30 percent higher (Table 3.2.2). Five additional species occur in Alaskan waters during the summer months and contribute another 30 million birds.

Population trends are monitored at 3 to 14 colonies per species. The sizes of breeding populations of seabirds in the BSAI and GOA are not static. The number of seabirds breeding in Alaskan colonies since the original counts were made in the mid-1970s have changed considerably. Trends are reasonably well known for species that nest on cliffs or flat ground such as fulmars, cormorants, glaucous-winged gulls, kittiwakes, murres (Tables 3.2.3, 3.2.4, and 3.2.5), and for storm-petrels and tufted puffins. Trends are known for one or two small areas of the state for the pigeon guillemots, two areas for murrelets, and two areas for auklets. Trends are unknown at present for other species [jaegers, terns, most auklets, and horned puffins; (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999)]. Population trends differ among species. Trends in many species vary independently among areas of the state, due to differences in food webs and environmental factors.

Seabirds are characterized by low reproductive rates, low annual mortality, long life span, and delayed sexual maturity; such traits make populations extremely sensitive to changes in adult survival (Ricklefs 1990; Ricklefs 2000; Russell et al. 1999; Saether and Bakke 2000). Population trends can result from changes in either productivity or survival, but most trends that have been adequately investigated are attributed to changes in productivity. This may have more to do with the difficulty of obtaining long-term demographic data on seabirds than from a clear link between trends and productivity. Many seabirds have life-history traits that favor adult survival over reproductive effort (Russell et al. 1999; Saether and Bakke 2000). For this reason, Russell *et al.* (Russell et al. 1999) caution against relying on productivity studies to reach conclusions about population dynamics. For example, Weimerskirch *et al.* 1997 (cited and presented in Russell *et al.*(Russell et al. 1999) showed increased rate of decline in five populations of wandering albatrosses (*Diomedea exulans*) corresponding to local increases in long-line fishing effort. Furthermore, in long-lived animals, observable impact on the breeding population may take years or decades. One study modeled impacts of loss of juvenile wandering albatross from long-line bycatch, and estimated 5-10 years to detect the decline in breeding populations, and 30-50 years for population stabilization after measures were taken (Moloney et al. 1994).

A major constraint on breeding for seabirds is the distance between the breeding grounds on land and the feeding zones at sea (Weimerskirch and Cherel 1998). Breeding success in most species is variable among years, but in stable populations, poor success is compensated for by occasional good years (Boersma 1998; Russell et al. 1999). Fluctuations in fish stock recruitment are likely to affect the survival of adult seabirds and seabird reproduction differently. Adult seabird survival is unlikely to be affected by the common interannual variability of prey stock because adults can shift to alternative prey or migrate to seek prey in other regions. In contrast, breeding birds are tied to their colonies, and local fluctuations in fish recruitment can have a dramatic effect on seabird reproduction.

Table 3.2.2 Estimated populations and principal diets of seabirds that breed in the Bering Sea and Aleutian Islands and Gulf of Alaska regions.

Species	*Population* [1,2]		*Diet* [3,4]
	BSAI	*GOA*	
Northern Fulmar (*Fulmarus glacialis*)	1.500,000	600,000	Q,M,F,Z,I
Fork-tailed Storm-Petrel (*Oceanodroma furcata*)	4,500,000	1,200,000	Z,Q,C
Leach's Storm-Petrel (*Oceanodroma leucorrhoa*)	4,500,000	1,500,000	Z,Q
Double-crested Cormorant (*Phalacrocorax auritis*)[5]	9,000	8,000	F.I
Pelagic Cormorant (*Phalacrocorax pelagicus*)	80,000	70,000	S,C,P,H,F,I
Red-faced Cormorant (*Phalacrocorax urile*)	90,000	40,000	C,S,H,F,I
Brandt's Cormorant (*Phalacrocorax penicillatus*)	0	100	?
Pomarine Jaeger (*Stercorarius pomarinus*)	Common	Common	C,S
Parasitic Jaeger (*Stercorarius parasiticus*)	Common	Common	C,S
Long-tailed Jaeger (*Stercorarius longicaudus*)	Common	Common	C,S
Bonaparte's Gull (*Larus philadelphia*)	Rare	Common	?
Mew Gull (*Larus canus*) [5]	700	40,000	C,S,I,D
Herring Gull (*Larus argentatus*) [5]	50	300	C,S,H,F,I,D
Glaucous-winged Gull (*Larus glaucescens*)	150,000	300,000	C,S,H,F,I,D
Glaucous Gull (*Larus hyperboreus*)[5]	30,000	2,000	C,S,H,I,D
Black-legged Kittiwake (*Rissa tridactyla*)	800,000	1,000,000	C,S,P,F,M,Z
Red-legged Kittiwake (*Rissa brevirostris*)	150,000	0	M,C,S,Z,P,F
Sabine's Gull (*Xema sabini*)	Common	Common	?
Arctic Tern (*Sterna paradisaea*) [5]	7,000	20,000	C,S,Z,F
Aleutian Tern (*Sterna aleutica*)	9,000	25,000	C,S,Z,F
Common Murre (*Uria aalge*)	3,000,000	2,000,000	C,S,H,0,F,Z
Thick-billed Murre (*Uria lomvia*)	5,000,000	200,000	C,S,P,Q,Z,M,F,I
Pigeon Guillemot (*Cepphus columba*)	100,000	100,000	S,C,F,H,I
Marbled Murrelet (*Brachyramphus marmoratus*)	Uncommon	Common	C,S,P,F,Z,I
Kittlitz's Murrelet (*Brachyramphus brevirostris*)	Uncommon	Uncommon	S,C,H,Z,I,P,F
Ancient Murrelet (*Synthliboramphus antiquus*)	200,000	600,000	Z,F,C,S,P,I
Cassin's Auklet (*Ptychoramphus aleuticus*)	250,000	750,000	Z,Q,I,S,F
Least Auklet (*Aethia pusilla*)	9,000,000	50	Z
Parakeet Auklet (*Cyclorrhynchus psittacula*)	800,000	150,000	F,I,S,P,Z
Whiskered Auklet (*Aethia pygmaea*)	30,000	0	Z
Crested Auklet (*Aethia cristatella*)	3,000,000	50,000	Z,I
Rhinoceros Auklet (*Cerorhinca monocerata*)	50	200,000	C,S,H,A,F
Tufted Puffin (*Fratercula cirrhata*)	2,500,000	1,500,000	C,S,P,F,Q,Z,I
Horned Puffin (*Fratercula corniculata*)	500,000	1,500,000	C,S,P,F,Q,Z,I
Total	36,000,000	12,000,000	

[1]Source of population data for colonial seabirds that breed in coastal colonies: modified from [USFWS, 1998a #27] Estimates are minima, especially for storm-petrels, auklets, and puffins.
[2]Numerical estimates are not available for species that do not breed in coastal colonies. Approximate numbers: abundant $\geq 10^6$; common = 10^5-10^6; uncommon = 10^3-10^5; rare $\leq 10^3$.
[3]Abbreviations of diet components: M, Myctophid; P, walleye pollock; C, capelin; S, sandlance; H, herring; A, Pacific saury; F, other fish; Q, squid; Z, zooplankton; I, other invertebrates; D, detritus; ?: no information for Alaska. Diet components are listed in approximate order of importance. However, diets depend on availability and usually are dominated by one or a few items (see text).
[4]Sources of diet data: see species accounts in text.
[5]Species breeds both coastally and inland; population estimate is only for coastal colonies.

Table 3.2.3 Recent population trends of breeding Alaskan seabirds: fulmars, storm-petrels, cormorants, and gulls.

Location	Northern Fulmar	Storm-Petrels	Pelagic Cormorant	Red-faced Cormorant	Glaucous-winged Gull
Chukchi Sea			?		
N. Bering Sea	0		?		
Central & SE Bering Sea	0	+	+	0	?
Bristol Bay			0	--	?
W. Aleutian Islands		+	--	?	--
C. Aleutian Islands	?	0	?	?	?
E. Aleutian Islands		0	--	–	0
W. Gulf of Alaska	?	?	?	?	?
N. Gulf of Alaska		?	--	--	0
SE Alaska		+	+		0

Increase: +; Stable: 0; Decline: --; trend unknown: ?; Species not present: blank. Other notes: Trends are shown for the last 5 years, for species monitored over 4 or more years. See text for earlier trends. Each area covers about 500 km of coast and includes 1 or more monitoring sites. If trends vary among colonies in area, trend is shown for overall population of area. No information on trends exists for double-crested cormorants gulls other than glaucous-winged gull, or jaegers. Trends in albatrosses and shearwaters are described in text. For sources, see text.

Table 3.2.4 Recent population trends of Alaskan seabirds: kittiwakes, murres, and guillemots.

Location	Black-legged Kittiwake	Red-legged Kittiwake	Common Murre	Thick-billed Murre	Pigeon Guillemot
Chukchi Sea	0		+	+	
N. Bering Sea	0		0	--	?
Central & SE Bering Sea	0	0	+	0	?
Bristol Bay	0		0		?
W. Aleutian Islands	+	0	?	+	?
C. Aleutian Islands	0		?	?	?
E. Aleutian Islands	?		0	0	?
W. Gulf of Alaska	?		?	?	?
N. Gulf of Alaska	0		+		--
SE Alaska			--		?

Increase: +; Stable: 0; Decline: --; trend unknown: ?; Species not present: blank. Other notes: Trends are shown for the last 5 years, for species monitored over 4 or more years. See text for earlier trends. Each area covers about 500km of coast and includes 1 or more monitoring sites. If trends vary among colonies in area, trend is shown for overall population of area. No information on trends exists for terns or black guillemots. For sources, see text.

Table 3.2.5 Recent population trends of Alaskan seabirds: auklets, murrelets, and puffins.

Location	Least Auklet	Crested Auklet	Kittlitz's Murrelet	Marbled Murrelet	Tufted Puffin
Chukchi Sea			?		?
N. Bering Sea	?	?	?		?
Central & SE Bering Sea	?	?			?
Bristol Bay			?	?	?
W. Aleutian Islands	?	?	?	?	?
C. Aleutian Islands	--	0	?	?	?
E. Aleutian Islands	?	?	?	?	0
W. Gulf of Alaska	?	?	?	?	?
N. Gulf of Alaska			--	0	0
SE Alaska			?	?	?

Increase: +; Stable: 0; Decline: --; Trend unknown: ?; Species not present: blank. Other notes: Trends are shown for the last 5 years, for species monitored over 4 or more years. See text for earlier trends. Each area covers about 500km of coast and includes 1 or more monitoring sites. If trends vary among colonies in area, trend is shown for overall population of area. No information on trends exists for other auklets, ancient murrelet, rhinoceros auklet, or horned puffin. For sources, see text.

If food supplies are reduced below the amount needed to generate and incubate eggs, or the specific species and size of prey needed to feed chicks is unavailable, local reproduction by seabirds will fail (Hunt Jr. et al. 1996b). The natural factor most often associated with low breeding success is scarcity of food (Cairns 1992; Croxall and Rothery 1991; Furness and Monaghan 1987; Kuletz 1983; Murphy et al. 1984; Springer 1991b). Seabird populations therefore are usually limited by food availability (Croxall and Rothery 1991; Furness 1982).

Foraging ecology differs among seabird species. Diets consist largely of fish or squid less than 15 cm long, large zooplankton, or a combination of both. Most seabirds depend on one or a few species of prey in each area (Springer 1991b). Diets and foraging ranges are most restricted during the breeding season, when high-energy food must be delivered efficiently to nestlings, and are somewhat more flexible at other times of the year. Seabird species differ greatly from one another in their requirements for prey and feeding habitats and, consequently, in their response to changes in the environment. Winter foraging ecology is not known for most species (Hunt Jr. et al. 1999a). Seabird diets and foraging ecology are described below.

The availability of prey to seabirds depends on a large number of factors and differs among species and seasons. All species of seabirds depend on one or more oceanographic processes that concentrate their prey at the necessary time and place, such as upwellings, stratification, ice edges, fronts, gyres, or tidal currents (Coyle et al. 1992; Elphick and Hunt Jr 1993; Hunt Jr. 1990; Hunt Jr. 1997; Schneider et al. 1987; Schneider et al. 1990; Springer et al. 1999). Prey availability may also depend on the ecology of food species, including productivity, other predators, food-web relationships of the prey, and prey behavior, such as migration of fish and zooplankton. Once a prey is captured, its value depends on its energy content.

Many factors that influence prey availability are completely unknown, including stock size and fishery harvests. Access to prey is limited by each bird's foraging behavior and range, and by prey size, depth, and behavior. Prey availability and density within each seabird species' foraging range is likely a principal factor that determines whether seabird populations are stable, increasing, or declining.

Groundfish fisheries can impact seabird survival directly through incidental take in gear. Seabirds are caught in commercial fishing gear while attempting to seize baits or discards, or while pursuing their natural food in the vicinity of gear. The majority of seabird bycatch in Alaskan groundfish fisheries takes place on longline gear, but trawlers and pot gear also take birds. Some species of seabirds scavenge discards from floating and onshore processors. Such behavior may make them vulnerable to being caught in gear. Large-scale exploitation of an artificial food source also can cause a seabird population to increase, which can result in major shifts within the avian food web. The presence of vessel traffic in Alaskan waters imposes the risk of accidents that can affect seabirds, and this risk would be influenced by changes in the number of groundfish vessel-days-per-year. Among the threats to seabirds are oil and fuel spills from collisions, groundings, and routine operations. Another threat from vessels is the introduction of rats to nesting islands from groundings or via ports; rats are voracious predators on young birds and can reduce seabird populations severely. The impacts of the commercial fisheries is discussed in Chapter 4.

Seabird life history, population biology and foraging ecology

Northern Fulmar. Fulmars (*Fulmarus glacialis)* breed in Alaska from the Bering Sea to the GOA (USFWS 1998a). Ninety-nine percent of the Alaskan population resides in four colonies: Semidi Island, Chagulak Island, Pribilof Islands, and Saint Matthew and Hall islands (Hatch and Nettleship 1998). Populations in the Bering Sea have increased gradually over the past two decades [Table 3.2.3; (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999)]. One recent estimate indicates the fulmar population in the Pacific to be four to five million individuals. The estimated species population worldwide is 10 to 12 million individuals (Hatch and Nettleship 1998).

Fulmars forage from the continental shelf to beyond the continental shelf break, ranging over large areas of ocean 100 km or more from breeding colonies (DeGange and Sanger 1986; Gould et al. 1982; Hatch 1993; Hunt Jr. and Eppley 1981b; Schneider and Hunt Jr 1984; Schneider et al. 1986). The foraging range is potentially large as they depart from the colony every four to five days on foraging trips, both before egg-laying and during incubation (Hatch and Nettleship 1998). They disperse throughout ice-free Alaskan waters and in the North Pacific in winter (Gould et al. 1982; Shuntov 1993). Food is taken from the water surface or just beneath it, including at night when pelagic prey migrate close to the surface (Hatch 1993; Schneider et al. 1986). Fulmars probably do much of their foraging at night, and may use olfactory cues in locating food by their sense of smell which is highly developed (Hatch and Nettleship 1998). During the summer, prey include squid, myctophids, other fish (including juvenile pollock in the Pribilof Islands), zooplankton, jellyfish, and other invertebrates (Ainley and Sanger 1979; Baird 1990; DeGange and Sanger 1986; Gould et al. 1997; Hatch 1993; Hunt Jr. et al. 1981a; Sanger 1986; Schneider et al. 1986). Fulmars also feed on debris from fishing and processing-at-sea when available (Furness and Ainley 1984). Fulmars obtain food by dipping, surface-seizing, surface-plunging, pursuit-diving (uncommon method, probably only used by food-stressed individuals), and scavenging. They are apparently unable to pick up prey while on the wing. Prey (mesopelagic fish, squid, and crustaceans available in surface waters only at night) and daily activity patterns (evening departures, morning arrivals at colonies) indicate the importance of nighttime foraging, at least at lower latitudes (Hatch and Nettleship 1998). Night feeding has been directly observed in the Bering Sea. Night sets during experimental tests of seabird mitigation measures showed significant increases of fulmar bycatch[2].

Storm-petrels. Two species of storm-petrels breed in Alaska: Leach’s storm-petrel (*Oceanodroma leucorhoa*) and the fork-tailed storm-petrel (*O. furcata*). Both breed on islands from the western Aleutian Islands through the GOA, but not farther north (USFWS 1998a). Most species are active at the colony

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only at night, and often stay at sea on moonlit nights (Boersma and Groom 1993). Populations are increasing in the Aleutian Islands and southeast Alaska [Table 3.2.3; (Byrd et al. 1998; Byrd et al. 1999)].

Storm-petrels forage at distances of more than 100 km from breeding colonies and typically forage over the shelf edge and deep water (Springer et al. 1999). Fork-tailed storm-petrels most typically forage over the outer shelf and adjacent ocean. This species has also been observed feeding on the southeast Bering Sea shelf near the Slime Bank area and also large groups feeding in Resurrection Bay coming out of Seward[3]. Leach's storm-petrels forage from the shelf-break seaward (Ainley and Sanger 1979; Gould et al. 1982; Hunt Jr. et al. 1981a; Schneider et al. 1986). Storm-petrels winter over the deep ocean, including the Bering Sea basin (Shuntov 1993). Storm-petrels seize prey from the surface of the water and also forage at night. They have well-developed olfactory systems and find their food and perhaps their nest site by odor (Boersma and Groom 1993). Storm-petrels feed on small fishes, particularly juvenile lanternfishes , squids, and euphasiids (Springer et al. 1999), but in some areas the fork-tailed storm-petrel may depend on small fish such as capelin (Ainley and Sanger 1979; Baird and Gould 1986; Sanger 1986).

The key to population stability in storm-petrels appears to be their high adult survivorship. Any perturbations that greatly depress storm-petrels' low reproductive output could lead to population decline, particularly if lowered output results in low recruitment into the adult life stage. Threats that severely reduce adult survivorship or greatly lower reproductive success have the potential to cause storm-petrel populations to decline (Boersma and Groom 1993).

Albatrosses. The three North Pacific albatrosses are Laysan's (*P. immutabilis*), black-footed (*P. nigripes*), and short-tailed (*P. albatrus*). All three breed in the subtropics during winter: Laysan's and black-footed albatross breed in the northwestern Hawaiian Islands and short-tailed albatross breed primarily on the island of Torishima in Japan. Albatrosses spend the summer (approximately May through September) in Alaskan waters, although some nonbreeding birds may be encountered at any time. Laysan's albatross occur from Japan to North America, and from the southern Bering Sea to the Hawaiian Islands (Shuntov 1972). In Alaska, Laysan's albatrosses are most abundant in the western Aleutian Islands, black-footed albatross are most abundant in the GOA. Satellite telemetry studies on the foraging destinations of Laysan's and black-footed albatrosses from their primary breeding colonies in the northwestern Hawaiian Islands (NWHI) (Midway Atoll in particular) corroborate this pattern of Laysan's traveling further north to the Aleutian Islands area and black-footed albatrosses foraging in waters to the south, in the GOA and off the western coast of the United States.[4] Trends in the nonbreeding part of the populations (primarily subadults) are unknown. This is a problem for all seabird species, but it is especially serious for albatrosses, for which approximately one-half the population is nonbreeding.

Numerous studies have noted that Laysan's albatross are more frequently observed at and seaward of the continental slope, over areas of strong, persistent upwelling, and at the boundaries between different water masses (review in (McDermond and Morgan 1993). The preferred habitats of Laysan albatrosses may in part be related to food distribution. Given that Laysan's albatross feed more predominantly on squid and that squid distribution may in turn be determined by the distribution and abundance of euphausiids, it has been suggested that it is the restriction of large euphausiids to cold waters that determines the southern limits of Laysan albatrosses (McDermond and Morgan 1993)). The Laysan's

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albatross is the most numerous of the North Pacific albatrosses with a worldwide population of approximately two and a half to three million birds (Gales 1998). Given the relative abundance of this species, compared to other species of albatross, its status is generally considered to be relatively secure. However, of the 16 breeding sites documented for the species, two populations, representing 93 percent of the total breeding stock, are known to be decreasing (Gales 1998). Since the 1970s, the Laysan's albatross has greatly expanded its presence in the southeastern Bering Sea; prior to then, it was highly unusual to encounter a Laysan's albatross in the Bering Sea, and most sightings occurred over the Basin[5]. At present, Laysan's albatrosses are regularly encountered in and north of the passes through the Aleutian Islands, over the shelf north of the Alaska Peninsula, and along the shelf break up at least as far as the Pribilof Islands, meaning that these birds are likely to be attending even more vessels than may have been the case previously[6]. Various threats may affect the Laysan's albatross but since the cessation of widespread harvesting of eggs and adults over 100 years ago, and the end of the intensive control programs of the U.S. military, mortality associated with fishing interactions represent the most recent and potentially significant threat to the species (Gales 1998).

The maximum range limits of the black-footed albatross are the coasts of China, Japan, and Russia east to continental North America; and from the Sea of Okhotsk and the Bering Sea southwards to about 18°N and occasionally to 10°N in the central Pacific (Shuntov 1972). Although the central Pacific is considered to be the preferred wintering area for nonbreeding adults, low numbers of black-footed albatrosses are found in the eastern temperate North Pacific throughout the entire winter as far north as 55°N (McDermond and Morgan 1993). Black-footed albatrosses are more abundant over the outer continental shelf, especially at the shelf break, than elsewhere. Areas with strong, persistent upwelling, or the boundaries of different water masses are also favored and their concentration over the continental slope may in part be a result of the distribution of fishing vessels (McDermond and Morgan 1993). The current world population of black-footed albatrosses is approximately 240,000 to 290,000. The major populations are either decreasing or of unknown status. Five of the nine Hawaiian populations (representing 47 percent of the world population) are decreasing, the others of unknown status (Gales 1998). In addition to past disturbances at breeding colonies and high levels of take in the now closed North Pacific high seas driftnet fisheries, recent threats to the black-footed albatross population include plastic ingestion, exposure to contaminants, and mortality from fishery interactions (Cousins and Cooper submitted). Noting the reported rates of decline in many of the NWHI breeding colonies (where 96 percent of the world population of black-footed albatross resides), Croxall and Gales (Croxall and Gales 1998) assigned vulnerable status to the species under the World Conservation Union (IUCN) criteria.

Relatively little is known about the seasonal movements or the factors determining the marine distribution of the short-tailed albatross (McDermond and Morgan 1993). It is believed that the species was formerly common off China, in the Japan Sea, the Sea of Okhotsk, the Bering Sea north to the Bering Strait, and throughout the entire temperate North Pacific from Alaska to Baja California (McDermond and Morgan 1993; USFWS 1998b). Areas of high productivity, such as along the Pacific coast of North America, in the Aleutians, and the Bering Sea, were favored (Hasegawa and DeGange 1982). The USFWS currently maintains a short-tailed albatross sightings database that contains sightings from as early as 1905 to the present. A brief summary of the sightings database follows: 655 sightings records; sightings reported as far south as 19°N (off Mexico), as far north as 60°N, as far west as 134°E (off Japan), and as far east as 107°W (off Mexico); over 90 percent of the records are of sightings of 1 or 2 birds (mostly single birds)

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and these sightings have been reported in all months of the year; as many as 40 short-tailed albatross were estimated in one sighting record and most of the multiple sightings records occur in the month of September. Six times as many sightings are reported from fishing vessels as from research vessels, the next highest type of vessel reporting sightings; and for those sightings records that include age(s) of the bird sighted, four times more non-adults (juvenile, immature, sub-adult) than adults were sighted. Recent sightings indicate short-tailed albatrosses frequenting areas around the Pribilof Islands and the western Aleutian Islands[78].

The short-tailed albatross is listed as endangered under the ESA. Its population was drastically reduced early in the century by commercial harvest (Hasegawa and DeGange 1982) and now numbers only about 600 breeding birds; the total population probably is about 1300 [9]. Based on egg counts from 1980 to 1998, the population on Torishima Island in Japan (the main breeding site) is increasing at an annual rate of 7 to 8 percent[10]. Although the short-tailed albatross population is increasing, it is still extremely vulnerable because of its small size and the fact that it breeds on only two islands[1], one of which is an active volcano.

Cephalopods play a major role in the diets of nine albatross species investigated, including the Laysan's and black-footed albatross (Cherel and Klages 1998). The squid families Ommastrephidae and Onychoteuthidae are the most important cephalopods in the diets of albatrosses, although the species of ommastrephids eaten by Laysan's and black-footed albatrosses are poorly known. All three albatrosses forage along the edge of the continental shelf because their prey are abundant in upwellings there. Short-tailed albatrosses also forage on the outer shelf. Few observations have been published of Laysan's and black-footed albatrosses feeding in the wild other than by scavenging near vessels and in association with the highseas driftnet fisheries. Both species have been reported to take food in the upper one meter of the ocean by surface seizing, contact dipping, and scavenging (Gould et al. 1998). All three species seize prey from the surface, or just below it, while sitting on the water. Laysan's and black-footed albatrosses feed on myctophids, squid and other invertebrates, and fish. In one study of the food habits and driftnet fisheries associations of non-breeding Laysan's and black-footed albatrosses prior to the cessation of the driftnet fisheries in 1992, fishes were more numerous than squids in the diets of non-breeding Laysan's while squids were more important than fishes in the diets of non-breeding Black-footed albatrosses (review in Gould, 1998). This differs from a study of the diet components of chicks and breeding birds in Hawaii where squid was the main component of the diets fed to Laysan's chicks while fish (primarily fish eggs) was the main component of the diet of black-footed chicks (Harrison et al. 1983).

The breeding status and association of albatrosses with fisheries (i.e. availability of an additional food source) appear to effect prey choice. Short-tailed albatross take similar foods and may also forage at night (Sherburne 1993). Laysan's albatrosses have better night vision, longer bills, and longer but lighter bodies than black-footed albatrosses. Laysan's albatross may be more capable than black-footed albatrosses of rapid retrieval of small prey that are active in surface waters at night. The heavier and more

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compact black-footed albatrosses, with their shorter, stockier bills, may be better adapted to scavenging naturally-occurring large carrion or refuse from ships (Gould et al. 1998). All three albatrosses are attracted to debris behind fishing vessels and processors and are vulnerable to being caught by longlines Designations as diurnal or nocturnal feeders are indirect and based primarily upon composition of the diet. The diet needs critical re-examination, in the absence of driftnet fishing, as does their designations as diurnal or nocturnal feeders.

Satellite tagging and telemetry studies are increasingly being used to determine albatross foraging areas in the southern hemisphere (review in (Gremillet et al. 2000)). One species, the black-browed albatross, relies on the marine resources of the Patagonian Shelf area, a highly productive continental shelf that has experienced a rapid development of commercial fisheries. Significant spatial-temporal overlap occurs between human and albatross fishing activities within the Patagonian shelf. Potential detrimental effects on the albatross population could be competition for food and additional longline mortality (Gremillet et al. 2000). In 1989 and 1999, satellite telemetry studies were initiated to determine the spatial distribution of 54 breeding Laysan and black-footed albatrosses nesting in the NWHI and Kilauea Point National Wildlife Refuge. Both species mixed short foraging trips near the nesting island with much longer trips, trackings being made during the months of January to June. Laysan albatrosses traveled primarily to the north on long trips, frequently reaching the Aleutian Islands and GOA. Long trips of black-footed albatrosses typically ended on the coasts of California, Oregon, and Washington State (Anderson et al. 2000). Thus, based on satellite telemetry data, breeding Laysan's albatrosses are known to forage in waters off Alaska. It is possible that breeding black-footed albatross may forage as far as Alaska also.

In its Biological Opinion on the effects of the Pacific halibut fishery off Alaska, the USFWS (USFWS 1998c) recognized that changes in the Bering Sea trophic system have been implicated in the decline of several marine species. USFWS found it impossible to determine whether indirect take of short-tailed albatrosses was resulting from ecosystem perturbations caused by the fishery. Because the population on Torishima Island appears to be increasing at near maximum biological potential, it seems that the species is not limited by food quantity or quality.

A better understanding of the feeding preferences and foraging habits of these species, along with a better knowledge of their distribution at sea, is necessary in order to understand and predict fishery impacts[11].

Shearwaters. Short-tailed (*Puffinus tenuirostris*) and sooty (*P. griseus*) shearwaters breed in the Southern Hemisphere, the former in southeastern Australia and Tasmania and the latter in New Zealand and also in Chile along the South American coast. Both short-tailed and sooty shearwaters visit Alaskan waters from May through September. Sooty shearwaters range primarily south of the Aleutian Islands and in the GOA, and short-tailed shearwaters are found in the Bering and Chukchi seas as well as the GOA (Gould et al. 1982; Hunt Jr. and Eppley 1981b). An overall decreasing trend in sooty and short-tailed shearwater abundance at colonies has occurred over the past 20 to 30 years[12]. The mechanism(s) for these declines have yet to be understood. Numerous potential causes have been identified: fisheries bycatch, overfishing of important seabird prey species, climatic anomalies such as El Nino events disrupting marine foodwebs, and long-term harvesting of chicks. These are potentially cumulative impacts that could decrease these seabird populations (Lyver et al. 1999). Three different time series of

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pelagic bird abundance collected in disparate portions of the California Current revealed a 90 percent decline in sooty shearwater abundance between 1987 and 1994 and the decline was negatively correlated with a concurrent rise in sea-surface temperatures (Veit et al. 1997; Veit et al. 1996). The widely-separated surveys suggest that this population change is occurring at a global scale in the sense that the worldwide population of sooty shearwaters seems likely to have been affected. The populations of these two species in Alaskan waters in summer account for over 50 percent of all seabirds combined (Sanger and Ainley 1988).

Shearwaters in the southeastern Bering Sea have in the past consumed a large biomass of euphausiids. Recent evidence (Baduini et al. 2000) suggests that, since 1997, short-tailed shearwaters over the southeastern Bering Sea shelf have been taking increasing amounts of fish. Inshore of the inner front, sand lance is taken, whereas most foraging flocks offshore of the inner front were focused on age-0 gadids, most likely pollock. This apparent dependence on age-0 pollock may occur when euphasiids are scarce over the middle domain (Hunt Jr. et al. 1999a).

Short-tailed shearwaters occasionally "die" off in large numbers during late summer, apparently due to widespread scarcity of prey during anomalous oceanographic conditions. The recent large-scale die-off of short-tailed shearwaters suggests that these birds are vulnerable to changes in the abundance or availability of their preferred foods in the southeastern Bering Sea (Vance et al. 1998). Changes in water temperature or productivity may influence the abundance of euphausiids either directly, through bottom-up effects, or indirectly through changes in the distribution of predators that compete with shearwaters for euphausiids. When euphausiids are scarce, shearwaters can use age-0 pollock, if they are present in high concentrations. Shearwater use of age-0 pollock may need to be considered in future management decisions[13]. Major die-offs were recorded in Alaska in 1983, 1986, and 1997[2] (Baduini et al. 1998; Hatch 1987; Irons et al. 1986; Mendenhall et al. 1998; Nysewander and Trapp 1984). In 1997, a die-off of short-tailed shearwaters was estimated at 11 percent of the population surveyed and the birds apparently died of starvation (Baduini et al. 2000). This estimate was based on a count of floating carcasses in the southeast Bering Sea as a percent of the population surveyed. In 1998, anomalous climate conditions were repeated for a second consecutive year, with elevated heat content of the water, cross-shelf advection of zooplankton and larval fish, major changes in the structure of the zooplankton community, and an unprecedented second observation of a large scale bloom of a coccolithophorid phytoplankton (Hunt Jr. et al. 1999a). Although no unusual mortality of short-tailed shearwaters was seen, birds were underweight. In both years, shearwater diets were broader than in previous years, with fish becoming a dominant prey in 1998. Major changes in the components of the zooplankton community will be likely to affect other higher trophic level species including fish and whales (Hunt Jr. et al. 1999a).

Both shearwaters forage on the surface and dive to at least 60 m (Weimerskirch and Cherel 1998; Weimerskirch and Sagar 1996). The short-tailed shearwater eats primarily large euphausiids and some jellyfish and small schooling fish (Marchant and Higgins 1990). Diets of short-tailed shearwaters in spring varied by region in the western Subarctic. Fish were the most important items everywhere except the Western Subarctic Current and West Wind Drift, where squid dominated (Springer et al. 1999). The fish species consumed were mostly juvenile *Pleurogrammus* spp. and small-sized lanternfishes (Myctophidae). Euphausiids, squid, and copepods ranked second, third, and fourth, respectively, in weight as components of their diet (Springer et al. 1999). The diets of short-tailed shearwaters in the western Subarctic apparently reflect the availability of prey species rather than dietary preferences, since elsewhere, (e.g., Sea of Okhotsk and Bering Sea) other prey predominate (Ogi et al. 1980). Shearwaters

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depend on areas where prey are concentrated by upwellings, convergences, or features of the bottom terrain, especially along the Inner Front (Hunt Jr. and Eppley 1981b; Hunt Jr. et al. 1996c; Schneider et al. 1986). Sooty shearwaters eat primarily small schooling fish, such as Pacific saury and myctophids and the movements of shearwaters is believed to coincide with the movements of the sauries (Ogi 1984). Sooty shearwaters forage on squid on the outer shelf and shelf break (DeGange and Sanger 1986) and with increasing prominence at higher latitudes (Ogi 1984).

Cormorants. Four species of cormorants breed in Alaska. The pelagic cormorant (*Phalacrocorax pelagicus*) breeds on all coasts of the state of Alaska, the red-faced cormorant (*P. urile*) west of Prince William Sound, and the double-crested cormorant (*P. auritus*) in the Aleutian Islands and GOA. Brandt's cormorant (*P. penicillatus*) primarily breeds south of Alaska but has two small colonies in southeastern Alaska and one near the entrance to Prince William Sound (USFWS 1998a); it is not described further here. Populations are difficult to monitor because birds move frequently among colonies. Pelagic cormorant numbers are stable or increasing in Bristol Bay, the central Aleutian Islands, and southeast Alaska, but declining at other sites in the Aleutian Islands and the northern GOA. Red-faced cormorants are stable or increasing in the Pribilof Islands and central Aleutian Islands but are declining in Bristol Bay, part of the Aleutian Islands, and the northern GOA [Table 3.2.5; (Byrd and Dragoo 1997; Byrd et al. 1998)].

Cormorants usually range within 20 km of shore (Schneider and Hunt Jr 1984); winter distributions are similar except that birds move to ice-free coasts. Cormorants forage by diving as deep as 40 m (DeGange and Sanger 1986). All species of cormorants specialize on some combination of small schooling or non-schooling fish, such as capelin, sand lance, and demersal or bottom-dwelling species and crustaceans. The pelagic cormorant consumes minor amounts of juvenile pollock (Siegel-Causey and Litvinenko 1993).

Jaegers. The three species of jaegers, *(Stercorarius longicaudus, S. parasiticus,* and *S. pomarinus*), forage on shore during the summer and are primarily present in Alaskan marine waters during their spring and fall migrations. Jaegers winter in the Southern Hemisphere. Population trends for jaegers are unknown. The principal marine foods for jaegers are small schooling fish such as capelin and sand lance, most caught by themselves, with some taken from other seabirds while in the air (Gabrielson and Lincoln 1959; Sanger 1986)

Gulls. Seven species of gulls are common in Alaska. Two large species are common at sea in all seasons: the glaucous gull (*Larus hyperboreus*) and glaucous-winged gull (*L. glaucescens*). Glaucous gulls breed from Bristol Bay northwards, and glaucous-winged gulls breed from the central Bering Sea southeastwards. Herring gulls (*L. argentatus*) are also present locally near the Bering Straits and in the GOA. The principal small gulls in Alaskan waters are the mew gull (*L. canus*) and Bonaparte's gull (*L. philadelphia*) south of the Bering Strait, and Sabine's gull (*Xema sabini*) from Bristol Bay northwards (USFWS 1998a). Glaucous-winged gulls are monitored in some areas; they are declining in the western Aleutian Islands but are stable or increasing in the eastern Aleutian Islands, northern GOA, and southeastern Alaska [Table 3.2.5; (Byrd et al. 1998)]. Large gulls may increase locally near fish processors and dumps (Patten Jr. and Patten 1982).

Gulls forage both nearshore and at the shelf edge during the summer, and food is also taken onshore when available. In winter, most gulls disperse across the shelf from the ice edge to the deep ocean (DeGange and Sanger 1986; Gould et al. 1982; Schneider et al. 1986; Shuntov 1993). A variety of prey are taken from the surface of the water or ground, including small schooling fish such as capelin, sand lance, herring, and invertebrates. In addition, detritus is scavenged where available, as well as naturally-occurring carrion and discards at fish processors and dumps (Baird and Gould 1986; Furness and Ainley

1984; Murphy et al. 1984; Patten Jr. and Patten 1982). Large gulls also prey on eggs and young of waterfowl and seabirds (Baird and Gould 1986; Bowman et al. 1997; Swartz 1966). Gulls are attracted to baits and discards behind fishing vessels, which exposes them to the risk of incidental take and entanglement.

Kittiwakes. Kittiwakes are small gulls that are specialized for pelagic feeding. The black-legged kittiwake (*Rissa tridactyla*) breeds throughout Alaska except for the southeast; the red-legged kittiwake (*R. brevirostris*) is restricted to four colonies in the BSAI (USFWS 1998a).

Kittiwake population trends differ among regions of the state (Hunt Jr. and Byrd Jr. 1999). Populations of both species on the Pribilof Islands declined steeply after 1976 (the year when monitoring began); red-legged kittiwakes declined to approximately half their original numbers. Although, as of 1997, it appears that kittiwake populations on Saint George Island have stabilized, it is not clear that the population of either species of kittiwake (particularly red-legged) on Saint Paul Island has stabilized (Hunt Jr. and Byrd Jr. 1999). These species appear to depend on fatty species of forage fish as well as age-0 and age-1 pollock for successful reproduction (Hunt Jr. et al. 1996b). The abundance of capelin and age-1 pollock near the Pribilof Islands has declined dramatically since the mid-1970s (Hunt Jr. et al. 1996c). Trends in the populations of myctophids and sand lance are not known. In contrast, both species have increased steadily in the western Aleutian Islands (Agattu and Buldir colonies) until the present. Black-legged kittiwakes are stable or increasing in the northern Bering Sea (Bluff colony), Aleutian Islands, and parts of the northern GOA; however, populations are declining in Cook Inlet, Kodiak Island, and parts of Bristol Bay [Tables 3.2.4 and 3.2.5; (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999)]. Declines and population shifts have been ascribed to lack of sufficient food during the breeding season (Hunt Jr. and Byrd Jr. 1999; Springer et al. 1986; Suryan et al. 1998b). Furthermore, it has been hypothesized that the failure of the seabird populations on the Pribilof Islands to show enhanced reproductive performance subsequent to the reduction of breeding populations suggests that the carrying capacity of the southeastern Bering Sea declined for seabirds in the early 1980s and was reset at a new, lower, level than had existed in the mid-1970s. Because kittiwake populations were apparently only affected at the Pribilof Islands, the mortality must have occurred when birds would have been near their colonies (Hunt Jr. and Byrd Jr. 1999).

Black-legged kittiwakes occasionally “die off” in large numbers during late summer, apparently due to widespread scarcity of prey at the surface during anomalous oceanographic conditions. Major die-offs were recorded in Alaska in 1983 and 1997 (Hatch 1987; Mendenhall et al. 1998; Nysewander and Trapp 1984). It has recently been hypothesized that the declines in both species of kittiwakes and thick-billed murres at Saint Paul and Saint George Islands were caused by large die-offs of adults from these populations (Hunt Jr. and Byrd Jr. 1999).

The red-legged kittiwake is a Species of Management Concern for the USFWS, because 80 percent of its worldwide population nests in only one colony, Saint George Island, and because its recent severe decline has not been explained (USFWS 1995a).

Black-legged kittiwakes forage over the entire continental shelf and shelf break: red-legged kittiwakes forage from the shelf break seaward; the foraging range during the breeding season is 100 km or more (Hatch 1993; Schneider and Hunt Jr 1984; Schneider et al. 1986). Both also forage locally near the coast if schooling prey are available (Schneider et al. 1990; Suryan et al. 2000; Suryan et al. 1998b). Black-legged kittiwakes require a shelf several tens of kilometers wide and are few or absent in colonies with a very narrow shelf (Byrd and Dragoo 1997; Springer et al. 1996). Black-legged kittiwakes winter over the shelf and deep ocean (Gould 1983; Shuntov 1993); the wintering area of the red-legged kittiwake is completely unknown. Prey are taken at the surface or by dives within a meter of the surface. Both consume small schooling fish and zooplankton, relying primarily on fish when feeding their young.

The principal fish prey of black-legged kittiwakes are capelin and sand lance, herring or small cods in some locations, and myctophids, as well as juvenile pollock in the central Bering Sea. Black-legged kittiwakes also consume processing wastes in the North Sea when larger seabirds are not numerous near vessels (Furness and Ainley 1984). Little is known about scavenging by this species in Alaska. Red-legged kittiwakes consume the same fish but with more emphasis on myctophids and zooplankton (Hatch et al. 1993; Hunt Jr. et al. 1998; Sanger 1987a; Springer et al. 1984; Springer et al. 1986). Myctophids (Hatch 1993), and probably zooplankton, are taken primarily at night.

Capelin and sand lance vary greatly in availability among years, and breeding success in most areas is correlated with abundance of one or the other species in the diet (Baird and Gould 1986; Baird 1990; Springer et al. 1987; Troy and Baker 1985). Similarly, the availability of juvenile herring affects kittiwake foraging efforts and breeding success in Prince William Sound (Suryan et al. 2000). For kittiwake colonies in areas of low productivity, the availability of all three forage species (capelin, sand lance, herring) may be important to maintaining productivity (Suryan et al. 2000). Consumption of juvenile pollock, although prominent in the Pribilof Islands area kittiwake diets in some years, results in slower chick growth than other principal forage fish, which have a higher energy content (Romano et al. 1998). Black-legged kittiwakes scavenge discards behind vessels to some extent. Winter diets are poorly known; both species probably rely more on invertebrates in winter than when feeding young (Hatch 1993).

Terns. Arctic (*Sterna paradisaea*) and Aleutian (*S. aleutica*) terns breed in all marine regions of Alaska (USFWS 1998a). The Arctic tern migrates to the sub-Antarctic for the winter. The wintering grounds of the Aleutian tern are at sea, although the location is unknown. Populations are not monitored in Alaska. Terns forage in coastal waters within a few miles of their colonies. They feed on the surface or just beneath it on small schooling fish (capelin, sand lance) and zooplankton; fish are essential when terns are feeding their young (Baird and Gould 1986; Baird 1990; DeGange and Sanger 1986; Hunt Jr. et al. 1981a).

Murres. Common murres (*Uria aalge*) breed in all marine regions of Alaska; thick-billed murres (*U. lomvia*) are found primarily in the Aleutian Islands, Bering Sea islands, and north of the Bering Strait (USFWS 1998a). Birds from colonies north of the Bering Strait winter in the central Bering Sea (Hatch et al. 1996; Shuntov 1993).

Murre population trends differ among regions. Both species are monitored together in some areas. Common murres have increased steadily until the present in the Chukchi Sea and on Saint George Island (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999). Elsewhere in most of Alaska, common murres decreased at one time or another during the 1980s but now appear stable or no overall trend; this includes the northern Bering Sea, Saint Paul Island, Bristol Bay, and eastern Aleutian Islands (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999; Murphy et al. 1986). Trends vary among sites in the GOA; (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999). Thick-billed murres have increased north of the Bering Strait and in the western Aleutian Islands. They decreased throughout the Pribilof Islands in the 1980s but are now stable or increasing. Thick-billed murres are decreasing in the northern Bering Sea (Byrd and Dragoo 1997; Byrd et al. 1998; Byrd et al. 1999)].

Common murres occasionally “die off” in large numbers during winter and early spring, apparently due to widespread scarcity of prey during anomalous oceanographic conditions. Major die-offs were recorded in Alaska in 1970, 1993, and 1998[3] (Bailey and Davenport 1972; Mendenhall et al. 1998; Piatt and van

Pelt 1997). It has recently been hypothesized that the declines in both species of kittiwakes and thick-billed murres at Saint Paul and Saint George islands were caused by large die-offs of adults from these populations (Hunt Jr. and Byrd Jr. 1999).

Murres forage over the continental shelf, particularly in small areas where benthic terrain features, currents, or upwellings create local prey concentrations. Unusually high concentrations of both species of murres are known to regularly forage on euphausiids over a submarine ridge on the east side of Saint George Island (Coyle et al. 1992). In the southeastern Bering Sea in April, thick-billed murres concentrated in the outer shelf zone, an area characterized by pelagic fauna; common murres were more commonly found inshore of the middle front (Woodby 1984). The euphausiids may have been concentrated on the ridge by a combination of their diurnal vertical migration behavior and tidal advection. Whatever the mechanism, a substantial portion of the resident murre population forages here. Thus these sites are important sources of energy for the nearby breeding colonies (Coyle et al. 1992). Thick-billed murres also forage over the outer shelf and shelf edge (Decker and Hunt Jr. 1996; Hunt Jr. et al. 1981d; Kinder et al. 1983; Schneider et al. 1990; Schneider and Hunt Jr 1984; Schneider et al. 1986; Shuntov 1993). Common murres require a shelf at least several tens of kilometers wide and are few or absent in colonies with a very narrow shelf; in contrast, thick-billed murres tend to occupy areas near a shelf edge, although they also breed in a few northern colonies on broad shelves (Byrd and Dragoo 1997; Springer et al. 1996; USFWS 1998a). Common murres have a foraging range of approximately 50 to 80 km. Thick-billed murres range up to 100 km; and dive as deep as 200 m (Bradstreet and Brown 1985; Hatch et al. 1996; Piatt and Nettleship 1985; Schneider and Hunt Jr 1984). They are highly dependent on densely-schooling prey (Cairns 1990; Mehlum et al. 1996; Piatt 1990). Common murres consume small fish, especially energy-rich species such as capelin and sand lance; other diet components include some zooplankton, juvenile pollock in the central Bering Sea, and small cods in northern regions. Thick-billed murres eat the same fish, in addition to myctophids, and larger numbers of zooplankton and other invertebrates than do common murres (Elliott et al. 1990; Hunt Jr. et al. 1981a; Sanger 1987b; Schneider et al. 1990; Vermeer et al. 1987). Thick-billed murres nesting in the western Aleutian Islands feed primarily on squids (Springer et al. 1996).

Guillemots. The pigeon guillemot (*Cepphus columba*) breeds in most marine areas of Alaska south of the Bering Strait. The black guillemot (*C. grylle*) breeds north of the Bering Strait (USFWS 1998a) and winters in the Bering Sea. Populations are monitored only for pigeon guillemots in the northern GOA, where the population has declined over the past two decades, possibly due to reductions in prey availability (Hayes and Kuletz 1997). However, their nearshore, benthic foraging behavior and tendency to socialize on intertidal rocks also makes them susceptible to oil spills (Oakley and Kuletz 1996).

Guillemots forage in coastal waters during the breeding season within 10km of the colony (Ewins et al. 1993; Golet et al. 2000). Pigeon guillemots winter in ice-free coastal waters; black and some pigeon guillemots winter at sea in and near the pack ice (Ewins et al. 1993; Shuntov 1993). Black guillemots dive to approximately 50 m (Piatt and Nettleship 1985) and pigeon guillemots up to 45 m (Ewins et al. 1993). The foraging ecology of pigeon guillemots has been studied in detail in Prince William Sound. The diet is diverse and includes small schooling fish such as capelin, sand lance, and herring, as well as bottom-dwelling fish and invertebrates (DeGange and Sanger 1986; Golet et al. 2000; Kuletz 1983). Benthic fish are a reliable food source but support only modest reproductive success. Schooling fish allow higher reproductive success (because their abundance and energy content are higher), but their availability fluctuates in time and space (Golet et al. 2000; Kuletz 1983). Pigeon guillemot chick growth and reproductive success (Golet et al. 2000) and population trends (Hayes and Kuletz 1997) are correlated with the availability of schooling species.

Auklets. The abundance and diversity of small auklets is much higher in the Bering Sea than elsewhere in the world, owing to the large-scale advection of oceanic zooplankton onto the shelf in areas such as the Aleutian passes and Bering Strait (Springer and Roseneau 1985). Least (*Aethia pusilla*), crested (*A. cristatella*), and parakeet (*A. psittacula*) auklets breed from the Bering Strait to the Aleutian Islands and western GOA. Breeding colonies of least auklets are located, with few exceptions, on islands in or near oceanic water containing *Neocalanus plumchrus*, a type of copepod (Hunt Jr. 1997). The distance that least auklets commute between their colonies and foraging sites differs with the species of copepod sought and the distribution of the copepods in the water column (Hunt Jr. 1997). Cassin's auklets (*Ptychoramphus aleutica*) breed in the Aleutian Islands and western GOA; whiskered auklets (*A. pygmaea*) breed in the Aleutian Islands only. Least and crested auklets are the most abundant seabirds in the state (USFWS 1998a). Population trends of auklets are poorly known at present because monitoring of their underground nests is difficult. Least auklets may be declining or stable in the central Aleutian Islands but increasing in the central and northern Bering Sea; crested auklets appear to be stable or increasing at these sites (Byrd et al. 1998; Springer et al. 1993). It has been suggested that auklet trends are due in part to food-chain changes following reductions in plankton-eating whales or other predators (Springer 1991b; Springer 1992; Springer et al. 1993). Other studies, however, indicate that decadal changes in primary productivity of northern vs. southern Pacific waters has altered zooplankton abundance, which has not always resulted in population increases of seabirds (Francis et al. 1998; McGowan et al. 1998).

Auklets forage over the continental shelf or deep water, and winter over ice-free areas of the shelf up to 50 km from colonies (Hunt Jr. et al. 1990; Shuntov 1993; Springer et al. 1993). They seek water structures that concentrate small prey at depths of 5-30 m, such as pycnoclines, fronts, or tide rips over shallow sills (Hunt Jr. 1990; Hunt Jr. et al. 1990; Hunt Jr. et al. 1993). All forage by pursuit diving (Ashmole and Ashmole 1967). Least and whiskered auklets depend exclusively on large zooplankton, crested auklets eat large zooplankton and other invertebrates, and Cassin's auklets take similar prey along with squid and some small fish. Least auklets specialize on copepods, particularly *N. plumchrus*, and crested auklets specialize on euphausids, particularly *Thysanoessa raschii* (Hunt Jr. et al. 1998). The parakeet auklet is more generalized and eats a diverse diet of small schooling fish such as sand lance and juvenile pollock, jellyfish, squid, other invertebrates, and zooplankton (Hunt Jr. et al. 1993; Hunt Jr. et al. 1998; Springer et al. 1993). A recent study conducted in the shallow passes of the Aleutian Islands demonstrated that least, crested, and parakeet auklets timed their foraging in a pass to correspond with the presence of strong tidal currents and exhibited small-scale spatial segregation among the species (Hunt Jr. et al. 1998). Similarly, the diets of these three auklet species differed in composition despite the proximity of the areas in which they foraged. The researchers concluded that the three auklet species exhibited strong preferences for particular prey types, and that these prey preferences resulted in small-scale differentiation of preferred foraging sites. The strong tidal currents provided the energy for the close juxtaposition of different mechanisms for enhancing prey availability (Hunt Jr. et al. 1998). Similarly, spatial segregation of least and crested auklets in Anadyr Strait is thought to arise because of different physical mechanisms (fronts) causing concentrations of preferred prey originating at different depths (Russell et al. 1999). Numerous studies highlight the foraging ecology of auklets and relationships to physical oceanographic processes (Hunt Jr. 1990; Hunt Jr. 1997; Hunt Jr. et al. 1998; Russell et al. 1999; Russell and Hunt Jr 1992).

Murrelets. Kittlitz's murrelets (*Brachyramphus brevirostris*) breed from north of the Bering Strait to southeastern Alaska; marbled (*B. marmoratus*) and ancient (*Synthliboramphus antiquus*) murrelets breed from the Aleutian Islands eastwards. Trends are known only for Prince William Sound. Kittlitz's murrelets have declined there since the 1970s (Kendall and Agler 1998). Marbled murrelets also declined between 1972 and 1984, but appeared to stabilize between 1989 and 1993, and declined further in 1996 and 1998 ((Agler and Kendall 1997; Agler et al. 1998; Lance et al. 1999). Marbled and Kittlitz's murrelets are "species of Management Concern" of the USFWS due to population declines (USFWS 1995a).

Marbled murrelets forage in shallow waters within 5 km of shore and are also associated with sites of upwellings or small fronts that might make prey available (Kuletz et al. 1995; Nelson 1997). Kittlitz's murrelets especially prefer inlets and forages near glaciers where available (Day et al. 1999; Day and Nigro 2000; Ostrand et al. 1998; Sanger 1987b). Ancient murrelets forage over the shelf and shelf break, but also occur near land at sites of tidal upwellings. Some murrelets winter in ice-free bays throughout the state; others apparently move southwards or offshore to unknown areas (Ewins et al. 1993). All three murrelets forage by diving. Marbled murrelets dive in water less than 50 m deep, but primarily less than 20 m deep (Nelson 1997). Diets are dominated by small schooling fish such as capelin and sand lance. Some zooplankton and other invertebrates are also consumed, more by Kittlitz's murrelet and especially by ancient murrelets (Ewins et al. 1993; Sanger 1987b; Springer et al. 1993).

Puffins. Horned (*Fratercula corniculata*) and tufted (*F. cirrhata*) puffins breed throughout marine areas of Alaska. Most winter south of Alaska over the deep ocean. The rhinoceros auklet (*Cerorhinca monocerta*, a misnamed puffin) breeds in the Aleutian Islands and GOA (USFWS 1998a). Tufted puffin populations have increased slightly in the central and eastern Aleutian Islands and southeastern Alaska; they have been stable in the northern GOA during the 1990s [Table 3.2.7;(Byrd and Dragoo 1997; Byrd et al. 1998)]. Trends of horned puffins and rhinoceros auklets are unknown.

Rhinoceros auklets and puffins forage both near shore and over the shelf, although rhinoceros auklets primarily feed near shore and puffins primarily feed on the shelf (DeGange and Sanger 1986; Sanger 1987a; Schneider et al. 1986). All three species dive for small schooling fish such as capelin, sand lance, and herring; horned and tufted puffins also consume pollock, squid, and zooplankton. The rhinoceros auklet may forage more often at twilight than the other puffins. The tufted puffin has the most diverse diet of the three and consumes the largest proportion of invertebrates (Byrd and Dragoo 1997; DeGange and Sanger 1986; Hatch and Sanger 1992; Vermeer et al. 1987). Tufted puffin populations in Prince William Sound may partly be limited by low prey densities (Piatt et al. 1997).

Other marine birds

Several groups of marine-oriented birds inhabit the nearshore or offshore areas of the BSAI and GOA which could potentially be affected by direct or indirect effects of the groundfish fishing industry. These groups include Gavidae (four loons), Podicipedidae (two grebes), Merganini (ten sea ducks), and Phalaropodidae (two phalaropes). The major sea ducks in this region include four species of eiders, harlequin ducks (*Histrionicus histrionicus*), oldsquaw (*Clangula hyemalis*), black scoters (*Melanitta nigra*), surf scoters (*M. perspicillata*) and white-winged scoters (*M. fusca*). Of these sea ducks, eiders are of special interest because of recent declines in populations, and because large portions of eider populations occur in areas potentially affected by the groundfish fisheries.

Common Eider. The Pacific race of the common eider (*Somateria mollissima*) is a large sea duck, the largest in North America, and has declined severely as a breeding species in western Alaska since the late 1950s (Hodges et al. 1996) and probably in the Russian Far East since the early 1970s (Goudie et al. 1994). Common eiders, along with spectacled eiders, have exhibited a sharp decline in western Alaska, with numbers falling over 90 percent on the Yukon-Kuskokwim Delta (YKD) (Hodges et al. 1996). Common eiders are the southern most breeding eider nesting from Southeast Alaska along the coast of Alaska to the Canadian Arctic (Bellrose 1980). Population trend data on this eider is complicated by the lack of comprehensive nesting surveys (USFWS 1999a). Spring migration counts at Point Barrow as eiders head toward Arctic breeding areas suggest that numbers of common eiders nesting in northern

Alaska and the western Canadian Arctic may have declined by 38 percent from 1976 to 1987 and 54 percent between 1976 and 1994, at a rate of approximately 4.5 percent per year (Suydam et al. 1997). Common eider numbers passing Point Barrow in 1976 were estimated at 150,000 (Woodby and Divoky 1982).

Common eiders may overwinter in the Arctic Ocean but most of the Pacific race are believed to winter from the Bering Sea pack ice south to the Aleutian Islands (Byrd 1992), the Kodiak area (Larned and Zwiefelhofer 1995), Cook Inlet (Erickson 1977), and in Russia south to the Kuril Islands (Kistchinski 1973). The large polynya (a large area of open water surrounded by sea ice) associated with Saint Lawrence, Saint Matthew and Nunivak islands and the south side of the Seward Peninsula provide a winter refuge for common eiders as well as other sea ducks such as oldsquaw, king and spectacled eiders (USFWS 1999a). Because these polynyas are located in areas of relatively shallow water, they provide access to benthic invertebrate prey for these ducks.

King Eider. The king eider (*Somateria spectabilis*) is a large, benthic-feeding sea duck which has a circumpolar distribution, breeding in the high-arctic and wintering as far north as seas remain open (Bellrose 1980). The center of distribution in North America is the Beaufort Sea region (Johnson and Herter 1989). The greatest concentration of nesting king eiders in Alaska is between the Colville River Delta and the Arctic National Wildlife Refuge (USFWS 1999a). It also nests on St. Matthew and St. Laurence islands. On the North slope, there is no information indicating a decline in the number of king eiders; the population appears to be stable or increasing in recent years (King and Brackney 1997; USFWS 1999a).

Recent counts of migrating king eiders at Point Barrow are not directly comparable with past estimates, yet they provide convincing evidence of a decline (Suydam et al. 1997). The apparent decline may represent actual population declines, or possibly a dramatic shift in the migration route (USFWS 1999a). Surveys indicate that the population nesting in northern Alaska and the western Canadian Arctic has declined 31 percent from 1976 to 1987 and 54 percent from 1976 to 1994 (Suydam et al. 1997). Reasons for the decline are unknown (USFWS 1999a).

The Bering and Chukchi seas are the primary molting and wintering areas for king eiders that breed in eastern Russia, Alaska, and western Canada (USFWS 1999a). Molting areas in Alaska include Kvichak Bay, Kuskokwim Bay, offshore near Platinum Village, and southeast Saint Lawrence Island. King eiders winter in the Bering Sea in polynya south of islands such as Saint Lawrence, Saint Matthew and Nunivak islands and south side of the Seward Peninsula, along the Alaska Peninsula, in the Aleutian and Pribilof islands, and south to the Kodiak Archipelago (USFWS 1999a). The king eider population is relatively dispersed in wintering areas compared to the spectacled eider[14].

King eiders are particularly vulnerable to oil spills when they congregate in large, dense flocks during winter, molting, and migration (USFWS 1999a). An oil spill from a collision of a freighter and a processor in the vicinity of the Pribilof Islands resulted in the death of approximately 1,700 king eiders (Flint et al. 1998). These birds were the most numerous casualties from the spill, suggesting that they are one of the major species in this area during the winter months.

Spectacled Eider. Spectacled eiders (*Somateria fischeri*) are large diving sea ducks that spend most of the year in marine waters where they primarily feed on bottom-dwelling molluscs and crustaceans. Besides breeding and molting in some Alaska coastal areas, spectacled eiders congregate during the

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winter in exceedingly large and dense flocks in polynya in the pack ice in the central Bering Sea between Saint Lawrence and Saint Matthew islands. Spectacled eiders from all three known breeding areas (in Alaska and Russia) use this wintering area. While at sea, spectacled eiders appear to be primarily bottom feeders, eating molluscs and crustaceans at depths of up to 70 m in the wintering area (USFWS 1999a). Because nearly all individuals of this species may spend each winter occupying an area of ocean less than 50 km (31 mi) in diameter, they may be particularly vulnerable to chance events during this time (USFWS 2000a).

Between the 1970s and 1990s, spectacled eiders on the Yukon-Kuskokwim Delta (YKD) (an Alaska breeding area) declined by 96 percent, from 48,000 pairs to fewer than 2,500 pairs in 1992. Based upon surveys conducted during the past few years, the YKD breeding population is estimated to be about 4,000 pairs (USFWS 2000a). Biologists estimate that about 9,000 pairs currently nest on Alaska's arctic coastal plain, and at least 40,000 pairs nest in Arctic Russia. The current worldwide population estimate is 360,000 birds, which is derived from winter surveys in the Bering Sea and includes non-breeding birds (USFWS 1999b). Spectacled eiders are currently listed as threatened under the ESA.

Causes of the decline of spectacled eiders are not well understood. Besides known and plausible land-based causes (lead poisoning from spent lead shot; predation by foxes, gulls, and ravens on breeding grounds; and hunting), marine-based causes are even less clear. Complex changes in fish and invertebrate populations in the Bering Sea may be affecting food availability for spectacled eiders during the eight to ten month non-breeding season (USFWS 1999b). Disturbance of marine benthic feeding areas by commercial bottom-trawl fisheries, environmental contaminants at sea, and competition with bottom-feeding walruses and gray whales for food may also affect spectacled eider populations (USFWS 1999b).

Steller's Eider. Steller's eider (*Polysticta stelleri*) are medium sized seaducks that inhabit the nearshore marine waters where they feed by diving and dabbling for molluscs and crustaceans. Primary foods in marine areas include bivalves, crustaceans, polychaete worms, and molluscs (USFWS 1997b). Three breeding populations of Steller's eiders are recognized, two in Arctic Russia and one in Alaska. Actual numbers nesting in Alaska and Russia are unknown, but the majority of Steller's eiders nest in Arctic Russia (USFWS 1997b). After the nesting season, Steller's eiders return to marine habitats where they molt. Concentrations of molting Steller's eiders have been noted in Russia, near Saint Lawrence Island in the Bering Sea, and along the northern shore of the Alaska Peninsula.

Whereas the Russian Atlantic population winters in the Barents and Baltic seas, the Russian Pacific population winters in the southern Bering Sea and northern Pacific Ocean, where it presumably intermixes with the Alaska-breeding population. During winter, most of the world's Steller's eiders concentrate along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet in shallow, near-shore marine waters. In spring, large numbers concentrate in Bristol Bay before migration. Along open coastline, Steller's eiders usually remain within about 400 m of shore normally in water less than 10 m deep but can be found well offshore in shallow bays and lagoons or near reefs (USFWS 1997b). Whereas the Russian Atlantic population is believed to contain 30-50,000 individuals, and the Russian Pacific population likely numbers 100-150,000, the threatened Alaska-breeding population is thought to include hundreds or low thousands on the Arctic Coastal Plain, and possibly tens or hundreds on the YKD. Overall numbers have likely declined from historical population sizes. Steller's eiders are listed as threatened under the ESA.

Factors that influence the availability of food to seabirds

Successful foraging by seabirds depends on adequate stocks of prey, and foraging also is limited by conditions that make prey available to the birds. The nonrandom distribution of birds at sea shows a correspondence to upwellings, surface convergences, currents, or other physical processes and factors that influence productivity (Woodby 1984). All seabirds depend on specific oceanographic processes to concentrate their prey at the necessary place, time, and position in the water column (review in (Hunt Jr. et al. 1999a). A growing body of evidence indicates that in partitioning prey resources, seabirds utilize different marine habitats for foraging (Croxall and Prince 1980; Harrison et al. 1983; Hunt Jr. et al. 1998; Weimerskirch et al. 1988; Weimerskirch and Cherel 1998). Partial information on the factors that influence prey availability near seabird colonies has been gained through recent research. These factors include oceanographic characteristics of the environment and the ecology and food-web relationships of forage species. The value of prey also depends on its nutritive content.

Data are lacking concerning factors that limit seabird prey availability for some species groups and for many areas of Alaska. Information is also needed for almost all species in winter. Most critical is the lack of information on how events beyond a seabird's foraging range may influence the availability of its prey. Such factors may include environmental changes, fluctuations in region-wide stocks of forage and non-forage species, and commercial harvests.

Factors that limit the availability of food to seabirds have been investigated primarily during the past ten years, and directed research is recent. Intensive work has taken place in the southeastern Bering Sea [short-tailed shearwaters, kittiwakes, and murres (Coyle et al. 1992; Decker et al. 1995; Decker and Hunt Jr. 1996; Hunt Jr. et al. 1981a; Schneider et al. 1990; Springer et al. 1986)]; northern Bering and Chukchi Seas [murres, kittiwakes, and auklets (Elphick and Hunt Jr 1993; Kinder et al. 1983; Springer et al. 1987)]; the western Aleutian Islands [auklets (Hunt Jr. et al. 1993; Hunt Jr. et al. 1998; Russell et al. 1999)]; and Cook Inlet and Prince William Sound (murres, kittiwakes, pigeon guillemots, and tufted puffins (Golet et al. 2000; Hayes and Kuletz 1997; Kuletz 1983; Ostrand et al. 1998; Piatt et al. 1998; Piatt et al. 1997; Suryan et al. 1998a; Suryan et al. 2000; Suryan et al. 1998b). In each place, only part of the factors affecting bird forage availability have been explored. All studies were restricted to summer. Limiting factors in areas that have not yet been studied are likely to differ in type and importance, and they may be completely different in winter, when forage species and locations are different. Winter diets have been recorded for common murres and marbled murrelets in Kachemak Bay, Alaska, by Sanger (Sanger 1987b). Albatrosses have not been directly studied in the BSAI or GOA. Some diet information is available on the Laysan's and black-footed from the central North Pacific (Gould et al. 1998), diet information from albatross colonies in the NWHI is available (Harrison et al. 1983) and recent satellite telemetry studies have noted breeding Laysan's albatross foraging in the Bering Sea (Anderson et al. 2000). Conversely, albatross have been studied extensively in the southern hemisphere where more procellarid species occur. The food and foraging ecologies of southern hemisphere albatrosses are much better known (Cherel and Weimerskirch 1995; Croxall and Prince 1980; Croxall and Prince 1996; Waugh et al. 1999a; Waugh et al. 1999b; Weimerskirch et al. 1985; Weimerskirch et al. 2000) and the potential impacts of fisheries on albatross populations have been noted, with the most serious concern being that of albatross mortality from longline fisheries (Brothers 1991; Croxall et al. 1990; De la Mare and Kerry 1994; Robertson and Gales 1998). Other impacts such as competition for prey (squid and fish) and fisheries providing additional food resources are also discussed (Gremillet et al. 2000; Reid et al. 1996).

Oceanographic factors affecting seabirds

Subarctic gyres (permanent ocean currents that move in a circular direction) are prominent oceanographic features of the North Pacific Ocean that provide linkage and exchange between subtropical and transitional waters of the North Pacific Ocean and arctic waters of the Bering Sea and Sea of Okhotsk (Springer et al. 1999). Although coastal and shelf production is much higher during summer, the pelagic areas encompassed by gyres form an important wintering and nursery area for many species of birds and marine mammals that breed on shore around the perimeters. The Eastern Subarctic Gyre (ESAG) is formed by the North Pacific Current on the southern boundary and by the Alaska Current which forms the eastward and poleward boundaries of the gyre. The Alaska Current is broad on the eastern side of the GOA (300 km), but narrows to about 100 km in the western GOA and is the only significant current contributing to the flow around the ESAG (Reed and Schumacher 1986). In contrast, circulation in and around the Western Subarctic Gyre (WSAG) is much more complex, with contributions from three major current systems that originate in distinct oceanographic settings. Seabird biomass in the subarctic North Pacific Ocean is concentrated over the shelf and slope near the continents in all seasons, with the densities at sea in the open ocean very small by comparison (Springer et al. 1999). Additionally, the densities are higher in the western subarctic than in the eastern subarctic, and the contrast is particularly noticeable in the centers of the gyres. The increased complexity of the physical oceanographic environment and more intense circulation in the western subarctic is probably what accounts for its higher primary and secondary production. Whereas seabirds are distributed more evenly across the WSAG, the abundance of several seabird species appears to be greatly reduced in the center of the ESAG. This distribution probably results from the physical process and patters of food web development that lead to higher abundances of prey at the margins (Springer et al. 1999).

Physical characteristic of the water column and ice cover concentrate the prey of seabirds. Bird species differ in their requirements and preferred habitats, depending on the birds' size, shape, and foraging method (surface-feeding or diving, nearshore or offshore). The oceanographic phenomena that influence seabird foraging habitat primarily are on the scale of hundreds of meters to hundreds of kilometers (Hunt Jr. and Schneider 1987). Favorable foraging conditions are likely to last for a relatively short time (hours to weeks) at one spot and for many Northern hemisphere seabirds foraging in shelf waters, small-scale physical processes that concentrate prey are very important for successful seabird foraging (Hunt Jr. et al. 1999). Different combinations of factors limit the availability of prey for different seabird species. Factors also differ among areas of Alaska (Byrd and Dragoo 1997).

Fronts and upwellings are important in concentrating seabird prey. The Inner Front (boundary between wind-mixed and stratefied water on the Bering Sea shelf) is associated with and upwelling 5-15km in width, which tends to concentrate some zooplankton and their predators (Brodeur et al. 1997; Schneider et al. 1987). This region is primarily exploited by diving seabirds, particularly the short-tailed shearwater (a plankton feeder) and murre (a fish feeder) (Decker and Hunt Jr. 1996; Hunt Jr. et al. 1996a). Availability of prey to these seabirds may vary with strength of the upwelling (Schneider et al. 1987). The Outer Front and shelf edge, where water from the continental slope upwells, is important to thick-billed murres and several surface-feeding seabird species, including northern fulmar, shearwaters, and kittiwakes. Some of the state's largest seabird colonies are located within foraging range of the shelf edge, including Saint George Island, several Aleutian Islands colonies, and the Semidi Islands (western GOA).

Upwellings also occur where tides or currents move water from deep water onto the shelf, such as tidal upwellings onto the shelf between islands in the Pribilof Islands (Coyle et al. 1992), Aleutian Islands (Hunt Jr. et al. 1998), or the Anadyr Current west of Saint Lawrence Island (Hunt Jr. and Harrison 1990). Auklets nest abundantly in these areas because upwellings bring their oceanic zooplankton prey to shallow waters nearby (Hunt Jr. et al. 1993; Springer and Roseneau 1985). Upwelling of deep water onto the shelf north of the Barren Islands and in the western GOA supports large colonies of murres, kittiwakes, and puffins (Piatt and Anderson 1996). At the Pribilof Islands, the currents that influence prey availability are mostly tidal, though zooplankton are advected from offshore(Hunt Jr. et al. 1996c; Stabeno et al. 1999). Currents that run parallel to the shelf break along the 100 m and 200 m isobaths, and which spawn eddies that cross onto the shelf, are likely to be most important (Stabeno et al. 1999). These currents may also be important for the transport of age-0 pollock to the Pribilofs, suggesting that pollock spawning events near Unimak Pass may influence the availability of prey at the Pribilofs.[15] The influence of upwellings and fronts on seabird populations and the effect of changes in these processes have not been studies in most areas. Eddies may be important in attracting and concentrating seabird prey in the vicinity of islands, headlands, and seamounts (Hunt Jr. and Schneider 1987).

Stratification of the water column is important in prey availability to seabirds. Small forage species, such as zooplankton, are concentrated at pycnoclines and thermoclines and are available there to shallow-diving seabirds such as least auklets (Haney 1991; Hunt Jr. et al. 1999a; Hunt Jr. et al. 1990). Prey availability for these birds depends on the presence of suitable stratification near breeding colonies (Hunt Jr. and Harrison 1990). Location of prey concentration vertically within the water column, due to a phycnocline, may vary from days to months, depending on the strength of mixing events (Hunt Jr. et al. 1999). Stratification can be disadvantageous to species that depend on complete mixing of the water column. Lack of wind in summer and strong solar heating can result in higher surface temperatures where by prey of surface-feeding species such as terns and kittiwakes may seek deeper water and be unavailable in such years (Baird 1990). Lack of mixing can also weaken the upwelling at the Inner Front on which short-tailed shearwaters depend. The influence of stratification on seabird foraging in most specific areas is unknown.

Currents vary in strength among years; their influence on seabird prey is known for a few areas. The principal prey of seabirds in these areas may be carried there by currents from a long distance. Currents are important for the availability of prey to auklets in the northern Bering Sea as well as in the Chukchi Sea [see review in (Hunt Jr. 1997)], and at the Pribilof Islands (Hunt Jr. et al. 1996c). Tidal currents at the Pribilofs are also important in determining the availability of euphausiids to murres (Coyle et al. 1992). The Alaska Coastal Current in the northern Bering and Chukchi seas originates in part from discharge of the Yukon River (Springer et al. 1984), but it may also be influenced by river flows as far away as the GOA (Piatt and Anderson 1996). The coastal current in the western GOA sweeps immature pollock from spawning grounds near Kodiak Island to the vicinity of seabird colonies on the lower Alaska Peninsula (Byrd and Dragoo 1997; Hatch and Sanger 1992; Wilson 1997). In northwestern Alaska, small schooling fish such as sand lance are available during the chick-rearing period of seabirds if a large warm "plume" of water reaches that coast in early to mid-July (Springer et al. 1984). Tidal currents at the Pribilofs are also important in determining the availability of euphasiids to murres (Coyle et al. 1992). The influence of currents on seabird foraging in most specific areas of the North Pacific, including colonies near the shelf edge, is unknown.

The edge of the ice pack and polynyas within it provide important winter and spring habitat for large gulls, guillemots, murres, and other seabirds, which forage on zooplankton and fish of the ice-edge system (Hunt Jr. 1991). Recently, the winter location of the threatened spectacled eider was found in openings of the pack ice south of Saint Lawrence Island (Petersen et al. 1999), indicative of the potential importance of this habitat outside of the breeding season.

Temperature of marine waters influences prey availability. Years with warm coastal currents are associated with high sand lance abundance and increased breeding success for black-legged kittiwakes in Norton Sound and the Chukchi Sea (Springer et al. 1987; Springer et al. 1984). Sea surface temperature also influences availability of forage to seabirds, irrespective of fish abundance; cold sea-surface temperatures are associated with high kittiwake breeding success in the Pribilof Islands (Springer and Byrd 1989). This occurs possibly because warmer surface waters are stratified and forage fish remain too

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deep for kittiwakes to obtain them. Temperature may influence forage fish availability for seabirds in many other ways, from local effects to large-scale stock trends, but nothing is known of these factors.

Regime shifts appear to influence the abundance and distribution of seabirds. Effects of regime shifts on Alaskan seabird populations can only be surmised for the past 20 years, when data on most seabird populations are available, which is a shorter period than that of some potential regimes. Water temperature and associated water-mass characteristics influence the productivity, abundance, and distribution (both vertical and horizontal) of seabird prey in both the short and long term. The availability of high-value forage species such as capelin and sand lance declined sharply when the regime shifted during the late 1970s and has not yet returned to former levels. The result has been declines in the breeding success and populations of piscivorus (fish-eating) species in several areas of Alaska (Agler et al. 1999; Anderson and Piatt 1999; Francis et al. 1998; Kuletz et al. 1997; McGowan et al. 1998; National Research Council 1996; Piatt and Anderson 1996; Springer 1992).

Numerous studies have demonstrated that seabirds reflect the distribution and abundance of prey through their foraging ecology [review in (Decker et al. 1995)]. Additionally, dietary changes of seabirds reflect prey availability and have been related to the collapse of commercial fisheries stocks (Montevecchi et al. 1988). Thus, seabirds may indicate fluctuations in fish populations brought on by environmental perturbations, such as climate change or commercial harvesting (Decker et al. 1995). Between 1975 and 1990, the reproductive performance of seabirds breeding at the Pribilof Islands fluctuated widely (Springer 1992). Major shifts occurred in the food habits of seabirds at the Pribilof Islands between the mid-1970s and the late 1980s. These shifts in diet coincided with the decline of murre and kittiwake populations there, and with the decline of forage fishes and age-1 pollock in the bottom trawl surveys around the Pribilof Islands (Decker et al. 1995; Hunt Jr. et al. 1996b; Hunt Jr. et al. 1996c). It seems very likely that the decline in the abundance of age-1 pollock around the islands had an impact on those populations at the Pribilof Islands[16]. Seabird reproductive performance and diets did not return to pre-1979 values after 1984, suggesting that the changes in the marine ecosystem to which the birds responded were of longer duration than the periods of warm and cool surface temperatures observed between 1975 and 1990 (Decker et al. 1995).

Likewise, several species of seabirds nesting in the GOA experienced a decrease in breeding success and abundance in the mid-1970s that coincided with shifts in diet, indicating changes in prey populations (Piatt and Anderson 1996). A shift in climate regime at this time triggered a reorganization of trophic structure in the GOA ecosystem and apparently occurred at the expense of both piscivorus marine birds and mammals (Anderson and Piatt 1999).

Longer climatic cycles have changed seabird communities in ways that can only be inferred from the fossil record (Duffy 1993; Warham 1996). Studies in the northwest Atlantic of sea surface temperature anomalies from the 1870s to the 1990s indicate a general long-term warming trend that implies interactive and synergistic effects on fish distributions and populations, and hence, on seabird feeding ecology and reproductive success. Such changes might be detected initially near the limits of seabird ranges and the margins of oceanographic regions (Montevecchi and Myers 1997). Effects of a given regime shift on seabirds, as for other environmental variables, can be expected to differ among species and among regions of the state.

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Ecological interactions affecting seabirds

Various ecological factors may determine whether valuable forage species are present within a bird's feeding range, and whether prey are available to the birds. Even where some information exists on forage species and areas that are important to seabirds, there usually is no information on the small age classes of fish (5-15 cm) consumed by birds.

Habitat requirements of forage species may limit whether a species is present within the foraging range of seabirds. Of the high-value forage species of seabirds, only one or two are typically available to seabirds in a given area (Springer 1991b): sand lance in most of the Bering Sea (Springer 1991b; Springer et al. 1996), pollock and formerly capelin in the Pribilof Islands (Decker et al. 1995; Hunt Jr. et al. 1981a; Springer et al. 1986), capelin and pollock on the Alaska Peninsula (Hatch and Sanger 1992; Springer 1991b), and capelin, sand lance, herring, and pollock in the northern GOA (Golet et al. 2000; Hatch and Sanger 1992; Piatt et al. 1998; Suryan et al. 2000; Suryan et al. 1998b). The availability of forage species often varies within small areas, such as Prince William Sound, Cook Inlet, and island groups in the Aleutian Islands (Byrd and Dragoo 1997; Piatt et al. 1998; Suryan et al. 1998b). The preferred forage species in each area usually is essential for successful seabird reproduction (Baird 1990; Golet 1998; Golet et al. 2000; Piatt et al. 1998; Piatt and Anderson 1996; Springer et al. 1987; Springer et al. 1986; Suryan et al. 1998a; Suryan et al. 2000; Suryan et al. 1998b).

At the Pribilof Islands, there has been a shift from capelin to sandlance as the fatty forage fish available to diurnal seabirds (Decker and Hunt Jr. 1996). At the Pribilof Islands there has also been a decline in the use and abundance of age-1 pollock (Hunt Jr. et al. 1996c). In an analysis of diet changes of seabirds at the Pribilof Islands, Hunt, Decker *et al.*(Hunt Jr. et al. 1996b) suggested that the decline in the use of fatty fishes, including myctophids, was correlated with reduced reproductive success. However, when pollock dropped significantly in diets and kittiwakes were forced to rely primarily on the fatty forage fishes that may have been scarce, reproductive success was also diminished. It appears, then, that at the Pribilofs, either because the colonies are so large, or because fatty forage fishes are generally scarce there, an abundant supply of pollock, preferably age-1 pollock, is important.

Habitat requirements of seabird forage species are poorly known, particularly for the size classes consumed by birds (6 to 15 cm for most bird species) and for the specific areas that are important to foraging seabirds. The information that exists is best for the species whose adults are prey of seabirds, such as capelin and sand lance, and for juvenile pollock. Habitats of other important forage groups, such as myctophids and juvenile herring, are poorly known. Recent studies, however, have provided data on the seasonal patterns and habitat for several species of forage fishes in Cook Inlet (Blackburn and Anderson 1997; Robards et al. 1999) and juvenile herring (Brown et al. 1999; Paul and Paul 1999) and juvenile pollock (Paul et al. 1998) in Prince William Sound.

Stock sizes and productivity of forage species are among the factors that determine the abundance and availability of these species in seabird foraging areas. Seabirds must have access to prey within efficient foraging range of the breeding colony in order to raise their chicks successfully (Golet et al. 2000; Piatt et al. 1998; Suryan et al. 1998a; Suryan et al. 2000). For instance, breeding success of black-legged kittiwakes in Cook Inlet varied with local stocks of capelin (Piatt et al. 1998). In Prince William Sound, success of black-legged kittiwakes (Suryan unpublished data), pigeon guillemots (Golet et al. 2000) and marbled murrelets (Kuletz unpublished data) correlated with relative abundance of forage species among years and among sites. For most seabird species or areas, specific information is rarely available on the relationship between forage stocks and breeding success. In other regions, however, there is considerable circumstantial evidence of links between depletion of forage fish stocks and subsequent declines in seabird populations (Furness 1982; Furness and Ainley 1984).

Presence of forage species in a bird's feeding range is not enough. Schools or swarms of forage fish must be of sufficient size and density for seabirds to exploit them efficiently (Hunt Jr. et al. 1990; Piatt et al. 1998). Schools also must be available in the respective habitat for each seabird species (Hunt Jr. and Harrison 1990; Ostrand et al. 1998), including at a depth which the seabird can reach. No information exist on the influence of stock size on the availability of forage schools to seabirds.

Stocks of many forage fish species may change with overall abundance. Seabird colonies near the edge of a forage species' range may therefore experience large fluctuations in food supply with changes in an overall forage stock, while food may be more reliable at colonies near the core of the forage species' range (MacCall 1984). Changes in overall fish stocks due to either fishery pressures or environmental changes may, therefore, affect the local availability of forage to seabirds. Any effects of stock changes on seabirds almost certainly will vary among areas. Although data on the relationship between stock sizes and availability to seabirds are lacking for most specific areas, improvements in hydroacoustic methods have increased our knowledge of these patterns (Hunt Jr. et al. 1999). The relationship between prey availability and density is complicated by different patterns of distribution for seabirds relative to their prey. When prey are at the surface, seabird aggregations may be tightly coupled with prey, but if prey are deep there is little correspondence beyond a coarse scale [review in (Hunt Jr. et al. 1999)]. Several studies indicate that when prey abundance is above some threshold, birds will no longer track prey closely, but in years with low prey abundance, birds will be tightly associated with prey patches [review in (Hunt Jr. et al. 1999)]. Three distinct levels of patchiness in the spatial relationship between murres and capelin in the Barents Sea have been observed with associations focused at >300 km, ~50 km and ~3 km. (Fauchald et al. 2000).

Movements and schooling behavior of forage fish species often determine whether the species will be available at a place and time suitable for seabird foraging. Densities of foraging seabirds are often correlated with densities of their prey (Fauchald et al. 2000; Hunt Jr. 1990; Hunt Jr. et al. 1999). Currents disperse some small forage species, but other species contribute to their own locomotion. Diurnal vertical migrations by pelagic plankton, myctophids, and squid determine their availability to surface-feeding birds such as northern fulmars and kittiwakes (Hatch 1993; Hatch et al. 1993). Sand lance, juvenile herring, and other forage species are available to birds at times when they form dense schools in shallow water; these fish may be dispersed too greatly at other times for efficient foraging by many seabird species (Blackburn and Anderson 1997; Hunt Jr. et al. 1990; Irons 1998; Piatt et al. 1998). Breeding success and population trends of kittiwakes in the northern Bering Sea and of pigeon guillemots in Prince William Sound are correlated with years when schools of sand lance are available (Hayes and Kuletz 1997; Springer et al. 1987). Schools must be at or near the surface in order for kittiwakes and terns to reach them; these birds are usually observed feeding on shoals of sand lance in years when reproductive success is high (Baird 1990).

Competition and predation may influence seabird prey availability. Links between seabirds and other species could be direct, or they could be extremely diffuse and indirect. Possible links include: competition between seabird species; competition of piscivorus seabirds with other large marine predators such as marine mammals and fish; cannibalism by large pollock on the smaller pollock that are eaten by some seabirds; competition for food among forage species of seabirds, such as small pollock, capelin, sand lance, herring, myctophids, and squid; competition between planktivorous seabirds with whales or planktivorous fish (including forage fish of other seabird species); and even ecosystem links with groups such as jellyfish. Little information is available on the magnitude or direction of these links.

The energy content of prey has recently been found to influence the growth of seabird chicks and reproductive success at the colony level (Golet et al. 2000; Kitaysky 1999; Kitaysky et al. 1999). Fish with high lipid and low water content provide the most efficient food "package" for growing seabird chicks; such fish include myctophids, capelin, sand lance, and larger age classes of herring. Energy-poor forage species include pollock and benthic fish. Young black-legged kittiwakes and tufted puffins fed high-value fish grow faster than those fed pollock (Romano et al. 1998). Slow-growing young birds in colonies may ultimately starve in the nest or be more vulnerable to post-fledgling stresses than well-fed young. Growth rates, reproductive success, and population trends of several seabird species are correlated with availability of high-value prey in the northern GOA (Anthony and Roby 1997; Golet 1998; Golet et al. 2000; Piatt et al. 1998; Roby et al. 1998; Suryan et al. 2000).

The influence of prey energy content on seabird trends in other parts of Alaska has not been investigated. For instance, kittiwakes and murres often consume pollock in the Pribilof Islands, where capelin and sand lance are less available (Hunt Jr. and Eppley 1981b; Schneider and Hunt Jr 1984), the birds are able to raise chicks. However, breeding success of kittiwakes is relatively low in these colonies compared with other parts of Alaska (Hatch et al. 1993), and murre and kittiwake populations declined recently on the Pribilof Islands. The relative value of prey species to breeding seabirds may vary among areas, depending on factors such as distance to foraging areas and body composition of forage species. The relative value of pollock and other prey to seabird populations in the Pribilof Islands is unknown.

The fraction of total exploitable stocks in the EBS that are consumed by seabirds have been estimated at 3 percent for pollock and less than 1 percent for herring (Livingston 1993), which is similar to an estimate of 4 percent for sand lance in the North Sea (Furness and Tasker 1997). Seabirds, therefore, may account for a very minor proportion of forage fish mortality, even for the young age classes that they consume (Livingston 1993). However, seabirds may have greater impacts on fish stocks within foraging range of seabird colonies because the birds are concentrated there during summer (Birt et al. 1987; Springer et al. 1986). Fifteen to eighty percent of the biomass of juvenile forage fish may be removed by birds each year near breeding colonies (Furness 1978; Logerwell and Hargreaves 1997; Springer et al. 1986; Wiens and Scott 1975). This suggests that food availability to birds may be limited, at least in a given season, by the size of the local component of fish stocks. Seabirds may, therefore, be vulnerable to factors that reduce forage fish stocks in the vicinity of colonies (Monaghan et al. 1994). The availability of forage fish to seabirds also would depend on the rate of fish immigration, and on factors that limit the ability of birds to capture the fish present in the area.

Estimates of predation pressure by seabirds on forage stocks are based on incomplete data. Existing information on diet, consumption, and energetics of seabirds has been obtained during the breeding season. Broad assumptions must therefore be made for the other nine months of the year, and for the nonbreeding component of seabird populations (roughly 15 to 50 percent of the total) throughout the year. Diets and factors that limit prey availability during nonbreeding periods presumably are different from those in summer. Some authors believe that food is more limited in winter than summer for many species (Croxall 1987). Outside the breeding season, diets, feeding habitats, energy requirements, and distributions have been studied only minimally for most seabird species[4]. Limited information suggests that, in winter months, many seabirds consume a greater variety of fish as well as higher proportions of zooplankton and invertebrates (Sanger 1986; Sanger 1987b). Predation pressure of birds on forage fish stocks is unknown for most stocks and areas. The proportion of noncommercial forage fish species taken by seabirds cannot usually be estimated because no information exists on stock sizes for these species. Recent studies in Glacier Bay, Cook Inlet and Prince William Sound, however, which obtained estimates of forage fish biomass, will provide information in the near future.

Region-wide conditions that may influence local prey availability are not well described, but are being investigated by GLOBEC. Climate and food-web changes can occur over the entire Bering Sea or GOA, and several reviews indicate that such large-scale fluctuations affect prey availability for seabirds (Agler et al. 1999; Anderson and Piatt 1999; Francis et al. 1998; McGowan et al. 1998). The mechanisms of how the oceanographic changes alter marine communities require further investigation.

Seabird responses to changes in forage availability

The availability of food resources to seabirds depends not only on the forage fish species and their physical environment, but also on the response of each bird species to prey availability. Seabird species differ in their foraging adaptations, ways in which they respond to change, relationships with competitors, and the effects on populations of changes in their food supply.

The response of several seabird species to changing forage conditions has been studied in some detail. For many species, however, flexibility and behavioral limitations are known only in general. The effects on seabird populations of changes in the food supply, and the minimum abundance of forage that each species requires, have been studied for only a few species in the northern GOA. Information is needed on limiting prey densities for most Alaskan species (the prey densities at which breeding success is insufficient to maintain populations). Studies are needed of all species in several areas of Alaska; limiting densities of prey are likely to differ among regions, depending on which prey birds depend on, its availability, and whether alternate prey are available. More specific data on minimum biomass required for reproductive success in seabirds may soon become available for parts of the northern GOA as Exxon Valdez Trustee Council studies are concluded.

Foraging behavior and flexibility. Foraging behavior and flexibility limit each species' responses to changing conditions. In general, seabird diets consist of fish or squid 5-15cm long or large zooplankton. Diets and foraging ranges are most restricted during the breeding season, when high-energy food must be delivered efficiently to nestlings. Species-specific adaptations include foraging range from breeding colonies, depth at which prey can be obtained, prey size and type, optimal and limiting densities of prey aggregations, and ability to switch to foods such as other fish species, invertebrates, detritus, or terrestrial organisms. Seabirds learn where to find aggregations of their prey under various conditions, and they may return to favorable areas regularly (Hunt Jr. et al. 1999).

Albatrosses are unique among seabirds in that they display the largest foraging areas so far recorded in any extant central-place forager [review in (Gremillet et al. 2000)]. During the breeding season, wandering albatrosses (*Diomedea exulans*), for example, may travel 15,000 km over the Southern Ocean during a single feeding trip. This performance is made possible by dynamic-soaring, a flight technique which enables these birds to travel at low energy costs for extended periods (Pennycuick 1989). Satellite tagging is being used to identify the vast foraging areas for many albatross species in the Southern Ocean.

Seabirds differ from one another in their ability to respond to changing conditions. For instance, most surface-feeding species can forage over greater distances than diving birds (Shuntov 1993), but diving birds can exploit prey at greater depths than surface-feeders (Baird 1990; Monaghan 1996). Murres can forage deeper than any other species, which buffers them against changes in vertical distribution of their prey; however, their need for dense aggregations of prey may make them vulnerable to occasional "die-offs" when prey are scattered or otherwise unavailable (Piatt and van Pelt 1997). Murres can increase the daily foraging time needed in order to obtain scarce or distant prey, and they sometimes are able to maintain breeding success under poor conditions; in contrast, seabirds such as terns and kittiwakes often do not have the extra time available each day to make this adjustment (Furness and Tasker 1997; Monaghan et al. 1992; Piatt et al. 1998). However, within Prince William Sound, differences can occur among kittiwake colonies in foraging range, trip duration and feeding rate, consistent with fish availability, suggesting some buffering capabilities (Suryan et al. 2000). Pigeon guillemots can forage either on schooling energy-rich fish or on dispersed, energy-poor benthic fish, but breeding success and population stability are supported best by schooling fish (Golet et al. 2000; Kuletz 1983). Gulls can switch to invertebrate prey or scavenging when schooling fish decline, but breeding success suffers (Murphy et al. 1984). Foraging adaptations of seabirds may differ among areas according to sizes of prey aggregations, availability of alternate prey, distance to foraging areas, depth of the prey, and many other factors.

Seabird interactions with each other and with marine mammals. Seabird interactions with each other and with marine mammals influence their populations [(Mehlum et al. 1998), review in (Hunt Jr. et al. 1999)]. Seabirds compete within and between species for food and nesting space. The influence of such competition on populations is largely unknown, although evidence has been presented that large Alaskan colonies may be limited by competition for food (Hunt Jr. et al. 1986). Seabirds that feed in flocks may benefit by interactions within and among other species; surface-feeding birds may attract others to aggregations of prey, while diving birds appear to drive subsurface prey within reach of surface-feeders (Hatch 1993; Hoffman et al. 1981; Maniscalco et al. 1998; Ostrand 1999; Ostrand et al. 1998). Bottom-feeding marine mammals such as gray whales also increase the availability of prey and detritus to surface-feeding birds (Harrison 1979; Hunt Jr. 1990; Obst and Hunt Jr 1990).

Population responses of seabirds to changes in forage availability. Trends in seabird populations are the result of forage availability and food-web changes. Depending on individual foraging success, the population of each species may maintain itself, increase, or decline. Population trends may last for a few years or many decades, and they may be local or cover large regions, depending on fluctuations in forage availability. Trends are likely to differ among seabird species in the same area and time period, because "forage availability" will vary with a seabird's body size and feeding behaviors (Chastel et al. 1995; Putz et al. 1998)

The responses of seabird populations to prey abundance have been examined theoretically, and forage/trend relationships have been studied for a few species in the field. When forage is below some minimum level of availability, birds cannot raise enough young to replace those that die, and (in extreme cases) adult birds may even die from starvation. One or two bad years will not cause a population decline, but if food remains scarce, the population decreases. Cairns (Cairns 1990) theorized that seabird productivity and populations show sigmoidal >threshold' responses to prey abundance He suggested that at intermediate forage levels, breeding is increasingly successful; populations are stable or fluctuate only slightly. At some higher level of forage availability, birds are able to raise the maximum number of young (roughly 0.5 to 3 young per breeding pair in each year, depending on the species), and the population increases. Additional forage above this upper threshold will not increase breeding success or population growth further due to other density-independent factors.

The relationships between forage abundance and seabird population trends differ among species. Some species can maintain themselves while foraging on relatively low prey densities; others in the same area require much higher densities. Examples include puffins exploiting lower densities of capelin than murres in Newfoundland (Piatt 1990). Preliminary data that suggests that murres may be able to subsist on lower densities of sand lance in Cook Inlet than kittiwakes (Piatt et al. 1998). Highly dispersed, non-colonial birds such as marbled murrelets may be particularly well adapted to patchy, highly dispersed prey in low-density schools (Kuletz 1999; Ostrand et al. 1998).

Field studies and modeling work on the relationships of seabird populations to local prey densities are only beginning. Much more information is needed on limiting prey densities for most Alaskan species. Prey densities per se are not the limiting factor experienced by birds, but rather densities of available prey. Limiting densities for many bird species may vary among regions of the state, depending on factors such as the principal and alternate prey species.

3.3 Features of the human environment

3.3.1 History of the BSAI pollock fishery

The following sections provide a brief historical summary of the development of commercial fisheries and fisheries management in the BSAI and GOA with particular attention to the development of the BSAI pollock fishery, the fishery most directly affected by proposed Amendments 61/61/13/8 to implement the AFA.

The earliest fisheries

Aboriginal use of fish for food and trade existed before the first Asian and European explorers and exploiters arrived off the shores of Alaska. These native subsistence fisheries have traditionally focused on near-shore species such as salmon, herring, shellfish (molluscan and crustacean), and a few demersal or groundfish species such as cod, halibut, and rockfish. These subsistence fisheries account for small amounts of fish relative to the commercial fisheries, and they continue in the present time.

Compared to the Atlantic cod resources on the Grand Banks off Newfoundland, Canada, which attracted exploitation by European fishermen long before Columbus "discovered" America in 1492, the Pacific cod and other groundfish resources in the Bering Sea and Gulf of Alaska remained unknown to Europeans until the late 18th century (Cobb 1906; Jensen 1972). The first reported commercial groundfish fishery did not begin until 1864, at the height of the U.S. Civil War and three years before the United States purchase of Alaska from Russia, when the American fishing vessel *Alert* caught nine tons of cod in Bristol Bay (Cobb 1927). In 1867, the U.S. purchase of Alaska from Russia was hailed as a boon to American fishermen because it allowed them to fish for cod without interference from the Russians. In fact, free access to fisheries may have been a compelling factor in the Alaska purchase. The *New York Times* of April 1, 1867, reportedly stated "that a memorial from the Territorial legislature of Washington Territory dated January, 1866, asking the President to obtain certain rights for the fishermen, was the foundation of the present treaty" (Jensen 1972). Also in 1867, another cod fishing expedition was made to the Gulf of Alaska. A regular annual fishery for Pacific cod did not commence off Alaska, however, until 1882. This fishery continued until 1950, when demand for Pacific cod declined to the point that its diminished economic value caused it to cease (BSAI groundfish FMP Sec. 5.2.1.1, published November 19, 1979, 44 FR 66376). This was the earliest groundfish fishery off Alaska. A fishery for sablefish (black cod) began about 1906, but was relatively unimportant until about 1935 (GOA groundfish FMP Sec. 3.2.1.2, published April 21, 1978, 43 FR 17253).

Other (non-groundfish) fisheries were more significant in the economic development of Alaska. The earliest Russian explorers were in search of fur-bearing animals; not fish. Consequently, from the "discovery" of Alaska by Vitus Bering in 1741, until the late 1800s when fisheries for salmon, Pacific cod, and other species began, fur seals, otters, and other fur-bearing animals were the focus of exploitation. The first small-scale fishing enterprise began in 1785 at the Karluk River on Kodiak Island to provide dried salmon to the Russian fur traders. Some export of salted salmon began in the early 1800s when the Russian American Company shipped small quantities of salted salmon to St. Petersburg, Russia. The commercial potential of the abundant Alaska salmon resource was not realized until the 1860s when a technique for large-scale canning of salmon was developed. The first salmon cannery on the Pacific Coast was opened in California in 1864, and salmon canneries were built in Alaska for the first time in 1878 (Cooley 1963). Another early fishery off Alaska was for Pacific halibut. Commercial fishing for halibut began in 1888, when the sailing vessel *Oscar and Hattie* landed 50,000 pounds of halibut in Tacoma, Washington (International Pacific Halibut Commission 1988). Although cod fishermen reported halibut being present in the Bering Sea and Gulf of Alaska in the 1800s, the fishery did not spread to

Alaska waters until after World War I. Market demand for halibut grew as experience and technology developed to ice and preserve halibut sufficiently to serve eastern and mid-western markets. Increased demand for halibut inspired fishermen to explore for larger halibut resources farther north. The fishery began off southeast Alaska, off the south end of Baranof Island in 1911 (Browning 1980).

Early fisheries management.

Fisheries management in Alaska during the 200 years between 1741 and 1941 was virtually non existent. Although the southeast Alaska native Tlingits had a complex system of owning fishing rights (Rogers 1960), non-natives in Alaska (and other areas), until the late 1900s, have steadfastly resisted this concept in fisheries management; preferring instead the common-pool approach in which, at once, no one and everyone owns fishery resources. Regardless of the management system, some form of government intervention is required to assure conservation of fishery resources and equitable distribution of their benefits. This became obvious almost immediately after Alaska was purchased from Russia. The following year, in 1868, the U.S. Treasury Department began to send agents to Alaska to protect fur seals and administer a lease to the Alaska Commercial Co. for their seal harvest in the Pribilof Islands. As the Alaska salmon industry developed, the agents also collected taxes on processed salmon products (Fredin 1987).

In 1870, the Federal Government became more directly involved in the fishery conservation business when Congress authorized funds to investigate the decline in fisheries off New England which had started in 1863. In 1871, Congress created the first federal fisheries agency, the United States Commission of Fish and Fisheries and appointed Spencer F. Baird the first Commissioner. The Commissioner's primary duty was to determine, whether and to what extent, marine food fishes (i.e., commercial species) had declined in abundance, and to report to Congress necessary remedial measures to be adopted (Bowen 1970). Although neither fishery regulation nor fish propagation were in the Commission's charter, it recommended the former be done by state governments while the Commission conducted the latter. This fish culture work was directed primarily at the North Eastern marine and Great Lakes fisheries. In 1903, the Fish Commission became the Bureau of Fisheries in the Department of Commerce and Labor (also created that year), and, among other things, received responsibility to carry out the U.S. Treasury's fishery work in Alaska (Fredin 1987). Ten years later, in 1913, the Department was split into separate Departments of Commerce and Labor with the Bureau of Fisheries being lodged in the Department of Commerce.

Although little of the Fish Commission's work concerned Alaska, shortly after Theodore Roosevelt became President, he ordered it to investigate the Alaska salmon fishery and recommend laws and regulations. David Starr Jordan was appointed to conduct the study which, in 1904, called attention to the inadequacy of existing conservation measures. Although limiting the number of canneries was mentioned as desirable, more emphasis was given to the need for government hatcheries "to maintain the supply of fish...without curtailing production," that is, by regulations which would be unpopular with the cannery owners and difficult to enforce (Cooley 1963). Although concern over the conservation of salmon continued to be raised throughout the early 1900s, Congress expressly denied the Alaska Territorial government authority to regulate fisheries, arguably due to the political influence in Washington, D.C., of cannery owners who resided outside of Alaska in states with elected voting representatives in Congress. Finally, Congress passed "An Act for the Protection of the Fisheries of Alaska" (the White Act), which was signed by President Coolidge in 1924. The White Act declared congressional intent that not less than 50 percent of the salmon should be allowed to escape the fishery, and gave the Secretary of Commerce broad powers to regulate fisheries in Alaska Territorial waters (Cooley 1963). Although salmon fisheries were the focus of the few fishery management regulations that existed during this early 1900s period, two provisions that applied to groundfish were a prohibition against wanton waste, and a requirement for any person engaged in the catching of fish or the processing of fish products to submit an annual report to the Department of Commerce and Labor (Fredin 1987). This early history of the Alaska salmon industry is important, as the salmon canneries evolved into the later-day groundfish processors that are involved in the BSAI pollock fishery.

Except for Pacific cod, and to a lesser extent sablefish, groundfish generally were ignored for targeted fisheries in the late 1800s and early 1900s. Market demand and the ability to transport fish products from remote locations in Alaska to the market at reasonable cost determined whether a fishery for a species would develop; not the abundance or availability of the species to fishermen. Hence, most groundfish, except for cod and halibut, were considered trash fish with no value and discarded or used for bait. For example, pollock was considered an excellent bait fish for cod. The abundance levels of groundfish off Alaska and relatively low levels of exploitation during this period tended to delude fishermen and biologists into thinking that this resource was inexhaustible (Fredin 1987).

Compared to current fisheries, these groundfish fisheries were small in scale and used hook and line gear either as hand lines or setlines (long anchored lines with hooks attached at intervals). Stationary gill net gear was introduced in the New England cod fisheries in 1878, by Commissioner Spencer F. Baird, and beam trawls towed by sailing vessels appeared in the 1890s, but the extent of their use in the Alaska cod fisheries is unknown. With the beginning of the 20th century came the introduction of steam power to fishing vessels. This power source allowed them to pull larger and more efficient otter trawls, which relied on otter boards or doors to open the mouth of a trawl instead of a beam (Jensen 1972). Beam trawl gear in the Northwest was first used in 1884, on a sail-powered fishing vessel, and a trade magazine in 1903 reported that an unnamed vessel was experimenting with an otter trawl in the halibut fishery in British Columbia. Trawl or drag fisheries became well-established in the Northwest, and presumably in Alaska, over the next 40 years as collateral technologies were developed (Browning 1980).

The increased catching power of trawl gear, coupled with the advent of powered refrigeration and gear handling equipment, electronic navigation, and other technologies, first posed a threat to the traditional Alaska fisheries for salmon, Pacific cod, sablefish, and halibut, but eventually opened fisheries for lower valued groundfish species, such as flatfish and pollock, because the trawl gear allowed harvesting of larger volumes of fish. This is reflected in the early regulations. The first mention of trawling in Alaska fisheries regulations was for fishing operations in 1930: “The use of any trawl in commercial fishing operations is prohibited, provided that this prohibition shall not apply to fishing operations conducted solely for the purpose of taking shrimp” (Fredin 1987). This prohibition remained in effect until 1935, when it was relaxed to allow trawl gear to take flounders, if flounder fishing with trawl gear did not result in the capture, injury, or destruction of other food fish. The trawl prohibition was further liberalized in 1939, to allow fishing for king crabs west of 150° west longitude outside of Cook Inlet. Eventually, in 1942, trawls were permitted in commercial fishing for all species except salmon, herring, and Dungeness crabs (Fredin 1987).

Meanwhile, the management of the Pacific halibut fishery took an early international aspect. As fishermen from Canada and the United States prosecuted this fishery from northern California through Alaska shortly before World War I, fishery officials, fishermen, and dealers from both countries began to express concern about increasing amounts of gear and decreasing catch per unit of gear. Beginning in about 1913, Canadian and U.S. officials began to discuss the possibility of an international research and management agency. The war effort slowed this work, but on March 2, 1923, the two nations ratified a halibut conservation treaty (Browning 1980). The 1923 agreement established the four-person International Fisheries Commission, with limited regulatory powers and a principal charge to conduct research. Nevertheless, the new Commission did impose an annual closure of the halibut fishery from November 16 to February 15 to protect spawning halibut (Browning 1980). The treaty was renegotiated in 1930 and 1937 to enhance the Commission's regulatory power, and treaty revisions in 1953 changed its name to the International Pacific Halibut Commission (IPHC).

Post-war development of the Alaska groundfish fisheries

World War II marked a major turning point in the character of fisheries off Alaska. These changes were the result of technological changes (some of which, like radar, were inspired by the war), marketing changes, and changes in fishery policies of some nations. Advances in science and technology in developed nations sowed the seeds of conflict for exploiting living marine resources and challenged the traditional international convention of freedom of the high seas generally accepted since the late 18th century. The freedom of the seas convention was based on three related assumptions: (1) that waters of the high seas were not susceptible to effective occupation, (2) that the resources of the seas were inexhaustible, and (3) that any specific use of the seas would not impair or impose costs on other uses (Koers 1973). Events immediately preceding WW II and during the war demonstrated the fallacy of these assumptions. For example, Bracken (Bracken 1983) provides evidence of a 55 percent decline in the catch per unit effort of sablefish and a decline in average weight from 8 pounds to 6.5 pounds off Alaska between 1937 and 1944. By the mid-1900s, these and other experiences from fisheries indicated frailties of the second assumption, and the war itself demonstrated the relative utility of the first and third assumptions. To preemptively obviate the claims of other nations in the high seas adjacent to U.S. coasts, the Truman Proclamation of 1945 asserted the U.S. right to adopt conservation measures in these areas and require foreign nations to comply with these measures (Koers 1973). Apparently, this unilateral claim was never effectively exercised with regard to fisheries resources until implementation of the Magnuson-Stevens Act beginning in 1977.

Although WW II severely decimated the fishing fleets of several nations, Japan and the Soviet Union undertook major rebuilding efforts as a means of stimulating their economy, providing a protein source for their people, and escaping the depleted fisheries in their own coastal waters. The Soviet Union, in particular, after losing much of its fishing fleet in the war, immediately began a five-year reconstruction plan in 1946. This effort was substantially accelerated in 1955, after the death of Stalin in 1953. Most Soviet fishing vessels at that time were built in East Germany and Poland, which were occupied by the Soviet Army, and sent to the U.S.S.R. as war reparations (Kravanja 1976). The Soviets adopted existing fishing technology developed in other countries, most notably the stern factory trawler (a British invention), which allowed the use of much larger trawl nets than could be used on traditional side trawlers. The strategy of deploying flotillas of such trawlers that work together with support vessels, including processor, cargo, and provisioning vessels, was mainly a Soviet achievement (Pruter 1976). The decision to speed the building of these distant- water fishing fleets was made at the highest levels in the government of the U.S.S.R. in 1956 and supported by an investment in the fishing industry of over 10 billion rubles between 1956 and 1975. By the end of that period, the Soviet fishing fleet was the largest in the world, comprising over 5,400 distant-water vessels and accounting for at least half of the world's total gross tonnage of such vessels (Pruter 1976). The total catch by the U.S.S.R. in 1975 (of all aquatic organisms, including plants, fish, and marine mammals) was 10.3 million metric tons (mt), which was six times the amount harvested by the U.S.S.R. in 1950, and exceeded on a worldwide basis only by Japan.

The Soviet Union sent exploratory fleets to the Bering Sea in 1958 and commenced commercial operations in 1959 on yellowfin sole and red king crab, and then expanded into Pacific ocean perch and herring in 1960. However, no catch statistics were provided until 1964 when the U.S.S.R. began to provide these data to the Food and Agricultural Organization of the United Nations. The Soviets moved into the GOA in 1964, pulse fishing and decimating Pacific ocean perch stocks before moving on to new fishing grounds off Washington and Oregon. The Republic of Korea (Korea) began fishing in the Bering Sea in 1967 and in the GOA in 1972. Poland sent one stern trawler to fish briefly in the Gulf of Alaska and Bering Sea in late 1973, taking less than 500 mt of pollock and herring. Taiwan commenced operations off Alaska in 1974-1975, trawling for pollock and gillnetting for salmon in the central and eastern Bering Sea, and longlining for sablefish off southeastern Alaska (NMFS 2001a).

Obtaining accurate fishing mortality data was a general problem of the foreign distant-water fisheries off Alaska. Pruter (Pruter 1976) estimated that the cumulative catch of bottomfish by all nations during the period 1954-1974 amounted to over 22 million mt, of which Japan accounted for over 15 million mt (67 %), the USSR for nearly 6 million mt (25 %), and the U.S. for about 1.5 million mt (6 %). The remainder was accounted for by the fisheries from other nations such as South Korea, Poland, East Germany, West Germany, China (Taiwan),and Canada. Historical catches of groundfish and squid taken in the Bering Sea, Aleutian Islands, and Gulf of Alaska are displayed in figures 3.3.1 through 3.3.3, respectively. These figures, at a glance, reveal the growth and magnitude of the foreign groundfish harvest off Alaska during the late-1950s through the early-1970s. Of particular note is the development of the Bering Sea pollock fishery in the mid-1960s, which, by 1970 became (and continues to be) the largest single species fishery off Alaska, and indeed, the entire U.S. Also of note are the high catches of the yellowfin sole fishery in the Bering Sea, which peaked in 1962, and the high catches of slope rockfish (e.g., Pacific ocean perch) in the Gulf of Alaska during the period 1963-1968. Both of these stocks were overfished, and while yellowfin sole is believed to have recovered, the slope rockfish stocks are still rebuilding.

In the early 1960s, the United States had fisheries authority only to 3 miles, and those waters were closed to all foreign fishing by P.L. 88-308 beginning in 1964. The U.S. thus had little leverage to restrict the large offshore Japanese and Soviet operations during their initial build-up. Fisheries research and information exchange were conducted initially with Japan and Canada under the auspices of the International North Pacific Fisheries Commission (INPFC), but it focused mainly on salmon interception issues beginning with its first organizational meeting in 1954. The Japanese provided some catch data, but the Soviets, fishing on five-year plans, and in the midst of the Cold War, provided very little information on their harvests.

P.L. 89-658 extended U.S. fisheries jurisdiction from 3 to 12 miles on October 4, 1966. It provided for continued foreign fishing in the 9-mile contiguous zone, but significantly increased U.S. leverage in controlling those fisheries. For example, INPFC first considered joint studies of groundfish (other than halibut), such as Pacific ocean perch and sablefish, in 1967-1971. It produced no joint conservation recommendations for either species even though it was well recognized that both stocks were in jeopardy.

Please see table of contents for figure or table.

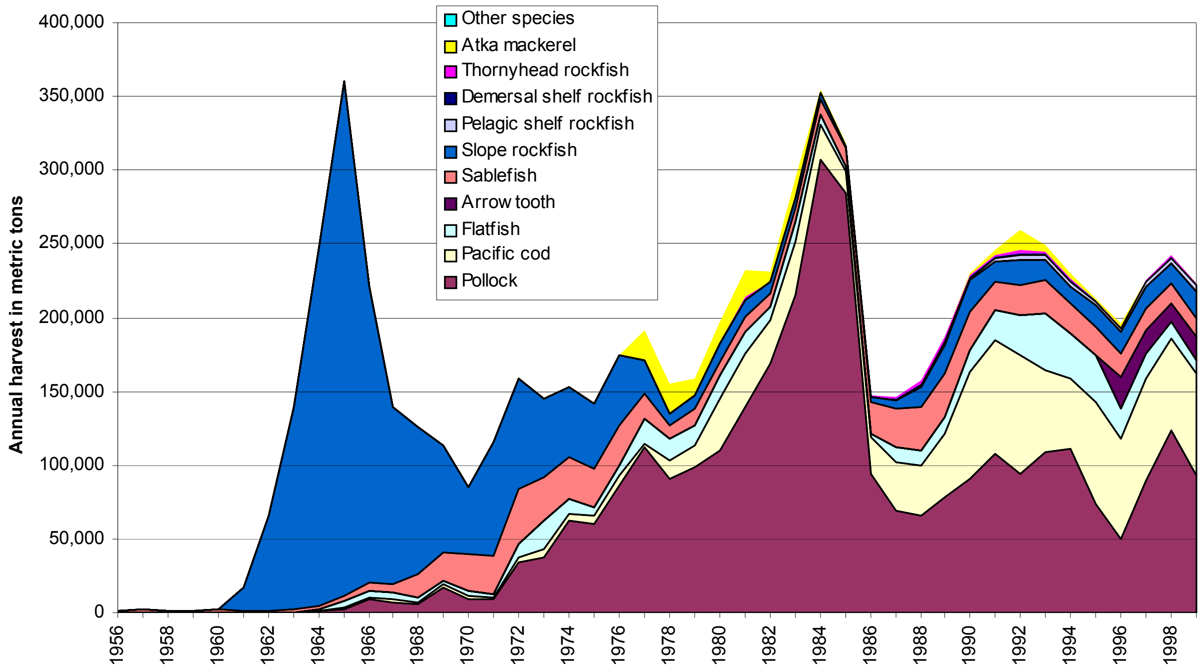

Figure 3.3.3 Groundfish harvests in the Gulf of Alaska by species, 1958-1999.

Prior to the passage of the Magnuson-Stevens Act, U.S.-foreign bilateral agreements were the main mechanism for managing the foreign fisheries. Bilaterals were negotiated in protracted sessions, beginning in 1967 with Japan and the USSR (there was a king crab bilateral with the Soviets in 1965). The first one was negotiated for groundfish with the Soviets in February 1967. The early bilaterals focused on protecting domestic crab, halibut and shrimp fisheries from gear conflicts and grounds preemption by foreign trawlers, and protecting fur seal populations in the Pribilofs.

Groundfish management was addressed beginning in 1972-1973. By then, foreign operations had spread from Alaska south to the Pacific Coast off Washington and Oregon, leaving very depressed stocks in their wake off Alaska. Catches of yellowfin sole in the eastern Bering Sea, for example, had fallen sharply following very large removals by Japan and the Soviet Union. Pacific ocean perch stocks were decimated. Pollock catches were increasing rapidly and were thought likely to follow the same pattern as perch and flatfish.

In 1973-74, for the first time in the history of the bilaterals, catch quotas were placed on eastern Bering Sea pollock and flatfish, and on Gulf of Alaska Pacific ocean perch and sablefish. Additionally a complex array of closures was established mainly to protect U.S. fisheries for crab and halibut. The catch quotas represented the average catches of the previous three to four years and were an attempt to put the fisheries on hold so the stocks could be evaluated. Unfortunately, each country was responsible for monitoring its catch quotas, the only internationally acceptable arrangement at the time. The final round of negotiations on bilaterals before the Act was passed occurred in late 1974 with Japan and in mid-1975 with the USSR. The U.S. had negotiated an agreement with Korea in 1972, effective through 1977, and with Poland in 1975.

While the species targeted by the Japanese, Soviet, and other fisheries off Alaska during this period were not significant traditional fisheries for Alaska fishermen, the effect on domestic fisheries was four-fold. First, the lack of adequate catch statistics prevented U.S. scientists from determining whether these distant-water fisheries were causing overfishing of the target stocks. Second, the incidental or bycatch, of salmon, halibut, and crabs, for which there were traditional Alaska fisheries, in the distant-water fisheries likely did have a significant negative effect on harvests of these species by U.S. domestic fishermen. Third, a wide variety of gear types were used by the foreign fleets. Gear included benthic trawls of various configurations, tangle nets that were essentially large mesh trawls used to capture crabs, hook and longline gear, and a variety of pots. Such gear was used with little concern over the effects on habitat, and for a long time there was little concern about grounds-preemption with American fishermen or the fate of their gear. Finally, the development and support of the foreign distant-water fisheries off Alaska as a matter of government policy by the participating nations amounted to subsidies to which U.S. fishermen had relatively little ability to respond in kind. The result was effective preemption of the groundfish fisheries by the foreign distant-water fisheries until 1977 (INPFC, bilaterals, etc.).

The Magnuson Fishery Conservation and Management Act of 1976

When the Magnuson Fishery Conservation and Management Act (later known as the Magnuson-Stevens Act) was passed on April 13, 1976, groundfish fisheries off Alaska were, for all practical purposes, totally foreign. Most groundfish management measures were designed to lessen their impact on domestic fisheries for halibut and crab. Bureau of Commercial Fisheries reports indicate that Japan, the Soviet Union, South Korea, and Taiwan landed over 1.64 million mt (Poland did not fish in 1976, but did later). The total number of foreign vessels ranged from 138 in January to 759 in June. More than 300 vessels were present each month from April to September. Japan deployed 64-616 vessels, the Soviets 42-147, South Korea 1-57, and Taiwan 0-4 vessels. Japan dominated the fisheries, landing 71% of the total foreign catch, the Soviets 21%, South Korea 7%, and Taiwan 1%. Foreign catch was 95% groundfish (mostly pollock), 2% salmon, 1% sablefish and herring, and 1% Tanner crab. Landings were distributed 79% in the Bering Sea, 10% in the Aleutian Islands, and 11% in the Gulf of Alaska (NMFS 2001a).

Japan also fished for snails to the northwest next to the U.S.-U.S.S.R. convention line, for shrimp near the Pribilof Islands, and deployed two factory ship fleets for Tanner crab in the eastern Bering Sea. Japan required its groundfish fleet to trawl off-bottom in crab areas and avoid areas of high crab density. Bilateral bycatch measures established time-area closures in the 3-12 mile contiguous zone and/or the high seas along the Aleutian Islands and the eastern Bering Sea shelf break, around the Pribilof Islands and in the Gulf of Alaska. They were applied in varying degrees to trawler and longline vessels, mainly in early spring to reduce bycatch of halibut and crab and to reduce gear conflicts with U.S. fishermen. Halibut could not be retained in trawls, but there was only limited monitoring of halibut bycatch.

U.S. commercial fisheries were limited mainly to red king crab in the Gulf of Alaska and eastern Bering Sea, herring in coastal waters, salmon, and halibut. Very little groundfish was taken other than sablefish and small amounts of Pacific cod off southeastern Alaska. The IPHC had banned all but longline gear for halibut as early as 1944.

There were some foreign fishing closures around the Pribilof Islands so that marine debris and netting from fishing operations would be less likely to harm fur seals. In the U.S., the short-tailed albatross already had been declared “endangered” in 1969, although no protective measures had been enacted in the fisheries.

With the passage of the Magnuson-Stevens Act, all bilateral agreements had to be brought into conformance with the purposes and provisions of the Act. Following its implementation on March 1, 1977, foreign fishing could be conducted in the new 200 nautical mile Fishery Conservation Zone (FCZ; later changed to Exclusive Economic Zone or EEZ) only pursuant to an international treaty or a governing international fishery agreement. Governing agreements were completed with Taiwan and the USSR in 1976 and with Japan, Korea and Poland in 1977. While these agreements allowed access to the

EEZ, all foreign nations had to fish under the rules of preliminary fishery management plans (PMP) that applied only to foreign fisheries.

Foreign fisheries off Alaska were managed under four PMPs, all published in the Federal Register in February 1977: (1) Trawl Fisheries and Herring Gillnet Fishery of Eastern Bering Sea and Northeast Pacific, (2) Trawl Fishery of the Gulf of Alaska, (3) Sablefish Fishery of the Eastern Bering Sea and Northeastern Pacific, and (4) Snail Fishery of the Eastern Bering Sea. The latter fishery was a very small fishery by Japan using 21 vessels that longlined with pots along the Bering Sea shelf edge northwest of the Pribilof Islands, harvesting about 3,000 mt of edible meats in the mid-1970s. The development of the PMPs and management measures contained within is discussed in detail in the draft PSEIS (NMFS 2001a).

First groundfish FMPs: 1979-1982

A major task of the Council, which first convened in October 1976, was to develop FMPs for the groundfish fisheries to replace the PMPs (which applied only to foreign fisheries). The first FMP developed was for the GOA, implemented in January 1979. The BSAI FMP was implemented in 1982. Both plans carried forward most of the management measures from the PMPs. OYs were set for each of the main species, and species complexes and fisheries were closed when the OY was reached. The first FMPs placed an emphasis on protecting prohibited species and the associated domestic fisheries. For example, each plan had an objective to protect halibut. The ban on retention of halibut in trawls was carried forward and some time-area closures were expanded Bottom trawl restrictions were applied to the foreign fisheries. No restrictions were placed on domestic fishermen in the Bering Sea other than non-retention of PSC species.

The first FMPs for groundfish were developed mainly to control the predominantly foreign fisheries, but they established the fundamental management tools that would later be used to control domestic fishing. PMP restrictions on foreign fisheries were carried over into the FMPs, expanded in many cases to further two policy objectives: (1) protecting target groundfish species, and (2) protecting bycatch species and the associated domestic fisheries.

The "Americanization" of the BSAI pollock fishery

From 1976 until the late 1980s, a variety of federal laws and programs were developed to promote the "Americanization" of fisheries inside the U.S. EEZ, especially the rich groundfish resources of the Bering Sea. A start towards this was made in the early 1980s with the advent of what was known as the "Fish-and-Chips" policy. Fish-and-Chips tied foreign fishing privileges in the EEZ to commitments by the foreign entities to purchase the products of the U.S. seafood industry. The Magnuson-Stevens Act was designed to promote the development of a U.S. offshore fleet through an allocation system that favored domestic vessels over foreign vessels and joint venture operations. This lead to the rapid development of joint ventures between foreign operators and U.S. harvesters, in which U.S. vessels would offload and sell their catches at sea to foreign factory ships that held permits to operate in the EEZ. Pollock joint ventures grew from a trickle in 1980 to peak at 1.1 million mt in 1987 using over 100 U.S. trawlers working within some 28 different company arrangements with such countries as Japan, South Korea, Poland, the Soviet Union, Portugal, and Iceland (Figure 3.3.4)

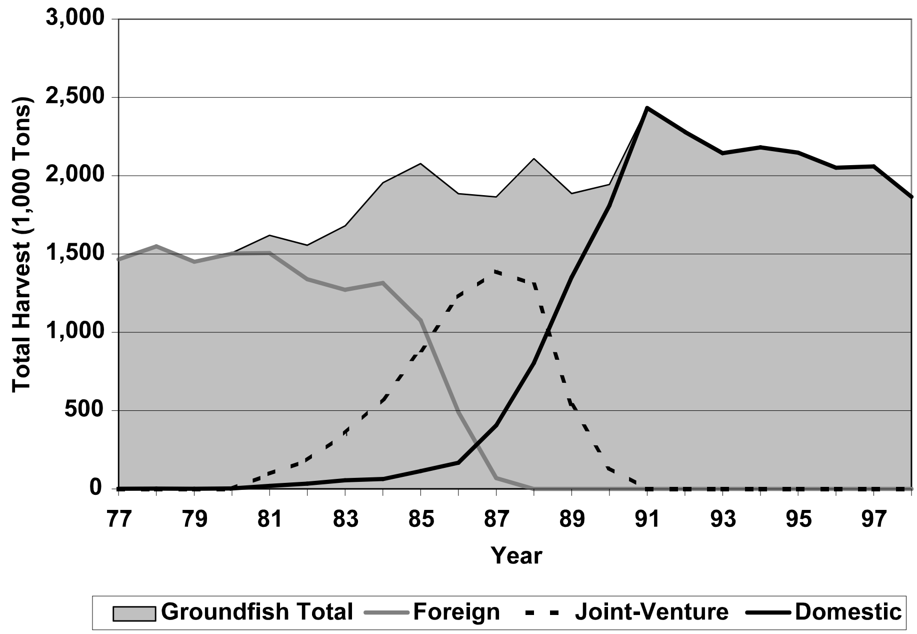

Figure 3.3.4 Foreign, joint-venture, and domestic groundfish fishing, 1977-1998.

A parallel program sponsored by NMFS, the Fisheries Obligation Guarantee Program (FOG), guaranteed over $150 million worth of loans since April 1977 for the construction of U.S. factory trawlers and floating processors (Gay 1992). In addition, the Commercial Fishing Industry Vessel Anti-Reflagging Act of 1987 (Anti-Reflagging Act) (101 Stat. 1778) was passed to restrict the way in which non-U.S. citizens could participate in the ownership and construction of U.S. fishing vessels by expanding the requirements for obtaining a fishery endorsement, restricting the ownership of U.S. fishing vessels by non-U.S. citizens, and modifying the rules on reflagging and rebuilding.

As a result of these policies, the groundfish resource off Alaska was harvested and processed entirely by U.S.-flagged vessels and processors by 1991, although the explosive growth of the domestic fishery was financed, in large part, by a flood of foreign capital into new vessels and processors. The last years of foreign directed fishing in the GOA and BSAI were 1986 and 1987, respectively. Foreign joint ventures peaked in 1987, and their last years of operation in the Gulf of Alaska and the Bering Sea were 1988 and 1991, respectively.

Most larger factory trawlers constructed at this time were intended for use primarily in the BSAI pollock fishery, although some smaller factory trawlers were designed primarily for head and gut processing of Atka mackerel, Pacific cod and flatfish. the majority of these vessels had originally been built for other purposes (e.g., as oil rig supply vessels or for fishing in other fisheries) and were converted into factory trawlers and motherships at shipyards in the U.S. and abroad. A typical vessel construction or conversion could represent an investment in the order of $38 million (American Factory Trawler Association 1993). Foreign investors from Norway and Japan led the construction and conversion of such U.S. flagged factory trawlers, leading some observers to conclude that the fishery was "Americanized" in name only. Most of these vessels operated out of the Seattle area, where the bulk of the economic activity (provisioning, maintenance, offloading, etc.) associated with their fishing activities in Alaska occurred. In addition, shore plants were constructed in Dutch Harbor and Akutan during this period, each with the capacity to process pollock products, primarily surimi. Two distinct sectors of the industry thus emerged: The Seattle-based offshore sector and the Alaska-based inshore sector and the stage was set for intense competition between the two sectors for access to the BSAI pollock resource.

Foreign ownership and the Anti-Reflagging Act of 1987

With the flood of foreign capital that entered the Alaska groundfish fisheries in the 1980s, foreign ownership and control of fishing vessels became a major issue. Prior to the Anti-Reflagging Act, 100% foreign ownership of a U.S. licensed fishing vessel was possible through the establishment of a U.S. subsidiary corporation, so long as the CEO and a majority of the board of directors were U.S. citizens. In addition, processing and tendering vessels were allowed to operate under the less restrictive registry license which permitted vessels originally built in foreign shipyards. During the passage of the Magnuson-Stevens Act, Congress had rejected restrictions on the level of foreign ownership because of a perceived need for foreign capital, and because international business relationships were considered necessary to provide export markets to U.S. harvesters and processors (Walsh and Weinstein 1988).

Attitudes towards foreign investment changed considerably by the mid 1980s. A flood of foreign investors were purchasing derelict U.S. vessels and converting them to modern factory trawlers in foreign shipyards. This flood of foreign capital and converted vessels coming out of foreign shipyards was rapidly leading to the overcapitalization of the Alaska groundfish fisheries, especially the BSAI pollock fishery. By the mid 1980s, U.S. shipyards, U.S. owned fishing companies, and North Pacific coastal communities began pressuring for a halt in the steady stream of foreign-owned factory trawlers emerging from foreign shipyards under U.S. flag. In response, Congress passed the Anti-Reflagging Act in 1987 which made three basic changes in the fishery license requirements designed to curtail foreign involvement. First, the Act expanded the definition of fishery to include fish processing, storing, and transporting (except in the case of foreign commerce). As a result, fish processors and tenders were now required to obtain a fishery endorsement rather than a registry endorsement. Second, the Act imposed restrictions on foreign ownership of fishing vessels similar to those for vessels involved in coastwise trade. Finally, the Act prohibited both the construction and conversion of fishing vessels in foreign shipyards.

The issue of vessel nationality. Under international maritime law, all documented vessels have a nationality. This vessel nationality (or flag) often differs from the nationality of the vessel's owners. For the purposes of the Magnuson-Stevens Act, a vessel's flag rather than the nationality of the vessel's owners is used to differentiate between foreign and domestic fishing operations. A fishing vessel must be documented and licensed under the U.S. flag in order to operate in the EEZ under the priorities of the Magnuson-Stevens Act.

Documentation refers to an administrative system dating to the beginning of the nation when the first Congress adopted maritime statutes corresponding to English law in force at the time. Today, as then, a vessel's certificate of documentation may contain one or more licenses known as "endorsements" authorizing specific types of commercial activities. Along with documentation and licensing, there are a variety of manning and control requirements that depend on vessel tonnage. On a typically-sized factory trawler, the ship's officers must all hold appropriate U.S. Merchant Marine licenses and be U.S. citizens (or legal resident aliens). Foreign crew members are limited to 25 percent of the vessel's total personnel. Four types of vessel endorsements are available under U.S. maritime law:

> *Registry*: This endorsement is required for U.S. vessels engaged in import/export trade with foreign nations. Registry is the most general endorsement and easiest to obtain. Registry endorsement permits one hundred percent foreign ownership (through U.S. subsidiary

corporations) and construction in foreign shipyards. The reflagging of foreign vessels with a registry endorsement is possible and often expedited in time of war.[17]

Coastwise: This endorsement is required for vessels engaged in trade between U.S. ports. Coastwise endorsements are limited by the provisions of the Jones Act which imposes more stringent domestic construction and ownership requirements.

Great Lakes: This endorsement is required for vessels engaged in international trade with Canada on the Great Lakes. Great Lakes endorsement contains restrictions similar to those required for a Coastwise endorsement.

Fishery: This endorsement is required for all vessels fishing in the navigable waters of the United States and in the EEZ. The Anti-Reflagging Act (and later, the AFA) made changes in the qualifying criteria for a fishery endorsement with the intent to restrict foreign ownership.

Limits on foreign ownership under the Anti-Reflagging Act. The Anti-Reflagging Act represented the first substantive limit on foreign investment in the U.S. fishing industry. For a vessel to qualify for a fishery endorsement under the Anti-Reflagging Act, U.S. citizens must have held a controlling interest in the vessel. In practice, this restricted foreign investment in a fishing vessel to 49 percent of the voting shares. To administer this requirement, the United States Coast Guard (USCG) applies the same "controlling interest" test used for coastwise (Jones Act) licensed vessels. When vessel owners apply to the USCG for documentation and licensing, they were required to submit a certified application containing citizenship information. In the case of corporations, the USCG simply requested the nationalities (but not identities) of the CEO or chairman of the board, and a rough indication of the proportion of voting shares owned by U.S. citizens (under 50 percent, 51 to 74 percent, or 75 percent and above). The USCG did not require a corporation to supply owner's identities or even an exact percentage of foreign ownership (GAO 1990).

The citizen ownership requirements of the Anti-Reflagging Act applied only to corporate control. Consequently, many other avenues for foreign investment remained open. There was no limit on foreign ownership of non-voting stock meaning that it was possible for a foreign investor to own 100 percent of a vessel's non-voting stock coupled with 49 percent of the voting stock. In addition, there were no restrictions on foreign investments structured as loans. Many foreign investors acquired a majority interest in fishing vessels through loans secured by a preferred ships mortgage in accordance with the Ships Mortgage Act (46 U.S.C.A. 911-984). Because a preferred ships mortgage is secured by the vessel itself, such loans gave foreign investors considerable influence and control over a highly mortgaged vessel. Shipyards and banks in Norway and Japan were reported to have invested hundreds of millions in factory trawler conversions through preferred ships mortgages (Gay 1992).

Limits on vessel reconstruction and reflagging. The Anti-Reflagging Act was successful in eliminating foreign construction and conversion of factory trawlers. The Anti-reflagging Act required that all processing and tendering operations to acquire a fishery endorsement which eliminated the use of reflagged foreign processors. In addition, the Act required that all rebuilding, including the construction of major components, must be done in U.S. shipyards.

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[17] An example of this practice was the reflagging of Kuwaiti oil tankers to U.S. flag during the Iran-Iraq war in the mid 1980s which was done so that the U.S. Navy could assert protection over shipping lanes in the Persian Gulf. During congressional debate over the Anti-Reflagging Act, there was concern within the Reagan Administration that the Act would restrict the ability of the U.S. government to reflag foreign vessels during times of emergency (GAO 1990).

Even prior to the Anti-Reflagging act, only U.S. built vessels were eligible for a fishery endorsement. However, prior to the Anti-Reflagging Act, there were no restrictions on the foreign reconstruction or conversion of U.S. built vessels. Under prior law, the U.S.-built status of a vessel would remain so long as foreign reconstruction was not so extensive as to deem the vessel "new". USCG regulations consider a vessel "new" if its hull and superstructure were constructed entirely of new materials, or if it was built with structural parts of an existing vessel that were torn down to the point that would no longer commit them to use in the building of a vessel. In practice, virtually any degree of foreign reconstruction was allowed so long as the reconstructed vessel contained some structural parts from the old vessel. To cite an extreme example, the 280 ft. factory trawler AMERICAN TRIUMPH was converted in Norway in 1990 from a 40 year old 85 ft. research vessel (Gay 1992).

Prior to the Anti-Reflagging Act, there were even fewer restrictions on floating processors and tenders. Such vessels were allowed to operate under the less restrictive registry license. Because a registry license imposed no domestic construction requirements, cheap foreign-built processing vessels were becoming increasingly commonplace in U.S. fisheries (Walsh and Weinstein 1988). Prior law allowed a reflagged foreign vessel, wholly owned by foreign investors, to operate as a U.S. fish processor under domestic priorities of the Magnuson-Stevens Act.

Savings clauses and exemptions. The Anti-Reflagging Act was signed into law on January 11, 1988, but was enforced retroactively as of July 28, 1987. If strictly enforced, this retroactive date would have eliminated numerous vessels under construction in foreign shipyards at the time. In response to considerable pressure from U.S. companies with vessels under construction in foreign shipyards, Congress inserted several savings clauses into the Anti-Reflagging Act "grandfathering" in many corporations that had embarked on foreign conversions based on prior law. The first category of savings clause eased the prohibition against foreign rebuilding. According to this clause, a vessel converted outside the United States would still be eligible for fishery endorsement if one of four conditions existed:

1. If before July 28, 1987 the vessel was licensed under registry and operated as a fish processor or tender in the navigable waters of the United Sates or the Exclusive Economic Zone;

2. if before July 28, 1987 the vessel was purchased by a U.S. citizen or corporation for use as a processor or tender under contract entered into before July 28, 1987;

3. if before July 28, 1987, the vessel was documented as a U.S. flag vessel and was rebuilt in a foreign country before July 28, 1987; and

4. if a U.S. built vessel is subsequently rebuilt in a foreign shipyard providing rebuilding is done under contract entered into before January 11, 1989, and the vessel is delivered before July 28, 1990 (101 Stat. 1779.4).

A second category of savings clauses ameliorated the meaning of the citizen control requirements. This savings clause was the primary focus of a subsequent lawsuit *Southeast Shipyard Assn v. U.S.* This savings clause reads:

> *[The citizen control requirement] applies to vessels issued a fishery license after July 28, 1987. However, that [requirement] does not apply if before that date the vessel…*
>
> *(1) was documented under chapter 121 of title 46 and operating as a fishing, fish processing, or fish tender vessel in the navigable waters of the United States or the Exclusive Economic Zone, or*

(2) was contracted for purchase for use as a fishing, fish tender, or fish processing vessel in the navigable waters of the United States or the Exclusive Economic Zone, if the purchase is shown by the contract or similarly reliable evidence acceptable to the Secretary to have been made for the purposes of using the vessel in the fisheries (46 U.S.C. 12102 note).

In response to the unclear and confusing language of the savings clauses, especially with respect to changes of ownership, the USCG formally adopted regulations interpreting the ownership savings clause on December 12, 1990. The regulation stated that a corporation meeting the pre-existing requirements regarding the citizenship of its president but not satisfying the newly enacted 51 percent citizen control requirement may nevertheless be eligible for a fishery endorsement if prior to July 28, 1987 the vessel came within subsection (1) or (2) of the savings clause (55 Fed. Reg. 51,252 (1990)). Simply stated, the effect of this interpretation was to make the savings exemptions "run with the vessel" rather than the owner. The implication of this ruling was profound, Any international corporation could now avoid the citizen control requirements altogether, by simply purchasing vessels holding "grandfathered" fishery endorsements. A General Accounting Office (GAO) study estimated that approximately 29,000 U.S. vessels were licensed for fishing, and thus "grandfathered" as of the savings clause cut off date (GAO 1990).

Southeast Shipyard Association v. the United States. On May 16, 1990, before the USCG's final rule was published, the Southeast Shipyard Association and several U.S. owned fishing companies challenged the granting of new fishery endorsements to two factory trawlers, the RESOLUTE and the NORTHERN HERO. Both vessels were owned by corporations controlled by U.S. citizens prior to July 28, 1987, and were subsequently sold to corporations in which foreign citizens held controlling interests. The first decision was reached on April 30, 1991 when District Court Judge Penn overturned the USCG's interpretation of the ownership savings clause ruling that "the savings clause did not attach to vessels and thus did not permit the transfer of 'grandfathered' vessels to noncitizen-controlled corporations". The USCG's interpretation, the court stated, would "effectively obliterate the primary purposes of the Anti-Reflagging Act," which the court identified as promoting "the continued orderly growth, development, and competitiveness of the U.S. fishing and fish processing industry..." (979 F.2d 1545).

The Penn decision sent immediate shock waves throughout the fishing industry. A survey of industry representatives came to the conclusion that over 40 percent of all vessels operating in the Alaska groundfish fishery representing over 60 percent of the total harvesting tonnage would be eliminated if the Penn ruling was enforced (Matsen 1991). By implication, it was suddenly obvious that at least 60 percent of the North Pacific offshore fishing industry was owned by foreign controlled corporations. The USCG decided not to appeal the Penn decision, and issued an advance notice of rulemaking to consider new interpretations of the savings clause exemption. However, no vessels were stripped of their fishery endorsements pending appeals by the affected companies.

On November 24, 1992, Eleventh Circuit Court Judge Randolf reversed Penn's decision and upheld the USCG's original interpretation of the savings clause as attaching to the vessel. Randolf's opinion was based on the fact that under maritime law, it is the vessel, not the owner, that is eligible for documentation. Randolf noted that endorsements are issued to vessels rather than owners. Furthermore, Randolf reasoned that the language of the savings clause clearly frames exemptions in terms of the vessel. According to Randolf:

On its face, the clause makes nothing turn on who holds title to the vessel in the future. The criteria mentioned in the clause relate back, not forward. Whether a ship is grandfathered depends on what documentation had been issued to it before July 28, 1987…to give the savings clause the meaning the plaintiffs ascribe to it--that a grandfathered vessel will lose its exemptions *if it is sold to another corporation after July 28, 1987 would require many additional words to be read into the statute (979 F.2d 1541).*

Penn's original opinion was not based on the language of the savings clause itself. Rather, it was based on a statement in a House report which supposedly indicated the legislative intent of the Anti-Reflagging Act. A Report on the Anti-Reflagging Act which was issued by the House Committee on Merchant Marine and Fisheries prior to voting states:

The savings clause in subsection (b) does not apply in the event that the ownership or operational control of a vessel protected under the provisions of subsection (b) changes in whole or in part. In such an instance, the controlling interest provisions of subsection (a) would apply (979 F.2d. 1541).

Penn interpreted this report as an indication that Congress intended a strict interpretation of the citizen control requirements. Penn reasoned that the USCG's interpretation of the savings clause would utterly defeat this intended policy because there are now over 29,000 grandfathered fishing vessels each of which could have its life extended indefinitely through rebuilding.

Randolf overruled Penn stating that the House Report could not be used to indicate legislative intent because the Act came before the Senate without the accompanying House Report. It appears then, from the record, that the Senate only had the language of the Act itself to study before voting. Randolf further reasoned that the House Report was useless because it made no attempt to define what is meant by a "change of ownership in part". Could the sale of even one share of stock could constitute a "change of ownership in part" and disqualify a vessel's grandfathered status? Clearly, such an interpretation would be impossible to implement.

Both the District and Circuit Court appeared frustrated by the Act's inexact language and incomplete legislative history. Indeed, attorneys with the USCG's Office of Documentation and Tonnage consider the Anti-Reflagging Act so poorly crafted that its meaning is often incomprehensible and consequently, impossible to implement. In any event, because the Circuit Court has upheld the USCG's original interpretation of the ownership savings clause, virtually any degree of foreign ownership and control is still possible in the U.S. fishing industry. This issue was not readdressed by Congress until the passage of the AFA in 1998.

The inshore/offshore allocation regime: 1992-1998

By 1990, there were more than 50 factory trawlers participating in the BSAI pollock fishery, along with several motherships and four major shoreside plants. The new domestic factory trawler fleet alone, bought enough capacity to the BSAI pollock fishery to catch and process considerably more pollock than allowed under the TAC. The inshore processing industry, supplied by smaller, mostly independent catcher vessels, also had considerable excess capacity. By 1989, the stage was set for intense competition among the inshore and offshore sectors of the pollock industry for access to the pollock resource off Alaska.

The precipitating event that led to the development of inshore/offshore allocations began in early 1989 when the rapid harvest of the GOA pollock TAC by several large factory trawlers forced an early closure of the GOA pollock fishery and prevented inshore catcher vessels and processors from realizing their anticipated economic benefit from the pollock fishery later in the year. At the April 1989 Council meeting, fishermen and processors from Kodiak Island requested that the Council consider specific allocations of fish for processing by the inshore and offshore components of the fishery to prevent future preemption of resources by one component of the industry. The Council considered the request and the impacts on coastal community development and stability of the fisheries and began preparation Amendments 18/23 to the FMPs for groundfish of the BSAI and GOA.

Inshore/Offshore 1 (Amendments 18/23). After 2 years of analysis, review, and debate on the inshore/offshore issue, the Council took final action on Amendments 18/23 in June 1991. Amendment 18 to the BSAI FMP, as adopted by the Council, established a Community Development Quota (CDQ) program and set aside one half of the pollock reserve (7.5 percent of the BSAI pollock TAC) for CDQ harvest, allocated 35 percent of the remaining BSAI pollock TAC to vessels catching pollock for processing by the inshore component and 65 percent of the remaining BSAI pollock TAC to vessels catching pollock for processing by the offshore component in the first year of the allocation, with the inshore allocation increasing to 40 percent in the second year, and 45 percent in the third and fourth years of the Amendment, respectively. Amendment 18 also established a catcher vessel operational area (CVOA) from which catcher processors and motherships would be excluded throughout the fishing year when operating in a directed fishery for pollock.

Amendment 23 to the GOA FMP, as adopted by the Council, allocated 100 percent of the GOA pollock TAC to vessels catching pollock for processing by the inshore component. Amendment 23 also allocated 90 percent of the GOA Pacific cod TAC to vessels catching Pacific cod for processing by the inshore component, and 10 percent of the GOA Pacific cod TAC to vessels catching Pacific cod for processing by the offshore component.

NMFS's review of the amendments began on December 1, 1991. On March 4, 1992, NMFS approved Amendment 23 to the GOA FMP. On the same date, NMFS partially disapproved Amendment 18 to the BSAI FMP by approving the 35/65 allocation split for 1992 but disapproving the increased inshore component allocations for 1993-1995. In his March 4, 1992, letter notifying the Council of his approval of Amendment 23 and partial disapproval of Amendment 18, the NOAA Administrator stated that NOAA was not opposed to the concept of an allocation between onshore and offshore interests as an interim measure pending development of a solution to overcapitalization--ideally, a market-based solution. NMFS's disapproval of the BSAI pollock allocations for 1993 through 1995 was based in part on a cost/benefit analysis prepared by NMFS that indicated a significant net economic loss to the Nation under the proposed allocations for years 1993 through 1995. The Administrator urged the Council to work as expeditiously as possible toward some other method of allocating fish than either direct competition among participants within an open access fishery, or direct government intervention. Meanwhile, he noted, preventing preemption by one fleet of another, safeguarding capital investments, protecting coastal communities that are dependent on a local fleet, and encouraging fuller utilization of harvested fish are desirable objectives that are provided for under the Magnuson-Stevens Act.

At its April 1992 meeting, the Council considered NMFS's actions and decided to revise Amendment 18. The Council supplemented its previous analysis of allocation alternatives. At a special meeting to consider this issue in August 1992, the Council again considered the comments of its advisory bodies and the public, adopted its preferred alternative, and submitted it to NMFS as revised Amendment 18. As adopted by the Council, revised Amendment 18 would have established a 35/65 inshore/offshore allocation for 1993, the first year of the revised amendment. The inshore allocation would then have increased to 37.5 percent for 1994 and 1995, the second and third years of the revised amendment. In addition, revised Amendment 18 proposed two changes to the CVOA. Under revised Amendment 18, the CVOA would take effect only during the pollock B Season (September 1 to November 1), and motherships (and catcher processors operating as motherships) were allowed to receive deliveries and process pollock inside the CVOA as long as they did not engage in directed fishing for pollock themselves. In September 1992, the Council submitted revised Amendment 18 to NMFS for review and approval.

On November 23, 1992, after consideration of the revised amendment, public comments, the record developed by the Council, and the analysis of the potential effects of the proposed amendment, NMFS partially disapproved revised Amendment 18. NMFS approved pollock allocations of 35 percent and 65 percent for vessels catching pollock for processing by the inshore and offshore components, respectively, for the years 1993 through 1995, and the establishment of the CVOA. However, NMFS disapproved the 2.5 percent increase for 1994 and 1995, finding that the sole purpose of the increased allocation to the inshore component during those years was economic, and therefore, in violation of national standards 4, 5, and 7 of Magnuson-Stevens Act, as well as Executive Order 12291. The final rule implementing these decisions was published on December 24, 1992 (57 FR 61326).

When the Council developed its original inshore/offshore amendments, it stipulated that Amendments 18/23 would expire on December 31, 1995, with the intention that by December 31, 1995, it would have adopted and NMFS would have approved a more comprehensive, long-term management program to address the overcapitalization and allocation problems facing the industry, not only for pollock and Pacific cod, but for all the groundfish and crab fisheries under the Council's authority.

Inshore/Offshore 2 (Amendments 38/40). By 1995, the Council had made some progress on its long-term plan. For example, in June 1995, it adopted license-limitation programs for the groundfish and crab fisheries. However, the Council estimated that it would take 2 or 3 more years to develop and implement a comprehensive rationalization plan that could more directly address these allocation issues. Consequently, the Council decided it would be necessary to extend the provisions of Amendments 18/23 for an additional 3 years to maintain stability in the industry, facilitate further development of the comprehensive management plan, and allow for realization of the goals and objectives of the pollock CDQ program. In making this decision, the Council continued the mandate it established for itself in 1992 when it recognized that a more permanent solution to overcapacity and preemption was needed.

The Council also determined that if the provisions of Amendments 18/23 expired, the fishery would return to the "free-for-all" state that existed before Amendments 18/23, and the inshore sector again would be faced with the threat of preemption by the large and efficient offshore sector. Thus, the Council began the process to extend the provisions of Amendments 18/23. The provisions of Amendment 18 became the basis for Amendment 38 to the BSAI FMP, and the provisions of Amendment 23 became the basis for Amendment 40 to the GOA FMP.

At its meeting in June 1995, the Council voted unanimously to adopt Amendments 38/40 through December 31, 1998, with two changes from Amendments 18/23. First, Amendment 38 decreased the size of the CVOA by moving the western boundary of the area 30 minutes to the east. Second, it allowed catcher processors to engage in directed fishing for pollock inside the CVOA if the inshore component pollock allocation was closed to directed fishing and the offshore component allocation was still open to directed fishing. A proposed rule to implement Amendments 38/40 was published in the *Federal Register* on September 18, 1995 (60 FR 48087). NMFS approved Amendments 38/40 on November 28, 1995, and a final rule to implement Amendments 38/40 was published in the *Federal Register* on December 12, 1995 (60 FR 63654).

Inshore/Offshore 3 (Amendments 51/51). In April 1997, recognizing that a comprehensive rationalization plan to address overcapitalization and preemption issues could not be adopted and implemented prior to the expiration of Amendments 38/40, the Council began development of a third set of inshore/offshore FMP amendments. These amendments became identified as Amendments 51/51. In

June 1997, the Council requested information in the form of pollock industry profiles that enabled it to examine the evolution and current status of the BSAI pollock fisheries from 1991 through 1996. At that time, the Council also decided to split the reauthorization of the pollock CDQ program in the BSAI and the reauthorization of BSAI inshore/offshore pollock allocations into separate FMP amendments. Under BSAI Amendments 18 and 38, the CDQ program had been included with the inshore/offshore pollock allocations. However, BSAI Amendment 51 only addresses inshore/offshore pollock allocations. The Council adopted a separate FMP amendment, Amendment 45, to extend the BSAI pollock CDQ program on a permanent basis.

At its September 1997 meeting, after examination of the industry profiles prepared by Council staff, consideration of public comment, and Council discussion, the Council adopted a complex set of inshore/offshore alternatives for analysis. During the course of the next several Council meetings, these evolved into five basic alternatives and included various suboptions within each alternative. These alternatives are described in detail in the EA/RIR/IRFA prepared for Amendments 51/51 (NPFMC 1999e).

At its June 1998 meeting, the Council voted 7-4 to adopt Amendment 51 to the BSAI with the following changes from the allocation scheme established under Amendment 38: (1) Four percent of the BSAI pollock TAC, after subtraction of reserves, would be shifted to the inshore component resulting in a 39/61 inshore/offshore allocation split; (2) a portion of the inshore component Bering Sea B season allocation, equal to 2.5 percent of the BSAI pollock TAC after subtraction of reserves, would be set aside for small catcher vessels, and would become available on or about August 25 of each year; and (3) catcher vessels delivering to the offshore component would be prohibited from fishing inside the CVOA during the B season from September 1 until the inshore component B season allocation is closed to directed fishing. Amendment 51 would remain in effect for the years 1999 through 2001.

Under BSAI Amendment 51, the BSAI pollock TAC, after subtraction of reserves, would be allocated 61 percent to vessels catching pollock for processing by the offshore component and 39 percent to vessels catching pollock for processing by the inshore component. In developing this preferred alternative, much of the Council discussion focused on a last minute proposal by major inshore and offshore industry representatives that would have established a 3-way allocation split: 40 percent inshore, 50.5 percent offshore, and 9.5 percent to "true" motherships. A separate category for "true" motherships would have enabled the remaining factory trawlers in the offshore sector to establish a harvesters cooperative similar to the cooperative operating in the hake fishery off the Pacific coast. However, several Council members expressed unease with the cooperative idea and uncertainty about the potential spillover effects into other fisheries. As a result, the Council rejected the industry agreement and chose to maintain a 2-way allocation split.

In rejecting the industry's 3-way split proposal, the Council noted that the industry proposal came very late in the process and that many affected members of the public did not have adequate time to analyze and comment on it. While the statutory moratorium on the development of new individual fishing quota (IFQ) programs does not prohibit the Council from adopting a 3-way allocation split, some Council members expressed concern that adopting a 3-way allocation split for the explicit purpose of facilitating a harvesters cooperative could be seen as violating the intent of the Congressional moratorium on IFQ programs.

In adopting its preferred allocation alternative for BSAI Amendment 51, the Council indicated that a shift of pollock TAC to the inshore component was warranted for several reasons. First, the Council noted that the analysis prepared for Amendments 38/40 concluded that the expected net losses to the Nation's economy were probably overstated in the cost/benefit analysis prepared for Amendments 18/23. A majority of the Council, therefore, believed that the Secretary's rationale for partially disapproving the original Amendment 18 in 1991 no longer was valid and that the allocation proposed under Amendment 51 was closer to the Council's original intent under Amendment 18. Second, the Council noted that the EA/RIR/IRFA prepared for Amendments 51/51 concluded that the inshore sector realizes greater gross revenues per mt of pollock than the offshore sector due to the higher recovery rates achieved by the inshore sector. The analysis generated gross revenue estimates for the various processing components using 1996 data and concludes that 4 percent of the BSAI pollock TAC (the amount shifted under Amendment 51) would generate the following gross revenues if processed by each of the following industry components, respectively: Inshore component $24.1 million; mothership component, $21.4 million; offshore component $21.7 million. Third, the Council noted that coastal communities in Alaska where onshore processors are located are disproportionately dependent on pollock processing as compared to the communities in which offshore processors are based.

The Council also voted unanimously to extend the provisions of GOA Amendment 40 without change for an additional 3 years. GOA Amendment 51, allocated 100 percent of the GOA pollock TAC and 90 percent of the GOA Pacific cod TAC to vessels catching pollock and Pacific cod for processing by the inshore component. Ten percent of the GOA Pacific cod TAC would be allocated to vessels catching Pacific cod for processing by the offshore component. The Council believed that an extension of the existing allocation percentages would maintain stability in the GOA pollock and Pacific cod fisheries and would prevent a reoccurrence of the preemption by large factory trawlers that led to the original inshore/offshore amendments.

Passage of the AFA and its effect on the BSAI pollock fishery

During 1998 while the Council was considering Inshore/Offshore 3 alternatives, the organization of the BSAI pollock fishery and the role of factory trawlers in U.S. fisheries also attracted the attention of Congress. During the spring of 1998, The American Fisheries Act (S. 1221) was introduced into the Senate. S. 1221 would have stripped the fisheries endorsements from numerous factory trawlers rebuilt in foreign shipyards under the Anti-Reflagging Act savings exemptions, established a 165' limit on U.S. fishing vessels, and limited foreign ownership in U.S. fishing vessels to 25%. During the same time that inshore/offshore allocations of the BSAI pollock resource were being analyzed and debated within the Council arena, Congress was considering superseding the provisions of the Anti-Reflagging Act with increased restrictions of foreign ownership and foreign rebuilt factory trawlers.

These two parallel issues, foreign ownership and BSAI pollock allocations, converged in the fall of 1998 when Senators from Alaska and Washington invited all sides of the BSAI pollock industry to Washington D.C. to resolve both the allocation battle and the issue of foreign-rebuilt factory trawlers and foreign ownership in the BSAI pollock fishery. The resulting compromise became the AFA which resolved both the issues of foreign ownership and rebuilt factory trawlers, and the issue of BSAI pollock allocations which had not been resolved to the satisfaction of all parties by the Council’s adoption of Amendments 51/51 above.

The AFA had two primary objectives; (1) to complete the process begun in 1976 to give U.S. interests a priority in the harvest of U.S. fishery resources, and (2) to significantly decapitalize the Bering Sea pollock fishery. The AFA was unprecedented in the 23 years since the enactment of the Magnuson-Stevens Act. With the Council system, congressional action is generally not needed to address fishery conservation and management issues in specific fisheries. However, Congress believed that the state of overcapacity that existed in the BSAI pollock fishery at the time of passage of the AFA in 1998 was the result of mistakes in, and misinterpretations of, the 1987 Commercial Fishery Industry Vessel Anti-Reflagging Act (Anti-Reflagging Act) that only Congress had the capacity to fix. The Council and

NMFS had no authority to turn back the clock by removing fishery endorsements or provide the funds required under the Federal Credit Reform Act to allow for the $75 million loan to remove capacity, to strengthen U.S. controlling interest standards for fishing vessels, or to implement the inshore cooperative program contained in the AFA (*Cong. Rec.* 1998, 12777-12782; Appendix B).

In addition to addressing what Congress believed were mistakes in the Anti-Reflagging Act, and providing for the decapitalization of the BSAI pollock fleet, the AFA resolved the longstanding sectoral allocation battle in the BSAI pollock fishery which began in 1991 with the passage of Amendments 13/19 which made inshore and offshore allocations of pollock in the BSAI and GOA. Meeting the AFA's objective of decapitalization of the BSAI pollock fleet through buyouts and a new limited entry program involving fishery cooperatives, the resolution of the pollock allocation battle through a new sectoral allocation formula, and the need to address the spillover effects of these two actions, forms the purpose and need for Amendments 61/61/13/8.

The AFA was passed by Congress and signed into law in October 1998 after Amendments 51/51 had been submitted by the Council for review and approval by NMFS but before the two amendments were approved. Faced with the new statutory requirements of the AFA which superseded the allocation scheme adopted by the Council under Amendments 51/51, NMFS was forced to partially disapprove Amendments 51/51 to comply with the new statutory requirements of the AFA. Consequently NMFS disapproved the BSAI inshore/offshore allocation scheme proposed under Amendment 51 to the BSAI FMP but approved the inshore/offshore allocation scheme proposed under Amendment 51 to the GOA FMP since the AFA did not address inshore/offshore allocations of pollock or Pacific cod for the GOA.

3.3.2 Profile of the BSAI pollock industry

This section profiles the various harvest and processing activities associated with the BSAI pollock fishery. It includes a brief summary of the evolution of this fishery, its current prosecution, and a description of each of the major industrial sectors involved. This profile draws upon data and information from a variety of sources, including the Council's 1998 analysis of inshore/offshore pollock allocations, the Council's 1994/1995 Industry Sector Profiles, and the 2001 Draft Programmatic SEIS for the Groundfish Fisheries (NMFS 2001a). Recent changes in the structure and prosecution of this fishery, which stem specifically from the provisions of the AFA, are also reflected.

The BSAI pollock fishery is the single largest and most valuable fishery in the North Pacific, with a current harvest of over 1 million mt, worth over $300 million (ex-vessel value only, prior to any value added processing). Quotas for this fishery have fluctuated between 1 million and 1.6 million mt during the past ten years. This fishery developed rapidly, from a minor joint venture fishery ain the early 1980's to a fully domesticated fishery in the late 1980's, to an overcapitalized, derby style fishery by 1990. The advent of a U.S. surimi technology in the mid-1980's and the development of fillet machine technology, coupled with a decrease in crab fishery resources, fueled the rapid domestic development of this fishery. Certain provisions of the 1987 Anti-Reflagging Act (which was intended to prevent foreign vessels from re-flagging as American vessels) also fueled the capacity influx, particularly in the at-sea processing sector, by allowing the construction or conversion of vessels already 'in the pipeline'.

Nearly a year round fishery in the early to mid-1980's, the pollock fishery shrank to less than 60 days by 1992, in the face of a steady, or slightly increasing, quota. Beginning in 1990, and continuing until the passage of the AFA, pollock fisheries have been the subject of intense allocation conflicts between competing harvesters and processors, and have been the focus of several major management actions taken by the North Pacific Fishery Management Council (NPFMC), and promulgated by the National Marine Fisheries Service (NMFS). Primarily these actions have been allocations of the pollock quota between the at-sea catcher/processor fleet, primarily based in Washington state, and the onshore plants (and harvest vessels delivering onshore), located in Alaska, but with headquarters in Washington. Each of the sectors currently involved in the pollock fishery, and their evolution, are further described below.

AFA catcher/processors

Foremost within the overall rapid development of this fishery was the at-sea processing, or factory trawl, fleet. Other sectors, including onshore processing plants and harvesting vessels, existed prior to the development of the domestic pollock fishery, but were involved in other fisheries. The at-sea fleet came into existence, largely, to specifically target the pollock fishery. The period from 1985 to about 1992 witnessed the growth of this sector from a few vessels to over 40. The rapid growth and huge catching/processing capacity of this fleet precipitated the race for fish in this fishery, with the attendant preemption and allocation conflicts beginning in the late 1980's. While there are non-pollock factory trawlers, about 25 ‘head and gut’, or H&G factory trawlers, which target species other than pollock, those vessels are not covered in this description. The pollock at-sea processing fleet has two fairly distinct components - the fillet fleet, which concentrates on fillet product, and the surimi fleet, which produces a combination of surimi products and fillets. Both of these sectors also produce pollock roe, mince, and to varying degrees fish meal.

Surimi catcher/processors. Vessels in this fleet range in size from 224-386 feet, with an average of 295 feet, and have an average rating over 500 gross tons and over 6,000 horsepower. Some of these vessels can harvest over 400 mt of fish per day, producing over 100 mt of frozen product, with freezer hold capacity of 1,500 mt. These vessels are equipped with full processing facilities below the main deck, containing multiple lines of both surimi and fillet producing machinery. While these vessels have surimi capability, the fillet lines allow them to also produce higher valued fillet product from the larger fish, and provide the flexibility to respond to prevailing market conditions.

The number of surimi catcher/processors has declined from its peak of 20 vessels in 1992, to the current 14 operating in 2001 A combination of excess capacity, reduced quotas for the offshore sector, and the AFA have resulted in this reduction in vessels. These vessels harvest and process species other than pollock, to a limited degree, with pollock comprising 90-95% of the total volume of fish processed. Surimi accounts for nearly half of the overall wholesale value for this sector, fillets about 30%, and the remaining 20% coming primarily from roe. All of these vessels are based in Washington state, with home offices and administrative staff located there. These vessels have large crews, averaging over 100 persons (predominately from the U.S. west coast), with total cost of labor on the order of 35% of total production value. Total wholesale production value for this fleet (all species and product forms) is estimated at about $200 million in 1999. Pollock specifically accounts for 85-90% of total wholesale value for this fleet, with the remainder coming from other groundfish and salmon processing. The non-pollock groundfish processing is primarily a function of incidental catches of other species within the pollock fishery rather than targeted efforts for non-pollock species.

Fillet catcher/processors. Fillet catcher/processors are typically smaller than their surimi counterparts, ranging from 210-296 feet with an average length of 240 feet, average gross tonnage of 460 tons, average horsepower of 4,200, and average crew sizes of 70-80 persons. They are less specialized in terms of species, but more specialized in terms of product forms from pollock. They produce fillets exclusively (except for roe and mince products), and therefore target the larger pollock typically found at the bottom of the water column. The sector’s requirement for larger fish also makes it more likely that these vessels will have greater amounts of incidental catch of non-pollock species. Consequently, bycatch rates of incidental species, other than salmon and herring, are higher than for the surimi fleet. Higher bycatch rates and the inability to produce surimi make fillet vessels relatively less desirable compared to other

AFA vessels. There were 21 of these vessels in the pollock fishery in 1993, which dropped to about a dozen from 1994-1998. With the passage of the AFA, and the permanent removal of several at-sea vessels, that number has dropped to only four operating in 1999. The primary product of this fleet is deep-skin, boneless fillets which are sold to various markets, including U.S. fast food and grocery markets.

Fillet catcher/processors processed 467,323 mt of groundfish in 1991. Production by fillet catcher/processors declined steadily from 1991 through 1999, with 90,963 mt reported in 1999. While pollock is the primary species for this fleet, Pacific cod is a significant secondary species, comprising about 10% of overall processing volume. Fillet product accounts for about 75% of total wholesale production value, with the remainder equally divided between roe and mince product. Total wholesale value of product for this sector was $55 million in 1999. Like the surimi fleet, these vessels are based in Washington state.

AFA catcher vessels

Vessels harvesting BSAI pollock deliver their catch to shore plants located in western Alaska, or to large floating (mothership) processors, with some landings going to the offshore catcher/processor fleet. Referred to as catcher vessels, these vessels comprise a relatively homogenous group, most of which are long-time, consistent participants in a variety of BSAI fisheries, including pollock, Pacific cod, and crab, as well as GOA fisheries for pollock and cod. Vessels in this sector range from under 60 feet to 193 feet, though most of the vessels fishing BSAI pollock are from 70-130 feet, with average horsepower of 1,500, an average gross tonnage of 225, and average hold capacity of 8,300 cubic feet.

The AFA established, through minimum recent landings criteria, the list of trawl catcher vessels eligible to participate in the BSAI pollock fisheries. There are 107 eligible trawl vessels, most of which are homeported in the Pacific Northwest, with some from Alaska coastal communities, most notably the Kodiak area or Aleutian Island communities. There is significant, and recently increasing, ownership of this fleet (about a third) by onshore processing plants. Nearly all of these vessels are over 70 feet in length and have participated for many years in the North Pacific fisheries, including the joint venture fisheries beginning in the late 1970's and continuing through the 1980's. Many of these vessels also have ties to the BSAI crab fisheries, going back to the boom day of those fisheries.

Forty-three of these vessels also qualify for crab fishery endorsements under the license limitation program for those fisheries. All of these vessels, but one that met the specific requirements for an exemption based on long term participation, are subject to restrictions in those crab fisheries. These restrictions limit their participation to crab fisheries in which they have active in the past, and for some species, limits the amount of crab they can catch. The AFA catcher vessels with crab endorsements obtained approximately 83 percent of their revenue from groundfish (pollock accounted for 85 percent of the groundfish revenue) and 17 percent from crab, in 1998. Since 1988, groundfish has accounted for at least 80 percent of the ex-vessel revenue generated by these vessels.

Thirty-five of the catcher vessels with a crab endorsement were owned by persons residing in Washington, three by residents of Alaska (all in Kodiak), and five by residents of other states. These vessels typically have a crew of four or five, including the skipper, when fishing for groundfish. When fishing for crab they may take on one or two additional crew members. Crew members are typically paid on a share basis, meaning that their salary is based on a percentage of the vessel’s revenue. The individual crew member shares can range from less than 1 percent for persons with no experience to almost 7 percent for persons with 10 years or more experience. Skippers receive the largest crew share. The size of the skippers share is usually between 11 and 14 percent. Engineers often receive the second highest crew share. In total, the crew will often be paid about 40 percent of the vessel's revenue after expenses.

The remaining sixty-four vessels eligible to participate in the BSAI pollock fishery are ineligible for any BSAI crab fishery. Over 97 percent of the ex-vessel revenue generated by these vessels came from groundfish over the 1988-98 time period. The other small amounts of revenue were generated in halibut, salmon, or other miscellaneous fisheries. This excludes any revenues generated outside of Alaska. Within the groundfish fisheries, pollock accounts for the majority of landings and revenue. During 1998, pollock accounted for 83.5 percent of these vessel's total ex-vessel revenue generated from fisheries in the North Pacific. Pacific cod was the next most important species in terms of revenue (14 percent). The remaining groundfish species accounted for the other 2.5 percent. This distribution of revenue among these species groups has been fairly stable over the 1988-98 time period.

Thirty-five of the sixty-four vessels were owned by persons residing in Washington, 14 by persons residing in Oregon, seven in the Kodiak area of Alaska, four from other states, and four of the vessels were unaccounted for during 1998. There is little information available on the residence of the crew members on these vessels. The total number of employees could be estimated by multiplying the number of vessels by 4.5 (assuming that there are usually four or five crew members on each vessel). Additional assumptions would be required to apportion those crew members to various states.

AFA Inshore processors

There are six land based and two floating processors eligible to participate in the inshore sector of the BSAI pollock fishery. Three of the land based processors are located in Dutch Harbor/Unalaska. The communities of Akutan, Sand Point, and King Cove are each home to one of the remaining land based processors. The two floating processors in the inshore sector are required to operate in a single BSAI location each year, and they usually anchor in Beaver Inlet in Unalaska to do their processing. However one of the floating processors has relocated to Akutan. In total, the inshore processors can take BSAI pollock deliveries from a maximum of 97 catcher vessels, as of June 23, 2000, according the regulations implemented by the AFA.

The land based processors produce primarily surimi, fillets, roe, fishmeal, and a minced product from pollock. Other products such as oil are also produced by these plants but accounted for relatively minor amounts of the overall production and revenue. These plants process a variety of species including other groundfish, halibut, and crab, but have historically processed very little salmon.

The two floating inshore processors have historically produced primarily fillets, roe, fishmeal, and minced products. Surimi production at these two plants has been limited over the 1995 through the first three quarters of 2000 time period. One of the plants produced a small amount of surimi in 1999. The other plant starting producing substantial amounts of surimi for the first time in 2000.

The six inshore processors physically located in the BSAI generated between $254 million and $287 million in first wholesale revenue over each of the last four years. In 1999, they generated a total of $268 million. Of the total, $134 million was a result of surimi production, $55 million from fillets, $23 million from roe, $3 million from mince, $37 million fishmeal, and $15 million from other products.

All six of the processors were registered to owners in Washington. However, it is widely known that the three large processors based in Dutch Harbor/Unalaska are at least 50 percent owned by Japanese parent companies. The plants in Akutan, Sand Point, and one of the floating processors are owned by the same company with U.S. ownership.

Two BSAI pollock processors are located in the Alaskan Peninsula area (in cities of Sand Point and King Cove). The Sand Point plant is owned by Trident Seafoods, the same company that owns the Akutan plant, and the BSAI pollock that had been delivered to that plant is now being delivered to Akutan under the AFA cooperative system. The other plant is located in King Cove and is owned by Peter Pan Seafoods. Five BSAI pollock catcher vessels are currently members of that plant's cooperative. The Peter Pan plant in King Cove the smallest BSAI pollock processor with only 0.72 percent of the inshore total (3,506 mt in 2000).

Processing employment in the inshore sector changes drastically by fishing season. The peak processing time has been during the pollock roe season. During the summer there is relatively little activity at the groundfish processors. When the fall pollock fishery begins, there is once again a large increase in the number of employees at the plants. The changes in employment primarily impact processing workers and not the management and support staff positions at these facilities. In terms of full time equivalent positions, the six BSAI pollock processors accounted for 1,631 jobs in 1999. This is an increase from the 1,464 jobs in 1998. The expansion is likely in part due the increased allocation of pollock to the inshore sector that began in 1999. Information compiled by the Alaska Department of Labor, for the Inshore/Offshore 3 Amendment package, indicated that over 85 percent of the employees of these processing plants were residents of states other than Alaska, in 1996 and 1997.

Wages for processing employees in the inshore sector are generally paid on an hourly basis. Information on wages indicates processing workers with no experience can expect to make about $6 an hour excluding time-and-a-half for overtime and other food and housing bonuses. These employees are often expected to sign contracts where they are required to work 1,000 to 1,500 hours for their transportation to the remote processing facility to be reimbursed. During peak weeks employees can often expect to work more than 50 hours per week.

AFA motherships

Motherships are defined as vessels that process, but do not harvest, fish. The three motherships currently eligible to participate in the BSAI pollock fishery range in length from 305 feet to 688 feet LOA. The first vessel entered the North Pacific fisheries in 1985, the second entered in 1989, and the third entered in 1990. These times correspond to the period when the U.S. pollock industry was rapidly expanding to displace the foreign owned harvesters and processors. As stated earlier, this influx of U.S. processing capacity was fueled by advances in surimi processing and filleting machine technology which enabled the large scale plants to operate efficiently.

Motherships contract with a fleet of catcher vessels that deliver raw fish to them. As of June 23, 2000 a total of 20 catcher vessels were permitted to make BSAI pollock deliveries to these motherships. These catcher vessels tend to be smaller than catcher vessels designed to deliver to the inshore sector. That is because they transfer codends to the motherships at sea and do not store pollock onboard in refrigerated seawater fish holds. Therefore, substantial harvesting and processing power exists in this sector, but it is not as great as either the inshore or catcher/processor sectors.

Motherships are dependent on BSAI pollock for most of their income, though small amounts of income are also derived from the Pacific cod and flatfish fisheries in Alaska. In 1999, a total of 101,384 mt of fish was delivered to motherships, and over 99 percent of the total was pollock. About $30 million worth of surimi, $6 million of roe, and $3 million of fishmeal and other products was produced from that fish. These figures exclude any additional income generated from the whiting fishery off the Oregon and Washington coasts in the summer. In 1996, whiting accounted for about 12 percent of the mothership's total revenue.

Only one of the three motherships participated in the GOA during 1999, and GOA participation in previous years was also spotty. This is likely due to the Inshore/Offshore restriction that prohibits pollock from being delivered to at-sea processors in the GOA.

The motherships reportedly employ 102 crew members/processing workers on average. These positions are not available throughout the entire year. When the jobs are converted to full-time equivalents (2,080 hours/year), it is estimated that there are 86 jobs. These positions were estimated to generate a total of $12 million in compensation in 1999. All of the employees hired by motherships were assumed to come from Washington state, since that is the point of hire for these operations. Washington is also listed as the owner's address for each of these vessels.

Summary and conclusions

Much of the information presented in this section of the document is based on how the BSAI pollock fishery has been traditionally prosecuted. However, the entire structure of the BSAI pollock fishery was altered in 1999. The BSAI pollock fishery is now managed based on AFA and Steller sea lion regulations. These new regulations impact all sectors, with Steller sea lion RPAs altering when and where pollock are fished (changed seasons and distributed catch inside and outside sea lion critical habitat), and the AFA basically changed the structure of the BSAI pollock fishery to one with individual fishing rights. Therefore, the fishing, processing, and employment patterns may be altered in the future as a result of these regulations.

3.3.3 Profile of the non-AFA groundfish industry

The groundfish fisheries of the BSAI and GOA supports a number of different types of vessels, gear types, and processing plants in addition to the pollock vessels and processors recognized in the AFA and described in Section 3.3.2 above. While these industry sectors are not affected directly by the regulations proposed under Amendments 61/61/13/8, they nonetheless are affected by the choice of alternatives in that spillover effects as a result of the AFA and Amendments 61/61/13/8 have the potential to dramatically affect the nature of other groundfish and crab fisheries.

This section has grouped these various non-AFA groundfish industry participants into categories by vessel size, gear type, and processor type. Additional detailed information about the industry sectors and regional profiles of the North pacific Groundfish Fisheries is found in a report entitled *Sector and Regional Profiles of the North Pacific Groundfish Fisheries* (Northern Economics, August 2000) and contained in Appendix I of the Draft PSEIS (NMFS 2001a).

Data for catcher vessels that delivered to shore plants or inshore floating processors are primarily from fishtickets collected by ADF&G and augmented by the Commercial Fisheries Entry Commission (CFEC). Data for catcher/processors are primarily from the NMFS Observer Program. Unlike deliveries to inshore plants, which use ADF&G fishtickets to indicate deliveries by species and areas, observers on the motherships estimate at-sea delivery amounts. The observers make estimates of total groundfish delivered by each at-sea catcher vessel, and make species-specific estimates of total harvests delivered to the mothership in aggregate. However, the observer does not routinely develop estimates on a species-specific basis for individual catcher vessels.

Non-AFA catcher vessels

Catcher vessels harvest groundfish using various gear types and deliver their catch to inshore processing plants or motherships. This section groups groundfish catcher vessels into six mutually exclusive groundfish classes to illustrate the differences and similarities among the catcher vessels that participate in the groundfish fisheries of the North Pacific. To focus the analysis on catcher vessels that rely on groundfish for a substantial part of their income, minor participants that had landings below a certain threshold limit were excluded from the analysis of catcher vessel participants. Different threshold harvest levels were used for different types of vessels. In general, larger vessels have larger threshold harvest levels, and trawl vessels have higher threshold harvest levels, than fixed gear vessels. Fish ticket data received from NPFMC for use in this analysis indicated that a total of 4,964 vessels made groundfish landings from 1988 through 1998. During the same period there were 1,367 that were not included for any year in any of the eight vessel classes and 3,597 that were included in a vessel class for at least 1 year. An analysis of landings and value associated with the minor participants that did not meet the threshold levels revealed that these vessels accounted for less than 0.06 percent of the total volume and 0.1 percent of the ex-vessel value of the groundfish harvests by catcher vessels from 1988 through 1998. In other words, at least 99.9 percent of the catcher vessel harvests of groundfish by volume and value are accounted for by the vessels included in the analysis.

1. **Trawl catcher vessel greater than or equal to 60 feet in length (TCV ≥ 60').** Includes all catcher vessels greater than or equal to 60 feet LOA that used trawl gear for the majority of their catch but are not qualified to fish for pollock under the AFA. Because these vessels are longer than 60 feet, they are ineligible to participate in Alaska commercial salmon fisheries with seine gear. Vessels must have harvested a minimum of 5 tons of groundfish in a year to be considered part of this class. The value of 5 tons of Pacific cod at $0.20 per pound is about $2,200.

2. **Trawl catcher vessel less than 60 feet in length (TCV < 60').** Includes all trawl catcher vessels less than 60 feet LOA. These vessels are allowed to participate in Alaska commercial salmon seine fisheries, which distinguishes them from longer trawl catcher vessels. The threshold level requires 2 tons of groundfish in a year. The value of 2 tons of Pacific cod at $0.20 per pound is about $900.

3. **Pot catcher vessel (PCV).** These vessels are greater than or equal to 60 feet LOA and rely on pot gear for participation in both crab and groundfish fisheries. All vessels included in the class are qualified to participate in the crab fisheries under the Crab LLP. Some of these vessels use longline gear in groundfish fisheries. Threshold harvest level varies by length. Vessels greater than or equal to 125 feet LOA needed to have harvested 2 tons to be included; for smaller vessels the level is 0.5 tons. Using Pacific cod, these harvest levels equate to $900 and $225, respectively.

4. **Longline catcher vessel (LCV).** Vessels greater than 60 feet LOA that use primarily longline gear. None of these vessels are qualified for the BSAI Crab LLP. These vessels concentrate their efforts on halibut and high-value groundfish such as sablefish and rockfish. The threshold level for inclusion was set at 0.5 tons. Since these vessels catch primarily sablefish the threshold level equates to $1,100, assuming $1.00 per pound for sablefish deliveries.

5. **Fixed gear catcher vessels 33 feet to 59 feet in length (FCV 33-59).** This class includes all vessels from 33 feet to 59 feet LOA that harvest their groundfish with fixed gear. The vessel lengths imply that these vessels could participate in most Alaska commercial salmon fisheries but precludes them from participating in the lucrative Bristol Bay drift gillnet fisheries. The threshold level for inclusion was set at 0.5 tons. Since these vessels catch primarily sablefish the threshold level equates to $1,100 assuming $1.00/per pound for sablefish deliveries.

6. **Fixed gear catcher vessel less than or equal to 32 feet in length (FCV ≤ 32).** These vessels are all less than or equal to 32 feet LOA and rely on fixed gear harvest groundfish. They are under the 32-

foot limit established for the Bristol Bay salmon gillnet fishery. The threshold level for inclusion was set at 0.25 tons in a year. This level equates to $550 of sablefish landings at $1.00 per pound.

Catcher vessels operate in different regions of Alaska, and their owners and crew reside in communities located in or out of the state. Several geographic regions are defined and used in the socioeconomic analysis that are not used in other sections of this EIS. These regions were defined to enhance the dissemination of information about the linkages among the fishing and processing industry and the communities and regions that are affected by fishery management decisions.

- **Alaska Peninsula and Aleutian Islands Region (AKAPAI)**. Includes the Aleutians East Borough and the Aleutians West Census Area.

- **Southcentral Alaska Region (AKSC).** Includes Valdez-Cordova Census Area, Kenai Peninsula Borough, Matanuska-Susitna Borough, and the Municipality of Anchorage.

- **Kodiak Island Region (AKKO).** Includes the Kodiak Island Borough and other parts of the Kodiak archipelago.

- **Southeast Alaska Region (AKSE).** Includes Yakutat Borough, Skagway-Hoonah-Angoon Borough, Haines Borough, City and Borough of Juneau, City and Borough of Sitka, Wrangell-Petersburg Census Area, Prince of Wales-Outer Ketchikan Census Area, and Ketchikan Gateway Borough.

- **Washington Inland Waters Region (WAIW).** All counties bordering Puget Sound and the Strait of Juan de Fuca, including Clallum, Island, Jefferson, King, Kitsap, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom.

- **Oregon Coast Region (ORCO).** Counties bordering the Northern Oregon coast including Lincoln, Tillamook, and Clatsop.

Catcher vessels harvest a number of species, including both groundfish and non-groundfish, as part of their annual fishing activity. In an effort to provide a relatively uniform description of the activities of each of the eight types of catcher vessels and to report as much of the catch data as allowed under the rule of confidentiality, the socioeconomic analysis has aggregated the groundfish species into four groups. (Confidentiality restrictions require that any disclosure of harvest data be aggregated to include the operations of at least four catcher vessels. Because of limited activity of some types of vessels in some regions, disclosure of less aggregated species data would have violated this confidentiality limitation.) Two of the groups are single species—pollock and Pacific cod. The other two groups are aggregations of multiple species. All flatfish species are aggregated into a single group defined as FLAT. FLAT does not include halibut, which is not managed as a groundfish under the BSAI and GOA FMPs. All other groundfish species are aggregated into a single group defined as ARSO. ARSO includes Atka mackerel, all rockfish species, sablefish, and “other” groundfish species as defined in the FMPs. Groundfish as a whole are designated as GFSH in the tables, and all other non-groundfish species such as salmon, halibut, herring, and crab are defined as non-GFSH.

- **ARSO**: Atka mackerel, all rockfish species, sablefish, and other groundfish.

- **FLAT:** All flatfish except halibut which is not classified as a groundfish species under the FMPs.

- **PCOD:** Pacific cod.

- **PLCK:** Pollock

  GFSH: all groundfish species, including PLCK, PCOD, FLAT, and ARSO

- **non-GFSH:** all non-groundfish species harvested in Alaska commercial fisheries, including salmon, crab, halibut and herring.

Table 3.3.1 summarizes the activities of non-AFA catcher vessels in the North Pacific groundfish fisheries. The first part of the table sets out the number of vessels active in the fishery and the total tonnage of groundfish catch. The data show a decline in the number of catcher vessels in the fishery, from 1681 in 1992 to 1184 in 1998. Most of this decline is due to the fact that fewer vessels in the two small vessel fixed gear classes (FGCV 33'-59' and FGCV = 32') are participating. Compared to the number of participating vessels, groundfish harvests by catcher vessels as a sector have remained relatively steady, fluctuating between a high of 786.3 million tons in 1992 and a low of 728.2 million tons in 1996. The relative stability of the harvest tonnage in comparison to participating vessels occurs because most vessels that have exited the fishery were small fixed gear vessels that tend to harvest less fish on average. Furthermore, total groundfish harvests depend less on the number of vessels and more on the allowable harvests and allocations between sectors as determined by NMFS and NPFMC.

The second section of the table presents ex-vessel values of groundfish and non-groundfish harvests from catcher vessels active in the groundfish fishery. In other words, the ex-vessel value of non-groundfish presented in the table includes only non-groundfish harvests by vessels that also achieved threshold level harvests of groundfish. Groundfish harvest values as a percent of total values are also presented. For the catcher-vessel sector as whole, the table indicates that non-groundfish is as important in terms of ex-vessel value as groundfish. Over the 11-year period shown, groundfish accounted for 50.4 percent of the total ex-vessel value harvested by all catcher vessels in the groundfish catcher-vessel classes. Vessels greater than 60 feet LOA accounted for 71 percent of the groundfish ex-vessel value, while catcher vessels less than 60 feet LOA accounted for 57 percent of the non-groundfish value. In comparison to groundfish volume (discussed in the previous paragraph), revenues from groundfish have fluctuated greatly from 1988 until 1998. Since revenue fluctuations do not coincide with volume, price changes are responsible for most of the revenue changes.

The third and fourth sections of the table show the percent of the ex-vessel value of groundfish harvests drawn from the various groundfish species groups and areas. In 1998 pollock accounted for 48.9 percent of total ex-vessel value of groundfish harvests, while the ARSO species group, which includes high-value sablefish and rockfish, and Pacific cod, accounted for 28.1 percent and 21.6 percent, respectively. Higher-valued Pacific cod and the ARSO harvests combine to account for approximately the same amount of revenues as lower-valued pollock, even though they are substantially smaller in tonnage than pollock harvests. Since 1991 between 40 and 50 percent of groundfish revenues have come from the Bering Sea, where the large trawlers harvest pollock. In the last 10 years, significant percentages of catcher vessel revenues have also been realized from harvests from the GOA, which is a major source of Pacific cod and ARSO species—most importantly, high-valued sablefish and rockfish.

The percentage of ex-vessel harvest value catcher vessel received from the various processors is presented in the fifth section of the table. As may be expected from the distribution of revenues by harvest location, the largest groundfish revenues are received from Bering Sea pollock inshore plants--approximately 40 percent of all groundfish revenues. The remaining revenues are distributed fairly equally among the other processors, with Southeast and Kodiak inshore plants both having slightly greater portions than those in other inshore plants and motherships.

The sixth and seventh sections of the table present employment and payments to labor for catcher vessels, which, in the analysis, are attributed to the area of the residence of the vessel owner. Employment data were estimated for each vessel type by multiplying the crew requirements for groundfish fishery participation for that vessel type by the number of vessels of that type that are active in the fishery. Employment, therefore, should not be construed as FTE employment since some vessel classes devote only a short portion of their efforts to groundfish participation.

The data show that catcher vessels owned by residents of AKSE that are active in groundfish fisheries have consistently employed the greatest number of people of any of the regions defined—in excess of 1,300 every year. AKSC also has maintained employment of about 900 or more each year, with the exception of 1989, when employment was less than 500. The 1989 decline may be due to the *Exxon Valdez* accident, which occurred in AKSC that year. The large number of positions on catcher vessels for these regions results from the fact that most of the small fixed gear catcher vessels, which account for the majority of catcher vessels that are active in any year, are owned by residents of AKSC and AKSE.

Estimated employment from catcher vessels with owners from WAIW has been consistently large and recently surpassed AKSC as the area providing the second largest number of jobs. Catcher vessels owned by residents of AKKO also provides substantial employment on vessels participating in the groundfish fisheries. The WAIW has consistently provided the greatest payments to labor from groundfish. Although this region appears to provide fewer jobs than some of the Alaska regions, its payments to labor have exceeded the sum of payments from the next three largest regions. The high payment to labor in WAIS results from the fact that the large trawl catcher vessels, which concentrate their efforts on groundfish, are owned primarily by residents of the WAIW region.

Table 3.3.1 Summary of North Pacific groundfish catcher vessel activities, 1991-1998 (including BSAI pollock).

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Vessels Landing Groundfish and Retained Groundfish Tons											
No. of Vessels	1163	987	1200	1510	1681	1421	1482	1325	1233	1301	1184
Thousands of Tons	340.5	386.5	511.5	680.8	786.3	730.9	762.4	745.6	728.2	741.4	760
Total Ex-Vessel Value in Major Alaska Fisheries ($Millions and Percent of Total)											
GFSH	121.7	116.6	132.2	211.3	271.3	176.0	209.6	263.5	230.7	267.0	183.7
Non-GFSH[a]	167.9	145.6	181.0	181.2	244.1	164.9	215.2	258.9	186.1	220.6	182.7
GFSH (% of Total)	42.0	44.5	42.2	53.8	52.6	51.6	49.3	50.4	55.3	54.8	50.1
Ex-Vessel Value of Species Groups as a Percent of Total Groundfish											
ARSO	48.7	42.1	31.5	26.3	21.3	28.7	33.2	32.9	33.9	30.0	28.1
FLAT	3.9	1.0	1.9	2.9	2.1	1.9	2.1	2.1	2.4	2.3	1.4
PCOD	15.8	19.0	28.9	27.3	14.5	16.6	13.8	17.5	20.4	20.6	21.6
PLCK	31.6	37.8	37.7	43.6	62.1	52.8	50.9	47.5	43.3	47.1	48.9
Ex-Vessel Value from FMP Subareas as a Percent of Total Groundfish											
AI	1.3	0.4	1.6	1.9	2.2	2.0	2.0	2.5	1.4	1.7	1.2
BS	28.4	42.7	38.9	43.5	55.8	56.1	46.9	48.3	51.5	48.6	51.0
WG	5.0	6.7	7.3	9.5	7.8	4.1	4.0	5.6	7.2	7.4	7.8
CG	35.0	26.9	33.3	29.6	22.7	23.1	22.2	23.7	21.3	24.1	25.4
EG	30.1	23.3	18.7	15.3	11.5	14.5	25.0	19.8	18.6	18.2	14.6
Ex-Vessel Value Paid from Processor Types as a Percent of Total Groundfish											
APA-SP	15.5	13.5	13.1	7.4	6.2	7.1	6.4	8.2	9.9	8.5	9.2
BSP-SP	27.3	38.2	41.8	42.5	48.3	41.0	42.0	42.8	39.7	40.5	37.9
K-SP	17.8	14.5	19.0	15.4	12.4	15.6	12.7	11.0	11.4	11.8	14.2
SC-SP	13.7	13.3	9.9	8.7	6.6	9.4	9.1	11.8	11.2	10.7	11.1
SE-SP	25.6	20.6	16.2	13.0	11.0	16.5	21.1	17.5	18.4	18.7	17.7
MS	0.0	0.0	0.0	13.0	15.5	10.4	8.7	8.6	9.4	9.9	9.9
Total Employment by Region (No. of Positions)[b]											
AKAPAI	342	224	207	285	292	204	300	361	342	380	350
AKKO	576	421	653	798	887	629	671	752	715	806	769
AKSC	933	489	896	1,432	1,634	1,304	1,393	1,229	1,015	1,094	949
AKSE	1,770	1,907	1,925	2,084	2,240	2,174	2,093	1,650	1,655	1,595	1,380
WAIW	934	870	993	1,223	1,400	1,127	1,224	1,275	1,148	1,219	1,156
ORCO	56	60	110	197	203	168	188	180	178	182	176
Total [c]	4,798	4,108	5,030	6,314	7,046	5,913	6,208	5,683	5,284	5,526	5,036
Total Payments to Labor by Region ($Millions) [b]											
AKAPAI	2.7	2.0	1.9	2.7	3.0	2.1	2.8	3.6	4.2	4.7	3.7
AKKO	8.4	7.3	8.4	12.5	15.0	9.0	10.7	13.5	12.4	14.1	9.8
AKSC	6.1	3.5	4.4	7.9	7.7	6.0	7.6	10.0	8.1	8.7	5.8
AKSE	8.5	9.6	7.9	9.4	9.1	9.3	11.3	13.2	12.4	12.1	7.9
WAIW	19.8	20.7	24.7	36.9	52.1	30.9	37.1	46.3	39.8	49.6	34.0
ORCO	0.8	2.0	3.3	9.5	13.9	7.9	9.0	11.8	9.3	11.1	7.9
Total [c]	48.7	46.5	52.9	84.2	108.5	70.5	83.9	105.3	92.2	106.7	73.5

Source: CFEC/ADF&G Fish tickets provided by NPFMC, June 2000.
[a] Salmon, crab, halibut, and other.
[d] Includes skipper, crew, and support staff.
[c] Includes estimates for residents of other regions.

Table 3.3.2 presents a summary of one year's activities for each of the six catcher vessel classes. The table is included to provide a better understanding of the relative level activities of the different classes.

The AFA qualified trawl catcher vessels described in Section 3.3.2 harvest the most groundfish in both weight and value and obtain the most revenue from groundfish. These vessels concentrate their efforts almost exclusively on the Bering Sea pollock fisheries so their payments to labor from groundfish harvests are the highest of any vessel class. Trawl catcher vessels greater than or equal to 60 feet also tend to concentrate their efforts on groundfish, obtaining more than 80 percent of ex-vessel value from groundfish harvests. Harvests of pollock by these vessels are substantially lower than those of the AFA qualified vessels, because they have not participated in the BSAI fisheries in recent years. Trawl catcher vessels less than 60 feet participate in the salmon seine fisheries as well as in groundfish fisheries. They catch a relatively high proportion of Pacific cod compared to other trawl catcher vessels.

Pot catcher vessels traditionally have focused on crab fisheries. These vessels have recently adopted pot fishing techniques for use in the Pacific cod fishery, which provide a secondary source of income between crab fishing seasons. Longline catcher vessels have concentrated their efforts in the sablefish and halibut IFQ fisheries. Since halibut is not a groundfish, halibut harvests do not appear in this table. Although longline catcher vessel harvest quantities are substantially less than those of trawl catcher vessels, because of the high value of sablefish, they have received substantial income from their groundfish harvests.

Far more fixed gear catcher vessels from 33 feet to 59 feet LOA are active in groundfish fisheries than any other class of vessel. These vessels have the third highest harvest value of groundfish among the catcher vessel classes. These vessels obtain most of their groundfish revenues from harvests of Pacific cod and high-valued species in the ARSO group, primarily sablefish and rockfish. Although their retained harvests are much smaller than those of the larger trawl catchers, they have obtained groundfish harvest revenues in excess of all other vessel classes except the AFA-qualified trawlers. Fixed gear catcher vessels less than or equal to 32 feet in length have limited activity in groundfish fisheries as most of these vessels were constructed specifically for salmon fisheries. They often harvest higher value groundfish such as Pacific cod and rockfish and sablefish when not engaged in the salmon fishery. Vessel size restricts the effectiveness of this class in groundfish fisheries.

Table 3.3.2 Summary of 1998 non-AFA catcher vessel activity in the groundfish fisheries off Alaska by vessel size and gear type.

Vessel Class	No. of Vessels	Retained Harvest (Thousands of Metric tons)				Ex-Vessel Value ($Millions)	Payments to Labor ($Millions)	Total Employment (No. of Persons)
		PLCK	PCOD	ARSO	FLAT			
TCV ≥ 60'	43	42.2	13.9	3.2	4.5	13.5	5.4	194
TCV < 60'	57	20.1	19.1	0.5	0.7	10.7	4.3	228
PCV	72	0.1	13.3	0.5	0.1	7.2	2.9	396
LCV	102	0	3.5	5.0	0.1	19.0	7.6	561
FGCV 33'—59'	705	0.1	16.2	9.0	0.3	36.8	14.7	2,836
FGCV ≤ 32'	102	0	1.0	0.2	0.1	0.7	0.3	357
CV Total	1081	62.5	67	18.4	5.8	87.9	35.2	4572

Non-AFA trawl catcher vessels greater than or equal to 60 feet in length

Description of the class. These vessels are generally shorter and less powerful than the classes of AFA catcher vessels described in section 3.3.3. The class was established because vessels shorter than 60 feet do not need to carry observers, and because vessels longer than 58 feet are not allowed to participate in Alaska commercial salmon seine fisheries. Vessels in this size category were typically constructed for use in multiple fisheries. They have an average length of 82 feet, average horsepower rating of about 650, average gross tonnage of approximately 144 tons, and an average hold capacity of 3,600 cubic feet. Vessels in this class can operate in more adverse weather conditions compared to vessels in the less-than-60-feet class. Therefore, they can fish more days and target species such as pollock that are often far from protected waters. Adequate fish hold capacity also enables these vessels to harvest and deliver pollock cost-effectively.

Participation in fisheries. In general, these vessels participated more in GOA fisheries than in BSAI fisheries. Many vessels in this class harvest a variety of species, using a combination of trawl, longline, and pot gear. A few have crab endorsements, and several participate in the halibut IFQ fisheries. The number of vessels in this sector increased dramatically from 1988 through 1992, when participation peaked at 65 vessels, and then dropped back to a more stable level between 40 and 44 vessels by 1994. Fourteen of the currently active vessels participated in the JV fisheries. The dependence of this fleet on groundfish is evident, because between 80 and 90 percent of total ex-vessel value of harvests has come from groundfish since 1991. Vessels in this class are typically active in the GOA groundfish fisheries from January through April, again in June and July, and finally in September and October. Non-groundfish activity is highest during May, August, and November—the slack periods for groundfish.

Groundfish landings by species. Total ex-vessel values in all major Alaska groundfish fisheries peaked for the class in 1992 at more than $26 million, then dropped to $15 million in 1994. Between 1995 and 1997, overall ex-vessel value climbed back above $20 million before dropping again in 1998. As with AFA trawl catcher vessels, pollock is the primary fishery in terms of retained groundfish harvests. However, Pacific cod is also very important and in some years exceeds pollock in total ex-vessel value. In 1998, pollock accounted for 66 percent of harvest volume and 47 percent of total ex-vessel value for these vessels, while Pacific cod was 22 percent of retained weight and 36 percent of total value. Flatfish and other ARSO species together accounted for 17 percent of total ex-vessel value. Although the AFA prohibits harvest of BSAI pollock by this fleet, non-pollock harvest restrictions on AFA trawl vessels may create a demand for increased BSAI activity by non-AFA trawl vessels. Coincident with the AFA, Kodiak shore plants have taken increasing deliveries, while deliveries to Bering Sea pollock shore plants and motherships have declined.

Employment and payments to labor. Crew sizes for nearly all vessels in this class are very similar—about four including the skipper. The employment level for this vessel class has been relatively stable since 1994, with estimated employment ranging between 180 and 198 persons. Estimated payments to labor have more variability, but appear relatively stable when compared to payments to labor on other type of catcher vessels. From 1993 to 1998, estimated payments to labor ranged between $5.1 million and $7.1 million—half to crews in Alaska, primarily Kodiak, and half to crews in Oregon and Washington.

Non-AFA trawl catcher vessels less than 60 feet in length

Description of the class. Vessels in the trawl catcher vessel less than 60' class are distinct from fixed gear vessels of a similar size because of their propensity to use trawl gear.[18] Vessels in this category typically were constructed for use as salmon purse seine vessels. Concerns about vessel stability typically prevent these small trawl vessels from mounting the trawl reel forward as is often done on larger trawl catcher vessels. On some vessels in this class, the trawl is brought onboard over the side, much like in a purse seine operation because there is no stern ramp. These vessels average 50 feet in length and have an average horsepower rating of about 370, an average gross tonnage of approximately 58 tons, and an average hold capacity of 1,470 cubic feet. More than 80 percent of these vessels are owned by Alaska residents and make short fishing trips, returning to their home port at the end of each trip to deliver to a processor.

[18] in this analysis, the definition used for this class does not require that the vessel be currently operating in the fishery.

Participation in fisheries. The primary groundfish target species of trawling vessels in this category are Pacific cod and pollock. Sablefish fished with longline gear make a substantial contribution to overall revenues. These vessels tend to target Pacific cod, perhaps due to their inability to compete with larger vessels in pollock fisheries, the need to harvest a higher-value species to obtain adequate returns, the need to operate in the closer Pacific cod fishing grounds, and restrictions on the operation of larger pollock trawlers in cod fisheries. The lack of retained harvest of species other than Pacific cod may also be a function of discarded fish, which due to the nature of the data are not included in this analysis. The number of vessels in this class increased steadily from 1989 through 1993, when 67 participated, and stabilized to between 56 and 60 vessels from 1994 through 1998. This increase coincides with development of domestic shorebased fisheries in the Western and Central GOA.

Groundfish landings by species. Between 1988 and 1997, ex-vessel value of harvests of this class rose steadily from $3.2 to $13.9 million before dipping to $10.7 million in 1998. In 1998, pollock accounted for nearly 50 percent of total retained harvest, but generated only 27 percent of the total ex-vessel value for the fleet. Although retained harvests of Pacific cod were less than those of pollock, Pacific cod generated 59 percent of the total groundfish revenue for the class. Catch of species in the ARSO species aggregation, primarily sablefish, accounted for just over 1 percent of retained harvest by weight but generated more than 12 percent of total ex-vessel value. With the exception of 1996, more than 70 percent of deliveries by value went to AKAPAI processors. Processors in Kodiak are also important to this fleet, accounting for roughly 15 percent of total ex-vessel value.

Employment and payments to labor. Vessels of this class have a crew size ranging from two to three (not including the skipper) depending on the fishery. The employment level for the class has increased steadily from 1988 through 1993. Since 1994 total estimated employment has been relatively stable, varying between 224 and 240 persons. Estimated payments to labor were relatively stable from 1992 through 1995, averaging near $3.3 million, but jumped in 1996 to well over $4 million. Almost half of these payments were to AKAPAI crews, with another 30 percent going to crews in AKKO and elsewhere in Alaska.

Pot catcher vessels

Description of the class. The vast majority of vessels in this class focus on crab fisheries, with groundfish a secondary yet substantial activity. This class is distinct from other fixed gear vessels because all vessels have crab endorsements under the Crab LLP, primarily use pots rather than longline or jig gear, and are longer than 60 feet. The fact that these vessels do not have large trawl landings distinguishes them from trawlers. Vessels in this class are typically equipped with one or two large deck cranes for moving and stacking crab pots and a steel-framed pot launcher. These vessels have an average length of about 100 feet, an average rating of about 175 gross tons, and an average horsepower rating of about 800. Historically, the pot fishery in Alaska waters produced crab. Several factors, including diminished king and tanner crab stocks, led crabbers to begin to harvest Pacific cod with pots in the 1990s. The feasibility of fishing Pacific cod with pots was also greatly enhanced with the implementation of Amendment 24 to the BSAI FMP, which allocated the target fishery between trawl and fixed gear vessels.

Participation in fisheries. The number of vessels in this class that have made more than incidental landings of groundfish has varied widely between 1988 and 1999. Vessels with substantial landings of groundfish increased from 38 in 1988 to 90 in 1992 and then dropped back down to 50 in 1994. During this period, many of the vessels were experimenting with pot fishing for Pacific cod. Many found they could not generate enough revenue to justify continued participation. In 1995, the number of vessels with substantial landings jumped to 137, coinciding with the decline in the tanner crab fishery. After 1995, participation declined. In 1998, 72 vessels made substantial landings of Pacific cod. Few if any of these vessels would likely be able to survive if they relied solely on the Pacific cod fishery. During the period when no crab fisheries are available—typically March through at least mid-August—many vessels in this category fish for Pacific cod using pot gear, and tender herring and salmon if they can obtain contracts. Advantages of using pots over trawls to harvest Pacific cod include the high rate of bycatch associated with trawl fishing. Other stated benefits of pot fishing are that cod harvested in pots is less bruised, handled in smaller quantities and thus bled quickly, of a more consistent size, and superior in overall quality to cod harvested by trawl gear.

Groundfish landings by species. In 1998 crab made up 81 percent of the total ex-vessel value for pot catcher vessels with groundfish, primarily Pacific cod, accounting for 12 percent of value. The importance of Pacific cod relative to other groundfish is apparent because Pacific cod accounted for 95.7 percent of harvest volume and 78.1 percent of total ex-vessel value in 1998. The ARSO species aggregation also accounts for a relatively large share of ex-vessel value of groundfish—between 16 and 40 of the vessels in this class participated in sablefish fisheries over the years. In recent years deliveries of groundfish to Bering Sea shore plants has grown. Kodiak shore plants have also received a stable flow of Pacific cod and sablefish from these vessels.

Employment and payments to labor. Pot vessels harvesting groundfish average three to four crewmen in addition to the vessel operator. Large variation in employment and payments to labor for this class has been mostly a consequence of entry and exit of vessels to groundfish fisheries. Between 1988 and 1998, employment ranged from 149 to 589 persons, while payments to labor ranged from slightly more than $1 million to slightly less than $6 million. Recently, employment and payments to labor been split almost equally between crews from Alaska and those from out of state.

Longline catcher vessels greater than or equal to 60 feet in length

Description of the class. A large majority of the vessels in this class operate solely with longline fixed gear, focusing on halibut and relatively high-value groundfish such as sablefish and rockfish. Operating parameters are primarily influenced by regulations for fixed gear in these fisheries. Both fisheries generate high value per ton, and these vessels often enter other high-value fisheries such as the albacore fisheries on the high seas. The reliance of these vessels on groundfish fisheries sets them apart from smaller fixed gear catcher vessels permitted to operate in Alaska salmon fisheries with multiple gear types. Overall, this fleet is quite diverse. Most vessels are between 60 feet and 80 feet long and have an average length of about 70 feet. These vessels have an average rating of about 85 gross tons, with a range from 40 to a maximum of 220 gross tons. Average horsepower rating is around 400, with a range of horsepower from135 to about 1,000. The larger vessels in this class can operate in the Bering Sea during most weather conditions. Smaller vessels can have trouble operating during adverse weather.

Participation in fisheries. The number of vessels in this class increased from 89 in 1988 to 126 in 1992. Since 1992, the number of these vessels making more than minimal groundfish landings has stabilized at about 100. Management of sablefish and halibut fisheries has changed dramatically since implementation of an IFQ management system in 1995. Previously, the two fisheries were common property fisheries characterized by a race for fish, with increasingly shortened seasons and an increasing number of vessels. With the IFQ system, vessel owners are allocated a percentage of the TAC. The system has significantly increased the value of fish harvested by longline vessels because fishers are better able to cater to fresh-fish markets, particularly with halibut, and are more able to sell their catch to the highest bidder. Vessels with halibut or sablefish IFQs may fish their share at any time during the open season—March 15 through November 15. Few vessels operate continually over the entire season.

Groundfish Landings by Species. Because of high-valued sablefish, the ARSO species complex, which in this analysis includes sablefish and rockfish, is the most important groundfish species for this sector in terms of harvest volume and total ex-vessel value. Pacific cod has been the second most important species in terms of volume for this sector since 1988, but is a much smaller component in terms of ex-vessel value. In 1998, the ARSO species aggregation accounted for 5,000 tons, or 58.5 percent of harvest volume and $17.3 million or 91.4 percent of total ex-vessel value. The EG and CG Subareas are the most important fishing areas for this sector, accounting for 75 to 83 percent of the total value of groundfish retained by this class from 1995 to 1998. Approximately 70 percent of ex-vessel value was paid by AKSE and AKSC processors between 1994 and 1998.

Employment and payments to labor. The longline catcher vessel sector is one of the most labor-intensive sectors. These vessels typically carry between three and six deckhands and a skipper who also works the deck—although the number of crewmembers has decreased since 1995 with IFQs. Between 1993 and 1998 employment has remained relatively stable on these vessels ranging from a low of 534 to a high of 649. Payments to labor, however, jumped at the outset of the IFQ program from below $4 million in 1993 to more than $12 million in 1995. Payments to labor fell to $7.6 million in 1998. Employment has been split, with about 50 percent in Alaska, dominated by AKSE and AKSC, and 50 percent elsewhere.

Fixed gear catcher vessels 33 feet to 59 feet in length

Description of the class. Vessels in this class vary greatly in size and power and have an average length of about 45 feet, an average rating of about 30 gross tons and average about 300 horsepower. The larger size of these vessels in comparison to the smaller fixed gear class results in greater capacity and fishing efficiency. Consequently, the class accounts for a larger portion of the total harvest for this gear category than is harvested by vessels 32 feet or less in length. This category also employs a mix of gear types, with smaller vessels typically using longline and jig gear and larger vessels typically employing longline and pot gear. A number of vessels in this class have holds with refrigerated seawater helping to assure quality. This class was established because vessels in this class typically were designed for and participate in a greater number of fisheries than do smaller fixed gear vessels.

Participation in fisheries. The number of vessels in this class ranged between 608 and 1,054 between 1988 and 1998. Most vessels in this class participated in the ARSO species complex every year between 1988 and 1998, whereas pollock and flatfish consistently had the least number of landings. The activities of this class have focused on salmon, halibut, and groundfish. Over the last 10 years, between 30 and 40 percent of the ex-vessel value of harvests has come from groundfish. The importance of groundfish varies significantly during the annual fishing cycle because most of this fleet shifts its efforts to salmon, crab, halibut and other species during June, July and August. On average, slightly more than one-third of the ex-vessel value has come from groundfish, slightly less than one-third from salmon, and slightly more than one-quarter from halibut. About 70 percent of the vessels participating in the groundfish fisheries also participate in the salmon and halibut fisheries.

Groundfish landings by species. The ARSO species complex, which in this analysis includes sablefish and rockfish, is the most important groundfish species for this sector in terms of total ex-vessel value. Because of high-valued sablefish, ARSO has been the most important species group over time. Pacific cod has been the second most important species in terms of volume for this catcher vessel sector since 1988, but is a much smaller component in terms of ex-vessel value. For example, 1998 ARSO accounted for about 35 percent of harvest volume and about 80 percent of ex-vessel value, while Pacific cod accounted for 63 percent of harvest volume and 20 percent of harvest value. The EG and CG have been the most important groundfish FMP subareas for this sector. From 1988 to 1998, these two areas accounted for almost all of the total value of groundfish retained by this fixed gear catcher vessel class. Since 1992, AKSE inshore plants have paid about half of total ex-vessel value to this sector.

Employment and payments to labor. This analysis uses an average crew size of 3.5 persons—which includes the skipper and the crew—for this type of vessel. Another 0.5 persons has been added to the average as vessel support staff. The actual number of crew varies, depending on a number of factors such as type of gear, presence of automatic baiting machines, size of the vessel, and amount of sablefish IFQ shares owned by the skipper and crew. Employment on these vessels ranged from 2,440 to 3,836 between 1988 and 1998. During the same period, payments to labor ranged from $12.8 million to $21.6 million. Approximately 80 percent of these payments are made to Alaskans—about 40 percent of the total is harvested by AKSE residents.

Fixed gear catcher vessels less than or equal to 32 feet in length

Description of the class. A large number of vessels in this class have been built to the 32-foot maximum vessel length for the Bristol Bay salmon drift gillnet fishery. These vessels may use a mix of longline, jig, and sometimes pot gear to harvest halibut and groundfish before or after the salmon season. Implementation of the halibut and sablefish IFQ system has enhanced the ability of vessels in this class to participate in the sablefish fisheries by reducing risk without diminishing catch. Vessels in this class are too small to operate in unprotected waters in adverse weather conditions, so they typically fish within several miles of shore. This class was established because these smaller vessels have constrained harvest capacity and limits on the gear types that they can effectively use. Vessels in this class have an average length of about 30 feet, an average rating of about 15 gross tons and an average horsepower rating of about 250.

Participation in fisheries. The primary target species of vessels in this category that use longline gear are halibut and groundfish, including Pacific cod and, to a lesser extent, sablefish and rockfish. Many pursue halibut and sablefish under the current IFQ system and harvest other groundfish as incidental catch. About half of the ex-vessel value received by this category came from halibut. A significant percentage of the fleet may pursue rockfish and other relatively high-value groundfish as a target species after reaching their IFQ cap. Vessels using jig gear typically pursue Pacific cod and rockfish. Pots are also used for Pacific cod. Vessels in this class can begin to fish in January, when the season opens for Pacific cod, and other groundfish species, but few vessels do so. Most wait until at least March 15, when the halibut season opens, but many wait until late April or May when the weather has further improved. IFQ owners will fish until their quotas are reached, or until they need to begin preparations for salmon season. Following salmon season, vessel owners with IFQs remaining will change gear to harvest the remaining quota. The number of vessels in this class decreased significantly from 209 in 1988 to 102 in 1998, a decline at least partly attributable to implementation of the IFQ systems.

Groundfish landings by species. Although total ex-vessel value of harvest from these vessels has dropped, the groundfish percentage of ex-vessel value has increased from about 10 percent in 1988 to about 20 percent in 1998. The ARSO species complex—which in this analysis includes sablefish and rockfish—and Pacific cod are the most important groundfish species for this vessel class in terms of harvest volume. The implementation of a Pacific cod quota within state waters and increasing prices have increased harvest activity in the Pacific cod fishery. In 1998, Pacific cod accounted for 78.8 percent of harvest volume and 64.9 percent of total ex-vessel value. The CG FMP subarea is the most important fishing area for this sector accounting for at least half of the total value of groundfish by this class. Processors in AKKO and AKSE take approximately 60 percent of the deliveries from this class by value.

Employment and payments to labor. This analysis uses an average crew size of three persons for this type of vessel—which includes the skipper and the crew. Another 0.5 full-time position has been added to the average as vessel support staff. The actual number of crew varies, depending on a number of factors such as the size of the vessel and the type of gear being employed. Employment has been cut in half since 1988, to a low of 357 in 1998. Payments to labor fell back to 1989 levels following a sharp rise in 1993 and 1994. More than 50 percent of the employment and payments to labor from this class are to AKSE and AKSC.

Non-AFA catcher/processors

A catcher processor is a fishing vessel that uses various gears to catch fish and then process them into products onboard the vessel. American-owned catcher/processors began operations in Alaska waters in about 1983. Three different non-AFA catcher/processor groups were defined for this analysis. These mutually exclusive definitions are based on the predominant product type or gear type associated with these vessels:

- **Trawl Head And Gut (H&G) catcher/processors.** These factory trawlers do not process more than incidental amount of fillets. Generally they are limited to headed and gutted products or kirimi. In general, they do not focus their efforts on pollock, opting instead for flatfish, Pacific cod, and Atka mackerel. Trawl H&G catcher/processors are generally smaller than AFA catcher/processors.

- **Pot catcher/processors.** These vessels have been used primarily in the crab fisheries of the North Pacific, but increasingly are participating in the Pacific cod fisheries. They generally use pot gear, but may also use longline gear. They produce whole or headed and gutted groundfish products, some of which may be frozen in brine rather than blast frozen.

- **Longline catcher/processor**. These vessels, also known as freezer longliners, do not trawl or use pot gear but use longline gear with a focus on Pacific cod. Most longline catcher/processors are limited to headed and gutted products, and in general are smaller than trawl H&G catcher/processors.

Table 3.3.3 is a summary of non-AFA catcher/processor activities by class for 1999. Of the 89 catcher/processors, 40 were trawl catcher/processors and 49 used longlines or pots.

Table 3.3.3 Summary of 1999 non-AFA catcher/processors activities by class.

	No. of Vessels	Reported Harvest—Retained and Discarded (Thousands of MT)				Wholesale Value ($Millions)	Payments to Labor ($Millions)	Total Employ-ment (FTE)
Vessel Class		**PLCK**	**PCOD**	**ARSO**	**FLAT**			
HT-CP	24	29.4	28.1	98.4	143.2	124.3	45	726
L-CP	40	3.9	95.5	17.0	6.0	102.7	37	419
P-CP	9	0.0	7.4	0.1	0.0	7.0	2	36
Total	**73**	**33.3**	**131.0**	**115.5**	**149.2**	**234**	**84**	**1181**

Each non-AFA catcher/processor class is described in more detail in the summary profiles in the following subsections.

Trawl H&G catcher/processors

Description of the class. The trawl H&G sector is the only trawl catcher/processor group that does not focus on pollock. This fleet typically targets flatfish species such as yellowfin sole and rock sole. The ARSO species aggregation (primarily Atka mackerel and rockfish) and Pacific cod are important secondary target species. Vessels in this sector average 170 feet LOA. Below the fishing deck is the fish processing deck, with plate freezers where the catches are headed, gutted, cleaned, sized, and frozen in blocks, each weighing about 40 pounds. Freezer holds on the vessels are capable of storing 200 to 500 metric tons of frozen product. Vessels have an average rating of about 370 gross tons and 1,700 horsepower.

Participation in groundfish fisheries. The number of trawl H&G vessels has decreased from 28 in 1992 to 24 in 1999, a decrease of about 15 percent. With few exceptions, vessels in this class process all four major species groups on an annual basis. The Bering Sea is clearly the focus of this class, but most also participate to some extent in the AI, WG, and CG areas. Many fewer trawl H&G vessels participate in the EG. Trawl H&G vessels target a number of species and operate for longer periods than the surimi and fillet catcher/processor vessels that focus on pollock. A fishing rotation in this sector might include Atka mackerel and pollock for roe in January; rock sole in February; rock sole, Pacific cod, and flatfish in March; rex sole in April; yellowfin sole and turbot in May; yellowfin sole in June; rockfish in July; and yellowfin sole and some Atka mackerel from August to December. The target fisheries of the HT-CP sector are usually limited by bycatch regulations or by market constraints. Only rarely are these vessels able to catch the entire TAC of the target fisheries available to them.

Groundfish landings by species. Vessels in this fleet reported harvested 299,057 mt in 1999, 48 percent of which was flatfish and 33 percent of which was ARSO. Reported harvests in recent years have ranged from 351,533 mt in 1994 to 216,369 mt in 1991. Fish from the BS and AI subareas constitute most of the activities. In 1999, approximately 63 percent of the reported tons was harvested in the BS subarea and 26 percent in the AI subarea. The trawl H&G fleet generated a total wholesale value of $124 million in 1999, with head and gut products accounting for 67 percent ($82 million) of the total.

Employment and payments to labor. The smaller vessel size and limited product forms in the trawl H&G sector result in smaller crew sizes. Crew sizes range between 12 and 56 persons, roughly one-third of the average crew size for surimi trawl catcher/processors and less than half of the average crew size for fillet trawl catcher/processors. In 2000, an estimated 1535 FTEs were employed by the trawl H&G sector (Groundfish Forum, comment on draft EIS). Trawl H&G vessels operate primarily in Federal waters outside the jurisdiction of the State of Alaska. As a result, employees are reported by state and federal agencies as being employed in the state where the vessel owner resides. In recent years, owners in Washington accounted for more than 60 percent of total employment associated with this sector each year. Alaska owners employed more than 20 percent of persons engaged in the sector each year, with other regions accounting for the balance.

Pot catcher/processors

Description of the class. Vessels in the pot catcher/processor sector use predominantly pot gear to harvest Bering Sea and GOA groundfish resources. The crab fisheries in the Bering Sea are the primary fisheries for vessels in the sector. Groundfish harvest and production are typically secondary activities. Vessels average about 135 feet LOA and are equipped with deck cranes for moving crab pots. Most pot vessel owners use their pot gear for harvesting groundfish. However, some owners change gear and participate in longline fisheries. Pot catcher/processor vessels typically have a processing deck and freezer holds, which enable them to process and freeze groundfish harvests. These vessels have an average rating of about 400 gross tons and 1,250 horsepower.

Participation in groundfish fisheries. The number of pot catcher/processors participating in the groundfish fishery has varied over the past 9 years, reaching a peak of 14 vessels in 1992 and a low of 3 vessels in 1993 and 1994. The success of these vessels in the crab fisheries influences the number participating in the groundfish fishery. In poor crab seasons, more vessels will participate in the groundfish fisheries. In recent years, the historically high prices of Pacific cod also have made the groundfish fishery more attractive for pot catcher/processors. In 1999, there were nine pot catcher/processors processing groundfish. These vessels tend to target Pacific cod and harvest other groundfish species as bycatch. In recent years, the number of vessels processing flatfish (8 in 1999) has exceeded the number processing pollock (4 in 1999), but trailed the number reporting Pacific cod and ARSO (9 in 1999 for both). Nearly all pot catcher/processor vessels are active in the Bering Sea, while only one-third to two-thirds of the vessels are active in other areas.

Groundfish landings by species. Pacific cod accounts for the largest volume of species harvested, accounting for nearly 98 percent of groundfish harvests in some years. In 1999, pot catcher/processor vessels reported harvests of 7,420 mt of Pacific cod (98 percent of the total harvest), 108 mt of ARSO (roughly 1 percent of the total), 36 mt of flatfish, and 9 mt of pollock. In most years, a majority of the harvest comes from the BSAI. In 1999, the harvest was split almost equally between the BSAI and GOA (3,560 mt in the BSAI and 4,014 in the GOA). Total wholesale production value in 1999 was $7 million, all of which came from head and gut products. Total product value in 1999 was higher than any other year during the period 1992-1999.

Employment and payments to labor. Although pot catcher/processor vessels require personnel with some expertise in processing activities, owners usually do not hire persons who process exclusively, as is the case for other catcher/processor operations. Rather, crewmembers are usually capable of fishing and processing, as well as fulfilling normal ship operational duties. Personnel structure similar to that of a catcher vessel. Employees on pot catcher/processor vessels earn a share of the vessel's earnings. Employee share systems vary by vessels. On some vessels, 28 percent of the profit is split among the crew. On other vessels, 40 percent of gross earnings may be divided. Methods of dividing revenues vary according to number of crew and other factors, but skipper shares tend to be the largest single component of crew shares. Estimated FTE employment in the sector was 36 individuals in 1999, up from 19 in 1998. Total payments to labor were $2 million in 1999, with most payments going to workers from the WAIW region.

Longline catcher/processors

Description of the class. Vessels in the longline catcher/processor sector use predominantly longline gear to harvest Bering Sea and GOA groundfish resources. Vessels in this class produce headed and gutted products. The longline catcher/processor sector evolved because regulations applying to this gear type provide more fishing days than are available to other gear types. Longline catcher/processor vessels are able to produce relatively high-value products that compensate for the relatively low catch volumes associated with longline gear. Longline catcher/processor vessels average just over 130 feet LOA. Most vessels in this category are equipped with gear that enables them to bait and haul about 30,000 to 40,000 hooks per day. Generally, these vessels are not built to standards that would permit them to be loadline certified, a requirement to produce fillets.

Participation in groundfish fisheries. In 1992, the longline catcher/processor sector consisted of 57 vessels. In 1999, there were 40 vessels operating in this sector. These vessels have tended to target Pacific cod, with sablefish and certain species of flatfish (especially Greenland turbot) as important secondary target species. Many vessels reported harvesting all four groundfish species groups each year from 1991 through 1999. Most harvesting activity has occurred in the Bering Sea, but longline catcher/processor vessels operate both the BSAI and GOA. In 1999, 39 of the 40 active vessels reported harvests in the Bering Sea, 23 in AI, 24 in WG, 19 in CG, and 10 in EG.

Groundfish landings by species. In 1999, the volume of total groundfish retained and discarded, 122,400 MT, was near the average of 125,000 mt per year for the period 1992-1999. Total production in 1999 was also near the long-term average of 48,700 mt (for final product from groundfish resources). Of the total reported tons in 1999, approximately 97,500 (78 percent of the total) were Pacific cod and 17,000 tons (14 percent of the total) were ARSO. Total wholesale production value in 1999 was $103 million, $100 million of which came from head and gut products. Total wholesale production value in 1999 was higher than in any other year during the period 1992-1999.

Employment and payments to labor. The main crew positions on an longline catcher/processor vessel are processing crew, fishing crew, and officers or other specialized personnel. Estimated FTE employment in the longline catcher/processor sector generated by the groundfish fishery was 419 people in 1999 and 456 in 1998. The number of vessels in these years suggests an average crew size of 19 persons. Total payments to labor in this sector were $37 million in 1999, with 73 percent of those payments going to residents of the Puget Sound region.

Non-AFA inshore processors

Inshore plants include traditional shorebased plants that process Alaska groundfish and several floating processors that are moored or anchored nearshore in protected bays and harbors. This section includes plants engaged in primary processing of groundfish. It does not include plants in Alaska or other states that are engaged in secondary manufacturing, such as converting surimi into analog products (imitation crab), or further processing of other groundfish products into ready-to-cook meals or products. Four groups of non-AFA inshore processors were defined for this analysis, primarily based on the regional location of the facilities: (1) Alaska Peninsula and Aleutian Islands, (2) Kodiak Island, (3) Southcentral Alaska, and (4) Southeast Alaska.

Alaska Peninsula and Aleutian Islands Inshore Plants

Description of the class. This sector includes non-AFA inshore processors located in the Alaska Peninsula and Aleutian Islands, as well as plants in the Pribilof Islands, that process groundfish resources from the BSAI. The geographic area extends from Chignik west to Adak, and north to St. Paul Island. The category also includes several smaller non-AFA plants in Unalaska/Dutch Harbor.

Participation in groundfish fisheries. In 1999, there were ten Alaska Peninsula and Aleutian Islands plants participating in the groundfish fishery. Between 1992 and 1998, the number ranged from six to eight facilities. Between 1991 and 1999, almost all of the facilities reported receiving fish every year from the BSAI. Most of the processors also reported receiving fish from the WG and CG subareas. In 1999, these facilities processed 66,635 round weight tons, of which 43,646 tons (66 percent) was pollock and 19,402 tons (30 percent) was Pacific cod. Also in 1999, 36,652 tons (55 percent of the total) came from the WG and 21,643 tons (32 percent) came from the BSAI.

Ex-vessel payments to catcher vessels by vessel type and product value. From 1991 to 1998, groundfish accounted for less than 30 percent of ex-vessel value each year. In 1998, crab accounted for 44 percent of total ex-vessel value and salmon accounted for 30 percent. Groundfish accounted for only

23 percent of total ex-vessel value in the same year. Total ex-vessel payments for groundfish in the APA-SP sector were less than $20 million in 1998. Total groundfish product value was $50 million in 1998 and $57 million in 1999. In 1999, 21 percent of the total groundfish product value came from H&G and whole products, while 79 percent of the total product value came from fillets, surimi, roe, and other products.

Employment and payments to labor. Estimated FTE employment generated by Alaska Peninsula and Aleutian Islands inshore plants by groundfish processing increased steadily from 1991 to 1999. In 1999, estimated employment generated by groundfish processing was 380 persons. Total payments to labor in 1999 were approximately $19 million, or 34 percent of the total groundfish wholesale production value in that year. Approximately 96 percent of the workers reside in Alaska, though many are only seasonal residents. (Many more persons were employed at these facilities for other activities, such as processing salmon. Estimates in this summary are only for workers and expenditures related to groundfish activities.)

Kodiak Island inshore plants

Description of the class. This group includes processing facilities on Kodiak Island. The number of plants processing groundfish on Kodiak Island has declined since 1991. In 1999, there were 10 facilities on Kodiak Island processing groundfish. There were only 9 facilities in 1998, but as many as 15 in 1992.

Participation in groundfish fisheries. Most plants process all four species groups every year, although the number of plants processing pollock is generally less than the number processing other species. In 1999, all of the facilities processed Pacific cod and ARSO. In addition, 9 of the 10 processed pollock and flatfish. The facilities processed a total of 101,354 round weight tons of groundfish in 1999, 51 percent of which was pollock and 30 percent of which was Pacific cod. All of the plants receive fish from the CG subarea every year. Most of the plants also receive fish from the WG and EG subareas.

Ex-vessel payments to catcher vessels by vessel type and product value. From 1991 to 1998, groundfish accounted for less than 50 percent of total ex-vessel value each year, though the percentage increased from just over 30 percent in 1991. In 1998, groundfish accounted for 46 percent of the total ex-vessel value by Kodiak inshore plants, salmon accounted for 39 percent, and halibut accounted for 11 percent. Total ex-vessel payments for groundfish by Kodiak inshore plants were less than $30 million in 1998. Total groundfish product value was $70 million in 1998 and $74 million in 1999. Approximately 62 percent of the wholesale production value of groundfish products in 1999 came from fillets and 14 percent came from surimi.

Employment and payments to labor. Estimated FTE employment generated by Kodiak Island shore plants from groundfish processing fluctuated between 1991 and 1999. In 1999, estimated employment generated by groundfish processing was 503 persons. Total payments to labor were $27 million in 1999, or 36 percent of the total groundfish product value in that year. Approximately 96 percent of the workers reside in Alaska, though not all are permanent residents.

Southcentral Alaska inshore plants

Description of the class. This group includes governmental units that border the marine waters of the GOA (east of Kodiak Island), Cook Inlet, and Prince William Sound.

Participation in groundfish fisheries. There have been 16 to 22 southcentral Alaska inshore processors participating in the BSAI and GOA groundfish fishery every year since 1991. In 1999, there were 18 plants in southcentral Alaska processing groundfish. All 18 plants reported processing Pacific cod, flatfish, and ARSO in 1999. In addition, 16 of the 18 reported processing pollock. The facilities processed a total of 10,846 round weight tons of groundfish, 42 percent of which was ARSO and 31 percent of which was Pacific cod. Virtually all of the plants receive fish from the CG subarea every year. Many also receive fish from the EG subarea, and some receive fish from the WG subarea. In 1998 and 1999, fewer than four processors took deliveries from catcher vessels operating in the BSAI.

Ex-vessel payments to catcher vessels by vessel type and product value. From 1991 to 1998, groundfish typically accounted for less than 30 percent of total ex-vessel value each year, though the percentage increased slightly from 1991 to 1998. In 1998, groundfish accounted for 29 percent of the total ex-vessel value by southcentral Alaska processors, salmon accounted for 40 percent, and halibut accounted for 31 percent. Total ex-vessel payments for groundfish by southcentral Alaska processors were approximately $20 million in 1998. Total groundfish product value was $32 million in 1998 and $26 million in 1999. Approximately 74 percent of the wholesale production value of groundfish products in 1999 came from H&G products, and 16 percent came from fillets. These processors tend to pay more to longline and certain fixed gear catcher vessels than to other vessel types. In 1998, for example, longline and fixed gear catcher vessels between 33'-59' accounted for roughly 90 percent of the total ex-vessel value for groundfish resources processed by southcentral Alaska processors.

Employment and payments to labor. Estimated FTE employment generated by groundfish processing increased from 1992 to 1995, and then fluctuated noticeably between 1995 and 1999. In 1999, estimated employment generated by groundfish processing was 94 persons. Total payments to labor in 1999 were $10 million, or 38 percent of the total groundfish product value in that year. Approximately 50 percent of the workers reside in Alaska, and 50 percent in the WAIW region.

Southeast Alaska inshore plants

Description of the class. The Southeast region extends from Yakutat in the north to Metlakatla at the southern tip of the Alaska Panhandle. This group is similar to the southcentral Alaska group because most processing plants in the region started with salmon and later expanded into groundfish. Southeast and southcentral Alaska plants process similar volumes of groundfish, but southeast Alaska plants processes a much larger volume of sablefish. As a result, the value of groundfish processed in southeast Alaska is much higher than in southcentral Alaska.

Participation in groundfish fisheries. The number of southeast Alaska participating in the BSAI and GOA groundfish fishery increased from 1992 to 1996, and then declined from 1996 to 1999. In 1999, there were 14 plants in the SE-SP sector processing groundfish. All 14 plants reported processing Pacific cod, flatfish, and ARSO in 1999. In addition, 10 of the 14 reported processing pollock. The facilities processed a total of 19,979 round weight tons of groundfish, 38 percent of which was pollock and 31 percent of which was ARSO. Virtually all of the plants receive fish from the EG subarea every year. Many also receive fish from the CG subarea. In 1998 and 1999, fewer than four processors took deliveries from catcher vessels operating in the WG and none took deliveries from vessels operating in the BSAI.

Ex-vessel payments to catcher vessels by vessel type and product value. From 1991 to 1998, groundfish typically accounted for less than 30 percent of total ex-vessel value each year, though the percentage increased slightly from 1991 to 1998. In 1998, groundfish accounted for 29 percent of the total ex-vessel value processed by southeast Alaska plants, salmon accounted for 40 percent, and halibut accounted for 20 percent. Total ex-vessel payments for groundfish exceeded $20 million in 1998. Total groundfish product value was $47 million in 1998 and $38 million in 1999. Approximately 69 percent of the wholesale production value of groundfish products in 1999 came from H&G products and 23 percent came from fillets.

Southeast Alaska facilities tend to pay more to fixed gear and longline catcher vessels than other vessel types. In 1998, for example, fixed gear catcher vessels 33'-59' accounted for roughly 70 percent of the total ex-vessel value for groundfish resources. Longline catcher vessels accounted for approximately 20 percent of the total ex-vessel value in the same year.

Employment and payments to labor. In 1999, estimated FTE employment generated by southeast Alaska processors by groundfish processing was 103 persons—down from 132 in 1998 but the same as in 1997. Total payments to labor in 1999 were $14 million, or 37 percent of the total groundfish product value in that year. Approximately 50 percent of the workers reside in Alaska, and 50 percent in the WAIW region.

Secondary processors

This section provides an overview of the primary products made from Alaska groundfish, as well as a brief discussion on secondary processing activities, and product flows. It also describes the data limitations related to secondary processing activities and product flows.

Primary products. Alaska groundfish are made into a wide range of product forms. Table 3.3.4 shows the various primary products made from Alaska groundfish, by species and year. In this section, primary product is defined as the product form after the initial stage of processing.[19] By this definition all products produced directly from raw fish are considered primary processing and includes all processing that occurs at Alaska shore plants, motherships, and catcher/processors. Primary products may be table-ready or final products, but more often are reprocessed before they are sent to retail markets. Secondary processing is defined as any processing that occurs after the primary products have been transferred to a different facility. Secondary processing include the production of *kamaboko* from surimi and the production of breaded fish sticks from fillets.

Atka Mackerel is primarily produced headed and gutted or whole products. Most flatfish by volume are also headed and gutted, often with the roe left intact. A large percentage of flatfish are frozen whole, while a small percentage, primarily yellowfin sole, are made into Kirimi, a steak-like product. Almost all sablefish are produced into headed and gutted product. Most of the product made from Pacific cod is headed and gutted, but a significant proportion is also made into fillets. It should be noted that comparing product by weights is somewhat akin to comparing apple and oranges. Fillets are typically skinless and boneless products. A 5-pound Pacific cod might yield 1.25 pounds of fillets. Prices for fillets are higher than prices for headed and gutted product, primarily because fillets require less secondary processing.

Surimi constitutes the largest portion of pollock product, with fillets accounting for the next largest percentage. Roe, which accounts for only 4 percent of total product by weight, is extremely important to processors because of its high price in Japan. Substantial amounts of meal and oil are also produced from pollock, although meal and oil are generally ancillary products made from bones, skin, and trimmings.

Summary description of product flows. Groundfish harvested in the BSAI and GOA are processed at a variety of inshore and, nearshore facilities, and on motherships and catcher. While some product is shipped from these primary processors to the Puget Sound region for secondary processing, much of the product is shipped to ports outside the U.S. How much remains in the U.S. and how much is shipped

[19] This definition of primary processing differs from definitions used by processors when they report their production to NMFS in Weekly Processor Reports. In weekly report processors differentiate primary products such as fillets or surimi from ancillary products such as roe and fishmeal.

abroad varies from year to year. In addition, some product shipped to Puget Sound is re-sorted and shipped out of the U.S. without being reprocessed. (Some of the fish leave Alaska in raw form, such as

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whole frozen fish. However, most groundfish is shipped from Alaska in a primary form—after primary processing at one of the processing facilities described in this analysis.)

Secondary processors. For the period covered in this analysis (with an emphasis on 1991-1999), there were no secondary processors operating in Alaska—all product was shipped out of Alaska in primary form. Alaska Seafood International has begun operations in Anchorage and is preparing table-ready products from a variety of Alaska fish, including some groundfish.

Groundfish harvested in Alaska is most often exported as a primary product. While most product exported from Alaska tends to go to Asia and Europe, some goes to the Lower 48. Products shipped to the Lower 48 may either be reprocessed there, (primarily Puget Sound) or re-sorted and exported as a primary product. Companies such as Icicle and Trident have primary production capacity in Alaska and secondary processing plants in the Puget Sound area. In these cases, it would be possible to track how much Alaska product is used in their secondary processing facilities and the related number of workers. However, numerous other food manufacturers take primary groundfish product from Alaska to make a variety of table-ready foods and other products. For example, Gorton's has secondary processing facilities that reprocess groundfish products from Alaska and other areas. Data on the number of workers in all such facilities and the percentage of primary product at these facilities that originates in Alaska are not available.

Final markets. Groundfish harvested in Alaska is processed into a variety of products and shipped to markets around the world. The mix of products and final destinations depend on factors such as product prices, shipping costs, and availability of substitutes. For example, the amount of Pacific cod harvested in the Alaska fishery, and the products made from those harvests, have increased in recent years as new markets have opened. New markets in Portugal and Norway have opened as cod harvests from the Barents Sea have declined noticeably. (Previously, these countries consumed cod from the Atlantic rather than the Pacific.) At the same time, product paths for Alaska groundfish thought to be stable and dependable—such as surimi from pollock—may fluctuate significantly in the future with demographic changes in Japan.

Groundfish transportation. Groundfish are transported from Alaska to domestic markets by a number of different carriers, depending on where the fish is processed. For example, the primary carriers operating in Western Alaska include CSX Lines, Coastal Transport, Samson Tug and Barge, and Northland Services. The primary carriers in Central Alaska include Totem Ocean Trailer Express, in addition to those noted as operating in Western Alaska.

Groundfish transported from Alaska to foreign ports typically are carried by foreign tramper vessels. Product carried from the Pacific Northwest to foreign ports can be carried by foreign trampers or steamships. In the past, some product transported from the U.S. to foreign ports was carried by American-owned and American-flagged companies, such as American President Lines (APL) and Sea Land. However, Sea Land is no longer American owned or flagged and APL is not American-owned. Such changes in ownership and flagging limit the role U.S. companies play in the movement of Alaska groundfish and limit the scope of potential impacts on U.S. firms from any changes in the groundfish fishery.

Data limitations. Sufficient data were not readily available to analyze shipments of groundfish from Alaska (in primary or any other form) to the Lower 48 or other countries. In addition, purchasing shipping data from commercial vendors such as the Port Import Export Report Service (PIERS) was beyond the scope of the project. Other data limitations include aggregation levels too broad for this study, confidentiality constraints, and different species and product groupings across data sources. For example, the *U.S. Seafood Trade Report* tracks annual seafood production and export volumes by fish species.

However, it is not clear when looking at a category such as frozen cod fillets, how much was produced in Alaska or other parts of the U.S. CFEC data provide insights into how much primary product, by species or product type, comes from Alaska. Unfortunately, it is not always possible to combine data from different databases because the categories often differ from one database to the next. National Oceanic and Atmospheric Administration (NOAA) technical memorandums are also available that focus on the production of fish products and exports of edible fishery products. These reports show the volume and value of groundfish products exported each year from the Northwest. With some species, such as Alaska pollock, it is obvious where the product originated, and time series data are available to chart changes in production and export patterns over time. With other species, however, the origin is unclear, and it is not always possible to construct a time series that shows how production and export levels have changed over time.

In general, market forces and variation in product forms prevent meaningful analysis of readily available data on the type of primary product typically sent to a particular destination. Data are available to track the flow of certain products, such as surimi made from Alaska pollock, but not other products. For example, from 1991 to 1999, roughly 50 percent of the total pollock product each year has been surimi. In the early 1990s, roughly 75 percent of the surimi produced each year was shipped to Japan. In most cases, however, the products made from a given species vary from year to year, as do the destinations for those products. In addition, the pattern for surimi from pollock—a pattern that has seemed stable from year to year—may be changing. One fish buyer interviewed for this report suggested that the demand for surimi (and surimi-based products) in Japan appears to be declining along with demand for other traditional foods.

In short, the final destination of primary and secondary products varies, depending on the quality of the primary product, food prices, and many other factors. Decisions about what to produce and where to ship it are made by fish buyers and brokers and may not be made until a harvesting vessel can report the type of species being intercepted, as well as the size, quality, and other information. No data are readily available that identify secondary processors in the U.S. or that show exactly how much primary product from Alaska is sent to those processors.

Main end users and markets for Alaska pollock. Roughly 60 to 70 percent of Alaska pollock is made into surimi, a fish paste product that can be used to make kamaboko (a traditional Japanese food) and numerous other products. In the U.S., surimi is used to make products such as imitation crabmeat. With approximately 10 surimi plants in the U.S., most of the surimi is produced by at-sea and shorebased processors in Alaska for Asian markets (primarily Japan). There are two secondary processing surimi plants in WAIW—the Icicle kamaboko facility and a facility owned by Trident.

Perhaps 15 percent of the total pollock harvest is made into deep skin blocks (fillets with the skin and fat removed), primarily for the U.S. fast food market (almost exclusively McDonald's). Most processing for this market occurs at the primary processing level. Approximately 3 to 5 percent of the total pollock harvest results in individually quick frozen (IQF) blocks for the U.S. food service industry. This product serves as a substitute for other whitefish fillets. The remainder of the harvest is typically made into traditional blocks that can be used in the European market. The demand for traditional blocks is totally dependent on the price and availability of other whitefish, although pollock is not typically viewed as a desired substitute.

Most significant primary and secondary processors. The most significant primary processors are the shore plants, motherships, and catcher/processors described in the sector analyses of this report. The most significant secondary processors are more difficult to describe. Several companies with ownership positions in primary processing facilities also have secondary processing facilities. At the same time, many other companies with secondary processing facilities have no direct connection with the primary processing facilities.

For surimi, the only secondary processing facilities in the U.S. are in Puget Sound. These facilities make surimi products for export and for use in the U.S. by food manufacturers. The Icicle secondary processing facility (that produces kamaboko from surimi) in Bellingham, Washington, has 115 full time employees. Icicle recently purchased the *Northern Victor*, a floating processor, and expects all surimi used in the Bellingham plant in the future to come from Alaska pollock. (Some surimi produced at the facility in Bellingham in the past has come from hake/whiting harvested locally.) Information on this and other secondary processing facilities is not included in the sector or regional analyses due to the lack of employment data and the percentage of product that originates in Alaska.

Market developments and uncertainties. The demand for traditional surimi products such as kamaboko appears to be declining in Japan. One possible reason is that much of the demand comes from older generations in Japan. Younger generations in Japan and many other Asian countries appear to prefer western foods more than the older generations. However, surimi can be used in the production of a variety of foods. The net effect of a decline in demand for kamaboko is not known. However, the effect is not likely to be decline in overall demand or production of surimi. Instead, the effect is more likely to be a shift in how surimi is used and where it is shipped. A fish buyer interviewed for this report said that food manufacturers in the U.S. are struggling to find new uses for surimi because surimi is a good binder in processed foods and retains water.

Transportation. Primary pollock products produced at sea are offloaded to trampers, which take products directly to secondary processors in Asia, the Lower 48 (Puget Sound area), or Europe. Primary products produced in shoreside facilities typically are shipped by one of the primary marine carriers to Japan or Puget Sound. Marine shippers have charged the same price to ship products from Dutch Harbor to Japan, whether routed through Seattle or not. The price has been the same for the different routes because of the lower cost of cold storage in the Bellingham and Seattle area. This fact underscores the significance of factors such as size of inventories and cost of storage in determining product flows from Alaska.

3.3.4 Affected fishing communities

The BSAI pollock fishery ranks among the largest industrialized fisheries in the world. It employs, either directly or indirectly, literally thousands of individuals in pollock harvesting, processing, transshipping, and support sectors. This labor pool is drawn from villages, towns, and cities across the United States and, indeed, from many foreign nations, as well. As a result, a large (but unknown) number of communities, in and outside of Alaska, have some form of economic linkage to the BSAI pollock fishery (beyond the products which flow from it to seafood consumers worldwide). However, there is a relatively small number of communities (most in rural coastal Alaska) which have a very clear, well defined, and direct relationship to this fishery and the resource base it exploits. These are the communities which receive and process the vast majority of the BSAI pollock catch, serve as "home port" to a significant portion of the pollock harvesting fleet, and/or providing logistical and management services to the industry.

A description of these 'key' pollock-dependent communities and villages (i.e., all but Seattle, Washington qualifying as 'small governmental jurisdictions' for Regulatory Flexibility Act purposes) is provided below. In addition to those explicitly described in the following section, there are a total of 65 rural western Alaska villages whose relationship to and dependence upon the BSAI pollock fishery is primarily attributable to membership in one of the Community Development Quota (CDQ) groups (established under the Magnuson-Stevens Act and administered by the State of Alaska). These villages have, for the most part, no direct linkages to the BSAI pollock fishery, but instead are indirectly dependent through their respective CDQ-group affiliations. The relationship of the CDQ groups to the BSAI pollock fishery, and the attributable effects of the proposed AFA action on that relationship, is treated separately in this document.

When NMFS Blend data are employed to rank Alaska fishing ports, from highest to lowest, on the basis of their 1999 groundfish landings and value, the first five ports account for in excess of 95% of total Alaska groundfish landings, the vast majority of which is comprised of pollock.

These communities listed in rank order in table 3.3.5 below:

Table 3.3.5 Major Alaska groundfish fishing ports.

Port	Metric tons* (Groundfish)	Value	No. of Processors (Groundfish)
1. Dutch Harbor/Unalaska	276000	$61,315,000	6
2. Akutan	>100,000	NA	1
3. Kodiak	106500	$47,800,000	9
4. Sand Point	<50,000	NA	1
5. King Cove	<25,000	NA	1

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

The communities of Dutch Harbor/Unalaska and Akutan are located on the Bering Sea side of the Alaska Peninsula/Aleutian Island chain, while Sand Point and King Cove are on the Gulf of Alaska side. Kodiak Island, where the port and City of Kodiak are located, is in the Gulf of Alaska. Nonetheless, a substantial portion of the groundfish processed in Sand Point and King Cove is harvested in the Bering Sea, as is a somewhat lesser share of that landed in Kodiak. Relatively small amounts of groundfish, including pollock, harvested in the GOA have been delivered for processing in Dutch Harbor/Unalaska and Akutan (e.g., in 1998, Alaska fish tickets recorded GOA pollock deliveries to Dutch Harbor for processing).

As suggested, pollock is the primary groundfish species landed and/or processed in these five ports, with Pacific cod making up almost all of the rest. In Dutch and Akutan, for example, pollock represented 83% and 76%, respectively, of the 1997 total groundfish landings in these ports (Pacific cod accounting for virtually all of the balance).[20] In the case of Sand Point, pollock was 69% of groundfish landings, Pacific cod 29%, with fractional percentages of other groundfish species accounting for the rest. King Cove presented the single exception among these port communities, with pollock catch-share at 31% and Pacific cod at 69% of the groundfish total. Kodiak presented the most diversified species complex, with pollock representing 43%, Pacific cod 36%, assorted flatfishes at 14%, and a mix of other groundfish species making up the balance of the total. These data clearly demonstrate, however, the substantial dependence these five communities have on the BSAI pollock resource.

Based upon the relatively limited data which are available on individual communities and processing facilities, the following characterizations of the principal pollock-dependent Alaska landings ports, which might reasonably be expected to incur measurable economic effects from the AFA-implementing actions, can be offered.[21]

[20] Source: State of Alaska Fish tickets

[21] As noted, while the proposed AFA-implementation actions are not expected to result in reductions in total pollock catch, they may cause shifts in operating patterns and schedules; changes in product mix, quality and/or price; increases in operating costs; and, in the limit, some intra-sectoral redistribution. Any of these may have localized impacts which are not amenable to quantitative measurement, given currently available data.

Dutch Harbor/Unalaska

The community of Unalaska is situated on the shores of Iliuliuk Bay and Dutch Harbor, on Unalaska Island in the Aleutian Chain. The community and port complex is located approximately 800 miles southwest of Anchorage and 1,700 miles northwest of Seattle. Unalaska is the 11th largest city in Alaska, with a reported year-round population of just under 4,200 (certified December, 1999, by Alaska DCED). The name Dutch Harbor is typically applied to the portion of the city on Amaknak Island, which is connected to Unalaska Island by bridge. Dutch Harbor actually lies entirely within the boundaries of the City of Unalaska. The combined area encompasses 116 square miles of land and 99 square miles of water.

The population of Unalaska is primarily non-Native. Unalaska is a rapidly-growing and culturally-diverse community, primarily focused on fishing and fish processing activities. Subsistence activities are important economically and culturally to the Alaska Native (primarily Aleut) community and many long-term non-Native residents, as well. According to 1990 U.S. Census data, there were more than 2,500 jobs estimated to be in the community. The official unemployment rate at that time was 1.0%, with 7.8% of the adult population not in the work force. The median household income was reportedly $56,215, and 15.3% of residents were living below the poverty level.

Dutch Harbor/Unalaska has been called *"... the most prosperous stretch of coastline in Alaska."* With 27 miles of ports and harbors and several hundred local businesses, most of them servicing, supporting, or relying on the seafood industry, the city is regarded as the heart of the Bering Sea fisheries.
Dutch Harbor has been the top ranked fishing port in the United States since 1989, both in terms of total landings and value of fish landed (NMFS 2000b).

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

Historically, Dutch Harbor was dependent crab fishing and processing for the bulk of its economic activity. Crab and other non-groundfish fisheries continue to be important components of a diverse processing complex in Dutch Harbor. In 1997, for example, nearly 2 million pounds of salmon, more than 1.7 million pounds of herring, and 34 million pounds of crabs were reportedly processed in this port. Nonetheless, since the mid-1980s, groundfish and particularly pollock has accounted for the vast majority of landings in Dutch Harbor/Unalaska. Again, utilizing 1997 catch data, over 93.5% of total landings were groundfish, 83% of which were pollock. This has been a consistent pattern to the present.

The facilities and related infrastructure in Dutch Harbor/Unalaska support fishing operations in the eastern Bering Sea, Aleutian Islands and GOA management areas. Processors in this port receive and process fish caught in all three areas, and the wider community is linked to, and substantially dependent upon, serving both the inshore and at-sea sectors of the fishing industry.

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

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

shore-based and many floating processors operate within municipal boundaries." (NPFMC 1994)

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

Unalaska enjoys a strategic position as the center of a rich fishing area, and for transshipment of cargo between Pacific Rim trading partners. The Great Circle shipping route from major west coast ports to the Pacific Rim passes within 50 miles of Unalaska, and Dutch Harbor provides a natural protection for fishing vessels.

The State of Alaska reports that, "In 1998, 597 million pounds of fish were landed in Unalaska, worth $110 million. Fifty-five residents hold commercial fishing permits. Onshore and offshore processors provide some local employment. However, non-resident workers are usually brought in during the peak season. Rapid growth occurred between 1988 and 1992 as the pollock fishery developed; the economy has now stabilized." (Alaska Department of Commerce and Economic Development 1999)

While Dutch Harbor reportedly has a budding tourist industry (during 1998, Unalaska received visitors from five cruise ships) and a new Convention and Visitors Bureau, and has been characterized as one of the world's best natural harbors, it offers few alternative opportunities for significant economic activity beyond fisheries and fisheries support. Its remote location, limited and specialized infrastructure and transportation facilities, and high cost make attracting non-fishery related industrial and/or commercial investment doubtful, at least in the short-run. [22]

Nonetheless, the community of Unalaska has continued to make capital improvements and long term investments in municipal facilities and services, largely in support of, and based upon, the tax revenues from commercial fishing. For example, a new water reservoir was recently completed at Icy Creek. Water is also supplied by a dam at Pyramid Creek and Unalaska Creek, and is chlorinated and stored in a tank. The City has asked the State for funds to construct a 2-million-gallon back-up storage tank above Ballyhoo Road. All homes and on-shore fish processors are served by the City's piped water system. Piped sewage receives primary treatment before discharge into Unalaska Bay. Nearly all households have plumbing; a few homes use septic tanks or privies. The City has a new lined 6-acre landfill and refuse bailer; recycling and hazardous waste disposal is provided. All on-shore processors generate their own electrical power. The future of infrastructure development is closely tied to the level of harvesting and processing of (especially pollock) fisheries resources in the Dutch Harbor/Unalaska municipality.

The municipal government of the City of Unalaska depends on the tax revenues which are generated from fishing, processing, and support activities, with pollock representing by far the single most important species. While a detailed treatment of municipal tax accounts is beyond the scope of this assessment, it is clear that, between the State of Alaska's Fisheries Business Tax and Fishery Resource Landings Tax revenues (both of which are shared on a 50/50 basis with the community of origin), local raw fish sales tax, real property tax (on fishery-related property), and permits and fees revenues associated with fishing enterprises, the City of Unalaska derives a substantial portion of its operating, maintenance, and capital improvement budget from fishing, and especially pollock fishing, related business activities.

[22] Sea floor minerals exploration, including oil drilling, in the region have been discussed. No such development seems likely in the short run, however. Unalaska, also, reportedly expected nearly 6,000 cruise ship visitors in 1996.

Akutan

The community of Akutan is located on an island of the same name in the eastern Aleutians, one of the Krenitzin Islands of the Fox Island group. The community is approximately 35 miles east of Unalaska and 766 air miles southwest of Anchorage. Akutan is surrounded by steep, rugged mountains reaching over 2,000 feet in height. The village sits on a narrow bench of flat, treeless terrain and encompasses 14 sq. miles of land and 5 sq. miles of water. The small harbor is ice-free year round, but there are frequent storms in winter and fog in summer. The community is reported to have a population of 408 persons (certified December, 1999, by DCED), although the population can swell to well over 1,000 during peak fish processing months.

Boats and amphibious aircraft are the only means of transportation into Akutan. A dock is available, but there is no small boat harbor. Plans are underway to develop a boat harbor west of the processing plant; construction will begin in 2000. The State Ferry operates from Kodiak bi-monthly between May and October. Cargo is delivered weekly by freighter from Seattle. Akutan has no airstrip due to the steep terrain, however, a seaplane base is available. Daily air service is provided from nearby Unalaska. High waves limit accessibility in winter months.

The 1990 U.S. Census (latest currently available data) estimated there were 527 jobs in the community. The median household income was $27,813, and 16.6% of the residents were living below the poverty level. There is one school in the community, serving 24 students. Village water is supplied from local streams, treated, and piped into homes. The seafood processing plant adjacent to the community operates its own water treatment facility.

Commercial fish processing dominates Akutan's cash-based economy. Trident Seafoods operates a large processing plant west of the village. The population of Akutan can more than double during processing months. Eight residents hold State of Alaska commercial fishing permits. Subsistence hunting and fishing activities supplement cash-based economy income sources.

Akutan is the second largest port for groundfish landings in the BSAI, most of which is pollock. Akutan has been characterized as a unique community in terms of its relationship to the BSAI fisheries. According to a recent social impact assessment, prepared for the Council[23], while Akutan is the site of one of the largest of the onshore pollock processing plants in the region, the community is geographically and socially separate from the plant facility.

As a result, Akutan has a very different relationship to the region's pollock fisheries than does, for example, Dutch Harbor/Unalaska or Kodiak. While the community of Akutan derives economic benefits from its proximity to the large Trident Seafoods shore plant (and a smaller permanently moored processing vessel, operated by Deep Sea Fisheries, which handles only crab), the entities have not been integrated in the way other landings ports and communities on the list have. The community does, however, derive some direct economic benefits, including a 1% raw fish tax, from the nearby fish processing plants.

The port of Akutan does not have a boat harbor, nor is there an airport in the community. Beyond the limited services provided by the plant, itself, there does not appear to be an opportunity in Akutan to provide a support base for other major commercial fisheries. Indeed, alternative economic opportunities of any kind are extremely limited. For example, fisheries for various crab species, halibut, salmon, and herring are important sources of income to the region, but are fully developed.

[23] Inshore/Offshore-3 Socioeconomic Description and Social Impact Assessment. Impact Assessment, Inc. NPFMC. July 15, 1998.

Kodiak

The fishing port of Kodiak is located near the eastern tip of Kodiak Island, southeast of the Alaska Peninsula, in the Gulf of Alaska. The City of Kodiak is the sixth largest city in Alaska, with a population of 6,893 (certified December, 1999, by DCED). The City of Kodiak lies 252 air miles south of Anchorage and encompasses 3 sq. miles of land and 1 sq. miles of water. The port and community are highly integrated, both geographically and structurally. The port and community are the *de facto* center of fishing activity for the Gulf of Alaska.

Kodiak is accessible by air and sea. The State-owned Kodiak Airport provides a 7,500' paved runway. Kodiak Municipal Airport offers a 2,475' asphalt airstrip. Two scheduled airlines serve Kodiak with several daily flights, and a number of air taxi services provide flights to other communities on the Island. The city-owned seaplane base at Trident Basin and Lilly Lake serve floatplane traffic. The Alaska Marine Highway System operates a ferry service to and from Seward and Homer. Two boat harbors provide moorage for more than 600 commercial and transient vessels. Boat launch ramps are also provided. A $20 million breakwater on Near Island provides another 60 acres of mooring space at St. Herman Harbor; float expansion began in 1999. Funds have also been provided to replace the 32-year-old float system at the St. Paul Inner Harbor downtown. Approximately 140 miles of state roads connect island communities on the east side of the island.

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

According to State of Alaska sources, Kodiak area residents hold 668 commercial fishing permits, and thirteen fish processing companies operate here year-round. At least, nine of these receive pollock harvested from the GOA and, to a lesser extent, the eastern Bering Sea and Aleutian Islands management areas, while four others process exclusively non-groundfish species.

The port also supports several hundred commercial fishing vessels, ranging in size from small skiffs to large catcher/processors and everything in between. On its website, the City of Kodiak suggests, *"The Port of Kodiak is 'home port' to 770 commercial fishing vessels. Not only is Kodiak the state's largest fishing port, it is also home to some of Alaska's largest trawl, longline, and crab vessels."*

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

Kodiak processors are highly dependent on pollock landings, with this species accounting for 43% of total groundfish deliveries, by weight, in 1997. Unlike the other primary landings ports discussed above, while pollock landings are an extremely valuable and important component of the suite of species processed, Kodiak tends to be much more of a multi-species fishing community. The port participates in a broader range of groundfish fisheries than any of the other ports in the state. Most of this activity centers on the numerous flatfish species which are present in the GOA, but also includes relatively significant rockfish and sablefish fisheries. In addition, salmon, halibut, crabs, and herring fisheries are very important to the local community. Many of these fisheries are highly seasonal, and Kodiak processors have come to rely upon pollock landings to bridge the inevitable operating gaps.[24] That is, Kodiak processors reportedly often depend on pollock deliveries as a means to maintain continuous operation of their plants and full employment of their processing crews.

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

In 1997, for example, the port recorded salmon landings of just under 44 million pounds, with an estimated exvessel value of over $12 million. Approximately 4.3 million pounds of Pacific herring were landed in Kodiak with an exvessel value of more than $713,000. Crab landings exceeded 1.1 million pounds and were valued exvessel at more than $2.7 million.

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

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

Sand Point and King Cove

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

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

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

Sand Point and King Cove, like Akutan, are part of the Aleutians East Borough. Both Sand Point and King Cove have had extensive historical linkages to commercial fishing and fish processing, and currently support resident commercial fleets delivering catch to local plants. These local catches are substantially supplemented by deliveries from large, highly mobile vessels, based outside of the two small Gulf of Alaska communities.

[24] Blackburn, C. (1998). "Personal Communication.", Chris Blackburn, P.O. Box 2298, Kodiak, AK 99615.

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

For decades, each of these the two communities has concentrated principally on salmon fisheries. For example, in 1997, both Sand Point and King Cove recorded salmon landings of several million pounds.[25] In addition, King Cove had significant landings of Pacific herring and crabs. Recently, each community has actively sought to diversify its fishing and processing capabilities. Groundfish, especially pollock, is key to these diversification plans.

By any measure, these two communities are fundamentally dependent upon fishing and fish processing. In recent years, groundfish (primarily pollock and Pacific cod) have supplanted salmon, herring, and crabs as the primary target species, becoming the basis for both communities' economic activity and stability.

Few employment alternatives to commercial fishing and fish processing exist, within the cash-economy, in these communities. However, subsistence harvesting is an important source of food, as well as a social activity, for local residents in both Sand Point and King Cove.

King Cove is somewhat unique among the five key groundfish landings ports profiled herein, insofar as it is relatively more dependent upon Pacific cod than pollock, among the groundfish species landed (69% and 31%, respectively). Sand Point follows the more typical pattern with pollock and Pacific cod representing 69% and 29% of its groundfish landings, respectively, in 1997.

As suggested earlier, these are very small, isolated villages with exceedingly limited infrastructure. There does not appear to be any viable source of alternative economic activity which could alleviate a significant decline in their primary groundfish species deliveries.

Seattle metropolitan area

The remaining "community" with substantial direct linkages to the BSAI pollock fishery is Seattle Washington, one of the largest and most economically diversified metropolitan areas in the United States. Seattle serves as the U.S. corporate headquarters for virtually all of the major fishing and processing companies in the BSAI pollock fishery. It's Lake Union, Fisherman's Terminal, and adjacent maritime facilities are the primary 'home port' and/or logistical support base for the BSAI pollock fishery. While Seattle's traditional economic and cultural dependence on commercial fishing, processing, and seafood trade has been surpassed by (among others) aerospace, commuter/software technology, and non-seafood importing/exporting, the community continues to identify itself with maritime industries, in general, and commercial fisheries (especially Alaska-based fisheries) in particular.

The economy of the Seattle and surrounding region is highly diversified, with retail trade and services, manufacturing, finance, construction, wholesale trade, and transportation ranking at the top of the list of employers. The commercial fishing sector (including harvesting, processing, and allied trade) represents an important component of the local economy, but is dwarfed in terms of its contribution to the aggregate community economy (e.g., employment, gross payroll, tax base, etc.) by other major sectors.

[25] State of Alaska data confidentiality requirements preclude reporting actual quantities and value when fewer than four independent operations are included in a category. Sand Point and King Cove each have one processor reporting catch and production data.

Community Development Program (CDQ) groups and communities

Overview. The Community Development Quota (CDQ) program was developed to enable residents of rural fishing communities in western Alaska to participate in the BSAI groundfish fisheries in a way that would foster significant local economic development. Because the program was intended to facilitate initial and then build ongoing engagement in fisheries in adjacent, federally managed waters, to be eligible to participate, communities could have no current or historical linkage to the fisheries in question at the time of the program's implementation. Sixty-five Alaska Native Claims Settlement Act (ANCSA) villages (primarily remote Alaska Native communities) in proximity to the Bering Sea have established eligibility under federal and state regulations, formed 6 CDQ groups (with 1 to 21 members each), and become engaged in the fishery through developing partnerships with fishing corporations.

The CDQ community contributes the asset of preferential access (their assigned CDQ quota), while the partnering firm brings the harvesting/processing capacity and experience in the fishery. Reports of consistently high bid prices for CDQ shares indicate that in the partnering companies also receive substantial benefits from these CDQ relationships. Increasingly, CDQ groups are using their CDQs to leverage capital investment in harvesting/processing capacity. The nature of these relationships differs from group to group.

The CDQ program, initially focused on pollock, now includes multiple species such as pollock, Pacific cod, flatfish, Atka mackerel, rockfish, sablefish, and other groundfish, halibut, and crab. 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.

Local hire and reinvestment of proceeds in fishery development projects are a required part of the program. Since inception in 1992, the program has provided significant numbers of jobs to CDQ village residents, in later years reaching about 1,000 jobs annually for region[26] residents (with total wages of about $30 million). The total regional population is approximately 3,900. Infrastructure development projects within the CDQ region, as well as loan programs and investment opportunities for locals, have also been important. CDQ group offices tend to be located in regional hub communities, near industry partner offices, or near ongoing projects.

CDQ group profiles. The following CDQ group profiles have been condensed and updated from those the in Inshore/Offshore Pollock Allocation Amendment to the Bering Sea Groundfish Fishery Management Plan (NPFMC 1999e).

Aleutian Pribilof Island Community Development Association (APICDA). The six communities represented by APICDA are relatively small and located adjacent to the fishing grounds. The total population of the six communities is approximately 730. Unalaska, the largest community in the region and the hub of the Bering Sea fishery, is not a CDQ community, but is a non-voting member of the APICDA Board of Directors. APICDA is allocated 16 percent of the pollock and 16 percent of the cod total CDQ allocations. This allocation is shared among inshore and offshore partners in such a way as to maximize the benefit to APICDA. Because of proximity to the fishing grounds and access to ice-free waters, APICDA focuses on community development and employment opportunities that occur in or near each community.

Bristol Bay Economic Development Corporation (BBEDC). BBEDC represents 17 villages near Bristol Bay, including Dillingham, which is the second-largest CDQ community and has approximately 2,200 residents. BBEDC is currently allocated 21 percent of the pollock and 20 percent of the cod total

[26] In this section only, "region" refers to the Western Alaska CDQ communities as a whole. This grouping is discrete from the "regions" discussed in 3.10.3 and other parts of this document.

CDQ harvest. To date, BBEDC has focused its community development efforts primarily on creating offshore employment opportunities, and has employed more village residents in pollock processing jobs than any other group. BBEDC has also invested in a variety of fishing vessels, including part interest in a pollock catcher/processor and a freezer longliner. However, BBEDC also has a program to evaluate investments in regional infrastructure. BBEDC has active vocational training and internship programs with its offshore partner, and provides internship opportunities with out-of-region and local businesses to develop administrative and other specialized skills.

Central Bering Sea Fisherman's Association (CBSFA). CBSFA is unique among CDQ groups in that it represents a single community, St. Paul in the Pribilof Islands. St. Paul is strategically located to serve the Bering Sea fishing industry. CBSFA has focused attention on working with other island entities to improve St. Paul's harbor facility, and on expanding the island's small vessel fleet. The group also operates a revolving loan program for resident fishers. Reflecting the focus of St. Paul residents on developing local fishing ventures and infrastructure, CBSFA has not seen much demand among residents for off-island processing jobs, either offshore or inshore. The group is partnered with a large offshore company and would like to build on the benefits of product offloads at the St. Paul harbor and the attendant support services its residents can provide. Currently, CBSFA receives 5 percent of the pollock and 5 percent of the cod of the total CDQ harvest.

Coastal Villages Region Fund (CVRF). CVRF manages 22 percent of the pollock and 17 percent of the cod CDQ harvest for its 21 member villages. These villages are in a remote area between the southern end of Kuskokwim Bay and Scammon Bay. The area is poorly located to engage directly in the current Bering Sea fisheries. CVRF has stressed employment in the offshore sector for its residents, primarily because of shorter time commitments and higher wages, but the group has both inshore and offshore partners. CVRF recently purchased 20 percent of American Seafoods (catcher/processors) and 20 percent of the F/V OCEAN PROWLER (a freezer longliner). CVRF provides jobs to fishers through its nearshore CDQ halibut fishery and a longline vessel that harvests CDQ sablefish. The group is interested in establishing salmon processing facilities both on Kuskokwim Bay and elsewhere in the region, as well as halibut processing facilities.

Norton Sound Economic Development Corporation (NSEDC). Fifteen villages and approximately 8,700 people make up the region represented by NSEDC, which ranges from St. Michael to Diomede. NSEDC has actively pursued both local fisheries and Bering Sea pollock investment strategies. The group purchased approximately 50 percent of its offshore processor partner since the program's inception. The group also independently owns two tender vessels especially built for the Norton Sound region. NSEDC has developed or planned fisheries development projects in several villages. NSEDC operates an employment and training office in Unalakleet and currently receives 22 percent of the pollock and 18 percent of the cod total CDQ allocations.

Yukon Delta Fisheries Development Association (YDFDA). YDFDA represents the communities of Alakanuk, Emmonak, Grayling, Kotlik, and Sheldon Point, with a combined population of approximately 1,750. YDFDA has created employment opportunities in the Bering Sea fishery, through both its mothership partner and other processors, both inshore and offshore. Another area of focus has been a comprehensive training program. YDFDA has received steadily increasing CDQ pollock allocations, and currently receives 14 percent of the pollock and 19 percent of the cod total CDQ allocations. While the group places residents with all three sectors (catcher/processors, catcher vessels and shore plants), YDFDA has indicated that offshore and mothership employment opportunities are the most useful for its residents. The group's CDQ royalties fund a variety of training activities encompassing technical and office skills.

CDQ program results. The NPFMC recently examined the contribution of the CDQ program to the economic development and stability of the rural communities of the BSAI. Over the duration of the CDQ pollock program, aggregate annual royalties consistently have exceeded $20 million, despite declining pollock TACs. Estimates indicate that the expanded multi-species program may provide an additional $10 million in annual royalties to the CDQ groups.

Equity accumulation by CDQ communities is another empirical measure of program performance. Data suggest that CDQ groups, when taken as a whole, have retained almost half of their gross revenues in some form of equity, whether infrastructure projects, vessel ownership, or cash. Since 1992, CDQ groups' equity growth has averaged 37 percent per annum, or slightly more than $10 million each year. For many Western Alaska village residents, employment and training opportunities have been one of the most tangible direct effects of the CDQ program. It has been reported that, by 1997, CDQ groups had more than 200 people employed in the pollock fishing industry alone. From 1993-1997, CDQ programs generated approximately 1,000 employment positions a year, with associated annual total wages of about $5 million to $8 million. Management and administration accounted for 6 percent of the jobs and 23 percent of the wages. Pollock harvesting and processing accounted for 25 percent of the jobs and 32 percent of the wages. Other fisheries, which include halibut, salmon, sablefish, herring and crab, accounted for 51 percent of the jobs and 26 percent of the wages. Other employment accounted for 18 percent of the jobs and 19 percent of the wages.

Training of CDQ community residents has been a primary objective for all the CDQ groups from the outset of the program and has been promoted as an essential means to a sustainable, locally based fishery economy. In 1997, for example, the State of Alaska reported that CDQ training had been extended to 846 individuals, reflecting a total expenditure by CDQ groups of $1,041,309. While it is impossible to estimate precisely the indirect employment and income impacts of the CDQ region, it is reasonable to assume that they are smaller than the direct impacts—probably about half the magnitude or less. Nevertheless, every contribution to jobs and income is valuable to these economically underdeveloped communities, and these additional impacts of the CDQ program should not be overlooked.

Chapter 4: Environmental and Economic Consequences

This chapter examines the environmental and economic consequences that are expected to result from adoption of each of the alternatives. Broader issues such as the effects of pollock fishing in general and the cumulative effects of groundfish fishing in Alaska are also addressed in this EIS. However, such issues are examined in much greater detail in the Programmatic Groundfish Fisheries SEIS (NMFS 2001a) that is being prepared concurrently with this document.

The task of describing how a particular fishery is expected to conduct itself under a comprehensive new set of rules involves some degree of conjecture and speculation. This is because the circumstances that lead fishermen and industry to behave in a certain manner are dependent on such a wide variety of unpredictable factors including weather patterns, sea ice conditions, the migratory patterns of the target species, worldwide market conditions, other regulatory changes, and a host of other factors that are difficult or impossible to predict. Nevertheless, the re-organization of the BSAI pollock fishery under the AFA that is reflected in each of the AFA-based alternatives (Alternatives 2-5) will result in certain predictable changes to fishing and processing practices and these changes will have some predictable environmental and economic consequences.

Section 4.1 describes the structural and organizational changes to the fishery that are expected to result from each of the alternatives and how these changes are expected to affect fishing and processing patterns. The most significant structural change resulting from the AFA is the imposition of a new allocation formula for the BSAI pollock fishery that increases the CDQ and inshore allocations and subdivides the remaining offshore allocation between catcher/processor and motherships. The most significant organization change to the BSAI pollock fishery is the emergence of fishery cooperatives which has eliminated the Olympic-style race for fish and has allowed for rationalization of the fishery.

These major structural and organizational changes are expected to affect patterns of pollock fishing and processing in the BSAI. Among the possible changes examined in this chapter are:

- **Effects on pollock fishing patterns.** How will each of the alternatives affect when and where pollock fishermen chose to fish?

- **Effects on fleet composition.** How will each of the alternatives affect the composition of the various pollock fishing fleets?

- **Effects on pollock processing patterns.** How will each of the alternatives affect how pollock processing (i.e. processing locations, product forms, and recovery rates)?

The conclusions with respect to fishing patterns, processing patterns, and fleet composition detailed in Section 4.1 form the basis for an analysis of potential effects of each of the alternatives on the physical environment in Section 4.2, and an analysis of the potential effects of each of the alternatives on biological resources in Section 4.3. Effects on managed fishery resources, benthic habitat, marine mammals, seabirds, endangered and threatened species, other species, and cumulative effects on the environment are examined in these sections.

Section 4.4 examines the economic and socioeconomic effects of the alternatives. These include impacts to pollock and non-pollock fisheries, impacts to coastal communities, impacts to consumers, and other economic and socioeconomic effects of the alternatives. Economic effects of the alternatives are also addressed in the regulatory impact review contained in Section 4.5 and the final regulatory flexibility analysis (FRFA) contained in Section 4.6. Section 4.7 addresses environmental justice considerations and examines the effects of the alternatives on minority and low-income populations. Section 4.8 addresses the energy requirements and conservation potential of the alternatives. Finally, Section 4.9 is a discussion of the cumulative effects of the alternatives.

As a starting point, each alternative under consideration is perceived as having the potential to significantly affect one or more components of the human environment. Significance is determined by considering the context in which the action will occur and the intensity of the action. The context in which the action will occur includes the specific resources, ecosystem, and the human environment affected. The intensity of the action includes the type of impact (beneficial versus adverse), duration of impact (short versus long term), magnitude of impact (minor versus major), and degree of risk (high versus low level of probability of an impact occurring). Further tests of intensity include: (1) the potential for jeopardizing the sustainability of any target or non-target species; (2) substantial damage to ocean and coastal habitats and or essential fish habitat; (3) impacts on public health or safety; (4) impacts on endangered or threatened species, marine mammals, or critical habitat of these species; (5) cumulative adverse effects; (6) impacts on biodiversity and ecosystem function; (7) significant social or economic impacts; and (8) degree of controversy (NAO 216-6, Section 6.02).

Differences between direct and indirect effects are primarily linked to the time and place of impact. Direct effects are caused by the action and occur at the same time and place. Indirect effects occur later in time and/or further removed in distance from the direct effects (40 CFR 1508.27). For example, the direct effects of an alternative which lowers the harvest level of a targeted fishery could include a beneficial impact to the targeted stock of fish, a neutral impact on the ecosystem, and an adverse impact on net revenues to fishermen, while the indirect effects of that same alternative could include beneficial impacts on the ability of Steller sea lions to forage for prey, neutral impacts on incidental levels of prohibited species catch, and adverse impacts in the form of multiplier effects reducing employment and tax revenues to coastal fishing communities.

The terms “effects” and “impacts” are used interchangeably. The CEQ regulations for implementing the procedural provisions of NEPA, also state “Effects and impacts as used in these regulations are synonymous.” (40 CFR §1508.8). The terms “positive” and “beneficial”, or “negative” and “adverse” are likewise used interchangeably to indicate direction of intensity in significance determination.

Each section below contains an explanation of the criteria used to establish significance and a determination of significance, insignificance or unknown for each resource, species, or issue being treated. The following ratings for significance are used; significant (beneficial or adverse), conditionally significant (beneficial or adverse), insignificant, and unknown. Definitions of the criteria used for these rankings are included in each section. Where sufficient information is available, the discussions and rating criteria used are quantitative in nature. In other instances, where less information on the direct and indirect effects of the alternative are available, the discussions and rating criteria used are qualitative in nature.

Although the significance ratings utilized are the same for each resource, species, or issue bing treated, the basic “perspective” or “reference point” differs. Table 4.0.1 summarizes the reference points for the topics addressed in this analysis. The first three reference points relate to the biological environment, while the later two are associated with the human environment. Social and economic consequences are not listed because the significance ratings were not similarly applied; rather, direct indicators of changes from current economic conditions were used. For each application listed in Table 4.0.1, one to five specific questions were addressed in the analysis. In each case, the questions were fundamentally tied to the respective reference point. The generic definitions for the assigned ratings are as follows:

S+ Significant beneficial effect in relation to the reference point; this determination is based on ample information and data and the judgement of the NMFS analysts who addressed the topic.

S- Significant adverse effect in relation to the reference point and based on ample information and data and the judgement of the NMFS analysts who addressed the topic.

CS+ Conditionally significant beneficial effect in relation to the reference point; this determination is lacking in quantitative data and information, however, the judgement of the NMFS analysts who addressed the topic is that the alternative will cause an improvement in the reference point condition.

CS- Conditionally significant adverse effect in relation to the reference point; it is based on insufficient data and information, however, professional judgement is that the alternative will cause a decline in the reference point condition.

I Insignificant effect in relation to the reference point; this determination is based upon information and data, along with the judgement of NMFS analysts, which suggests that the effects are small and within the "normal variability" surrounding the reference point.

U Unknown effect in relation to the reference point; this determination is characterized by the absence on information and data. In instances where the information available is not adequate to assess the significance of the impacts on the resource, species, or issue, no significance determination was made, rather the particular resource, species, or issue was rated as unknown.

NA Not Applicable. In instances where the full spectrum of significant negative, conditionally significant negative, insignificant, conditionally significant positive, and significant positive are not logically described, the undescribable situation is noted "not applicable." An example of an undescribable situation is evaluating the impact vector of incidental take on marine mammals. In this example, a continuum of significant adverse to insignificant is describable (though with less precision than perhaps desired by decision makers), however, within the area known to be insignificant the point of no impact from the vector of incidental take is reached, therefore, the situations of conditionally significant beneficial, and significant beneficial do not apply.

In this analysis, and the often referenced Draft Programmatic Groundfish Fisheries SEIS (NMFS 2001a), NMFS uses the term "conditionally significant" to allow informed decision making to proceed in spite of incomplete or unavailable information. When information is incomplete or unavailable to quantify an impact's significance (beneficial or adverse), or if the point at which an effect becomes significant is not supported by scientific data, the qualifier "conditionally" is applied. The qualifier implies that significance is assumed, based on the credible scientific information and professional judgement that are available, but more complete information is needed for certainty. In other words, we may believe that an impact has a significant adverse or a significant beneficial effect, but we do not have a high level of certainty about that finding. This approach provides a heightened sense of where information is lacking, and may guide research efforts in the future. An interesting point to make about this approach is that if an impact is rated as insignificant, there is a high level of confidence that the impact is truly insignificant, or it would have been moved to the "conditional significance" category.

Table 4.0.1 Reference points for significance determinations

Reference Point	*Application*
Current population trajectory or harvest rate of subject species	(1) Marine mammals (2) Target commercial fish species (3) Incidental catch of non-specified species (4) Forage species (5) Prohibited species bycatch (6) ESA list Pacific salmon (7) Seabirds
Current size and quality of marine benthic habitat and other essential fish habitat	Marine benthic habitat and other essential fish habitat
Application of principles of ecosystem management	Ecosystem
Current management and enforcement activities	1.01 State of Alaska managed fisheries 1.02 Management complexity and enforcement
Current rates of fishing accidents	Human safety and private property (vessels)

4.1 Effects of the alternatives on Bering sea pollock fishing patterns

All of the AFA-based alternatives (Alternatives 2 though 5) represent a dramatic restructuring and reorganization of the BSAI pollock fishery. These changes, which are detailed in Chapter 2, are expected to modify pollock fishing patterns in ways that could have environmental and economic consequences.

4.1.1 Structural and organizational changes to the BSAI pollock fishery.

A variety of AFA-related structural and organizational changes in the BSAI pollock fishery have the potential to affect pollock fishing and processing patterns. A major structural change is the allocation shift mandated by section 206 of the AFA which shifts 15% of the pollock TAC from the offshore to the inshore sectors. The most dramatic organizational change in the BSAI pollock fishery is the formation of fishery cooperatives which is expected to have substantial effects on fishing patterns and processing patterns and fleet composition.

Pollock allocation shift from the offshore to the inshore sectors

Under the AFA, 15% of the BSAI pollock TAC has been reallocated from the offshore catcher/processor and mothership sectors to the inshore sector. Because inshore processors are tied to a single geographic location, this allocation shift in favor of the inshore sector could be expected to result in an geographic shift of the fishery to fishing grounds most adjacent to the major inshore processors located in Dutch Harbor and Akutan. This is because inshore catcher vessels are constrained to some extent in the distance they can range from their processor and still deliver high quality fish back to their processor. Vessels delivering pollock to inshore processors typically have no more than 72 hours from the time the first haul is brought on board the vessel to the time the pollock are offloaded at the plant and some processors prefer an ever shorter turnover time, especially when producing fillet products. These time constraints and such factors as sea conditions limit the range of inshore catcher vessels. Offshore catcher/processors and mothership operations, which are self-contained harvesting and processing operations face no such geographic constraints. Because all of the AFA-based alternatives contain the same allocation scheme, the affects of the allocation shift would not be expected to vary among the AFA-based alternatives (Alternatives 2-5). However, all things being equal, a comparison between Alternative 1 (no action) and the Alternatives 2-5) suggests that the allocation shift could lead to increased fishing effort within the vicinity of Dutch Harbor and Akutan where most of the inshore processing capacity is based. Of course this tendency may be moderated or completely reversed by the imposition of Steller sea lion protection measures that mandate a geographic dispersion of the fishery. For this reason, it is difficult to disentangle the effects on fishing patterns resulting from the AFA from the effects of simultaneously-implemented Steller sea lion protection measures.

Emergence of fishery cooperatives

The most significant organizational change in the BSAI pollock fishery resulting from the AFA is the emergence of fishery cooperatives. Many of the AFA's provisions are specifically designed to foster the development of fishery cooperatives in all three sectors of the BSAI pollock fishery. The emergence of fishery cooperatives has resulted in dramatic changes to fishing and processing patterns as well as fleet composition. The extent to which each of the alternatives would result in the development of fishery cooperatives will determine, to a large extent, the fishing and processing patterns that are expected to develop under the alternative.

Development of cooperatives under Alternative 1 (no-action). Under Alternative 1, the no-action alternative, the development of fishery cooperatives is extremely unlikely in either the inshore or offshore sectors. Sullivan (Sullivan Unpublished) identified certain circumstances that must be present in order for cooperatives to form in a given fishery. There must be a relatively small number of participants with a sufficient community of interest to make negotiation possible. There must be adequate system for gathering adequate fishery data for monitoring and compliance. There must be significant barriers to prevent new participants from entering as "free riders" on the system. There must be an opportunity to attain additional value through an allocation agreement that is sufficient to outweigh expectations that individual operators could do better under an Olympic-style race for fish. And finally, the formation of cooperatives must be consistent with anti-trust law.

The no-action alternative lacks many of these necessary circumstances. First, the license limitation program that would govern access to the BSAI pollock fishery under the no-action alternative is not sufficiently restrictive to limit the BSAI pollock fleet to small discrete numbers of participants that share a sufficient community of interest. Under the LLP program BSAI groundfish licenses are endorsed by gear type but not species meaning that any trawl vessel owner that holds a BSAI groundfish license could potentially enter the BSAI pollock fishery even if he never had a history of participating in the fishery previously. Second, the no-action alternative does not divide the offshore sector into separate catcher/processor and mothership allocations. During Council consideration of inshore/offshore 3 in 1998, many industry members testified to the Council that keeping the catcher/processor and mothership groups together under a single allocation would effectively prevent the emergence of fishery cooperatives in the offshore sector due to anti-trust considerations. For these reasons, the BSAI pollock fishery that would likely result from adoption of the no-action alternative would be an Olympic-style race for fish of the type that characterized the fishery from 1990 to 1998.

Development of cooperatives under Alternative 2 (AFA baseline). Alternative 2 would implement the minimum measures required under the AFA without additional modification by the Council or NMFS. Under this alternative, fishery cooperatives could be expected to emerge in the catcher/processor and mothership sectors, but would face difficulties forming in the inshore sector. Indeed, the fishery that emerged in 1999 is expected to look very much like the fishery that would result from adoption of Alternative 2. In 1999, the BSAI pollock fishery was managed largely under direct authority of the AFA with few implementing regulations and in 1999 cooperatives emerged in the catcher/processor sector but not in the inshore or mothership sectors.

With respect to the development of cooperatives in the catcher/processor and mothership sectors, all of the AFA-based alternatives are largely indistinguishable. The AFA creates the pre-conditions for cooperatives to emerge in these two sectors by mandating a closed class of vessels for each sector and granting each sector an exclusive allocation, 40% in the case of the catcher/processor sector and 10% in the case of the mothership sector. In addition, paragraph 210(d)(1) of the AFA provides the three AFA motherships with an anti-trust exemption for the purpose of joining a fishery cooperative if 80% or more of the mothership catcher vessels agree to enter the cooperative. These essential conditions for the formation of cooperatives would be the same across all of the AFA-based alternatives meaning that the likelihood of catcher/processor and mothership sector cooperatives forming under Alternatives 2 through 5 is essentially the same.

However, the formation of inshore cooperatives under Alternative 2 faces several significant barriers that are addressed and resolved under Alternatives 3 through 5. In developing its Preferred Alternative (Alternative 3), the Council made three changes to the allocation formula set out in subparagraph 210(b)(1)(B) of the AFA that were designed, in part, to facilitate the formation of cooperatives. The first change was to modify the formula to use the best 2 of 3 years from 1995-1997 so that vessel owners would not be penalized if they had a bad year during one of the qualifying years due to breakdown or lack of markets. Otherwise, vessels that were likely to receive very small co-op allocations would have little incentive to join co-ops.

The second change was to provide vessel owners greater than 499 mt of offshore landings with compensation for their offshore catch history. Some inshore catcher vessels made significant pollock landings to offshore catcher/processors during the qualifying years. In some instances, these landings were made at the request of the vessel's inshore processor which also owned offshore catcher/processors. Under the AFA such catch history would have otherwise been lost to inshore catcher vessels because they are by definition excluded from further participation in the catcher/processor sector under Section 208(a) of the AFA.

The third change was to eliminate from the 210(b)(1)(B) inshore co-op allocation formula, all of the 1995-1997 inshore catch history earned by non-AFA vessels. As written, the AFA co-op allocation formula includes all inshore catch history by vessels that are not inshore AFA vessels, and assigns all such catch history to the open access quota under Alternative 2. Approximately 4% of total inshore pollock landings from 1995-1997 were made by non-AFA vessels and AFA catcher vessels that lacked inshore sector endorsements. The addition of this 4% into the open access sector creates an open access quota that is inflated to such a degree relative to the catch history of the participants that many vessel owners that were likely to earn small co-op shares within an inshore co-op could believe themselves to be better off if they did not join a co-op and stayed in the open access sector.

In developing its preferred alternative, the Council also developed sideboard exemptions for the BSAI Pacific cod and GOA groundfish fisheries for catcher vessels under 125 ft LOA and that averaged less than 1700 mt of pollock landings during the qualifying years. The Council recognized that some inshore catcher vessels were primary participants in other groundfish fisheries and only participated secondarily in the BSAI pollock fishery. Grouping these vessel owners with the rest of the AFA fleet for the purpose of sideboard management was viewed as unfair because such vessel owners would be highly restricted in their ability to participate in other groundfish fisheries but would not receive much benefit from the AFA due to their low level of participation during the qualifying years. Some vessel owners testified to the Council that they were considering staying out of cooperatives or abandoning the BSAI pollock fishery all together in favor of other sideboard fisheries unless they were provided with sideboard exemptions.

The extent to which vessel owners would have chosen not to join inshore cooperatives absent these changes to the 210(b)(1)(B) allocation formula and the sideboard exemptions is difficult to estimate. However it is certainly possible that some or all of the inshore cooperatives could have faced great difficulty reaching the 80% membership threshold that is required for an inshore cooperative to qualify for a pollock allocation if sufficient numbers of vessel owners would have felt disenfranchised by the 210(b)(1)(B) allocation formula. If any inshore cooperative did not reach this 80% threshold, the cooperative would have been ineligible for a cooperative allocation under the AFA and all of the vessels would have been reassigned to fish under the open access allocation. Therefore, the percentage of the BSAI pollock TAC that would have been harvested by cooperatives under Alternative 2 would have likely ranged between 50% of the TAC (with only the catcher/processor and mothership sectors forming cooperatives) to 100% (with all of the inshore sector vessels choosing to enter cooperatives.

Development of cooperatives under Alternatives 3 through 5. As discussed above, when developing its Preferred Alternative, the Council made three modifications to the 210(b)(1)(B) allocation formula that were designed to make the inshore cooperative allocation formula more equitable and foster the development of cooperatives. These three changes are included in Alternatives 3 through 5 and were included in the emergency interim rule that governed the BSAI pollock fishery for the 2001 fishing year. In 2001, approximately 99.85% of the Bering Sea pollock TAC was harvested by cooperatives or by CDQ groups (which operate in a manner similar to cooperatives). Only a few small inshore vessels chose to remain in open access and harvested only 0.3% of the total inshore allocation. Because the same inshore cooperative allocation formula would apply under Alternatives 3 through 5 as was in effect during the 2001 fishing year it is likely that a similar percentage of vessels would enter into cooperatives under these alternatives.

Consequently, the percentage of the Bering Sea pollock TAC harvested by cooperatives or CDQ groups under Alternatives 3 through 5 is likely to be close to 100 percent.

The extent to which each of the alternatives is expected to lead to the development of cooperatives is summarized in Table 4.1.1. The five alternatives may be combined into three different scenarios for the level of rationalization in the BSAI pollock fishery: Non-rationalized, partially-rationalized, and fully-rationalized.

Table 4.1.1 Potential for development of cooperatives under each of the alternatives.

Alternative	*Potential for offshore co-ops*	*Potential for inshore co-ops*	*Projected percentage of TAC harvested by co-ops*
Alternative 1 (no action)	Low: Necessary preconditions do not exist.	Low: Necessary preconditions do not exist.	zero
Alternative 2 (AFA baseline)	High: Closed class of participants and TAC allocation split between C/Ps and MS makes co-op formation likely.	Medium: Preconditions exist however perceived inequities in AFA allocation formula and lack of sideboard exemptions could produce barriers to co-op formation. Some co-ops may not meet required 80% membership threshold.	50% to near 100% depending on success of inshore co-op organizing efforts.
Alternative 3 (preferred)	High: Closed class of participants and TAC allocation split between C/Ps and MS makes co-op formation likely.	High: Revised allocation formula and sideboard exemption program addresses potential barriers contained in Alternative 2.	near 100%. Some inshore vessels may continue to fish in open access in order to switch co-ops.
Alternative 4 (co-op autonomy)	High: Closed class of participants and TAC allocation split between C/Ps and MS makes co-op formation likely.	High: Revised allocation formula and sideboard exemption program addresses potential barriers contained in Alternative 2.	near 100%. Some inshore CVs may continue to fish in open access in order to switch co-ops.
Alternative 5 (market freedom for CVs)	High: Closed class of participants and TAC allocation split between C/Ps and MS makes co-op formation likely.	High: Revised allocation formula and sideboard exemption program addresses potential barriers contained in Alternative 2. Ability to change co-ops without spending a year in open access eliminates last potential reason for inshore CVs to remain in open access.	100%. Ability to change co-ops without spending a year in open access eliminates last potential reason for inshore CVs to remain in open access.

Changes in fleet composition

The composition of fishing fleets evolves in response to many variables including management measures, changing costs, and availability of target species. Since the passage of the AFA, all sectors of the BSAI pollock fleet have experienced reductions in fleet size as marginal vessels have been removed from the fishery through fishery cooperatives. Fishery cooperatives, which allow for the transfer of fishing quota to the most efficient operators have encouraged the removal of marginal vessels including both small vessels and large vessels that were inefficient, either because of high fuel costs or high maintenance costs. As a result, streamlined fleets developed by 2000 in all of the BSAI pollock sectors. The various pollock fishing fleets are profiled below.

In addition, the Bering Sea pollock fleet also has evolved since 1998 in response to emergency measures to protect Steller sea lions that were implemented in 1999 that had the effect of shifting fishing further offshore where larger and faster vessels have a competitive advantage. For this reason, it is difficult to disentangle the effects on fleet composition that have resulted from the AFA compared to the effects on fleet composition that have resulted from Steller sea lion protection measures.

Catcher/processor sector. Sections 207 and 209 of the AFA provided for a $95 million buyout of nine pollock catcher/processors. Under the provisions of section 209, eight of these vessels were required to be scrapped and the ninth vessel, the F/V AMERICAN EMPRESS, was permanently stripped of its U.S. fisheries endorsement and prohibited from fishing in the U.S. EEZ, or in foreign or international waters on any stock of fish that occurs within the U.S. EEZ. The buyout of these nine catcher/processors resulted in nearly a one-third reduction in the size of the catcher/processor fleet, although overall capacity in the catcher/processor sector was reduced by a somewhat lesser amount because these nine vessels were among the smallest and least efficient vessels in the catcher/processor fleet. In 1998 prior to the passage of the AFA, 30 catcher/processors ranging in size from 185 to 376 ft LOA harvested pollock. Twenty of these vessels were authorized by name to fish in the 1999 fishery, under the provisions of the AFA. One additional vessel (F/V OCEAN PEACE) qualified based on catch history under a separate provision set out at paragraph 208(e)(21) of the AFA, and fishes independently of a cooperative.

However, the formation of a fishery cooperative in the catcher/processor sector allowed for additional reductions in the size of the catcher/processor fleet. In 1999, five of the 21 catcher/processors authorized to fish under the AFA chose not to fish during the A/B season and six chose not to fish during the C/D season. Trident Seafoods chose not to fish three of its vessels, the F/V AMERICAN ENTERPRISE, the F/V SEATTLE ENTERPRISE, and the F/V U.S. ENTERPRISE. American Seafoods chose not to fish the F/V AMERICAN DYNASTY, and the ENDURANCE also chose not to fish. This pattern continued in the 2000 fishery when 15 catcher/processors harvested pollock. Vessel size ranged from 201- 376 ft LOA (Table 4.1.2).

The AFA authorizes seven catcher vessels to deliver to catcher/processors. These seven catcher vessels participated in the 1998 fishery and traditionally delivered the majority of their pollock to catcher/processors. Under the AFA, these seven catcher vessels were allocated 8.5% of the catcher/processor directed fishery offshore allocation. In 1999, these seven vessels formed a cooperative (High Seas Catchers' Cooperative, (HSCC)) and since that time, they have leased much of their TAC allocation for pollock to catcher/processors. Since 1999, none of the seven HSCC vessels have engaged in directed fishing for pollock, choosing instead to lease their catch to the AFA catcher/processor fleet.

Mothership sector. The AFA authorizes three motherships to participate in the BSAI pollock fishery, the GOLDEN ALASKA, EXCELLENCE, and OCEAN PHOENIX and twenty catcher vessels to deliver pollock to these three motherships. In 1998, 31 vessels landed greater than 10 mt of pollock to be processed by offshore motherships. In 1999, the number of catcher vessels delivering to motherships dropped to 27. In 2000, the first year in which a cooperative was operating in the mothership sector, that number dropped again to 19 catcher vessels.

Inshore sector. In 1998, there were 107 inshore catcher vessels that delivered greater than 10 mt of pollock to inshore processors (including stationary floating processors). That number decreased slightly in 1999 (100 vessels), and again decreased in the 2000 roe fishery (91 vessels). In 1998, the size of participating vessels ranged from 58-217 ft LOA. In 1999, the range was reduced from 58-200 ft LOA. After the 1998 and/or 1999 fisheries, the vessels less than 60 ft LOA dropped out of the fishery (1 vessel in 1998 and 2 additional vessels in 1999), as did some of the larger vessels that participated in either or both of the 1998 and 1999 fisheries. These boats were probably less efficient; due to either high fuel costs or high maintenance costs (e.g., converted oil rig supply vessels or "mud" boats).[1] Other vessels that may have been eliminated from this sector include those for whom a few trips would not be sufficiently supported by the limited quota available due to their port location (e.g., Washington, Oregon, Kodiak.) While the average length of inshore catcher vessels was highest in 1998, vessel length did not differ substantially between 1998, 1999, and 2000 (121-125 ft LOA).

In June 2000, the Council voted to modify the AFA definition of "qualified catcher vessel" for the purpose of determining eligibility to join inshore cooperatives. The definition of "qualified catcher vessel" as contained in the AFA required that a catcher vessel must have delivered more pollock to its cooperative's designated processor than to any other processor in the year prior to the year in which the cooperative will be in effect. As a result, all inshore catcher vessels were required to make at least one landing every year in order to maintain their qualification to join a cooperative the following year. The Council voted to modify this provision to so that a catcher vessel would qualify to join the cooperative associated with the processor where it delivered most of its pollock during the most recent year in which the vessel participated in the BSAI pollock fishery. This change is reflected in Alternatives 3 through 5 and was implemented for the 2001 fishing year through emergency interim rule. As a result of this change, inshore AFA catcher vessel owners are able to retire their vessels from the BSAI pollock fishery while maintaining their membership in a fishery cooperative in the same manner that vessel owners have done in the catcher/processor and mothership sectors.

This change to the definition of "qualified catcher vessel" was implemented through emergency interim rule in 2001. However in anticipation of its eventual approval, vessel owners began to retire vessels from the BSAI pollock fishery during the 2000 fishing year. While it is difficult to project how many vessel owners will chose to take advantage of this new provision, industry sources suggest that at least 15% of the inshore catcher vessel fleet is expected to retire from active participation in the BSAI pollock fishery as a result of this change[2].

The catcher boats that are expected to retire as a result of this change are the smaller vessels with smaller horsepower and hold size and less capacity to fish offshore in adverse winter weather. However, the extent to which inshore catcher vessels retire from the BSAI pollock fishery is also largely dependent on what type of Steller sea lion protection measures are ultimately adopted for the BSAI pollock and Pacific cod fisheries. If such measures have the effect of pushing the inshore pollock fleet further offshore and do not provide exemptions for smaller catcher vessels, then a greater number of small catcher vessels may be expected to abandon active participation in the BSAI pollock fishery, especially if the change to the definition of "qualified catcher vessel" allows them to do so.

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[1] J. Gruver, United Catcher Boats, 1711 W. Nickerson, Suite B, Seattle, WA, 98119, personal communication

[2] J. Gruver, United Catcher Boats, 1711 W. Nickerson, Suite B, Seattle, WA, 98119, personal communication.

Table 4.1.2 Fleet composition in the 1998-2000 pollock fisheries.

Vessel Type	*1998*	*1999*	*2000*
Catcher/Processors			
1.03 # of vessels eligible to participate	n/a	21[1]	21[1]
1.04 # of vessels that landed pollock	30	17[1]	15[1]
1.05 size range	185-376 ft	201-376 ft	201-376 ft
1.06 # of co-ops	n/a	1	1
Offshore catcher vessels			
1.07 # of vessels eligible to deliver to:			
catcher/processors	n/a	n/a	7
motherships[3]	n/a	n/a	20
1.08 # of vessels that landed pollock	38	27(5)[4]	19(1)[4]
1.09 size range	86-217 ft	86-185 ft	86-124 ft
1.10 # of co-ops	n/a	1	2
Inshore catcher vessels			
1.11 # of vessels that landed pollock	107	100	91[4]
1.12 size range	58-217 ft	58-200 ft	86-162 ft
1.13 # of co-ops	n/a	n/a	7
1.14 # of vessels authorized to operate in co-ops	n/a	n/a	83
Inshore Processors	6 shoreside 2 floating	6 shoreside 2 floating	6 shoreside 2 floating

Source: NMFS observer data and ADF&G fish ticket data.
[1]Twenty vessels were named in sections 208 (e)(1) through (20) in the AFA to qualify for unrestricted catcher/processor permits. In addition, one vessel qualified for a restricted catcher/processor permit under section 208(e)(21).
[2]The number of catcher/processor vessels that participated in the 1999 and 2000 pollock fisheries are indicated as the total number of co-op member vessels and the independent vessel, F/V Ocean Peace.
[3]Three motherships are authorized by vessel name to process pollock harvested in the BSAI directed pollock fishery for delivery to motherships.
[4]Ninety-seven inshore catcher vessels possessed permits that allowed them to participate in the pollock fishery.

4.1.2 Effects on pollock fishing patterns

The passage of the AFA in 1998 has resulted in dramatic changes to pollock fishing patterns. The most dramatic and obvious change has the slowing of the pace of fishing and temporal dispersion of fishing effort. Slowing the pace of fishing has also resulted in a fishery that is more spatially dispersed on the fishing grounds. The reasons for these changes and their magnitude is described below.

Pre-AFA race for fish

Prior to passage of the AFA, the inshore and offshore BSAI pollock fisheries operated as open access fisheries regulated by TAC allocations and season dates. Under these regulations, each vessel was free to harvest as much of the pollock TAC as possible until directed fishing for pollock was closed due to attainment of the sector's allocation. The resulting race for fish produced a fishery that was temporally concentrated as each sector's entire fishing fleet would begin fishing on the season opening date and would fish as fast as fishing or processing capacity would allow until the TAC was attained and the fishery was closed. Fishermen tailored their operations to harvest maximum quantities of pollock in a short period of time. The largest and fastest operations were, therefore, rewarded with the greatest harvest.

An ancillary effect of the incentive to harvest fish quickly was the spatial concentration of harvests. In the pre-AFA fishery, participants could maximize fishing time and harvests by concentrating their efforts in the most productive fishing grounds that were closest to their processors. Fishing near the processor reduced the time of traveling to and from fishing grounds to deliver harvests to the processor, increasing harvest rates and the share of the TAC. Participants in the pre-AFA fishery benefitted from both temporally and spatially concentrating harvests.

When pollock were highly aggregated and easy to catch as was often the case during the winter roe season, fishing capacity would often outstrip processing capacity and both inshore and offshore operations would find their fishing pace limited by the speed at which they could process pollock. When processing capacity reached its peak, processors would curtail the pace of their fishing operations to match their processing capacity. Inshore processors would do this by instituting a delivery rotation for their catcher boats and catcher/processors would do this by fishing at a slower pace.

On the other hand, during the summer and fall fishing periods when pollock were more dispersed and difficult to harvest, fishing capacity rather than processing capacity may have governed the pace of the fishery. However, in either instance, fishing operations were motivated to harvest and process as much pollock as possible during the relatively short season openings of a month or more.

Slowing the pace of fishing under the AFA

The emergence of fishery cooperatives in the BSAI pollock fishery has eliminated the open access race for fish and, along with other measures such as the buyout of nine catcher/processors, has resulted in a dramatic slowing in the pace of the BSAI pollock fishery. Several reasons account for this slower pace of fishing. First, under the system of cooperatives which operate as a type of private IFQ system, each operator is issued a fixed quota which may be fished or leased to other operators. Fishermen are, therefore, guaranteed a fixed harvest and no longer need to race for fish at the same time as the rest of the fleet in order to assure their harvest. Under the prior open access regime, fishermen were forced to fish at the start of every fishery opening announced by NMFS or they would forfeit catch to their competitors. Secondly, fishermen may fish slower under cooperatives because they may be targeting a more specific size range of pollock for fillet or surimi processing, or may be ranging farther in attempts to locate higher quality catch. Thirdly, under cooperatives, processors may chose to operate at different times of the year than their competitors for logistical or market reasons. For example, a processor may wish to schedule pollock processing to avoid conflicts with salmon or crab processing activity so that the same processing crews and facilities may be more efficiently used in multiple fisheries. And finally, differences in markets may lead one processing operation to operate at different times of the year from its competitors. The advent of fishery cooperatives has provided this flexibility to all sectors of the BSAI pollock fleet where previously they had to compete with each other directly during each open access pollock opening to guarantee a percentage of the harvest.

The slower pace of pollock fishing under the AFA is illustrated in Figure 4.1.1 which shows the overall pace of pollock removals declining by more than half from peaks of about 13,000 mt per week in 1997 to approximately 6,000 mt per week in 2000. While this slowing of the overall pace of pollock fishing in the Bering Sea may be due in part to Steller sea lion conservation measures imposed in 1999 that were designed to disperse the fishery over time and space, the elimination of the race for fish is probably the largest contributing factor.

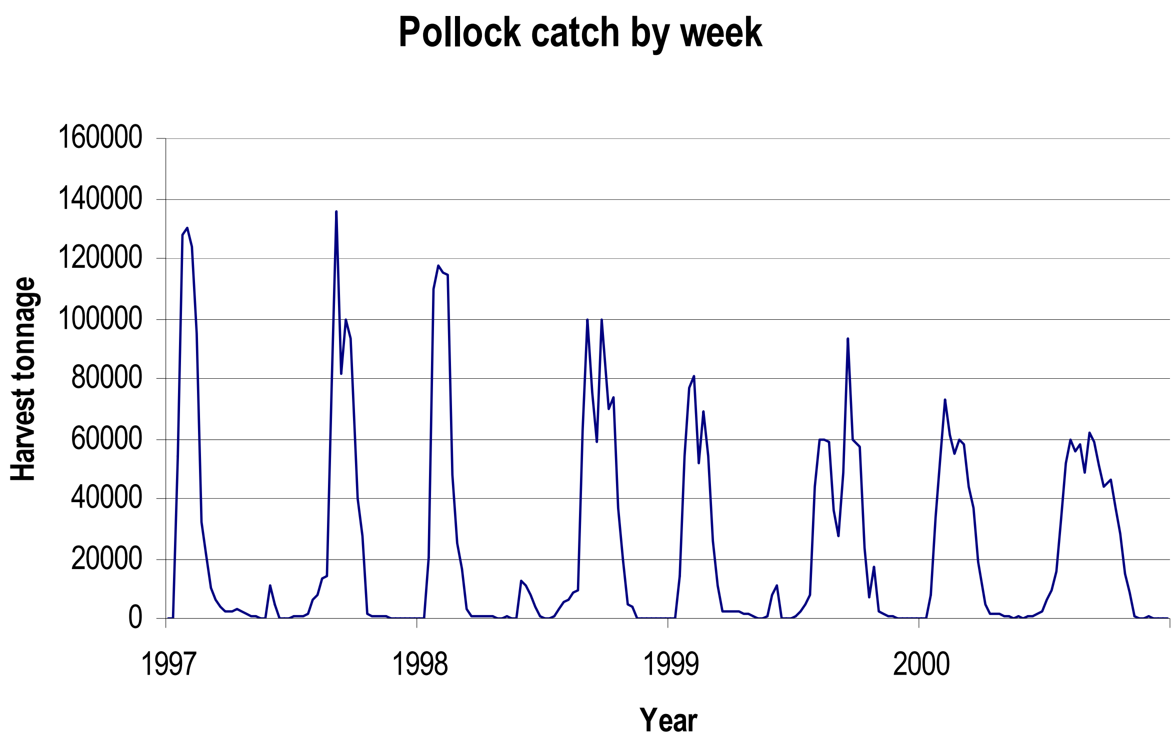

Figure 4.1.1 Bering sea pollock catch by week from 1997-2000, all sectors included.

Spatial distribution of fishing effort under the AFA

Since the implementation of the AFA in 1999, the Bering Sea pollock fishery also has disbursed more widely on a spatial basis than had been the case in previous years. The most significant reason for this spatial dispersion of fishing effort was likely the 1999 implementation of Steller sea lion protection measures which established strict limits on harvests within the Steller Sea lion Conservation Area (SCA) which was composed of a combination of the Catcher Vessel Operational Area (CVOA) and the major foraging area designated as Steller Sea lion Critical Habitat (CH). However, a second reason for the increased spatial dispersion may be the slower pace of fishing under the AFA cooperatives. Because pollock is a migratory species, a side effect of slowing the pace of fishing may be the fishermen need to range over a wider area to encounter migrating schools of pollock at different times of the year. However, the extent to which increased spatial dispersion of fishing effort is due to a slower-paced fishery under the AFA is difficult to estimate because it is difficult to disentangle the effects of the AFA from the effects of Steller sea lion protection measures that were implemented simultaneously.

Nevertheless, implementation of the AFA likely helped the fleet in their effort to comply with the mandates imposed in the BiOp1 and RFRPA by providing BSAI pollock fleet greater flexibility in their fishing operations by eliminating the need to race to harvest BSAI pollock. However, without additional regulations to those included in the AFA, the fleet would not have had incentives to fish outside of Steller sea lion critical habitat or spread out the times of year when pollock are harvested. The fleet would be inclined to decrease catch rates to levels where the vessels and plants can operate most efficiently. From a processor's view point it would make little sense to slow the harvest of pollock to levels where their plants could not operate in an efficient and profitable manner; from a vessel's view point it would not make sense to harvest only partial loads or increase the time between deliveries for vessels. Variable operating costs increase as the season is lengthened. For example, it may cost vessels an additional month of insurance premiums and increase food costs to keep the crew on board for longer times. Increased waiting times would like make the crew unhappy because they would realize they could be making the same amount of money in less time. What does make sense is for vessel and processor owners to use less equipment more efficiently to harvest and process their BSAI pollock allocation. The AFA has provided the tools and incentives to remove the least efficient equipment from the fishery, which has reduced overall harvesting and processing capacity.

Implementation of the AFA alone would not have created economic incentives for the fleet to meet the mandates required to protect the Steller sea lion population. Without additional regulations such as those contained in the BiOp1, economic incentives would have still existed for the fleet to fish inside Steller sea lion critical habitat. The primary reason they would continue to want to fish inside sea lion area is to reduce fishing costs (assuming pollock catch rates are the same or greater inside those areas). Sea lion protection areas are closer to the plants in Unalaska and Akutan and therefore less time and fuel would be required when fishing in those areas. The fleet would also prefer to harvest more pollock during the roe season when the females bearing prime roe are most valuable.

Overall, the AFA has provided the tools and incentives for the BSAI pollock fleet to improve their fishing practices by ending the race for pollock. However, the AFA creates few incentives for fishermen to modify their behavior when it results in increased costs or lowers the overall revenues they could derive from harvesting a set quota.

Size and type of fishing gear deployed

Fishermen in the BSAI pollock fishery deploy a variety of pelagic trawl nets of different designs and sizes depending on the size and horsepower of the vessel. Since 1998, bottom trawling for pollock has been prohibited by regulation making pelagic trawls the only practical gear type that can be used in the fishery.

The advent of the AFA in 1999 has not let to any wholesale modifications in the type of gear deployed in the BSAI pollock fishery. While gear technology is constantly evolving on a worldwide basis, and fishermen are constantly upgrading fishing gear to replace damaged and worn out nets, Industry representatives not observed any significant changes in fishing gear that are directly attributable to the AFA. Industry representatives report that the selectivity and quality of the catch has been increasing under the AFA. However, these changes result from more deliberate and precise gear deployment and sharing of information among cooperative members rather than changes in fishing gear.[3]

4.1.3 Changing fishing patterns under the AFA from 1998 through 2000

The phased-in implementation of the AFA beginning in 1999 provides the opportunity to examine changes in the temporal and spatial distribution of the Bering Sea pollock fishery under pre-AFA open access conditions in 1998, under partial implementation of the AFA in 1999 when only the offshore sector was operating under cooperatives, and in 2000 when 98% of the BSAI pollock TAC was harvested by fishery cooperatives. These three years provide examples of fishing under each of the three scenarios for the extent of rationalization that is likely to occur under the five alternatives. However, 1999 also marked the implementation of the first Steller sea lion RPA measures, which were designed to cause greater temporal and spatial distribution of the pollock fishery, and also contributed greatly to the change in fishing patterns

[3] J. Gruver, United Catcher Boats, 1711 W. Nickerson, Suite B, Seattle, WA, 98119, personal communication.

compared to 1998. Furthermore, colder than average water conditions in 1999 also could have affected the temporal and spatial distribution of fishing effort. It is impossible, therefore, to disentangle those effects caused by the AFA from those caused by these other factors.

Each of the five alternatives considered in this analysis is predicted to result in a fishery that generally resembles one of these three scenarios: (1) non-rationalized fishery, (2) partially-rationalized fishery, and (3) fully rationalized fishery. The relative catch of pollock in the Eastern Bering Sea in 1991-2000 has been mapped. These maps provide an overview of recent fishery patterns under the three scenarios and are described below. Figures 4.1.2 through 4.1.7 display the temporal and spatial distribution of the Bering Sea pollock fisheries in 1998-2000.

This section provides a summary of the distribution of pollock fishing effort under each scenario and is followed by a description of the potential environmental effects resulting from these management scenarios (1998-2000). The spatial distribution of catch during each year and season is displayed in Figures 4.1.2 through 4.1.7. The spatial distribution of each season's fishery is displayed in 10 day periods in Figures 4.1.8 through 4.1.12 (Additional maps of fishing intensity are available online at (http://www.refm.noaa.gov/stocks/CPUE/ebharvests.html)

1998 fishery. In 1998, prior to the passage of the AFA, the BSAI pollock fishery operated in an open access-style "race for fish" with in the inshore and offshore sectors which were allocated 35% and 65% of the TAC after subtraction of the 7.5% CDQ reserve. While access to the pollock fishery itself was limited by a groundfish vessel moratorium that was in effect in 1998, the fishery was already considered overcapitalized and the vessel moratorium had little or no effect in curtailing the race for fish. In 1998, the only sector of the fishery that was able to operate in a rationalized manner was the CDQ sector which harvested 7.5% of the BSAI pollock TAC. The 1998 fishery will be used as an example of the possible distribution of fishing effort under Alternative 1 (no action). Figures 4.1.2 and 4.1.3 illustrate display the temporal and spatial distribution of the Bering Sea pollock fisheries during the 1998 fishing year and represent Scenario 1.

1999 fishery. The 1999 BSAI pollock fishery operated under a limited number of provisions of the AFA which allowed for rationalization of the offshore sector only. In 1999, approximately 50% of the pollock fishery TAC was allocated to cooperatives (includes CDQ groups and catcher/processor cooperative). In addition, NMFS initially implemented RPAs in 1999 that were intended to disperse fishing effort in time and space to protect Steller sea lions (64 FR 3437, January 22, 1999). Figures 4.1.4 and 4.1.5 illustrate display the temporal and spatial distribution of the Bering Sea pollock fisheries during the 1999 fishing year and represent Scenario 2. The partially-rationalized 1999 fishery will be used as an example of the possible distribution of fishing effort under Alternative 2 (AFA baseline).

2000 fishery. Finally, the third scenario of fishery operation (fully rationalized fishery) is illustrated by the 2000 BSAI pollock fishery. In 2000, RPAs had been in place for a year to protect Steller sea lions and an increased proportion of the fishery was organized into cooperatives (97.5% of the TAC was allocated to CDQ or cooperatives), which relieved most of the race for fish that had been present in earlier years. The spatial distribution of this fishery is displayed in Figures 4.1.6 and 4.1.7. The fully-rationalized 2000 fishery will be used as an example of possible distribution of fishing effort under Alternatives 3 through 5.

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Scenario 1: 1998 Open Access Fishery (Alternative 1–No action)

In the years up to and including 1998, the BSAI pollock fishery was characterized by an open access race for fish within the inshore and offshore sectors of the fishery. The TAC was allocated 35% to the inshore sector and 65% to the offshore sector after subtraction of the 7.5% CDQ reserve which had been in effect since 1991. Thirty-eight offshore catcher vessels, 30 catcher/processors, and 107 inshore catcher vessels participated in the 1998 fishery. In 1998 the Bering Sea pollock fishery was divided into two fishing seasons. The A season (roe fishery) began on January 20 for the inshore sector and January 26 for the offshore sector and ended upon attainment of each sector's 45% A season apportionment, and the B season (non-roe fishery) which began on September 1 and ended upon attainment of each season's 55% B season apportionment. The seasons were of limited length as vessels raced to catch their quota. The pollock roe fishery on the Eastern Bering Sea shelf had been concentrated primarily north and west of Unimak Island (NMFS 1999b). There also had been A season effort along the 200 m contour between Unimak Island and the Pribilof Islands (through 1999). This concentrated catch associated with productive areas surrounding oceanographic features such as the 200 m curve may have resulted in localized depletions of pollock (Figure 4.1.2). This is particularly true in the area just north of Unimak Island in late-January through mid-February and to a lesser extent in the area surrounding the 200 m curve southeast of the Pribilof Islands (near Pribilof Canyon) in early February and again in early March.

Similar to the A season, the B season in 1998 was open access and catch was concentrated in the area known as the "Horseshoe" (where the 200 m contour forms a horseshoe-shaped curve as displayed on nautical charts and the figures in this section) and southwest, along the 200 m curve. Outside this area, catch was concentrated in areas north of the "horseshoe", albeit to a lesser extent (Figure 4.1.3). From July through late August, all pollock was caught in the "horseshoe" area or southwest of that area along the 200 m curve. By late September/early October, catch was beginning to concentrate in an area north of the "horseshoe", outside the area that is now called the Steller sea lion Conservation Area.(SCA).

Given that Alternative 1 (no-action) would revert to the inshore/offshore management regime that was in effect in 1998 prior to the passage of the AFA, fishing patterns under Alternative 1 would be expected to most closely resemble those described in Scenario 1 as represented by the 1998 pollock fishery at least in terms of concentration of effort in time and space. Under Alternative 1, Steller sea lion RPA measure would remain in place as such measures are independent from Amendments 61/61/13/8. Consequently RPA-mandated spatial and temporal shifts in fishing patterns would be expected relative to 1998 even under the no-action alternative. It is not possible to disentangle those effects that are due to Steller sea lion RPA measures from those that are due to the AFA given that both sets of management measures have been implemented simultaneously. However substantially greater concentrations of effort in time and space would be expected under the no-action alternative relative to any of the AFA-related alternatives due to the characteristics of the race for fish regardless of what Steller sea lion management regime is in place. Specifically, an intense race for fish would be expected wherever RPA measures establish limited quotas within productive or desired fishing grounds such as the SCA with the fleet exhausting the quotas in the most desirable areas first and only then moving on to fish in less productive areas.

Scenario 2: 1999 Partially-Rationalized Fishery (Alternative 2–AFA baseline)

The management and prosecution of the 1999 BSAI pollock fishery were different from those in previous years. The AFA was passed and measures to protect Steller sea lions were implemented prior to the 1999 season. These protection measures included closing the Aleutian Islands to directed pollock fishing, reducing the proportion of early season TAC that could be taken from the SCA, dividing the early season for different sectors, and implementing pollock trawl exclusion zones near sea lion haulouts. In 1999, the roe fishery was divided into A1 and A2 seasons with a 5 day stand down separating the two seasons and the non-roe fishery was divided into summer/fall C and D seasons. In 1999, under the AFA, catcher/processors were organized into cooperatives and catch began to disperse in time and space, as a result of the reduced race for the fish and of the sea lion protection measures. The roe season SCA harvests dropped from 87% of the catch in 1998 to 55% of the catch in 1999 (NMFS 1999b). The 1999 roe season was almost double the length of that in 1998. The non-roe summer/fall season was 49 days long in 1998 and was lengthened to 92 days for the 1999 season. This slower pace is partially attributed to the rationalization of the offshore sector, however, it was probably also influenced by implementation of RPAs and bad weather on the fishing grounds (At Sea Processor's Association 1999).

Twenty-five offshore catcher vessels, 17 catcher/processors, and 100 inshore catcher vessels participated in the 1999 fishery. Figure 4.1.4 shows that the cumulative concentration of harvest in the pollock roe fishery was spread out temporally relative to the 1998 fishery. Increased effort in the area north of Unimak Island is apparent, but not to the extent illustrated in Figure 4.1.2 for 1998. In addition, relative harvest was rather low in 1999 along the 100m curve southeast of the Pribilof Islands. Instead, an area east of the Pribilof Islands emerged as a concentration area for harvest. In comparison to 1998 fishing distribution, the 1999 pattern appears to be more dispersed, but retains some areas of high cumulative concentrations of harvest.

Early February indicates some concentrated fishing north of Unimak Island, however, not to the extent of that which occurred in 1998. Further, some of the catch was concentrated in late February in an area to the east of the Pribilof Islands. The "popular" area along the 100m curve utilized in 1998, was extended in 1999 over a broader range. Daily harvest rates in the catcher/processor sector were reported to be one third the rate in the 1998 roe season fishery (At Sea Processor's Association, 1999). Some of the decline in harvest rates can be attributed to a decline in fleet size (16 catcher/processors in 1999 compared to 29 catcher/processors in 1998). In addition, the 16 vessels who participated in 1999 reduced their daily catch rates by 60% from the 1995-1998 time period (At Sea Processor's Association, 1999).

The 1999 summer/fall fishing season is displayed in Figure 4.1.5 and shows considerable concentration of catch around the "horseshoe" area with a broad distribution of catch north of the SCA along the continental shelf east of the Pribilof Islands. Under the regulations in effect during 1999, the mothership and catcher/processor sectors of the BSAI pollock fishery were excluded from fishing inside the SCA during the summer/fall season. Consequently, the inshore sector of the industry, which was not operating under cooperatives, was fully responsible for all fishing inside the SCA and for the concentration of effort around the "horseshoe".

note: Geographic locations of catch in 1999 were probably significantly affected by colder than average water on the fishing grounds. The average bottom temperature in 1999 was lower than any other year observed by NMFS in the Eastern Bering Sea trawl surveys. Most of the pollock was on the outer shelf in 1999 (100-200 m, (NMFS, 1999b)). Nevertheless, fishing patterns on the whole were significantly influenced by implementation of the AFA and RPAs in 1999.

Alternative 2 (AFA baseline) is expected to result in a fishery that most resembles Scenario 2 in which the catcher/processor and mothership sectors of the pollock fishery would be operating under fishery cooperatives but at least part of the inshore sector would likely continue under open access race for fish conditions within the overall limits on vessel and processor participation contained in the AFA. Alternative 2 would contain none of the measures recommended by the Council under Amendments 61/61/13/8 to facilitate the formation of inshore cooperatives. These measures (which are present in Alternatives 3-5) include:

- Basing the inshore co-op allocation formula on the best 2 of 3 years fishing history from 1995-1997.

- Providing “compensation” for inshore vessels with more than 499 mt of offshore landings from 1995-1997.

- Providing sideboard exemptions for catcher vessels less than 125 ft, with less than 1700 mt of annual pollock landings from 1995-1997, and with 20 landings in the BSAI Pacific cod fishery and or 30 landings in the GOA groundfish fishery during 1995-1997.

- Requiring the all cooperatives manage their sideboard fishing to assure that smaller vessels with significant histories of participating in sideboard fisheries are not displaced by larger vessels in a race for sideboard species.

Without these suite of measure that are intended to encourage the formation of cooperatives by providing a more fair playing field for all inshore-qualified vessels, it is probable that some or all of the existing inshore cooperatives would find it difficult or impossible to reach the 80% threshold required under the AFA to become an authorized inshore cooperative and receive an allocation of pollock. Absent these four measures recommended by the Council under Amendments 61/61/13/8 it is probable that significant numbers of inshore catcher vessel owners would refuse to join inshore cooperatives in the belief that they would have greater fishing opportunities if they remain in the open access sector of the fishery. This would jeopardize the ability of the remaining vessels in each existing cooperative to reach the required threshold of 80% of the qualified vessels. The extent to which inshore cooperatives would be unable to form under Alternative 2 is conjecture at this point given that all four of these measures were included in the emergency rule that is governing the BSAI pollock fishery during 2000. However, if some inshore cooperatives were able to form under Alternative 2 then the projected fishing patterns under Alternative 2 would fall somewhere between the patterns displayed in Scenarios 2 and 3.

Scenario 3: Fully-Rationalized Fishery (Alternatives 3, 4, and 5).

In the 2000 pollock roe fishery, approximately 98% of the pollock TAC was allocated to cooperatives (or CDQ groups), and RPAs were in place to disperse effort temporally and spatially, in order to protect Steller sea lions. The 2000 Steller sea lion protection measures were somewhat modified from 1999. The fishery inside the SCA was divided into four seasons. Two roe seasons, the A and B season began on January 20 and April 15, respectively. Two non-roe seasons, the C and D season began on June 10 and August 20, respectively. The fishery outside the SCA was divided into just two seasons the A/B season roe fishery and the C/D season non-roe fishery. Vessels were limited in the amount of pollock that could be removed from the SCA during each season but faced no limits other than the A/B and C/D season apportionments of 40% and 60%, respectively. Nineteen offshore catcher vessels, 15 catcher/processors, and 91 inshore catcher vessels participated in the fishery. Catch rates decreased as each cooperative harvested its individual allocation making inseason closure notices unnecessary in fisheries other than the small remaining open access inshore fishery which accounted for approximately 2.5% of the TAC.

Figure 4.1.6 illustrates minimal concentrations of catch in the “Horseshoe” area north of Unalaska Island and in the area northwest of Unimak Island. However, in general, effort appears to be dispersed throughout the SCA area and the areas to the northeast. These more northeasterly fishing grounds were used heavily in the 1999 roe season, however in 1999, the catch was concentrated into a smaller area. Figures 4.1.12 and 4.1.13 indicate similar dispersed patterns of fishing with no concentrated effort in any of the ten-day periods illustrated. No consistent pattern emerges throughout the season; the fishery appears to be prosecuted in several areas in each of the periods.

As noted previously, it is difficult to isolate the effects on fishing patterns that have resulted from the measures to protect Steller sea lions versus measures to implement the AFA. It is clear, however, that whatever the cause, weekly localized catch rates of pollock decreased dramatically with the establishment of co-ops. Furthermore, increased potential may exist for pollock bycatch reduction under this scenario (Alternatives 3-5), because of the removal of derby fishing conditions. This removal of the race for the fish (increased length of fishing season and lower daily catch rates) would allow fishermen to spend time searching for the size of fish they desire and therefore affects fishing behavior and patterns (NMFS 1999b).

Alternatives 3-5 are expected to result in fishing patterns that most closely resemble Scenario 3. Each of these alternatives contains a suite of management measures designed to encourage the formation of inshore cooperatives as noted in the discussion of Scenario 2 above. Alternatives 3 and 4 differ in whether the management of pollock and sideboard fishing is accomplished at the co-op level or through an inter-cooperative agreement. Alternatives 3 and 5 differ in the degree of flexibility independent catcher vessels have to change cooperatives. However, neither of these differences are expected to change fishing patterns by the different fleets.

The At Sea Processor's Association (1999) reported that catcher/processor fishing practices were altered in 1999 from 1998 patterns due to improvements resulting from rationalization of the offshore sector of the pollock fishery. During the 1999 roe season, vessels completed fewer tows per day and reduced tow sizes, on average, than in 1998. The At Sea Processor's (1999) reported a 45-percent decrease in the number of hauls per day for the 16 vessels, and the average catch per tow was 27% lower from 1998 to 1999. The length of the roe season was considerably longer for the catcher/processors in 1999 than in 1998, despite quota cuts. In addition, catcher/processors reportedly increased the mesh size of the nets. In 1999, the average daily catch rate was one third that of the rate in 1998.

In-season transfer of allocations from one vessel to another within a company and between companies has occurred for the purpose of economic efficiencies (e.g., small amount of quota left that didn't warrant another trip would be transferred to another vessel making a trip, (Pollock Conservation Cooperative and High Seas Catcher's Cooperative (PCC/HSCC) 2000)).

While few inshore vessel operators have conducted gear research under the new management scheme, the reduction in overcapacity of the inshore sector will likely encourage vessel operators to alter their fishing practices to increase the net value of their fishing trips; either through decreased roe damage, decreased bycatch, or increased value of the catch due to targeting high value fish (i.e., for fillets or surimi). Changes in mesh size are not apparent, nor is the increase in smaller codends. The inshore catcher vessel sector, however, appears to be communicating better amongst themselves, which may decrease bycatch and increase the catch of high-value fish[4].

4.1.4 Summary of expected changes to fishing patterns under the alternatives

Both an examination of the structural and organization changes expected under the alternatives, and the observed pollock fishing patterns from 1998 through 2000 suggest that the AFA-based alternatives are likely to result in a BSAI pollock fishery that is more widely dispersed over time and space relative to the no-action alternative. A summary of the expected changes to pollock fishing patterns under the AFA is contained in Table 4.1.3.

[4] J. Gruver, United Catcher Boats, 1711 W. Nickerson, Suite B, Seattle, WA, 98119, personal communication.

Table 4.1.3 Summary of expected changes to pollock fishing patterns under the alternatives.

Type of effect	*Alternative 1 (no action)*	*Alternative 2 (AFA baseline)*	*Alternatives 3-5*
Temporal distribution of the BSAI pollock fishery	Concentrated. Open access "race for fish" will result in highly concentrated pulse fisheries.	Somewhat dispersed. Partially-rationalized fishery will result in some slowing of fishing effort and less intense pulses relative to the no-action alternative	Most dispersed. Fully-rationalized fishery will result in the most temporally dispersed fishery as individual operators have flexibility to chose when to fish.
Spatial distribution of the BSAI pollock fishery	Concentrated. Open access race for fish will result in concentrated pulses of effort in localized areas.	Somewhat dispersed. Slower-paced fishery will result in some spreading of effort, especially during the non-roe season.	Most dispersed. Slower pace of fishing will result in spreading of effort across the fishing grounds as fishermen pursue migrating pollock at different times of the year, especially during the non-roe season.
Fleet size	Largest. Access in all sectors would be governed by the LLP program which is less restrictive than the AFA.	Moderately reduced. 30% reduction in C/P and mothership fleets. Minimal reductions in inshore catcher/vessel fleet because inshore co-op rules do not allow retirement of vessels.	Most reduced. 30% reduction in C/P fleet with similar reductions in mothership and inshore CV fleets.
Fleet composition	Widely disparate. Open access conditions and lack of barriers to entry mean that a wide variety of vessels may move in and out of the fishery depending on market conditions and conditions in other fisheries.	More efficient. Smaller, older, and less efficient vessels likely to be removed from the C/P and MS sectors. Less changes likely in inshore sector because co-op rules prevent inshore vessels from retiring.	Most efficient. Smaller, older, and less efficient vessels eliminated from all three sectors as co-op rules allow quota to be harvested by the most efficient vessels.
Size and type of fishing gear deployed.	Pelagic trawl gear with net size dependent on vessel size and horsepower.	No significant changes expected relative to the no-action alternative	No significant changes expected relative to the no-action alternative.

4.1.5 Projected changes to processing practices and utilization rates

Higher utilization rates have resulted from fishermen and processors being guaranteed a specific percentage of the BSAI pollock fishery. Since the approximate amount of pollock going into a processing plant is known at the beginning of the year, the only way to increase production is to better utilize the fish being delivered. Slowing the rate pollock can be harvested while still allowing vessels and processors to maintain their share of the fishery has resulted in more product being produced. This occurs because the factories can operate slower, taking more care to extract useable products from the fish that are harvested.

Members of the AFA are keenly aware of the importance of utilization rates in terms of their own bottom line. Processors that are able to generate more product from a given amount of pollock would likely increase their revenues.[5] This also translates to increased profits for the firm, if they are able to produce that product for less than the cost of production.

Great emphasis was placed on better utilization of the pollock resource during the Inshore/Offshore-3 allocation debate. Therefore processors have been pleased to report the increases in utilization rates that have occurred under the AFA. According to information presented in the catcher/processors's cooperative report, utilization rates in their sector increased about 26% from 1998 to 1999 (the overall utilization rate in 1999 was just over 25 percent) and about 35% from 1998 to 2000 (the overall utilization rate in 2000 was just over 27 percent). This indicates that companies in the catcher/processor sector are indeed utilizing more of the resource that they have been given the right to harvest under the AFA. It also indicates that the factory managers of these processing facilities are becoming even more important members of the company's staff than they were prior to implementation of the AFA.

The inshore sector also increased their utilization rate of BS/AI pollock after cooperatives were implemented. Members of the inshore sector increased their utilization rate about 2.3% from 1999 to 2000. Their overall utilization rates increased from 35.8% in 1999 to 36.6% in 2000 (their utilization rate was about the same in 1998 as it was in 1999). While their increase was not as great as that seen in the catcher/processor sector, it still indicates they were able to produce about 4,000 mt more product in 2000 relative to what they would have produced had their utilization rate remained at the 1999 levels.

The mothership sector was able to produce a total of 26,302 mt of products from the 98,284 mt of pollock they harvested in 2000. That equates to a utilization rate of 26.8 percent. In 1999 the mothership sector was able to produce 18,053 mt of product from a harvest of 86,601 mt of pollock. Calculating the utilization rate indicates that the 20.8% of the harvested pollock was converted to saleable products. The mothership sector's pollock utilization rate in 1998 (20.7 percent) was almost exactly the same as it was 1999. Comparing the utilization rates before cooperatives were in place in 1999 and after they were implemented shows that utilization rates increased by almost 29 percent.

Table 4.1.4 shows a summary of the impacts of the AFA on pollock utilization rates. It shows that each sector was able to increase their utilization of the pollock they harvested after cooperatives were implemented. Utilization rate increases were most dramatic in the mothership and catcher/processor sectors. However, the inshore sector still produces the most product from each ton of pollock harvested.

[5] Revenues would not increase if the greater supply of products on the market caused the price to drop to a level where the increased production did not offset the decrease in price.

Table 4.1.4 Pollock utilization rate (percent) by sector from 1998-2000.

Sector	1998	1999	2000
Catcher/Processor	20.3%	**25.5%**	**27.5%**
Inshore	35.7%	35.8%	**36.6%**
Mothership	20.7%	20.8%	**26.8%**

Source: NMFS Weekly Production Reports and Blend data from 1998-2000.
Note 1: Bolded numbers represent years when that sector was operating under a cooperative structure.
Note 2: In 2000, all of the Blend data for the catcher/processor and mothership sectors was derived from Observer data, while about 98% of the inshore catch was calculated by converting product weights (Weekly Production Report data) to round weight.

A summary of the product mix produced by each of the AFA processing sectors are provided below. The pie charts show the percentage of each product made from pollock during the years 1998-2000. Those charts indicate that the inshore sector produces the most diverse suite of product while the mothership sector concentrates its efforts on surimi, roe, meal, and oil.

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4.1.6 Summary of expected changes in BSAI pollock fishery.

Under the Preferred Alternative, fishing patterns are expected to be dispersed temporally and spatially. Because catch rates would slow down under Alternatives 2-4 relative to the situation in the open access fishery, fewer vessels are expected to actively participate in the directed fishery in all sectors. It is likely that among the inshore fleet, the less-efficient vessels will lease their share of the co-op TAC allocation and may participate in other fisheries. Fishing methods may also evolve with the elimination of the derby fishery, as communication increases between co-op members (offshore) and between individual co-ops (inshore fleet).

The AFA vessels that were organized into co-ops in 1999 and 2000 may have benefitted from the reduced derby nature of the fishery through reduced daily catch rates and a slightly longer fishing season. A comparison of 1998, 1999, and 2000 pollock fisheries are an example of the potential changes in fishing patterns which would result from implementation of AFA provisions. However, it is likely to be several years before NMFS can estimate the full effects of the AFA provisions, particularly the effects resulting from the formation of cooperatives. It appears as though the measures to protect Steller sea lions successfully dispersed the fishing effort for pollock in time and space.

Rationalization of fisheries can be an effective approach to minimizing environmental impacts. Decreasing catch rates results in longer seasons and economic gain. Fishermen may disperse effort in order to search for market-size fish and improve their retention rates. The change in fishing effort distribution illustrated in the 2000 pollock roe fishery is recognized as a positive benefit to fishermen and to many marine organisms.

4.2 Predicted effects of the alternatives on the physical environment

Analyses of physical environmental effects resulting from the alternatives are based on the operation of the BSAI pollock fishery in recent years. These fisheries will be used as a model to estimate environmental and economic effects. As the fishery evolves in response to final rulemaking that implements provisions of the AFA, some of these effects can be expected to change. However, for the purposes of this analysis, the following scenarios were examined: Operation of the open access pollock fishery (Alternative 1), operation of a partially-rationalized fishery (Alternative 2), and operation of a fully-rationalized fishery (Alternatives 3 through 5). The potential effects of the alternatives on the BSAI and GOA physical environments are from impacts of the fishing gear on habitat and impacts of shifting a large portion of pollock processing to shore based processors.

4.2.1 Fishing gear effects on substrates and benthic habitat

This section examines the effects of fishing gear on substrates and benthic habit under each of the three scenarios described in Section 4.1.

Scenario 1: Open Access Fishery (Alternative 1–No action)

The principal gear type used in BSAI pollock fishery is pelagic trawl gear. It is also the largest fishery in the North Pacific, accounting in 1998 for 65% of the groundfish catch. Under Scenario 1, the fisheries would be expected to have similar effects on the substrate and benthic habitat as demonstrated in the past. Effort would be distributed in similar patterns and the fisheries would be conducted at similar times.

Pelagic Trawl Gear. Pelagic trawl gear is the principal gear used in the directed pollock fisheries in the GOA and BSAI. The FMP prohibits nonpelagic gear use in the directed pollock fishery in the BSAI. Further, a performance standard in the BSAI prohibits a vessel engaged in directed fishing for pollock from having 20 or more crab of any species, with a carapace width of more than 1.5 inches at the widest dimension, on board at any time. In the GOA, where approximately one-tenth as much pollock was caught in the 1999 pollock trawl fisheries (91,754 mt) as in the BSAI (850,048 mt), nonpelagic trawling for pollock is permitted but represents a very small percentage of the fishery. In 1999, 98.7% of the pollock caught in the GOA was caught with pelagic gear.

Pelagic trawl gear have not been studied to the extent that bottom trawl gear has because it is generally fished in midwater. Pelagic trawl gear, when used in midwater, has no known direct effects on the substrate or benthic communities. The pelagic trawls used off Alaska are generally designed to fish downward from the depth of the doors and the doors themselves are not designed for contact with the sea floor, although the footropes can come in contact with and affect the bottom. The gear itself can be damaged from contact with rough bottom, so it is unlikely to be fished hard on substrate with complex structures.

In any event, direct effects to pollock EFH from pollock fishing efforts are not likely. Adult pollock may be found near the bottom, but they are not associated with seafloor substrata. Adult pollock key into anything that congregates prey such as upwellings, gyres and fronts. Trawl gear could possibly affect larval life stages of crab and groundfish. Few systematic surveys have been done to identify specific locations where concentrations of these larvae may be found. Some of the larvae are pelagic, and others are bottom dwellers. The mesh sizes of commercial gear have been designed to not retain larval life stages. For this reason, the effects of Alternative 1 on substrates and benthic habitat are considered to be insignificant.

Scenarios 2 and 3: Partially-Rationalized Fishery (Alternative 2–AFA baseline) and Fully-Rationalized Fishery (Alternatives 3, 4, and 5)

BSAI pollock fishery. Scenarios 2 and 3 would reduce effort in the pollock fishery and allow the fishery to spread out in time and space. To the extent that pelagic trawl gear impacts the benthic environment, this would be expected to reduce the effects of pelagic gear on the physical environment. Although, as discussed under Scenario 1, pelagic trawl gear does not significantly impact the substrate and benthic habitat. For this reason, the effects of the Alternatives 2 through 5 on substrates and benthic habitat are expected to be insignificant.

Other gear types and fisheries. The sideboards enacted under the AFA would limit the effort of AFA vessels in the other groundfish and crab fisheries, however, the overall quotas in these fisheries would not be affected and adequate capacity exists to harvest most other groundfish and crab fisheries without the participation AFA vessels. Consequently, any harvest forgone by AFA vessels as a result of sideboard measures is expected to be harvested by other non-AFA vessels, although the pace of such fisheries could decrease without participation of the AFA fleet. For this reason, the impacts of Alternatives 2 through 5 on EFH through spillover effects in other fisheries are expected to be insignificant.

4.2.2 Effects of pollock processing on substrates and bottom habitat

Scenario 1: Open Access Fishery (Alternative 1–No action)

Fish Processing Waste. Discharge into marine waters of organic waste from land-based fish processing facilities as well as processing vessels operating at-sea has occurred as long as fishing has occurred in Alaskan waters. Effects of the discharge are best evaluated in terms of 1) location and rate of nutrients returned to the marine environments and 2) effects on or changes to the ambient water quality parameters in the locations where they are returned.

The EPA has identified major the components of seafood processing wastes as blood, tissue, liquids, meat, viscera, oil and grease, shells, bones, and chlorine (EPA 1994). The wastes are primarily organic matter that are, except for the bones and shells, highly biodegradable. Major pollutants consist of total suspended solids, oil and grease, and biochemical oxygen demand (BOD). These major pollutants are all considered conventional and are of a non-toxic nature. Smaller concentrations of chlorine, ammonia, and fecal coliforms may also be present. The EPA summarized the potential water quality impacts as follows (EPA 1994).

Organic seafood wastes can exert a large BOD in receiving waters. This is a critical issue in seafood waste disposal since the BOD of the effluent stream is the basis for estimating the dissolved oxygen which will be consumed as the wastes are degraded. It is possible to reach conditions where the dissolved oxygen in the water is totally exhausted, resulting in anaerobic conditions and the production of undesirable gases such as hydrogen sulfide and methane. Emission of these gases has been observed in seafood processing centers, such as Dutch Harbor, in sufficient quantities to form bubbles and cause skin and eye irritation to divers. The reduction of dissolved oxygen can be detrimental to fish populations, fish growth rate, and organisms used as fish food. The total lack of oxygen can also result in the death of all aerobic aquatic inhabitants in the affected areas. Water with high BOD also has increased bacterial concentrations which degrade water quality.

The TSS in seafood processing waste will include both organic (grease, oil, seafood waste) and inorganic (sand and shell fragments) materials. These solids may settle out rapidly or remain in suspension for a time prior to settling. Solids may either be inert, slowly degradable substances or rapidly decomposable materials. While in suspension they increase the turbidity of the water, reduce light penetration, and impair the photosynthetic activity of aquatic plants. Suspended solids may kill fish or shell fish by causing abrasive injuries, by clogging gills and respiratory passages, screening out light, and promoting the development of noxious conditions through oxygen depletion.

There appear to be three zones of impact associated with seafood waste discharge (Pearson and Rosenburg 1978). In the first zone the impacts are readily observable, with non-mobile benthic life being smothered as the wastes accumulate in easily identified "waste piles." Recolonization of these areas will not occur at active discharge sites and may not occur for several years after discharge has ceased.

The second zone of impact lies outside of the immediate zone of accumulation. It is probable that this zone is dynamic, changing in size and impact with respective environmental conditions. Organisms residing in this second zone may be exposed to the smothering effects of accumulated wastes as well as environmental degradation from increased suspended solids, turbidity, color and hydrogen sulfide, and decreased dissolved oxygen. Smothering in this zone is caused by the less dense, fleshy waste materials and slurry as they slowly settle after being transported by the prevailing currents. In the secondary zones recolonization may occur, but is limited by the availability of the suitable attachment surfaces and recurrence of stressful conditions.

The third zone of impact lies outside of the zones of primary, persistent accumulation and secondary, intermittent accumulation. The third zone is a zone of enrichment, wherein the benthic community may be more diverse and productive than typical of an area due to the benefits of increased supplies of food and nutrients in amounts which do not exceed the assimilative capacity of the benthos.

Aesthetic effects can occur from the discharge of seafood processing wastes, especially in concentrated processing areas. Water discoloration, floating solids, scum and foam may be observed if adequate flushing is not available or if outfall lines are not operating properly. These may cause a nuisance by accumulating in fishermen's nets or on beaches or shorelines.

All fish waste is biodegradable. The size of the particles discharged, and whether it is ground into fine particles before discharge or discharged whole, is the primary determinant of the path it takes back into the marine food chain. Other determinants are a function of the location, depth, and circulation patterns of receiving waters, and the species of opportunistic feeders present near the discharge. Many observations have documented large chunks of waste being consumed by opportunistic predators soon after discharge. The opportunistic predators include species of invertebrates, fish, birds, and marine mammals.

Scavenging seabird species such as northern fulmars and large gulls are well-known consumers of fish processing waste. Though the food source may appear to benefit populations of some species, such as gulls, it can be detrimental to species displaced or preyed upon by the increased population of gulls (Furness and Ainley 1984).

In order to control discharge and prevent occurrences of over-enrichment in localized areas, discharge is regulated under the Clean Water Act (section 402). Under this Act, National Pollutant Discharge Elimination System (NPDES) permits are issued by the U.S. Environmental Protection Agency (EPA). Most at-sea floating processors apply for and receive NPDES permits authorizing them to discharge fish waste with the stipulation that the waste be ground into finer than one-half inch particles and discharged below the surface. The intent of the stipulation is to avoid quantities of organic materials accumulating in a confined waterbody to the degree that during decomposition it consumes so much of the available dissolved oxygen that oxygen depletion of the surrounding waters occurs. If depletion of oxygen were to occur short term, it could result in mortality of invertebrates, such as crab, or in the long term, result in changes in species composition of the area as the species with lower tolerances for anoxic waters move out.

Unauthorized organic discharge is generally understood to mean accumulations of dead fish, crab shells, and/or fish waste material that either smother the bottom or impair the surrounding water quality to a such a degree that viability of marine species is compromised. Observations of this in Alaska are undocumented, though anecdotal accounts abound.

The point source discharges from established onshore processing operations in ports (e.g., Kodiak, Dutch Harbor, St. Paul, and Akutan) are also subject to Clean Water Act permitting requirements. Each permit application is evaluated in an open public forum when it is being considered for issuance by the U.S. EPA, and it remains subject to EPA's oversight. Some facilities in locations, such as Captains Bay near Dutch Harbor, are required to collect waste streams and to barge it several miles offshore prior to discharge.

Using the Clean Water Act, the Alaska Department of Environmental Conservation established total maximum daily load limits for Udagak Bay (Beaver Inlet on Unalaska Islands in the Aleutian Islands) and King Cove lagoon in King Cove (on the Alaska Peninsula in the Aleutians East Borough) because of the effects of seafood wastes on water quality in those waterbodies (Environmental Protection Agency 1998a; Environmental Protection Agency 1998b). In Udagak Bay, the Northern Victor Partnership facility P/V Northern Victor produced seafood processing wastes (from processing Pacific cod, halibut, herring, pollock, salmon, and a variety of other fish) that created a waste pile deposit of settleable solid residues measuring at least 2.4 acres in area and 7 feet thick on the seafloor. The waste pile exceeded State of Alaska water quality standards for residues. The waste pile at King Cove created by Peter Pan Seafoods facility covered 11 acres of seafloor to an average depth of 3 feet (Environmental Protection Agency 1998a; Environmental Protection Agency 1998b).

While the impacts of inshore processing wastes on localized water bodies is a potential area of concern, NMFS believes that existing EPA oversight over processing waste discharges under the Clean Water Act are adequate to prevent significant impairment of nearshore water quality or the nearshore benthic environment. Therefore, the effects of Alternative 1 on nearshore water quality and nearshore benthic environments are considered to be insignificant.

Scenarios 2 and 3: Partially-Rationalized Fishery (Alternative 2–AFA baseline) and Fully-Rationalized Fishery (Alternatives 3, 4, and 5).

Under the AFA, inshore processing would increase by approximately 40 percent. Concomitantly, inshore discharges of processing wastes would increase by approximately 40 percent. In addition, the elimination of the race for fish is likely to lead to longer fishing seasons meaning that point source discharges of seafood processing wastes are likely to occur during longer periods of time. Processors will potentially receive a steady stream of pollock throughout the season as opposed to pulses of pollock and will have the flexibility to spread out pollock deliveries and processing activity to distribute pollutant discharges of biochemical oxygen demand, oil and grease, solid processing wastes and nutrients over longer time periods in inshore bays. The worst time to discharge is between mid-July and mid-September when the water column is stratified by a summer pycnocline (H. Burney Hill, EPA Region 10, pers. comm). Figures 4.2.1 through 4.2.4 examine the weekly processing rates for the eight inshore processors operating in the BSAI pollock fishery and display total pollock landings between July 15 and September 15 of each year. Due to data confidentiality, the weekly processing tonnages of each inshore processor cannot be identified. However the trend in weekly processing tonnages from 1998 through 2001 shows that while peak weekly tonnages have not increased under the AFA, the processing season has lengthened considerably and the total tonnage of pollock processed during the critical mid-July to mid-September period has increased dramatically from 58,396 mt in 1998 to 243,815 mt in 2001.

While the AFA-mandated 40% increase in inshore pollock processing raises concerns about nearshore water quality, especially given the increases in the tonnage of pollock processed during the critical mid-July to mid-September period, the inshore cooperative program authorized by the AFA provides inshore processors with significantly greater flexibility to comply with EPA-mandated water quality requirements through slowing the pace of processing and scheduling processing for time periods when water conditions are most optimal for dispersion of processing waste discharge. In addition, the increased recovery rate demonstrated by the inshore sector under the AFA means that inshore processors should have less solid fish waste to discharge per mt of pollock processed than under the no-action alternative. Furthermore, the increased profitability of the inshore sector under the AFA should mean that inshore processors are in a better position to deploy best available technologies to treat and reduce processing waste. However, the inshore processing sector will be faced with a tradeoff between water quality and product quality if B season processing is shifted to earlier in June when recovery rates may be lower. Likewise, a similar tradeoff between water quality and Steller sea lion protection may occur if B season processing is delayed until October or later which may be a more critical time period for Steller sea lion foraging.

With respect to the environmental impacts of the AFA-based alternatives, the amount and type of daily effluent discharge allowed under each processor's NPDES permit will not change and the amount of cumulative will increase. Although the processors will process more pollock and discharge more total pollutants, they will not be allowed to exceed their existing point source daily discharge limits. Under an NPDES permit, effluent discharges, waste piles on the sea floor, residues on the sea surface and shoreline, and ambient water quality (esp. dissolved oxygen) are monitored to ensure compliance with the permit.

While NMFS believes that the existing EPA oversight over processing waste discharges under the Clean Water Act are adequate to prevent significant impairment of nearshore water quality or the nearshore benthic environment, the 40% increase in inshore processing under the AFA, and the recent increases in processing during the critical July-September period raise concerns about the impacts of the AFA-based alternatives on inshore water quality around the location of major inshore processing facilities in Dutch Harbor/Unalaska, Akutan, and Beaver Inlet. The dramatic increase in processing tonnages during critical time periods for water quality suggest that continued monitoring of water quality and waste residues around AFA inshore processing plants is necessary to ensure that significant degradation of water quality and habit does not result from implementation of the AFA. Therefore, the effects of Alternative 2 through 5 on nearshore water quality and nearshore benthic environments are considered to be insignificant provided that monitoring continues and NPDES permits are reviewed on a timely basis to ensure that AFA-driven increases in processing activity do not degrade nearshore water quality and benthic habitat.

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4.2.3 Essential Fish Habitat (EFH) assessment

This section of the document addresses the mandatory requirements for an EFH Assessment enumerated in the Interim Final Rule (IFR)(62 FR 66531, December 19, 1997) implementing the EFH provisions of the Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). These requirements are:

- A description of the proposed action;
- An analysis of the effects, including cumulative effects, of the proposed action on EFH, the managed species, and associated species, such as major prey species, including affected life history stages;
- The Federal agency's view of the action on EFH; and
- Proposed mitigation, if applicable.

An EFH assessment may incorporate by reference other relevant environmental assessment documents, such as an ESA Biological Assessment, another NEPA document, or an EFH Assessment prepared for a similar action.

EFH is defined in the Magnuson-Stevens Act as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." (16 U.S.C. 1802 Sec. 3, 104-297). The IFR defines adverse effect as "any impact which reduces quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, or reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (62 FR, 66551, December 19, 1997).

The area affected by the proposed action has been identified as EFH for all of the FMP managed species in the BSAI and GOA. EFH for these species is described and identified in five FMP amendments which were approved January 20, 1999. These are: Amendment 55 to the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area; Amendment 55 to the FMP for Groundfish of the Gulf of Alaska; Amendment 8 to the FMP for the Commercial king and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands; Amendment 5 to the FMP for Scallop Fisheries off Alaska; and Amendment 5 to the FMP for the Salmon Fisheries in the Exclusive Economic Zone off the Coast of Alaska.

Analysis of effects of the alternatives on EFH

Pollock is fished exclusively by pelagic trawl gear in the BSAI, and nearly entirely by pelagic trawl gear in the GOA. Pelagic trawl gear, although it is designed for midwater, is sometimes fished on the bottom, especially where the bottom is smooth, but it is less likely to be fished hard on the bottom and the door generally does not touch the substrate. Bottom trawl gear does have effects on the substrate and water column, and associated flora and fauna, which have been documented in a number of studies. As described in Section 4.1, the changes proposed by this rule are expected to result in the dispersion of the BSAI pollock fishery over time and space. And, in combination with concurrent implementation of Steller sea lion RPA measures, this action is expected to result in relocation of fishing effort from Steller sea lion critical habitat areas, which have been heavily fished in recent years, to other areas which have been under less fishing pressure. The proposed action would not change the pollock TAC or the type of gear used for pollock fishing. However, it could affect the number and size of vessels remaining in the fishery as described in Section 4.1.4.

General effects of pollock fishing on EFH

Pelagic trawl gear is the principal gear used in the directed pollock fisheries in the GOA and BSAI. Amendment 57 to the FMP for the Groundfish Fishery of the BSAI, approved by the Secretary of Commerce March 8, 2000, prohibits nonpelagic gear use in the directed pollock fishery in the BSAI. Prior to approval of the amendment, nonpelagic trawl gear was prohibited starting in 1999 by allocating zero mt of pollock to nonpelagic trawl gear. In the GOA, where approximately one-tenth as much pollock was caught in the 1999 pollock trawl fisheries (91,754 mt) as in the BSAI (850,048 mt), nonpelagic trawling for pollock is permitted but represents a very small percentage of the fishery. In 1999, 98.7% of the pollock caught in the GOA was caught with pelagic gear[6].

Pelagic gear have not been studied to the extent that bottom gear has because it is generally fished in midwater. Pelagic trawls may, however, be fished on the bottom. Fishermen often avoid fishing pelagic gear hard on the bottom, since the nets can be damaged by benthic structures, but may fish on the bottom in smooth areas. In such cases, some disruption may be caused by the footropes, but not by the doors, as the pelagic trawls used off Alaska are generally designed to fish downward from the depth of the doors, and the doors themselves do not come in contact with the seafloor.[7] There is a performance standard designed to discourage fishermen from using pelagic gear to fish for pollock on the bottom (50 CFR 679.7(a)(14)). The performance standard prohibits a vessel engaged in directed fishing for pollock from having 20 or more crabs of any species, with a carapace width of more than 1.5 inches at the widest dimension, onboard at any time. This performance standard will be in effect permanently in the BSAI once regulations are implemented for Amendment 57, which prohibits bottom trawling in the directed fishery for pollock in the BSAI and which was approved by the Secretary of Commerce in March, 2000.

Bottom trawl gear has numerous effects on the substrate and water column. These are discussed in detail in the 1998 EIS (NMFS 1998i), in the EA for the EFH amendments (NPFMC 1999b), and in the EFH Assessment for the 2000 Groundfish Fisheries of the BSAI and the GOA [(NMFS, 1999a), Appendix E]. As detailed in that assessment, a few studies have been done in the Alaska region. A study of bottom trawl impacts in the BSAI was completed recently (McConnaughey et al. 2000), which compared 42 pairs of trawled and untrawled one square nautical mile sites in a shallow, soft-bottom area of the eastern Bering Sea. The researchers found that sedentary megafauna (such as anemones, soft corals, and sponges) as well as neptunid whelks and empty shells were more abundant in the untrawled areas; that motile groups such as crabs, sea stars, and whelks showed mixed responses, in some cases increasing in the trawled areas; and that long-term exposure to bottom trawling, at least in the experimental area, reduces diversity and increases patchiness in the epibenthic community.

A study in the GOA (Freese et al. 1999) involved trawling eight sites in August 1996and videotaping each trawl path and a nearby reference transect to obtain quantitative data. The researchers found that a single trawl pass displaced a significant number of boulders and removed or damaged large epifaunal invertebrates. A significantly lower density of sponges and anthozoans was found in the trawled transects than the reference transects, and more of these organisms were damaged in the trawled transects.

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[6] NMFS Blend database.

[7] Craig Rose, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115, Oct 15, 1999, personal communication.

The findings of these studies are generally in line with research worldwide. Particularly applicable to the Alaska situation is the idea that environmental variables, including the structure and composition of the bottom, depth of the water column, oxygen content in bottom layers, and natural wind stress all play a role in determining the effects of trawling. Drawing broad conclusions from worldwide or regional studies however is difficult, as most of the work has studied short-term effects of trawling, and little research has been done (none in the North Pacific) showing a direct connection between the effects of trawling on habitat complexity and the populations of managed fish.

In any event, direct impacts to pollock EFH from pollock fishing efforts are not likely. Adult pollock may be found near the bottom, but they are not associated with seafloor substrata. Adult pollock key into anything that congregates prey such as upwellings, gyres and fronts.[8] Trawl gear could possibly affect larval life stages of crab and groundfish. Few systematic surveys have been done to identify specific locations where concentrations of these larvae may be found. Some of the larvae are pelagic, and others are bottom dwellers. The mesh sizes of commercial gear have been designed to not retain larval life stages.

Direct effects on EFH due to the proposed alternatives

The expected changes in fishing patterns described in Section 4.1 would have no direct effects on EFH relative to the status quo because under no circumstances could non-pelagic trawl gear be deployed in the BSAI pollock fishery. To the extent that fishermen are able to slow their fishing practices under the fully rationalized fishery expected under Alternatives 3-5, they may be less likely to accidently come into contact with the sea floor while using pelagic nets. However, such speculation is impossible to quantify and in any event, the effects of the proposed changes are expected to be insignificant relative to the status quo.

Indirect Effects on EFH due to proposed alternatives

Changing the times and locations where the fishery is concentrated could have effects on the ecosystem, but these would be difficult to predict, especially without knowing where the fishermen will go when required to lessen fishing effort in certain areas. Changes in the spatial distribution of the pollock fishery could alleviate fishing impacts on discrete populations of pollock. However, it is possible that bycatch of some other species may increase in other areas. If the fleet is required to move elsewhere in search of high concentrations of pollock, bycatch of other species could be affected in either direction. Salmon will receive some protection from the rule. Most of the Chum Salmon Savings Area and Chinook Salmon Savings Area (both established by the Council in 1995 in the BSAI) are within the Steller Sea Lion Conservation Area, which is being afforded protection by concurrent Steller sea lion RPA measures.

Loss of prey for a managed species is listed in the IFR as an indirect adverse effect on EFH. Actions that significantly reduce the availability and population of a major prey species, through direct harm, capture, or adverse impacts to the prey species' habitat, may be considered to have adverse effects on a managed species and its EFH. This action, since it will change fishing patterns, could change the proportions of species caught in the directed fishery and as bycatch. It is possible that some adverse impacts to prey for managed species could occur in some areas.

The question for this proposed action is whether it might affect the availability of pollock as prey for pollock. Possible losses of juvenile pollock, as prey for pollock, might occur if the action's effect were to shift trawl

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[8] Lowell Fritz, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115, March 28, 2000, personal communication.

effort to areas of higher juvenile pollock abundance. In the eastern Bering Sea, juvenile pollock are more dense in the northern outer and middle shelf areas (Fritz 1996). Redistribution of fishing effort could mean greater effort in areas of higher juvenile pollock abundance, particularly in the eastern Bering Sea. However, historically the bycatch rates in midwater pollock fisheries of juvenile pollock that are the appropriate sized prey (<20cm) for adults has averaged less than 1% of the total catch number (Fritz 1996). These bycatch rates were low even in the late 1970s, when fisheries may have been operating in areas of higher juvenile pollock abundance. Furthermore, the IR/IU program implemented in 1998, under which all pollock must be retained while directed fishing for pollock is open, has given fishermen a strong incentive to avoid catching juvenile pollock. This is accomplished through two techniques: selectively fishing over schools of larger fish, or modifying the gear (e.g., by using larger or square mesh) so that smaller fish are less likely to be retained. However, mortality rates of pollock escaping nets, modified or not, are high (Erickson et al. 1999). So while retained bycatch of juvenile pollock may be lower with modified gear, our knowledge of true fishing mortality does not allow us to say with certainty that the gear improves fishing mortality rates for juveniles.

Effect of the alternatives on species growth and fecundity

An effect on species fecundity might be expected if food intake to support reproduction were affected. This action does not however appear to be likely to adversely affect the abundance and availability of prey for pollock. It is possible, since the action will result in spreading out the fishing season, that more mature pollock will have a chance to spawn in February through April. This cannot be stated with certainty, but at any rate it is not expected that the action will have an adverse impact on growth, reproduction or fecundity.

Cumulative effects on EFH

Because none of the alternatives will affect the size of the pollock TAC and because the BSAI pollock fishery is conducted exclusively with pelagic trawl gear which is relatively “clean,” that is, since direct and indirect effects on EFH for pollock are expected to be relatively minor, specific cumulative effects of this action taken together with other fishery actions would be difficult to identify. For discussions of the cumulative effects of the exploitation of managed fisheries in the North Pacific, refer to the Stock Assessment and Fishery Evaluation (SAFE) reports (NPFMC 1999c), which are produced annually for the crab, scallop, and groundfish fisheries, and which now include Ecosystem Considerations sections detailing specific concerns that are considered by fishery managers for maintaining sustainability of marine ecosystems. The Environmental Assessment for the EFH amendments (NPFMC 1999b) also contains a section dealing with the cumulative effects of fishing.

Summary of effects on EFH

The temporal changes to fishing patterns described in Section 4.1 would have no direct effect on EFH, but a more even distribution of the catch throughout the year might reduce the likelihood of indirect adverse ecosystem effects to EFH by minimizing the potential for temporary localized depletion. It is also possible that spreading out the season could allow more mature pollock to spawn. This cannot be stated with certainty, but in any case the action is not expected to have an adverse impact on growth, reproduction or fecundity.

Few direct effects are expected as a result of the changes in spatial distribution. Adult pollock may be found near the bottom, but they are not associated with seafloor substrata. Adult pollock key into anything that congregates prey such as upwellings, gyres and fronts. Thus, direct impacts to pollock EFH from pollock fishing efforts are not likely. For managed species which are associated with the bottom, there could be some effects (both positive and negative) from redistribution of nonpelagic trawl gear effort. Effort in some areas would be lowered, and in others could be increased. Some of these latter areas could be further offshore and have bottom habitat which is slower to recover than in areas currently fished. However, the pollock fishery is exclusively a pelagic trawl fishery in the BSAI, and the nonpelagic trawl fishery constitutes less than 5% of effort in the GOA (2% in 1998). The seafloor is already subject to trawling from other fisheries. Pelagic gear can also potentially alter the substrate and water column if the gear contacts the seafloor or removes significant prey species, but the gear does not usually come in contact with the bottom and can be damaged if it does so, unless the substrate is smooth. In the context of the fishery as a whole and of the other bottom trawl fisheries in the North Pacific, any direct effects from redistribution of pollock trawl effort on the substrate and water column, beneficial or adverse, are expected to be relatively minor.

In terms of indirect impacts to EFH, the primary concern would be the effect on juvenile pollock as prey for pollock. Levels of species taken as bycatch, including juvenile pollock, which tend to be concentrated further north in the eastern Bering Sea, may increase in some areas. However, the historic bycatch rates for juvenile pollock are low and were low even in the late 1970s when fisheries may have been operating in areas of higher juvenile pollock abundance. In addition, pelagic gear is configured in such a way that it does not catch and retain fish that are prey for pollock, including juvenile pollock (ages 0 and 1). In addition, the fleet tries to avoid small schooling fish. Therefore, the impacts of the proposed actions to pollock prey (primarily juvenile pollock) are expected to be insignificant.

The redistribution of effort could affect the levels of other species taken as bycatch in the pollock fishery. Again, levels would be raised or lowered in different areas as areas of fishing concentration changed. Changes in bycatch levels could have EFH implications for managed species in that predator-prey relationships could be affected. However, bycatch rates of species other than pollock in the pollock fishery is extremely low, and any impact on bycatch rates from the rule should be inconsequential

Pelagic gear has little if any effect on EFH unless the gear contacts the seafloor and alters habitat sensitive to disturbance. Although pelagic gear can be fished on the bottom, it is designed so that the door does not come in contact with the seafloor. A performance standard, in conjunction with Amendment 57,[9] would further decrease the likelihood of pelagic trawls being fished on the bottom, especially in the BSAI.

Pollock are not associated with sediment or structure, but rather key into anything that congregates prey such as upwellings, gyres, and fronts. Thus, direct impacts to pollock EFH from pollock fishing efforts are not likely. It is possible that pelagic gear may remove some larval distributions of crab and groundfish. Few systematic surveys have been done to identify specific locations where concentrations of these larvae may be found. Some of the larvae are pelagic, and others are bottom dwellers. However, the mesh sizes of commercial gear have been designed to not retain larval life stages, so the consequence of changes in fishing patterns from this action on larvae is expected to be negligible.

EFH Mitigation

Indirectly, the rationalization of the BSAI pollock fishery under the preferred alternative may lessen the fishing effort in certain areas and the potential impact to EFH in those areas. On the other hand, the effort thus displaced could increase impacts in other areas which are currently less heavily fished. However, the effect of this action on EFH is expected to be negligible. NMFS does not see a need for additional mitigation in connection with this action.

[9] Amendment 57 was approved March 8, 2000 and final regulations implementing it are currently under federal regulatory review.

4.3 Effects of the alternatives on biological resources

Provisions of the AFA being proposed for implementation at this time may have positive or negative environmental effects, depending on the resulting behavior of the fishery. Other provisions will have predictable benefits, regardless of changes in fishery operation (e.g., increased observer coverage). As stated earlier, the analysis presented in this section relies on 1998 fishing patterns to predict fishery operations and impacts under Alternative 1, 1999 patterns to predict impacts under Alternative 2, and 2000 patterns to predict impacts under Alternatives 3, 4, and 5. If any of Alternatives 2-5 is implemented, the fishery may evolve beyond what was observed in 1999 and 2000 and impacts predicted here may be affected. However, the 1998-2000 fisheries are representative years for which we have data and can evaluate possible changes in fishery patterns.

The measures encompassed in each alternative include the following components:

- Pollock sectors and sector allocation
- Fishery cooperatives
- Sideboard protections for other fisheries
- Catch measurement and monitoring

Measures that relate to each component will be discussed with respect to the potential environmental effects that may result if that component is implemented as part of an alternative. The environmental effects of some of these measures will be the same regardless of the alternative that is implemented (Alternatives 2-5). For example, Alternative 5 contains many of the same measures as Alternative 3.

Some fishery management measures result in general environmental impacts which would be shared by all affected species (e.g., improved catch monitoring could benefit target and non-target catch, protected species, etc.). Those measures with general impacts are described immediately below. Other measures effect species-specific impacts, and those effects are discussed in detail in later sections.

Component 1: Pollock sectors and sector allocation. The allocation of pollock between inshore and offshore users could increase vessel traffic to and around coastal communities. However, NMFS has established protective buffer zones around Steller sea lion rookeries and haulouts to minimize disturbance. By establishing a limited group of eligible fishery participants in the Bering Sea pollock fishery, Alternatives 2-5 may reduce environmental impacts through increased education of participants regarding the costs of negatively affecting protected species. This group may then seek to decrease their environmental impacts through increased search time, avoidance of "problem" areas, etc.

Establishing excessive share caps may benefit Steller sea lions and other species by preventing any one company from dominating the fishery, which could lead to concentration (spatial or temporal) of the fishery which may result in negative environmental impacts.

Component 2: Fishery cooperatives. Establishing fishery cooperatives under any of the Alternatives 2-5, would provide the opportunity to reduce the race for the fish and would increase temporal dispersion of the offshore fleet's fishing effort. Likewise, spatial dispersion would result from cooperative management because fishermen would be able to spend more time searching for optimal fishing conditions. This kind of dispersion is evident in the 1999 and early 2000 fisheries. Providing the mechanism for establishment of inshore catcher vessel cooperatives (Alternatives 3-5) could further eliminate the race for the fish, and disperse the fishery in time and space. This dispersed fishing behavior in both the inshore and offshore fleets can only be viewed as positive with respect to many species. In addition, the inshore catcher vessel operators, no longer participating in a derby fishery, appear to be communicating better amongst themselves, which may decrease bycatch of pollock and incidental catch of non-target species, and increase the catch of high-value fish[10].

Component 3: Sideboard protections. Sideboard protections for other fisheries prevent AFA vessels from redirecting their fishing power into other fisheries which could result in negative environmental impacts, particularly if bycatch or habitat disruption is higher in those fisheries. The sideboard protection measure contained in Alternatives 2-5 mitigates the potential for greater temporal concentrations of catch in fisheries other than the BSAI pollock fishery, that would result from implementation of other AFA measures. The differences between Alternatives 2-5 regarding *calculation* of catcher/processor sideboards are not expected to have any impact on the environment.

Restrictions on catcher vessels (particularly under Alternative 2) would mitigate the above-mentioned potential negative environmental impacts that could result from redirection of effort into other fisheries. Alternatives 3-5 contain measures to restrict sideboards, however, these alternatives also contain measures to exempt AFA catcher vessels from these restrictions. The exemptions would apply only to catcher vessels that had relatively low levels of fishing in the BSAI pollock fishery and extensive histories of fishing in other fisheries during the same period. These exemptions are not likely to redirect effort so that it exceeds fishing levels in recent years (prior to emergency implementation of AFA provisions in 1999). *If* the Pacific cod sideboard exemptions resulted in increased effort on Pacific cod in critical habitat areas, alternatives containing those exemptions may increase the impact on Steller sea lions. NMFS is currently examining the effect of Pacific cod harvesting on Steller sea lions and may develop measures to reduce competition between Pacific cod fishermen and Steller sea lions. The preferred alternative also would exempt one vessel from BSAI crab sideboards and no environmental impacts would be expected as a result of implementation of this measure.

Under Alternatives 2-5, NMFS' sideboard management responsibilities range from complete control through NMFS-managed directed fishing closures to dependence on each cooperative for in-season management. Under Alternatives 2, 3, and 5, NMFS would continue to manage aggregate groundfish and PSC sideboards through directed fishing closures in coordination with catcher vessel cooperative managers. Implementation of Alternative 4 would relax NMFS' authority to close the directed fishery and rely on co-op managers to be more involved in managing the fishery. NMFS expects that some involvement by the agency (Alternative 3) would minimize any potential environmental impacts that could result from lax co-op management of groundfish and PSC sideboards.

Component 4: Catch measurement and monitoring requirements. The measures contained in Alternatives 2-5, which include increased observer coverage, more comprehensive catch measurement and monitoring measures (including scale requirements), in-season monitoring options, and vessel monitoring systems among them, are likely to have a positive impact on the environment in general, relative to Alternative 1. Increasing observer coverage and scale requirements for BSAI catcher/processors, for example, is likely to increase the amount of and the accuracy of fisheries data from this sector. These data are used for assessment of the pollock stock, fishing practices, and potential effects on Steller sea lions. Further, increased monitoring of all sectors of the pollock fishery would improve in-season management effectiveness.

[10] J. Gruver, United Catcher Boats, Seattle, WA, personal communication.

Implementing increased monitoring and reporting requirements, therefore, through implementation of Alternatives 2, 3, 4, or 5 is expected to have positive impacts on a number of species, through improvement of data collection and subsequent analysis of fishing practices. Alternative 2, however, does not encompass as many of the monitoring requirements as Alternatives 3-5. Alternative 4 substantially increases catcher vessel monitoring beyond the requirements contained in Alternatives 3 and 5, in order to facilitate effective in-season management by the cooperatives.

4.3.1 Effects on marine mammals: Methodology and summary

The Draft Programmatic SEIS (NMFS 2001a) examined effects of groundfish fishery management alternatives by focusing analyses around four core questions, modified from Lowry (Lowry 1982):

1. Is the alternative management regime consistent with efforts to avoid direct interactions with marine mammals (incidental take and entanglement in marine debris)?

2. Does the alternative management regime result in fisheries harvests on prey species of particular importance to marine mammals, at levels that could compromise foraging success (harvest of prey species)?

3. Does the alternative management regime result in temporal or spatial concentration of fishing effort in areas used for foraging by marine mammals (spatial and temporal concentration of removals with some likelihood of localized depletion)?

4. Does the alternative management regime modify marine mammal or forage behavior to the extent that population level impacts could occur (disturbance)?

Those four questions, and the associated rating criteria established were modified for use in this analysis from the process used in the Draft Programmatic SEIS (NMFS 2001a). The main departure from how they were used in the Draft Programmatic SEIS analysis was it evaluated alternatives with respect to consistency with a policy of marine mammal protection, whereas, in this analysis each suite of specific fishery management measures is evaluated independently against a criteria for significance established for each of the four above questions. Additionally two management tools used in the Draft Programmatic SEIS are not relevant to discussions of effects on marine mammal populations: vessel monitoring requirements and experimental design.

In cases where absolute quantitative criteria for significance could not be established, the fishery management measures in effect in 1998 were used as a benchmark upon which to compare these five alternatives with respect to effects on marine mammals, as expressed by the above questions. That is, once it was determined how much of an effect could be expected, as delineated by the above questions, other alternatives were evaluated relative to the performance of the 1998 benchmark.

This analysis is comprised of three tiers:

a. The effects on each of seven marine mammal species or species groups are discussed separately (Steller sea lions, ESA listed great whales, other cetaceans, northern fur seals, harbor seals, other pinnipeds, sea otters).
b. Each alternative is addressed for each species or species group.
c. Each question (type of effect) is addressed for each alternative within each species or species group

Please see table of contents for figure or table.

A summary of the effects of the alternatives on each marine mammal species for each direct and indirect effects under analysis is contained in Table 4.3.3. The rationale for each of these findings is contained in the sections on individual species below.

Table 4.3.3 Summary of the effects of the alternatives on marine mammals.

Species	*Effect*	*Alt. 1*	*Alt. 2*	*Alt 3-5*
Steller sea lion	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	CS-	CS+	CS+
	Disturbance	I	I	I
ESA-listed cetaceans	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	I	I	I
	Disturbance	I	I	I
Other cetaceans	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	I	I	I
	Disturbance	I	I	I
Northern fur seal	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	U	U	U
	Disturbance	I	I	I
Harbor seal	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	I	I	I
	Disturbance	I	I	I
Other pinnipeds	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	I	I	I
	Disturbance	I	I	I
Sea otters	Take/entanglement	I	I	I
	Harvest of prey	I	I	I
	Temporal/spatial	I	I	I
	Disturbance	I	I	I

S = Significant, CS = Conditionally Significant, I = Insignificant, U = Unknown, NA = Not Applicable

4.3.2 Effects on Steller sea lions

Direct and indirect interactions between endangered Steller sea lions and groundfish fisheries occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important sea lion prey, and due to temporal and spatial overlap in sea lion foraging and commercial fishing activities. Of the groundfish species targeted for harvest, pollock, Atka mackerel, and Pacific cod rank foremost among important sea lion diet items (Sinclair and Zeppelin Submitted) and similar sizes are targeted by sea lions and fisheries. Consequently, the effects of the BSAI pollock fishery on Steller sea lions has been a subject of intense investigation and controversy over the past decade.

Section 7 consultations on the effects of proposed Amendments 61/61/13/8 on Steller sea lions

In August 2001 NMFS prepared a draft BiOp on the effects of the BSAI and GOA groundfish fisheries as modified by proposed AFA amendments 61/61 and proposed Steller sea lion amendments 70/70 (Appendix A of NMFS 2001d). The draft BiOp concluded:

After reviewing the current status of the endangered western population of Steller sea lions, the environmental baseline for the action area, the proposed action for Alaska groundfish in the Bering Sea and Aleutian Islands and Gulf of Alaska, and the cumulative effects, it is NMFS' biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the western population of Steller sea lions.

After reviewing the current status of critical habitat that has been designated for the western population of Steller sea lions, the environmental baseline for the action area, the proposed action for Alaska groundfish in the Bering Sea and Aleutian Islands and Gulf of Alaska, and the cumulative effects, it is NMFS' biological opinion that the action, as proposed, is not likely to adversely modify its critical habitat.

Direct effects: Incidental take and entanglement (Question 1)

Angliss, *et. al,* (Angliss et al. 2001) estimated the mean annual mortality of Steller sea lions and other marine mammals from the 1995-1999 groundfish fisheries. The level of incidental take in either the BSAI or the GOA has not increased over the past decade. Takes of Steller sea lions currently are rare events in all of the Alaskan groundfish fisheries, with no apparent pattern to their temporal or spatial distribution.

The estimated annual incidental take for the BSAI pollock fishery was estimated for each of alternatives by multiplying the ration of observed incidental take of dead animals to observed groundfish catch to the projected TACs under each of the alternatives. Because none of the alternatives would affect the overall TAC for the BSAI pollock fishery relative to the no-action alternative, none of the alternatives would be expected to vary in their direct effects of Steller sea lions. For all alternatives, the estimated annual take of Steller sea lions is 5 animals with a confidence interval of 3 to 7 animals as reflected in Table 4.3.4. The level of annual take has been determined to be insignificant in the most recent BiOp on the groundfish fisheries of the BSAI and GOA as proposed to be amended by Amendments 61/61/13/8. Therefore, the effects of all of the alternatives on incidental take and entanglement of Steller sea lions is considered to be insignificant according to the criteria set for significance (Table 4.3.1).

Table 4.3.4 Estimated incidental take of Steller sea lions and other marine mammals in the BSAI directed pollock fishery.

		Alternatives									
		1		2		3		4		5	
Fishery and Area	Species or Group	Mean	CI	Mean	CI	Mean	CI	Mean	CI	Mean	CI
Eastern Bering Sea Pollock	Steller sea lion	5	3-7	5	3-7	5	3-7	5	3-7	5	3-7
(areas 508 to 530) (Trawl gear only)	All marine mammals	18	15-21	18	15-21	18	15-21	18	15-21	18	15-21
Aleutian Islands Pollock	Steller sea lion	1	0-2	1	0-2	1	0-2	1	0-2	1	0-2
(areas 541,542,543) (Trawl gear only)	All marine mammals	1	0-2	1	0-2	1	0-2	1	0-2	1	0-2

Table 4.3.5 provides a summary of incidental mortality of marine mammals in the BSAI groundfish trawl fishery (including other groundfish targets in addition to pollock). A comparison of the mean annual mortality level with the Potential Biological Removal (PBR) level provides an indication of the relative importance of the annual trawl mortality to each stock. Fisheries which incur mean annual mortality levels which are high relative to a particular stock's PBR level receive increased management under the MMPA.

Table 4.3.5 Summary of incidental mortality of marine mammals in the groundfish trawl fisheries of the BSAI.

Stock	Mean annual mortality	Potential Biological Removal (PBR) level
Steller sea lion, western U.S.	7.4 (CV = 0.22)	234
Northern fur seal, eastern Pacific	1.4 (CV = 0.43)	18,244
Harbor seal, Bering Sea	2.2 (CV = 0.44)	379
Bearded seal, Alaska	2 (CV = 0.63)	n/a
Ringed seal, Alaska	0.6 (CV = 1.0)	n/a
Ribbon seal, Alaska	0.2 (CV = 1.0)	n/a
Killer whale (either eastern North Pacific northern resident or transient)	0.6 (CV = 0.67)	7.2 or 2.8, respectively
Harbor porpoise, Bering Sea	1.2 (CV = 0.31)	86
Dall's porpoise, Alaska	6.0 (CV = 1.7)	1537
Humpback whale (either central or western North Pacific)	0.2 (CV = 1.0)	0.7

Source: Ferrero *et al.*, (Ferrero et al. 2000). Transient killer whale information is from Forney *et al.*, (Forney et al. 2000).

Direct effects: Fishery harvest of prey species (Question 2)

This question address whether the alternative management regime result in fisheries harvests on prey species of particular importance to marine mammals, at levels that could compromise foraging success (harvest of prey species). This question is of greater relevance to management decisions that affect the overall harvest of pollock by the commercial fisheries as a whole such as the annual TAC-setting process and the development of Steller sea lion protection measures under Amendments 70/70. With respect to the alternatives for Amendments 61/61/13/8 to implement the provisions of the AFA, none of the alternatives would address or affect the annual TAC setting process or is expected to result in levels of pollock harvest that differ from the no-action alternative. Because this action will implemented concurrently with Steller sea lion protection measures proposed under Amendments 70/70, which do address the question of overall TAC levels for BSAI pollock, it is assumed that all of the alternatives would be implemented with pollock TAC levels that have been determined not to have a significant effect on the harvest of Steller sea lion prey species. In other words, it is assumed that other management measures that are implemented concurrent with this action will prevent any significant negative effect on the harvest of prey species. For this reason, the direct effects of all of the alternatives on harvest of prey species is considered to be insignificant according to the criteria set for significance (Table 4.3.1).

Indirect effects: Temporal and spatial concentration of fishery (Question 3)

Indirect interactions between the BSAI pollock fishery and Steller sea lions are much more difficult to detect and document. They include competition for similar prey resources which may result in localized depletions of pollock or Pacific cod; and disturbance by fishing activities. Additional impacts may include alteration of the age structure of the stock targeted by a fishery, resulting in a shift in biomass from older to younger age groups or alteration of the abundance of fish stocks which results in the ecosystem dominance of less desirable fish species. These last two concerns are speculative and cannot be objectively evaluated with regard to their impacts on marine mammals under any of the considered alternatives.

Implementing AFA provisions, particularly formation of co-ops, has resulted in slower fishing effort and dispersed fishing patterns, thereby supporting Steller sea lion protection measures proposed under Amendment 70.

Relative to Alternative 1, Alternatives 2-5 provide for greater allocation of the TAC to the inshore sector (taken from the offshore allocation). In general, inshore vessels have less fishing power than offshore catcher/processors. Reduced fishing power aids in temporal and spatial dispersion of the catch and reduces the potential for localized depletion of pollock which should be beneficial to Steller sea lions. However, inshore vessels are subject to more restrictions than offshore catcher/processors and they have a more limited range, due to their smaller size. Allocating more TAC to the inshore fleet may result in higher spatial concentration of catch within the inshore sector. But, if mitigating measures in place include the closed areas to protect Steller sea lion habitat, and inshore catcher vessels are authorized to organize into cooperatives, concentrations of effort may be reduced. The cooperatives eliminate the race for the fish which may allow fishing vessels to increase their fishing range (to the extent possible). Based on recent data, it is apparent that inshore vessels are capable of fishing outside of the Steller sea lion critical habitat and the SCA.

Restrictions on catcher vessels prevents them from re-directing their effort into other fisheries. However, Alternatives 3-5 contain measures to exempt AFA catcher vessels that had relatively low levels of fishing in the BSAI pollock fishery and extensive histories of fishing in other fisheries during the same period. These exemptions are not likely to re-direct effort so that it exceeds fishing levels in recent years (prior to implementation of AFA provisions in 1999). If the Pacific cod sideboard exemptions resulted in increased concentrations of effort on Pacific cod in areas close to the SCA, biological interactions with Steller sea lions may increase. NMFS is currently considering management measures to address potential negative impacts to Steller sea lions resulting from operation of the Pacific cod fishery. These analyses would likely include measures to disperse the Pacific cod catch in time and space.

Another indirect impact on Steller sea lions would result from the VMS requirement under Alternatives 3 through 5. Implementation of this requirement would likely benefit Steller sea lions because it would contribute to successful management *within* a cooperative of fishing inside and outside the SCA, regardless of the presence or absence of an observer on board. Further, VMS would provide NMFS with additional enforcement capability for enforcing Steller sea lion protection measures.

Alternative 1. Alternative 1 represents a reversion to the pre-AFA open access race for fish that characterized the BSAI pollock fishery through 1998. Although it is assumed that Steller sea lion management measures developed since 1998 would continued to be implemented under Alternative 1. As illustrated in Section 4.1.3, this fishery was characterized by temporal and spatial concentration of fishing effort. It is assumed that the absence of fishery cooperatives would result in greater spatial and temporal concentration of fishing effort relative to any of the AFA-based alternatives. Consequently, regardless of the Steller sea lion protection measures in place, Alternative 1 is expected to result in greater spatial and temporal concentration of fishing effort. The 2001 draft BiOp concluded that high levels of harvest during particular seasons may adversely affect sea lions. For example, during the winter months, sea lions may have relatively infrequent foraging opportunities and may be less able to travel large distances in search of food. Similarly, juvenile sea lions may rely on easy feeding opportunities during periods when they are learning to forage independently. Substantial harvests of pollock during these times may lead to nutritional stress, even if ample food is available at other times of the year. In addition, concentration of fishing effort in a localized area can affect the distribution and abundance of pollock in the area making it harder for sea lions to forage in those areas.

In addition, a reversion to pre-AFA open access fishing conditions in the BSAI pollock fishery under Alternative 1 would likely complicate the development of Steller sea lion protection measures under Amendment 70/70 and could significantly undermine existing agency and industry efforts to reduce the concentrations of pollock fishing in time and space and enforcement of areas closed to directed fishing to protect Steller sea lions. this reason, Alternative 1 is expected to have the greatest potential for negative indirect effects on Steller sea lions relative to the other alternatives. Therefore, the effects of Alternative 1 on Steller sea lions is considered to be conditionally significant negative.

Alternative 2. As described in Section 4.1, Alternative 2 is expected to result in between 50 and 100% of the BSAI pollock fishery being harvested by fishery cooperatives. As described under Scenario 2, Alternative 2 is expected to result in less temporal concentration of fishing effort relative to Alternative 1 but possibly greater temporal concentration of fishing effort than Alternatives 3 through 5 depending on extent that cooperatives would form in the inshore sector. However the overall spatial and temporal distribution of the pollock fishery is much more likely to be governed by the imposition of Steller sea lion protection measures under proposed Amendment 70. Nevertheless, the extent to which the formation of fishery cooperatives facilitates efforts to reduce the spatial and temporal concentration of fishing effort, Steller sea lion protection efforts could be enhanced under Alternative 2 relative to the no-action alternative. Therefore, the effects of Alternative 2 on Steller sea lions is considered to be conditionally significant positive due to the potential for AFA cooperatives to facilitate Steller sea lion management measures under Amendments 70/70.

Alternative 3 through 5. As described in Section 4.1, Alternatives 3 through 5 are all considered likely to lead to nearly 100% of the BSAI pollock fishery being harvested by fishery cooperatives which is expected to result in greater temporal dispersion of the BSAI pollock fishery relative to Alternatives 1 or 2. Alternatives 3 through 5 are also expected to result in greater spatial dispersion of fishing effort to the extent that fishermen choosing to fish at different times of the year would be expected to locate migrating schools of pollock in different locations. However the overall spatial and temporal distribution of the pollock fishery is much more likely to be governed by the imposition of Steller sea lion protection measures under proposed Amendment 70. Nevertheless, the extent to which the formation of fishery cooperatives facilitates efforts to reduce the spatial and temporal concentration of fishing effort, Steller sea lion protection efforts could be enhanced under Alternatives 3 through 5 relative to the no-action alternative. In addition, the emergence of fishery cooperatives provides managers and industry greater ability to micro-manage fishing effort at the individual vessel level relative to the previous open access fishery. For example, fishery cooperatives have demonstrated the ability to internally regulate the fishing activities of individual vessels in both the BSAI directed pollock fishery and in non-pollock sideboard fisheries. Under the open access regime in effect prior to 1999, pollock fishery management measures were bluntly applied in the aggregate to the inshore and offshore fleets, respectively with no attempt or ability to regulate the individual fishing patterns of individual vessels. This increased management capacity can only increase the ability of managers and industry to successfully implement Steller sea lion protection measures that have yet to be finalized under Amendments 70/70. Therefore, the effects of Alternative 3 through 5 on Steller sea lions is considered to be conditionally significant positive due to the expected dispersion of fishing effort and potential for AFA cooperatives to facilitate implementation of Steller sea lion management measures under Amendments 70/70.

Indirect effects: Disturbance effects (Question 4)

The existing groundfish management regimes in the BSAI and GOA already contain measures that avoid important forms of disturbance to Steller sea lions at rookeries during the breeding season. In particular, the prohibition of vessel entry within 3 nm of 37 rookeries avoids intentional and unintentional disturbance of hauled-out sea lions, including new born pups, or those animals aggregated near shore. More than 3,250 km^2

around 37 sites are already protected. In addition, measures currently under consideration under Amendments 70/70 would greatly extend these protections.

Vessel traffic, nets moving through the water column, or underwater sound production may all represent perturbations, which could affect foraging behavior, but few data exist to determine their relevance to Steller sea lions. We note especially, that the influence of trawl activities on Steller sea lion foraging success cannot be addressed directly with existing data. Foraging could potentially be affected not only by interactions between vessel and sea lion, but also by changes in fish schooling behavior, distributions, or densities in response to harvesting activities. In other words, disturbance to the prey base may be as relevant a consideration as disturbance to the predator itself.

For the purposes of this analysis, it is recognized that 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 do impose limits on fishing activities inside critical habitat, we assume at least some protection is provided from these disturbance effects. These protections occur as byproducts of other actions which either reduce fishing effort or create buffer zones to limit impacts on foraging. Also, they occur directly in the case of the 3-nm, no-entry zones around rookeries. Whether the residual levels of disturbance represent significant effects on Steller sea lions can not be determined from data currently available.

Anecdotal evidence, however, suggests that fisheries-related disturbance events are unlikely to be of consequence to the Steller sea lion population as a whole. For instance, vessel traffic and underwater sound production have long been features of the Bering Sea and Gulf of Alaska, at least over much of the twentieth century. Such circumstances have prevailed before, as well as after, the decline of Steller sea lions, suggesting no obvious causal link. Steller sea lions also appear to be tolerant of at least some anthropogenic effects, as noted by their attraction to fish processing facilities and gillnets, as well as their distributions in proximity to ports. Further, the eastern stock of Steller sea lions is increasing, despite anthropogenic activities throughout their range on the west coast of North America and particularly in southeast Alaska. Indeed, the level of disturbance on the eastern stock of Steller sea lions is likely to be even greater due to much higher levels of development, vessel traffic, and human population in Southeast Alaska and along the west coasts of Canada and the U.S. compared to the Bering Sea and Aleutian Islands. Overall, these circumstances suggest that disturbance effects are likely to be insignificant to Steller sea lions at the population response level. Thus, the effect of all of these alternatives are considered to be insignificant according to the criteria set for significance (Table 4.3.1).

Re-initiation of consultation under Section 7 of the ESA is appropriate for the proposed action

Section 402.16(c) requires re-initiation of consultation on an action "if the identified action is subsequently modified in a manner that caused an effect to the listed species or critical habitat that was not considered in the biological opinion..." The NMFS 2000 Biological Opinion was a comprehensive analysis of the BSAI and GOA groundfish fisheries and for all species listed as endangered or threatened. The proposed action, however, contain modifications to fishery management regime for BSAI pollock that are different than the specific (largely pre-AFA) fishery management measures that were analyzed in the 2000 Biological Opinion. Because the determination of what constitutes differences in management measures that may be important to the determination of jeopardy to the listed Steller sea lion or adverse modification of critical habitat is quite subjective, the agency determined re-initiation of consultation is appropriate.

Section 402.16(b) also requires re-initiation of formal consultation "if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered...". Since the 2000 Biological Opinion, new information about Steller sea lion movements based on telemetry studies and new analysis of Steller sea lion scat samples have become available. An examination of that information as it relates to necessary protection measures is warranted.

NMFS recognized consultation under Section 7 of the ESA was appropriate early in this process. The consultation is proceeding in parallel with preparation of this EIS. The draft Biological Opinion is contained in the SEIS under preparation for Steller sea lion protection Amendments 70/70 (Appendix A of NMFS 2001d).

4.3.3 Effects on ESA-listed cetaceans (Listed great whales)

Seven species of large whales that occur in Alaskan waters are listed under the ESA including: the North Pacific right whale, blue whale, fin whale, sei whale, humpback whale, sperm whale, and bowhead whale. Direct interactions with groundfish fishery vessels have been documented between 1989 and 2000 for three of the seven species: fin, humpback, and sperm whales. Several cases of entanglements in marine debris also have been reported for humpback and bowhead whales. Four of the seven species listed consume groundfish as part of their diet: fin, sei, humpback, and sperm whales. Discussions of each potential effect will focus principally on the species noted above.

The criteria for determining significance of effect in this and other cetacean species groups presented above in Table 4.3.2 differs from those developed specifically for pinnipeds and sea otters (Table 4.3.1). The differences are with respect to rating significance and insignificance for the questions of harvest of prey species and spatial/ temporal concentration of fishery. Harvest levels of prey species and the temporal and spatial concentration of fisheries with levels and patterns similar to those of 1998 are considered to have insignificant effects on cetacean populations in consideration of these species life histories, dependence upon pollock, Pacific cod, and Atka mackerel as prey species, and foraging behavior.

Percentages used in determining the significance of effects are given as a plausible a point of departure to initiate discussion as opposed to being deemed statistically meaningful per se. Incidental takes attributed to the fisheries and entanglement in fishing gear and marine debris occur at low levels thought to be insignificant to marine mammal populations. The ideal level is undoubtably zero, however even a reduction to zero is considered to be insignificant to marine mammal populations. Therefore NMFS considers effect ratings of conditionally significant positive and significantly positive as not applicable to this analysis. A similar interpretation of significance has been made for disturbance effects on marine mammals. Given that the level of disturbance established for management measures comparable those in effect for 1998 were deemed insignificant in the Draft Programmatic Groundfish SEIS (NMFS 2001a), and that the additional management measures proposed under Amendments 70/70 which could result in even less disturbance than that which is insignificant is also deemed insignificant to marine mammal populations. Therefore NMFS considers effect ratings of conditionally significant positive and significantly positive as not applicable to these analyses.

Direct effects from incidental take and entanglement

Direct mortalities of endangered whales from entanglement in fishing gear have been observed and reported infrequently in the groundfish fishery. Since 1989, three of the seven listed species have been killed incidental to the fishery. Incidental takes attributed to the fisheries and entanglement in fishing gear and marine debris occur at low levels thought to be insignificant to marine mammal populations. The ideal level is undoubtably zero, however even a reduction to zero is considered to be insignificant to marine mammal populations.

A single fin whale mortality was reported in the GOA pollock trawl fishery operating south of Kodiak Island and Shelikof Strait in autumn 1999. Fin whales were reported in this region year-round, most often in the summer and autumn (Platforms of Opportunity Program (POP) 1997). The mortality may have been the result of prey competition, although pollock have not been identified as a key prey species of fin whales in the GOA. Humpback whales are present year-round in Alaska waters but are most frequently reported during the summer and autumn. In 1997, a dead humpback was found entangled in netting and trailing orange buoys near the Bering Strait. It is often difficult to determine if the entanglement occurred with active or derelict gear, or to identify the fishery the derelict gear originated from. Two mortalities (in October 1998 and February 1999) were reported by observers in the Bering Sea pollock trawl fishery operating near Unimak Pass. The extent of interactions between bowhead whales and the groundfish fishery are not known. Bowhead whales are present in the Bering Sea during winter and early spring but are usually associated with ice-covered regions. Rope entanglement injuries and deaths as well as ship-strike injuries appear to be rare. Of 236 bowhead whales examined from the Alaskan subsistence harvest (from 1976 to 1992), three had visible ship-strike injuries from unknown sources and six had ropes attached or scars from fishing gear (primarily pot gear), one found dead was entangled in ropes similar to those used with fishing gear in the Bering Sea (Philo et al. 1992). Since 1992, additional bowhead whales have been observed entangled in pot gear or with scars from ropes.[11] Sperm whale interactions with the groundfish fishery have primarily been documented in the GOA longline fishery targeting sablefish in management zones 640 and 650 (Hill and DeMaster 1999). Two of the three entanglements reported between 1997 and 2000 resulted in release of the animal without serious injury. The extent of the injuries to the third animal was not known though it was alive at the time of release. Similar entanglements have not been observed in the BSAI pollock fishery

Under all of the alternatives, the take rate for the pollock fishery on fin whales would not change greater than ±25% relative to the status quo because the overall BSAI pollock TAC would not change and none of the alternatives would result in dramatic modifications of fishing gear. Therefore, this effect is rated insignificant for all alternatives. Assuming only one Alaska stock of fin whales exists, population level effects would be insignificant. Estimated incidental take rates for the fisheries operating where the humpback whale mortalities occurred (EBS Pollock and EBSAI Mackerel) would not change greater than ±25% under Alternative 1, therefore, the intensity of this effect is considered insignificant. Although take levels are low, the western North Pacific stock numbers below 400 whales and rates of mortality and serious injury cannot be considered insignificant and approaching zero (Angliss et al. 2001). Population level effects are uncertain because it is not known what portion of the western North Pacific stock utilizes these areas and whether gear entangling some whales originated from the U.S. groundfish fishery. Changes to groundfish fishery operations in the Bering Sea would not alter incidental take by more than ±25%, therefore, the intensity of this effect is rated insignificant for bowhead whales. Population level effects would be insignificant given the current increasing trend in abundance of Bering Sea bowhead whales under a managed subsistence harvest. None of the alternatives would affect the sablefish longline fishery where all incidental takes of sperm whales have occurred, therefore, the intensity of this effect is rated insignificant. Population level effects are uncertain because reliable abundance estimates are not available for the North Pacific stock.

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Direct effects from prey removal

One or more of the target species (pollock, Atka mackerel and Pacific cod) of the GOA and BSAI groundfish fisheries have been identified as prey species of fin, sei, humpback, and sperm whales. The consumption of pollock by fin whales appears to increase in years where euphausiid and copepod abundance is low (Nemoto 1957; Nemoto 1959). Regional variation in diet has also been documented. Pollock consumption was greatest in fin whales occupying shelf waters of the Bering Sea while this prey item was not found in animals in the GOA or western North Pacific Ocean (Kawamura 1982). Pollock consumed were less than 11.7 in (30 cm) in length, within the size range targeted by the fishery: 5.9- 19.5 in (15-50 cm). Atka mackerel and Pacific cod have also been identified as prey of fin whales though their importance is not known. The diet of sei whales is comprised almost entirely of copepods. Although young mackerel and other small schooling fish were present in a few of the sei whale stomachs sampled in Japan waters, these fish species also prey on copepods and may have been consumed incidentally (Nemoto and Kawamura 1977). Atka mackerel and walleye pollock are preferred prey species of humpback whales found in waters near the Aleutian Islands (Nemoto 1959). Atka mackerel consumed were between 5.8-11.7 in (15-30 cm) in length, and were probably juveniles (adult fish targeted by the fishery usually ranged in size from 14-19 in (35-50 cm; (Fritz and Lowe 1998)). Walleye pollock eaten by humpback whales were identified as adults but lengths were not provided (Nemoto 1959). Other important prey species include euphausiids, herring, anchovy, eulachon, capelin, saffron cod, sand lance, Arctic cod, rockfish, and salmon. Sperm whales feed primarily on mesopelagic squid, however, fish consumption becomes more evident near the continental shelf break and along the Aleutian Islands (Okutani and Nemoto 1964). Diet composition of sperm whales in the Bering Sea is roughly 70% - 90% squids and 10% - 30% fish which include Atka mackerel, Pacific cod, pollock, salmon, lantern fishes, lancetfish, saffron cod, rockfishes, sablefish, sculpins, lumpsuckers, lamprey, skates, and rattails (Kawakami 1980; Rice 1986b; Tomilin 1967). Pollock do not appear to be a key prey species in any area but have been observed in whales taken in the northwestern Pacific (Kawakami 1980). The importance of Pacific cod and Atka mackerel to sperm whales is not known (Yang and Page 1999).

However, none of the alternatives would affect the overall BSAI pollock TAC. In addition, bycatch of other fin and sei whale prey (herring, capelin, arctic cod, saffron cod, Pacific cod, Atka mackerel, rockfishes, smelt and salmon) in the BSAI pollock fishery does not exceed 1% for each of these species (NMFS unpublished observer data)[12]. therefore, none of the alternatives is expected to result in significant prey competition with cetaceans relative to the no-action alternative. Given that the level of prey interaction established for management measures comparable those in effect for 1998 were deemed insignificant in the draft SEIS on the groundfish fisheries, the effects of the additional AFA-based measures that are expected to further disperse fishing effort are also deemed insignificant.

Indirect effects of spatial and temporal concentration of the fishery

As noted above, prey competition is not evident for any of the great whale species, therefore, temporal and spatial concentration of fish removals would have an insignificant effect. For humpback whales, where prey competition may be occurring and TAC does change, the extent of prey overlap may be low because these whales appear to be consuming mostly juvenile fish while the fishery is targeting adults. Therefore, any increase or decrease in concentrations of prey removed would not necessarily effect this species at a population level. The intensity of this effect is rated insignificant under all of the alternatives.

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Indirect effects from disturbance

The effects of disturbance caused by vessel traffic, fishing operations, or underwater noise associated with these activities on baleen whales (North Pacific right, blue, fin, sei, humpback, and bowhead whales) and toothed whales (sperm whales) in the GOA and BSAI are largely unknown. Most baleen whales appear to tolerate or habituate to fishing activity, at least as suggested by their reactions at the surface. Collisions with ships have been a major source of mortality of North Atlantic right whales (Kenney and Kraus 1993). Blue, fin, and sei whales react strongly by diving or moving away when vessels approach on a direct course or make fast erratic approaches (reviewed in Richardson et al. 1995). Humpback reactions to vessels are highly variable. Observed short-term effects have included avoidance and on rare occasions “charging” at the vessel while long-term effects included abandoning high-use areas (reviewed in (Richardson et al. 1995)). However, long-term negative effects were not apparent at the population level (Bauer et al. 1993). Bowheads often attempt to out-swim vessels, turning perpendicular away from the vessel track only when the ship is about to overtake it. Displacement can be as much as a few kilometers while fleeing (Richardson et al. 1995). When chased, sperm whales often change direction and travel long distances underwater (Lockyer 1977). However, sperm whales sometimes accompany vessels for extended periods of time when the vessels are operating nonaggressively (e.g., GOA sablefish longline fishery). Reaction to gear, such as pelagic trawls is unknown, although the rarity of incidental takes suggests either partitioning or avoidance. Given their distribution throughout the fishing grounds, at least some individuals may be expected to occasionally avoid contact with vessels or fishing gear, which would constitute a reaction to a disturbance. Assuming these instances occur, the effects are likely temporary.

Vessel noise and the routine use of various sonar devices are audible to whales and may be disturbance sources. When disturbed by vessels: right whales were consistently silent (Watkins 1986), fin whales continued to vocalize but low-frequency vessel noise often masked social calls (Edds 1988), and humpbacks tended to be silent when vessels were near (Watkins 1986). Wintering humpback whales have been observed reacting to sonar pulses by moving away (Maybaum 1990; Maybaum 1993). Bowheads stopped calling after bombs were detonated during the Native subsistence harvest. Calling behavior of sperm whales was little affected by boats (Gordon et al. 1992), however, sperm whales sometimes fell silent when they heard acoustic pingers pulsed at low levels, 6-13 kHz (Watkins and Schevill 1975). The criteria used to describe the disturbance effects of the alternative are qualitative. A rating of insignificant indicates the same level of disturbance, while “marginally” more disturbance results in a rating of conditionally significant negative, and “much” more results in a rating of significantly negative. Given that the level of disturbance established for management measures comparable those in effect for 1998 were deemed insignificant, the additional management measures contained in Alternatives 2 through 5 which could result in even less disturbance than that which is insignificant is also deemed insignificant to marine mammal populations.

Re-initiation of Consultation under Section 7 of the ESA is unnecessary

Effects were evaluated to determine if a need to reinitiate formal consultation, pursuant to Section 7 of the ESA would be necessary as a result of any of the alternatives. None of the alternatives are expected to negatively effect ESA listed cetaceans by an increase in incidental take. Critical habitat has not been designated for ESA listed cetaceans. In addition, no new information has become available since or alternative actions modified in a manner not previously considered by the NMFS (NMFS 2000a) Biological Opinion that would be expected to change the conclusion that no adverse effect to ESA listed cetaceans will result from any of the alternatives. Consequently, re-initiation of ESA Section 7 consultation is not necessary for ESA listed cetaceans.

4.3.4 Effects on other cetaceans (not listed under the ESA)

Ten species of whales and dolphins occur in Alaskan waters and are protected under the MMPA (but not listed under the ESA) including: the gray whale, minke whale, beluga whale, killer whale, Pacific white-sided dolphin, harbor porpoise, Dall's porpoise and beaked whales (Baird's, Cuvier's and Stejneger's). Each proposed alternative will be discussed in terms of four potential effects on these cetaceans: 1) direct (or incidental) take/entanglement in marine debris, 2) harvest of prey species, 3) temporal/spatial concentration of the fishery, and 4) disturbance. To date, direct interactions with groundfish fishery vessels have been documented between 1989 and 2000 for five of the ten species: minke whales, killer whales, Pacific white-sided dolphins, harbor porpoise, and Dall's porpoise. Several cases of entanglements in marine debris also have been reported for gray whales. Five of the ten species listed consume groundfish as part of their diet: minke whales, killer whales, Pacific white-sided dolphins, harbor porpoise, and Dall's porpoise. Discussions of effects will focus principally on these species.

The criteria for determining significance of effect in this and other cetacean species groups is presented in Table 4.3.2.

Direct effects from incidental take or entanglement

Direct mortalities of five species from entanglement in fishing gear have been observed and reported in the groundfish fishery since 1989. The criteria for determining significance of incidental take (Table 4.3.2) were applied to evaluate level of take for each alternative. A rating of insignificant is, therefore, a take rate that is below that which would have an effect on population trajectories. A rating of conditionally significant negative is a take rate that increases by 25% to 50% the average annual incidental take for the years 1996-2000. A rating of significantly negative is a take rate that increases by more than 50% the average annual incidental take for the years 1996-2000. Increasing take rate significance ratings in increments of 25% are coupled more with scientific uncertainty about knowledge of the actual take rate more than indicating progressively negative degrees of significance. Incidental takes attributed to the fisheries and entanglement in fishing gear and marine debris occur at low levels thought to be insignificant to marine mammal populations. The ideal level is undoubtably zero, however even a reduction to zero is considered to be insignificant to marine mammal populations. Therefore NMFS considers effect ratings of conditionally significant positive and significantly positive as not applicable to this analysis. Closures to fishing areas were also considered when evaluating this effect by comparing the portion of takes that occurred within proposed closed areas to total incidental take for the fishery from 1989-1999.

A single minke whale mortality was reported in the BS/GOA joint-venture trawl fishery (predecessor of the current fishery) in 1989. Ten years later, a single minke whale mortality was reported in the BS pollock trawl fishery operating in the eastern Bering Sea in autumn 1999. Minke whales are reported in this region year-round, most often in the summer (Platforms of Opportunity Program (POP) 1997). Killer whale mortalities are second only to Dall's porpoise in the groundfish fishery. The majority of takes reported between 1989 and 1999 occurred in the BS trawl fishery (8 deaths) followed by the BS longline (2 deaths) and GOA longline (1 death) fisheries. Two mortalities of Pacific white-sided dolphins have been reported in the EBS pollock groundfish fishery. One in the trawl fishery in the spring of 1992, the other in the longline fishery during the winter of 1995. These dolphins are present in Alaska waters year-round although sightings are reported with greater frequency during the summer (Platforms of Opportunity Program (POP) 1997). Four harbor porpoise mortalities were reported in the EBS trawl fishery between 1994 and 1997. Although harbor porpoise occur year-round in coastal and shelf waters of the AI, BS and GOA, mortalities occurred in all seasons except winter. The highest incidental take rate for any cetacean is that of Dall's porpoise. Most mortalities reported between 1989 and 2000 occurred in the BS trawl fishery (1 injury and 45 deaths) followed by the BS longline (3 deaths), GOA trawl (3 deaths), and BS jig (1 injury) fisheries. The extent of interactions between gray whales and the groundfish fishery are not known. Rope entanglement injuries and deaths as well as ship-strike injuries appear to be rare. Since 1997, five entanglements (mostly in pot gear) and one ship strike mortality have been reported in Alaska waters.

Minke whale mortalities may have been the result of prey competition (see Harvest of Prey Species below) because these whales appear to avoid vessels in northern waters (Palka and Hammond 2001), though this behavior has not been reported in Alaska waters. Under all of the alternatives, the take rate for the pollock fishery would not change greater than ±25%, therefore, the intensity is rated insignificant. Area closures to pollock and trawl fishing do not apply to the region where the mortality occurred in 1999. Population level effects are uncertain because abundance estimates are available for only a small part of this stocks range and "home ranges" have not been determined. However, takes have been reported infrequently (once every ten years), therefore, the effect of take on minke whales is insignificant.

Incidental take rates of all marine mammals relative to TAC for the BS fishery (pollock, Pacific cod, and Atka mackerel) (Table 4.3.4) do not change by more than -5%, therefore, the intensity of this effect is rated insignificant (take rate is similar (±25%)) under all of the alternatives. For killer whales, fishery interactions, at least with longline vessels, appear to be a function of attraction to the vessel in order to consume non-target species rather than direct prey competition. Population level effects are uncertain because it is unknown whether this behavior is pod specific, in which case one mortality per year could potentially diminish pod viability. For these reasons the effect on killer whales of Alternative 1, and all other alternatives considered, is unknown. The effect of take on Pacific white-sided dolphins is insignificant. Although population level effects are uncertain because abundance estimates are not available for the Bering Sea, takes have been reported only two times in the past 10 years. Because harbor porpoise in northern waters appear to avoid vessels (Palka and Hammond 2001; Taylor and Dawson 1984), mortalities may have been the result of prey competition (see Harvest of Prey Species below). However, current abundance estimates show even if prey competition is occurring, population level effects would be insignificant. Vessel attraction behavior rather than prey competition appears to be a factor in interactions between the fisheries and Dall's porpoise. Overestimates of abundance of this stock may be as high as fivefold because of vessel attraction behavior (Turnock and Quinn 1991). The effects of incidental take on Dall's porpoise would be insignificant at the population level given current estimates of abundance. The extent of interactions between gray whales and the groundfish fishery are not known, however, population level effects would be insignificant given the current increasing trend in abundance of eastern North Pacific gray whales and recovery of this stock from endangered status under the ESA.

Direct effects from prey removal

One or more of the target species (pollock, Atka mackerel and Pacific cod) of the GOA and BSAI groundfish fisheries have been identified as prey species of minke whales, killer whales, Pacific white-sided dolphins, harbor porpoise, and Dall's porpoise. Prey preferences of eastern North Pacific minke whales are not known but may be inferred from western North Pacific studies (Kasamatsu and Hata 1985; Tamura et al. 1998). Pelagic schooling fishes (in particular herring, walleye pollock, mackerel, anchovy, and saury) make up over 90% of the total prey weight ingested. Other important prey include sand lance, capelin, saffron cod, Arctic cod, crustaceans, and small quantities of squid. The stomach of a minke whale stranded in the Aleutian Islands contained walleye pollock ranging in size from 4.6 to 6.8 in. (11.8 to 17.5 cm), on the low end of the size range targeted by the fisheries: 5.8-19.5 in (15-50 cm).

Killer whales consume a wide variety of prey including fish, birds and other marine mammals (Jefferson et al. 1991). Walleye pollock has not been identified as prey of killer whales, however, the ranges of these species overlap in areas where both are abundant. Atka mackerel were consumed by killer whales caught in the coastal waters off Japan, but importance of the species to killer whales was unknown (Yang 1999). Where interactions with experimental longline groundfish fisheries have been observed, killer whales preyed upon sablefish, Greenland turbot, arrowtooth flounder and Pacific halibut while ignoring other species of fish available to them such as Pacific cod, grenadier, rockfish, walleye pollock, and shortspine thornyhead (Yano and Dahlheim 1995).

Pacific white-sided dolphin prey varies relative to sampling location. In pelagic populations in the north Pacific and off the coast of northern Japan, fish prey included lanternfish, deep-sea smelt, and *Argentina* sp., and squid (Walker and Jones 1993). In coastal regions, preferred prey include northern anchovy, Pacific hake, Pacific herring, capelin and squid, and to a lesser extent, pollock, rockfish, mackerel, smelt, saury, eulachon, and sanddab (Morton 2000; Walker et al. 1986).

Harbor porpoise prey studies have not been conducted in Alaska. However, prey studies in Washington and British Columbia found their diet included cephalopods and a wide variety of fish, including Pacific herring, smelt, eelpout, eulachon, pollock, Pacific sand lance, and gadids (Gearin et al. 1994; Walker et al. 1998). Most porpoise appeared to feed on juvenile, possibly even larval gadids (e.g., tomcod and hake) as estimated by the relative size of otoliths.

The diet of Dall's porpoise in Alaska waters is principally cephalopods and fish (including Pacific herring, salmon, capelin, deep-sea smelt, lanternfish, walleye pollock, Arctic cod, eelpout, Pacific sand lance, rockfish, sablefish, Atka mackerel, and flatfish). Commercially important fish species were present in only small amount in animals taken in the North Pacific Ocean (e.g., pollock only occurred in 8 of 272 stomachs examined) (Crawford 1981). Walleye pollock ranged in size from 1.6 to 5.8 in. (4-15 cm), on the low end of the size range targeted by the fisheries: 5.8-19.5 in (15-50 cm).

Assuming pollock are a key prey species of minke whales and harbor porpoise, no changes in pollock TAC are proposed under any of the alternatives so the intensity of the effect is rated insignificant. Pollock consumed by these species are usually smaller (larval and juvenile fish) than those targeted by the fishery.

Key prey species of Pacific white-sided dolphins and Dall's porpoise include cephalopods and small schooling fishes. Fishery interactions in the case of Dall's porpoise may be more a function of attraction to vessels rather than direct prey competition. Bycatch of these fish species do not exceed 1% of the total catch (NMFS unpublished observer data). The intensity of this effect is rated insignificant under all of the alternatives (same removals of one or more key prey species (±5%)).

Indirect effects from the temporal and spatial concentration of the fishery

As described in Section 4.1, the advent of fishery cooperatives is expected to result in greater temporal dispersion of the fishery relative to the no-action alternative. The extent of this effect is dependent on the percentage of the TAC that would be harvested by fishery cooperatives relative to the percentage of the TAC that would continue to be harvested under open access conditions. Under Alternative 2, between 50 and 100% of the TAC would be harvested by fishery cooperatives while under Alternatives 3 through 5, near 100% of the TAC would be harvested by fishery cooperatives. For those species where prey competition is not evident, increases or decreases in concentrations of fishery removals will have an insignificant effect. In addition, because direct prey competition is not considered significant for any of the other cetacean species, the effects increasing or decreasing concentration of harvest is also not considered significant.

Indirect effects from disturbance

The effects of disturbance caused by vessel traffic, fishing operations, or underwater noise associated with these activities on baleen (gray and minke whales) and toothed (beluga, killer whale, Pacific white-sided dolphin, harbor porpoise, Dall's porpoise and beaked whales) whales in the GOA and BSAI are largely unknown. Migrating gray whales sometimes exhale underwater, expose their blowholes only to inhale (termed "snorkeling"), and change course when disturbed by vessels (reviewed in(Richardson et al. 1995)). Conversely, gray whales will sometimes approach idling or slow moving vessels. Similarly, minke whales generally do not approach and sometimes avoid vessels that are underway (Palka and Hammond 2001), but may swim toward and under stationary or slow-moving vessels (Leatherwood et al. 1982; Tillman et al. 1986). Reactions by belugas to vessels largely depends on boat type and operation, and whale activity and experience. These whales abandoned summering areas only for short periods when disturbed (even when the disturbance was hunting boats) and at times would interact with vessels (reviewed in (Richardson et al. 1995)). Killer whales, Pacific white-sided dolphins, Dall's porpoise and beaked whales sometimes accompany vessels for extended periods of time. In some cases, vessel attraction was so intense that it comprised estimates of abundance for Pacific white-sided dolphins (Buckland et al. 1993) and Dall's porpoise (Turnock and Quinn 1991). Conversely, harbor porpoise tend to avoid vessels (Palka and Hammond 2001; Taylor and Dawson 1984). Reaction to gear, such as pelagic trawls is unknown, although the rarity of incidental takes suggests either partitioning or avoidance. Given their distribution throughout the fishing grounds, at least some individuals may be expected to occasionally avoid contact with vessels or fishing gear, which would constitute a reaction to a disturbance. Assuming these instances occur, the effects are likely temporary.

Vessel noise and the routine use of various sonar devices are audible to whales and may be disturbance sources. Calling behavior in gray whales changed to reduce masking by boat noise (Dahlheim 1987). Higher-frequency motor noise was found to mask minke whale sounds (reviewed in (Richardson et al. 1995)). High-frequency components of vessel noise were found to modify pod integrity, surfacing and diving behavior, and call types of belugas (Cosens and Dueck 1993), while propeller cavitation noise form icebreakers was predicted to mask beluga calls within 8-38 nm (14-71 km) of the ship (Erbe and Farmer 2000). Most shipping noise is below the hearing thresholds of the smaller odontocetes (sensitivity is usually above 10 kHz: (Dotinga and Oude Elferink 2000)), and for most cetaceans, repeated exposure to sound sources led to habituation (Richardson et al. 1995).

Bottom trawls on the eastern Bering Sea shelf operate during the summer when most of the eastern North Pacific stock of gray whales forages in that area. The question then arises, does the bottom trawling activity affect the availably of benthic prey, an important food source for gray whales? The criteria used to describe the disturbance effects of the alternative are qualitative. A rating of insignificant indicates the same level of disturbance, while "marginally" more disturbance results in a rating of conditionally significant negative, and "much" more results in a rating of significantly negative. Given that the level of disturbance established for management measures comparable those in effect for 1998 were deemed insignificant (NMFS 2000a), the additional management measures contained in Alternatives 2 through 5 which could result in even less disturbance than that which is insignificant is also deemed insignificant to marine mammal populations.

4.3.5 Effects on northern fur seals

As with other apex predators such as Steller sea lions, ecological interactions between northern fur seals and the groundfish fisheries are caused by spatial and temporal overlap between fur seal foraging areas and groundfish fisheries and from competition for target and bycatch species taken by the fisheries. The diet of northern fur seals includes a wide range of fish species, with less apparent dependence on Pacific cod and

Atka mackerel compared to Steller sea lions. However, both adult and juvenile pollock occur in the diet of northern fur seals and consumption rates vary according to the abundance of different age classes of pollock in the foraging environment (Sinclair et al. 1996; Swartzman and Haar 1983).

Direct effects from incidental take and entanglement

The incidental take of northern fur seals is uncommon in the groundfish fisheries. The last recorded mortality in any Alaskan groundfish fishery occurred in 1996, when the take rate was one animal per 1,862,573 mt of groundfish harvested. Observer records from 1990 to 1999 indicate that direct interactions with groundfish vessels occurred only in the BSAI trawl fishery, despite observer placement in pot, longline and trawl fisheries in both the BSAI and GOA. In the BSAI trawl fishery, the average annual take rate (1994 to 1998) was 1.4. This level of take contributes little to the northern fur seal potential biological take (PBR) of 18,244 (Ferrero et al. 2000) and is inconsequential to population trends.

Northern fur seal entanglement in marine debris is more common than any other species of marine mammal in Alaskan waters (Fowler 1987; Laist 1987; Laist 1997). Fowler (1997) concluded that mortality of northern fur seals from entanglement in marine debris contributed significantly to declining trends in the Pribilof Islands during mid to late 1970s and early 1980s. Laist (1997) suggested that modest signs of northern fur seal population recovery in recent years may be an indication that entanglement in net debris is among the factors impeding population recovery. As noted earlier in Section 4.1.1 Annex V of the MARPOL statute prohibits the discard of plastics, including net debris. The contribution of intentional discard of net debris from Alaskan groundfish fisheries vessels is thought to have declined over the past decade. However, consistent numbers of seals entangled in packing bands on St. Paul Island may reflect disposal of these materials in proximity to the islands. Recent data from satellite-tracked drifters deployed in the Bering Sea suggests a "trapped" circulation pattern around the Pribilof Islands (Stabeno et al. 1999) which may retain marine debris in the nearshore environment. An increase in the number of Antarctic fur seals (*Arctocephalus gazella*) entangled in polypropylene packing bands was observed at Bird Island, South Georgia, in the late 1980s as these materials came into common usage by at-sea processing vessels (Croxall et al. 1990).

Involuntary sources of marine debris, as in loss of gear, are diminishing as fishery cooperative systems develop (such as in the BSAI offshore pollock allocation). That is, as the pace of fisheries is slowed, there is less incentive to risk capital equipment.[13] Data do not yet exist to assess the rates at which various gear types are lost or discarded to result in risk to fur seals, especially in regard to fishery or nation of origin. In consideration of progress in stemming the loss and discard of net fragments and other plastic debris by domestic commercial fisheries, the extent to which the current FMP, or any alternatives to it, could change the rate of fur seal entanglement in marine debris is considered to be low. There seem to be few alternatives, given the likelihood that sources beyond the control of fisheries managers (i.e., foreign fisheries, international shipping, and shoreside refuse) constitute significant sources of discard. In view of these factors, the effects of incidental take and entanglement on northern fur seals is considered insignificant for all of the alternatives.

Direct effects from prey removal

Management actions under the current BSAI and GOA FMPs, specific to the protection of northern fur seals, have not been addressed directly. Trawl closures around the Pribilof Islands, established mainly for the protection of crab stocks, may offer positive benefits for fur seals by limiting prey removals in waters surrounding the Pribilof Island rookeries. However, only northern fur seals foraging close to the islands

[13] Jim Coe, "Personal Communication," AFSC, 7600 Sand Point Way NE, Seattle, WA 98115.

would benefit by the availability of an undisturbed prey field and recent tracking studies show that foraging trips of both adult female and juvenile male fur seals extend well beyond the trawl closure boundaries.

All of the alternatives result in the removal of northern fur seal forage. The size of the fish removed and whether the bycatch of squid, small schooling fish, pollock, and Pacific cod are a large fraction of their estimated biomass in the Bering Sea must be considered in determining if the harvest could have significant effects on the population. Catches of squid and small schooling fish (e.g., fish designated in the forage fish assemblage) in the groundfish fisheries of the BSAI and GOA are low, generally less than 1,000 mt per year. While precise biomass estimates for these groups do not exist, the exploitation rate on these groups in the groundfish fisheries is also thought to be very low. For instance, squid biomass in the Bering Sea may be as large as 4 million mt, based on marine mammal food habits, daily ration, and abundance data (Sobolevsky 1996). Similarly, with respect to small schooling fishes, consumption of capelin in the Gulf of Alaska by arrowtooth flounder alone may be as large as 300,000 mt per year (Livingston 1994a). Assuming that these crude projections of squid and capelin biomass at least approximate the order of magnitude of the true population levels, then the fisheries removals would amount to only a fraction of 1% of those populations.

Fisheries for pollock do not target fish younger than 3 years of age (Dorn et al. 1999; Fritz 1996; Ianelli and Gaichas 1999; Thompson and Dorn 1999; Thompson and Zenger 1994). The overall catch of pollock smaller than 30 cm is small, and thought to be only 1 to 4% of the number of one- and two-year olds each year in the eastern Bering Sea and GOA (Fritz 1996). However spatial and temporal patterns in the bycatch of juvenile pollock in the Bering Sea may influence the rate of removals in areas where northern fur seals forage. Exploitation rates of 2-3 year old pollock ranged between 11% and 21% from 1973 to 1979 during the period when the foreign fishery in the eastern Bering Sea operated northwest and west of the Pribilof Islands (Fritz 1996). Seasonally, the highest bycatch of small pollock occurs during early summer (May-July) when spawning aggregations have dispersed and pollock are generally less segregated by size (Fritz 1996). Data on the consumption rate of adult pollock by northern fur seals is inconclusive. Analysis of data from stomach collections (e.g., (Sinclair et al. 1994; Swartzman and Haar 1983)indicate that fur seals may consume adult pollock when it is available in the foraging environment , whereas studies based on scat analysis show a diet consisting of primarily of juvenile pollock (Antonelis et al. 1997; Sinclair et al. 1996). Carbon and nitrogen isotope analysis of fur seal tissues suggests that the diet of lactating females includes prey at trophic levels equivalent to 2 - 4 year-old walleye pollock and small Pacific herring during the fall (Kurle and Worthy 2000). Fatty acid analysis of milk samples from lactating fur seals consistently diving to depths greater than 328 ft (100 m) in outer continental shelf waters of the Bering Sea had fatty acid signatures most similar to fatty acid signatures of walleye pollock. 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 1989b) suggesting that the diet of deep diving fur seals in these areas includes adult pollock.

Therefore, while fisheries do harvest prey of northern fur seals (i.e., pollock and Pacific cod), competition due to the harvest rates of those species may vary depending on the size range consumed by fur seals. The overall catch of juvenile pollock has tended to be low in recent years and the degree to which adult pollock occur in the northern fur seal diet is not certain. While the potential overlap with fisheries may be moderated by these factors, effects on northern fur seals may yet exist, the relevance of which is not reflected by estimates of biomass removals over large geographical areas.

Ultimately this question address whether the alternative management regime result in fisheries harvests on prey species of particular importance to northern fur seals at levels that could compromise foraging success (harvest of prey species). This question is of greater relevance to management decisions that affect the overall harvest of pollock by the commercial fisheries as a whole such as the annual TAC-setting process and the development of Steller sea lion protection measures under Amendments 70/70. With respect to the alternatives for Amendments 61/61/13/8 to implement the provisions of the AFA, none of the alternatives would address or affect the annual TAC setting process or is expected to result in levels of pollock harvest that differ from the no-action alternative. Because this action will implemented concurrently with Steller sea lion protection measures proposed under Amendments 70/70, which do address the question of overall TAC levels for BSAI pollock, it is assumed that all of the alternatives would be implemented with pollock TAC levels that have been determined not to have a significant effect on the harvest of northern fur seal prey species. For this reason, the direct effects of all of the alternatives on harvest of prey species is considered to be insignificant according to the criteria set for significance (Table 4.3.1).

Indirect effects from the temporal and spatial concentration of the fishery

The competitive overlap between fisheries for Pacific cod and pollock and northern fur seals is influenced by several factors determining whether removals are concentrated in space or time. First, to the degree that the size of fish targeted by the fishery is greater than that generally eaten by fur seals, competition may vary depending on the availability of smaller prey in foraging areas.

Changes in harvesting activity and/or concentration of harvesting activity in space and time as a result of the alternatives may differentially impact fur seal foraging habitat at both the population and sub-population level. The draft SEIS prepared for Amendment 70/70 Steller sea lion protection measures (NMFS 2001d)) indicated that the spatial shift in the BSAI pollock fishery since 1998 that has resulted in greater catch harvested near the Pribilof islands rather than the SCA may represent potential increases in competition between the pollock fishery and Northern fur seals. The smaller size of the population in conjunction with a higher rate of decline in pup production on St. George Island in recent decades suggests that the impact of the pollock fishery in this area on the foraging habitat of St. George Island females should be considered. While spatial shifts in fishing effort since 1999 that are displayed in figures 4.1.2 through 4.1.7 are likely to have resulted more from Steller sea lion harvest restrictions in the SCA than AFA implementation, the combined effects of these two management measures are difficult to completely disentangle. Given the uncertainty in the degree to which fur seals compete with the fishery for adult pollock in fur seal foraging areas where spatial and temporal overlap has been identified, and the extent to which fishing under any of the alternatives will result in a particular spatial distribution of fishing effort, the effects of all of the alternatives on Northern fur seals is considered to be unknown.

Indirect effects resulting from disturbance

The potential for disturbance effects caused by vessel traffic, fishing gear, or noise appears limited for northern fur seals. Kajimura (in (Johnson and Herter 1989) reported no response by fur seals when approached by ship, and NMFS observers on board Japanese driftnet vessels regularly reported fur seals in close proximity to both the gear and fishing vessels (International North Pacific Fisheries Commission [INPFC] reports from the 1980s). Interactions with other types of fishing gear, such as trawl nets, also appear limited based on the rare incidence of takes in groundfish fisheries.

Disturbance effects on northern fur seal prey are difficult to identify. Fisheries in the Bering Sea do occur in areas used by foraging northern fur seals, and their prey are represented as both target species (e.g., pollock) and bycatch species. The same principle for assessing prey disturbance effects as developed for Steller sea lions is, therefore, applied here as well. If harvesting activity or concentration of that harvesting activity in space and time change relative to the no-action alternative, then the effects on northern fur seals, if any, may be altered. For example, the proportion of hours trawled in June-October catch in combined fur seal female foraging habitat increased from an average of 40% in 1995-1998 to 65% in 1999-2000 (NMFS 2001d). The proportion of hours trawled in Steller sea lion critical habitat decreased from an average 58% to 20% in the same period. Similar to the spatial distribution of pollock catch discussed above, the number of hours trawled in the area where lactating fur seals from St. George Island forage was consistently higher in 1995-2000 than the hours trawled in foraging areas used by St. Paul Island females. The Pribilof Island trawl closure provides some constraints on fishing activity in areas where northern fur seals forage, however as discussed above, habitat partitioning between breeding groups and the distance at which fur seals forage from the islands reduce the effectiveness of the trawl closure. The variability of potential disturbance effects among years and between breeding groups on each island suggests that the intensity of disturbance is not well known and that the disturbance effect under all of the alternatives is unknown.

4.3.6 Effects on harbor seals

Incidental takes of harbor seals by the groundfish fisheries operating the GOA and BSAI are uncommon. Harbor seal population estimates and trends are discussed in Section 3.3. Several harbor seal study sites have experienced dramatic population declines from the mid 1970s to the 1990s, however more recent population trends have shown a modest increase in numbers. Direct and indirect interactions between harbor seals and groundfish fisheries occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important harbor seal prey, and due to temporal and spatial overlap in harbor seal foraging and commercial fishing activities. Of the groundfish species targeted for harvest Atka mackerel, pollock, and flatfish in the BSAI and pollock and Pacific cod in the GOA are important prey species for harbor seals. Harbor seals exhibit a preference for nearshore habitat. These animals do not range far and feed at shallow depths on a variety of prey, including pollock, Pacific cod and Atka mackerel.

The alternatives are discussed below in terms of four potential effects: 1) direct effects (incidental take or entanglement in marine debris), 2) fisheries harvest of prey species, 3) temporal and spatial concentration of the fishery, and 4) disturbance effects. The criteria used for determining the significance of effects on harbor seals is outlined in Table 4.3.1.

Direct effects of incidental take and entanglement

In both the GOA and BSAI, groundfish fisheries takes of harbor seals are at levels approaching zero and are insignificant factors in population trends. Reported cases of harbor seal entanglement in marine debris are less prevalent than for northern fur seals or Steller sea lions (Laist 1987; Laist 1997). Given their inshore distribution and the high frequency with which they are observed, the low incidence of entanglement is unlikely to be a result of few opportunities to document such events. Thus, the effect of direct take and entanglement is considered insignificant for all of the alternatives.

Direct effects of prey removal

Pollock, Pacific cod and Atka mackerel are consumed by harbor seals in the GOA and BSAI area. The potential for competitive interaction from fisheries exists; however, competition would be largely dependent on the amount of fish removed and the temporal and spatial distribution of fishing effort. TAC levels are unchanged under all of the alternatives and it is presumed that existing management measures are adequate to maintain pollock stocks on a continuing basis. In addition, Steller sea lion protection measures currently under development under Amendments 70/70 are considering the implementation of a global control rule to further reduce TAC levels when pollock abundance is low. For this reason, it is presumed that fishing under all of the alternatives would have an insignificant effect on harbor seals from prey removal

Indirect effects of the temporal and spatial concentration of the fishery

Harbor seals exhibit a preference for nearshore habitat. These animals do not range far and feed at shallow depths on a variety of prey, including pollock, Pacific cod and Atka mackerel. Harbor seals would receive some protection from competitive interaction for prey resources under all of the alternatives to the extent that no transit/no trawl fishing areas exist within 3-20 nm of shore in areas of Steller sea lion haulout sites and rookeries that overlap with harbor seal locations. This is particularly so in the Aleutian Islands area where many of the no transit and trawl exclusion zones exist. Given the nearshore preference demonstrated by harbor seals and the largely offshore distribution of the pollock fishery under all of the scenarios (un-rationalized, partially rationalized, and fully rationalized) examined in Section 4.1, it is unlikely that any of the alternatives would produce a pollock fishery that overlaps significantly with harbor seal foraging. Therefore, all of the alternatives are considered insignificant to harbor seals with respect to the temporal and concentration of the fishery.

Indirect effects of disturbance

Effects from disturbance are difficult to identify. Effects could result from acoustic impact in the environment, both above and in the water; direct displacement of animals from a feeding area; or displacement of prey, reducing the foraging efficiency of the harbor seals. Some local individual impact could occur for any one of the described effects. However, population level impacts are largely unknown for this type of effect. To the extent that fishing occurs in nearshore habitat and overlaps with harbor seal foraging areas, some unquantifiable amount of disturbance could occur. The effect would likely be negligible unless vessels were highly concentrated for a long period of time in a given area. Little overlap between the BSAI pollock fishery and harbor seal foraging is expected under all of the alternative. Therefore, disturbance effects are considered insignificant for all alternatives.

4.3.7 Effects on other pinnipeds

The "other pinnipeds" group includes the ice seals (spotted, bearded, ringed, and ribbon seals), Pacific walrus, and northern elephant seal. Ecological interactions between these species and commercial groundfish fisheries are limited by both spatial separation and differences between commercial harvest targets and the species food habits. The alternative management measures would be expected to have little or no effect on those species where contact with commercial fisheries remained limited.

In particular, the ice seal distributions tend toward seasonally or permanently ice-covered waters of the Beaufort, Chukchi, Bering, and Okhotsk Seas, which are generally north of most areas commercially fished for groundfish. The annual distribution of the seals depends on the extent of the sea ice, which can vary widely from year to year (Burns 1981a; Burns 1981b). The sea ice in the Bering Sea typically extends to the continental shelf break, but in heavy ice years, the ice edge can extend as far south as the eastern Aleutian Islands, while in light ice years, the ice edge can be as far north as St. Lawrence Island (Burns 1981b). Occasionally, individuals of each species can be found south of the ice edge in the Bering Sea, but infrequent contacts with fisheries would not precipitate population level effects.

Of the ice seals, the spotted seals occur closest to groundfish fishing areas, inhabiting the front zone of the pack ice (the transition zone between the southern fringe of ice and the heavier southward-drifting pack ice; (Braham et al. 1984; Burns 1981a) during the winter and spring. Spotted seals move to coastal waters of the Bering and Chukchi seas in summer and fall (Braham et al. 1984; Lowry et al. 2000; Lowry et al. 1998), where their nearshore distribution would limit their contact with groundfish fisheries in much the same way it would for harbor seals. Spotted seals are less dependent than harbor seals on commercially targeted fish, as the pollock eaten by spotted seals in the Bering Sea are of smaller size than commercially targeted pollock (Frost and Lowry 1986). Ribbon seals also inhabit the front zone of the pack ice (Braham et al. 1984; Burns 1970). Ribbon seals feed on pollock, but the size classes targeted are smaller than commercially targeted pollock (Frost and Lowry 1980; Frost and Lowry 1986). Little is known of the distribution and food habits of ribbon seals during the open water season (July-November).

Bearded seals, ringed seals and walrus are found in pack ice in the winter and spring, north of the ice front (Braham et al. 1984). Bearded seals are found throughout the pack ice; they are benthic feeders, and although they have been known to eat pollock, it does not make up a large part of their diet, and thus there is little overlap with commercially targeted prey. Ringed seals are distributed in heavy pack ice (Braham et al. 1984) or shorefast ice (Burns 1970; McLaren 1985; Smith 1987; Smith and Stirling 1975), and thus would have no interaction with fisheries. In summer and fall, most bearded and ringed seals move north with the receding ice, away from Bering Sea commercial fishing grounds.

Effects on Pacific walrus would be small because of differences in their distribution (especially concerning areas used by large aggregations) and commercial fishing grounds. During the winter, walrus aggregate in heavy pack ice (Braham et al. 1984), where fishing vessels would not be present. Although Pacific walrus occur in the shelf waters of the Bering Sea in the summer, most of the population congregates at the southern edge of the Chukchi Sea pack ice during this time (Allen 1880; Fay et al. 1984; Smirnov 1929). With the exception of adult males which remain in the Bering Sea during the summer, most habitat utilized by the population is associated with the availability of haulout sites on ice (Brooks 1954; Burns 1965; Fay 1955; Fay 1982; Fay et al. 1984). Walrus remaining in the Bering Sea many use haulouts on Round Island, which is a State of Alaska preserve with a 12 nm (22.2 km) no fishing zone established around it. Others may remain near haulouts on islands in the Bering Strait, the Punuk Islands, or the beaches at Cape Seniavin, all of which are adjacent to shallow waters not used by federally-managed groundfish fisheries.

Northern elephant seals occur in the GOA and Aleutian Islands during the spring and fall (LeBoeuf et al. 2000; Stewart and DeLong 1994). Males migrate to foraging areas near the continental shelf break, where they spend 26-89 days feeding (LeBoeuf et al. 2000; Stewart and DeLong 1994); during this time they dive to a mean depth of 1024 ft (312 m). Seldom seen, they appear to have little or no contact with commercial fisheries. Based on their more southerly distribution and the positive trend in their population status, we assume that the effects of Alternative 1 or any of the other alternatives on them would be insignificant.

The alternatives are discussed below in terms of four potential effects: 1) direct effects (incidental take or entanglement in marine debris), 2) fisheries harvest of prey species, 3) temporal and spatial concentration of the fishery, and 4) disturbance effects. The criteria used for determining the significance of effects on other pinnipeds is outlined in Table 4.3.1.

Direct effects from incidental take and entanglement

The incidental take rates in commercial fisheries for ice seals, walrus and northern elephant seals are very low. NMFS observers on board BSAI groundfish trawl, longline, and pot fishing vessels from 1990 to 1999 and logbook data from Bristol Bay salmon drift gillnet fishery from 1990 to 1993 reported nine spotted seals, ten bearded seals, two ringed seals, and three ribbon seals taken, resulting in estimated takes of 2.5, 0.6, 0 and 0.2 seals per year, respectively (Angliss et al. 2001). These rates constitute levels approaching zero according to NMFS standards (Angliss et al. 2001). Of the approximately 17 Pacific walrus that were caught each year in groundfish trawl fisheries in the eastern Bering Sea between 1990 and 1997, over 80% were already decomposed and not likely to have actually been killed as a result of fisheries interactions (Gorbics et al. 1998). At a rate of 17 walrus per year, the take rate qualifies as an insignificant level, approaching zero by

NMFS standards. NMFS observers on board BSAI and GOA groundfish trawl, longline, and pot fishing vessels from 1990 to 1999 reported six northern elephant seals were incidentally taken in the trawl and longline fishery. This take rate constitutes a level approaching zero by NMFS standards (Forney et al. 2000). Entanglement in marine debris is likewise rare for these species and is considered to have insignificant effects.

Of the federally-managed fisheries in Alaska, only the eastern Bering Sea and Aleutian Islands pollock fishery would be likely to have an impact on ice seals and walrus, because of their northern distribution in the Bering Sea. Calculated estimates of incidental takes for all marine mammals (Table 4.3.4) indicate that in the eastern Bering Sea and Aleutian Islands pollock trawl fishery, 18 marine mammals other than Steller sea lions would be taken under all of the alternatives. Given that only a few of these 18, if any, would be ice seals or walrus, this rate of incidental take constitutes a level approaching zero. Because of their distribution in Alaska in the Gulf of Alaska and south of the Aleutian Islands (LeBoeuf et al. 2000; Stewart and DeLong 1994), northern elephant seals would be likely to be affected only by the Aleutian Islands component of the BSAI pollock fishery. Calculated estimates of incidental takes for all marine mammals (Table 4.3.4) indicate that in the Aleutian Islands fishery, one marine mammals other than Steller sea lions would be taken under all of the alternatives. This incidental take rate constitutes a level approaching zero for northern elephant seals.

Overall, direct effects on the other pinnipeds stemming from incidental take or entanglement in marine debris are considered insignificant for all of the alternatives.

Direct effects from prey removal

With the exception of spotted seals and ribbon seals, the food habits of the ice seals do not overlap with commercial fisheries targets. Bearded seals consume primarily benthic prey including crabs and clams as well as shrimps and Arctic cod (Kosygin 1966; Kosygin 1971; Lowry et al. 1980a; Lowry et al. 1981a; Lowry et al. 1981b). Ringed seals eat Arctic cod, saffron cod, smelt, herring, shrimps, amphipods and euphausiids (Fedoseev 1965; Johnson et al. 1966; Lowry et al. 1980b; McLaren 1985). Ribbon seals eat crustaceans, cephalopods, and fish, including pollock, Arctic cod, saffron cod, capelin, eelpout, sculpins, and flatfish (Arsen'ev 1941; Burns 1981b; Frost and Lowry 1980; Shustov 1965b). Spotted seals include pollock in their diet when feeding in the central and southeast Bering Sea (Bukhtiyarov et al. 1984; Sobolevsky 1996). Spotted seal diet is not very dependent on commercially harvested fish species, as the pollock they target are smaller (mean length 4.2 in [10.9 cm] in the Bering Sea and 6.2 in [15.9 cm] in the Okhotsk Sea; (Frost and Lowry 1980) than commercially targeted pollock (greater than 11.7 in [30 cm] in length; (Wespestad and Dawson 1992). Likewise, ribbon seals target smaller fish (1-year-old fish, mean length 4.4 in [11.2 cm]) than commercially targeted pollock (Frost and Lowry 1980; Frost and Lowry 1986). Thus, the effects on ice seals are insignificant under all of the alternatives.

The diet of Pacific walrus is composed almost exclusively of benthic invertebrates (97%), particularly bivalve molluscs. Fish ingestion has been considered incidental to their normal feeding behavior (Fay and Stoker 1982b). Groundfish removals would not have a meaningful effect on walrus populations. The diet of northern elephant seals in the GOA is unknown; however, the species is known to be a deep diver in Alaskan waters (LeBoeuf et al. 2000; Stewart and DeLong 1994). This behavior suggests that their foraging may be partitioned by depth from most groundfish fishing activities. Based on the lack of overlap between fisheries and the foraging behavior of ice seals, walrus and northern elephant seals, the effects are considered insignificant under all of the alternatives, with respect to the harvest of prey species.

Indirect effects from the temporal and spatial concentration of the fishery

In general, there is little spatial, temporal, or dietary overlap of ice seals, northern elephant seals, and walruses with groundfish fisheries. The criteria used for determining the significance of an alternative's effect on pinniped populations requires marginally less temporal and spatial concentration of the fisheries as a benchmark for reaching a conclusion of insignificance (Table 4.3.1). These benchmarks are intended to serve as basis for further discussion with respect to the intensity of impacts on pinniped populations. While this criteria for reduced temporal and spatial concentration of the fisheries has not been met for Alternative 1, given the lack of overlap with regard to species consumed versus fishery targets, there would be no spatial or temporal effects. The effects on other pinniped populations are considered insignificant under Alternative 1, with respect to the temporal and spatial concentration of the fisheries. Likewise decreased temporal and spatial concentration of the BSAI pollock fishery that is projected under Alternatives 2 through 5 would also result in insignificant effects on other pinnipeds.

Indirect effects of disturbance

Given the general lack of spatial, temporal, or dietary overlap with groundfish fisheries, disturbance effects caused by vessel traffic, noise, or fishing gear are likely to be small under all of the alternatives. Individual animals in the pinniped group venturing into fishing areas could temporarily modify their behavior; however, those cases would not constitute population level effects. None of the alternatives would cause disturbance effects that would affect ice seals, walruses or northern elephant seals at a population level. The disturbance effects on other pinniped populations would be similar under and are considered insignificant under all of the alternatives.

4.3.8 Effects on sea otters

The USFWS estimates the total sea otter population size in Alaska at 70,500 (USFWS, unpublished)[14]. Currently, only the sea otter stock in California is listed as threatened under the ESA; the population in Alaska is neither listed as threatened or endangered under the ESA nor as depleted under the Marine Mammal Protection Agency. However, the Alaskan population has been experiencing severe declines in the central portion of its range in recent years (Estes et al. 1998). As a result, the USFWS is conducting a formal review to determine whether or not the Alaskan population should be considered for listing pursuant to the ESA. Estes et al. (1998) suggested that increased predation by killer whales is the likely cause of these declines. Further, the authors speculate that the increased predation may have resulted from declines in the populations of other killer whale prey, namely Steller sea lions and harbor seals. If this hypothesis is correct, then any impact the groundfish fisheries may have on Steller sea lion recovery could also be considered a factor in the sea otter declines, in so far as they may have contributed to a shift in predator-prey relationships. Having said that, no data currently exist to test the validity of this hypothesis and for the purposes of this analysis, only the proximal effects of fisheries on sea otters can be evaluated.

The alternatives are discussed below in terms of four potential effects: 1) direct effects (incidental take or entanglement in marine debris), 2) fisheries harvest of prey species, 3) temporal and spatial concentration of the fishery, and 4) disturbance effects. The criteria used for determining the significance of effects on sea otters is outlined in Table 4.3.1.

[14] R. Meehan, "Personal Communication," 1011 E. Tudor Road, Anchorage, AK 99503.

Direct effects from incidental take and entanglement

Sea otter interactions with fishing gear, either passive or active are infrequent. Sea otter entanglement in marine debris is rare (Laist 1997). Likewise, incidental takes in fishing gear occur at a rate too low to cause population level effects. While the PBRs for the three sea otter stocks in Alaska were 871 (southeast), 2,095 (southcentral) and 5,699 (southwest), mortalities incidental to commercial fishing were 0, less than 1, and less than 2 per year, respectively.

A recent summary by population stock related to groundfish interactions was provided by the USFWS. For the southeast stock, no mortality was reported from 1990-1993. Self-reported fishers were incomplete for 1994 and not available for succeeding years. In south-central Alaska, Self-reported fishers show one kill and four injuries in 1990 due to gear interactions and three injuries due to deterrence in Prince William Sound, Copper River, and Bering River drift-gillnet fishery. No mortalities were reported from 1991 to 1993 and 1996. There are no current estimates for 1997 to the present. In southwest Alaska, the NOAA observer program reported eight kills in the Aleutian Islands black cod pot fishery in 1992. No other sea otter kills were reported by NOAA observers in the region from 1990 to 1996. One kill from gear interactions was self-reported in the Alaska-Kodiak salmon gillnet fishery in 1991. Otherwise, no kills were reported from 1990 to 1993 and 1996. In the 2000 "List of Fisheries" sea otters were added to the Bering Sea and Aleutian Islands groundfish trawl as a "species recorded as taken in this fishery." The USFWS is currently pursuing information regarding the extent of that possible interaction.

The total fishery mortality and serious injury for the Alaska sea otter is considered to be insignificant (i.e., less than 10% of the calculated PBR). Therefore, the effects from incidental take and entanglement is considered insignificant for all of the alternatives.

Direct effects from prey removal

The effects of the alternatives on sea otters are limited by differences between their prey and the fisheries harvest targets. Sea otters consume a wide variety of prey species, including annelid worms, crabs, shrimp, mollusks (e.g., chitons, limpets, snails, clams, mussels, and octopus), sea urchins, and tunicates. Occasionally, groundfish (e.g., sablefish, rock greenling, and Atka mackerel) may also be consumed but invertebrates are considered the predominant elements of their diet. Given the minor importance of groundfish and absence of pollock in their diet, fisheries removals are not expected to have significant effects under any of the proposed alternatives. Furthermore, given the lack of overlap between fisheries and the foraging behavior of sea otters, the effects from harvest of prey species is considered insignificant for all of the alternatives.

Indirect effects from temporal and spatial concentration of the fishery

There is little basis for suggesting competition for forage between sea otters and commercial fisheries occurs, despite the species broad geographical distribution in the Gulf of Alaska and the Aleutian Islands. Sea otters inhabit waters of the open coast, as well as bays and the inside passages of southeastern Alaska. Because their primary prey items are found on the bottom in the littoral zone, to depths of 164 feet (50 m), the majority of otters feed within 0.6 miles (1 km) of the shore (Kenyon 1981). In areas, where shallow waters extend far offshore (e.g., Unimak Island), sea otters have been reported as far as 10 miles (16 km) offshore. They are often seen resting and diving for food in and near kelp beds (Kenyon 1969). Because of this habitat preference for shallow areas, they do not overlap spatially with groundfish fisheries. Given the lack of overlap between fisheries and the foraging behavior of sea otters, the effects are considered insignificant with respect to the temporal and spatial concentration of the fisheries for all of the alternatives.

Indirect effects from disturbance

There are several sources of potential Level B harassment of sea otters in the coastal waters of Alaska. These include: small boat traffic (boat strikes), float plane landings and take offs, and mariculture sites. Other potential sources of disturbance include changes in forage behavior to include feeding on fish offal and foraging in harbor areas which have heavy contamination. USFWS has no data at present to suggest that any one of these factors alone are impacting sea otters at the population level.

As noted for many of the other marine mammals, the effects of disturbance caused by vessel traffic, fishing operations, or sound production on sea otters in the GOA and BSAI are expected to be not significant. Sea otters exhibit considerable tolerance for vessel traffic and in some cases are attracted to small boats passing by (Richardson et al. 1995). Sea otters may be more tolerant of underwater sound relative to other species, owing to the greater amount of time they spend at the surface. Overall, given these attributes, as well as the spatial partitioning of sea otters and groundfish fishing operations, disturbance effects are considered to be minimal and insignificant under all of the alternatives.

4.3.9 Effects on the pollock resource

The projected harvest of pollock from the BSAI does not vary under any of the alternatives. None of the alternatives would affect the process under which TACs are established and it is assumed that the entire TAC would be harvested under each of the alternatives as has been the case since the emergence of the domestic pollock fishery. The general impacts of fishing mortality under the ABC/OFL definitions established by Amendments 51/51 are discussed in Section 2.7.4 of the Draft Programmatic SEIS (NMFS 2001a), and apply to walleye pollock in the Aleutian Islands, the Bering Sea, and the Gulf of Alaska. Pollock in the Bering Sea fall within Tier 1a of the ABC/OFL definitions; and in the Aleutian Islands, within Tier 5.

Alternative 1 (no-action). Historically, large fractions of the total removals of BSAI pollock occurred in a relatively short period of time in a fairly concentrated area. Under Alternative 1 this historic pattern would be expected to continue. However, the imposition of Steller sea lion protection measures since 1999 served to disperse fishing effort over time and space. At one extreme, a return to the pre-AFA race for fish under Alternative 1 could be predicted to result in a re-concentration of fishing in time and space and increased potential for localized depletions of pollock stocks. However, the continued imposition of Steller sea lion management measures designed to disperse the fishery over time and space would likely mitigate that tendency. The level of habitat disturbance and the temporal/spatial concentration of the catch under Alternative 1 does not appear to affect the sustainability of the stock either through changes in the genetic structure of the population or changes in reproductive success, as measured by the ability of the stock to maintain itself above its MSST. However, it should be recognized that genetic structure of pollock is not well understood. MSST and genetic structure is unknown, therefore no information is available to evaluate whether distribution of the catch changes the genetic structure of the population such that it jeopardizes or enhances the ability of the stock to sustain itself at or above the MSST. This alternative, if unmitigated by continued implementation of Steller sea lion management measures designed to disperse the fishery could result in depletion of relatively distinct spawning populations not presently recognized under the current management system, particularly those close to major ports.

The trophic interactions of pollock are described in Section 3.3 The current levels and distribution of harvest do not appear to impact prey availability such that it affects the sustainability of the stock as measured by the ability of the stock to maintain itself above its MSST.

Given that continued pollock fishing under the existing TAC-setting framework as described in the Draft Programmatic Groundfish SEIS (NMFS 2001a) is not expected to jeopardize the capacity of the pollock stock to produce MSY on a continuing basis, is not expected to lead to genetic change in the structure of the population, is not expected to change prey availability, and is not expected to affect pollock habitat, the effects of Alternative 1 on pollock stocks are considered to be insignificant.

Alternatives 2 through 5. By slowing the pace of fishing through the implementation of AFA fishery cooperatives, Alternatives 2 through 5 could be expected to reduce the potential for localized depletions of BSAI pollock stocks relative to Alternative 1. However predicting the effects of fishing effort on pollock stocks is difficult because pollock distributions are not static. Bottom trawl and acoustic surveys demonstrate that pollock distributions vary considerably interannually. The distribution of pollock biomass within the EBS and GOA is dependent on the composition of the stock and environmental conditions. In the EBS, younger pollock tend to be concentrated in the Northwestern shelf while mature pollock are more common in the southeastern Bering Sea shelf, especially during spawning (Lynde et al. 1986; Shuck 2000).

To the extent that fishing under AFA cooperatives slows the pace of the BSAI pollock fishery and distributes fishing effort over a wider area, the likelihood that the fishery could result in depletion of relatively distinct spawning populations not presently recognized under the current management system could be reduced. However as noted above, MSST and genetic structure is unknown, therefore no information is available to evaluate whether distribution of the catch changes the genetic structure of the population such that it jeopardizes or enhances the ability of the stock to sustain itself at or above the MSST. The level of habitat disturbance and the temporal/spatial concentration of the catch under Alternatives 2 though 5 do not appear to affect the sustainability of the stock either through changes in the genetic structure of the population or changes in reproductive success, as measured by the ability of the stock to maintain itself above its MSST.

Any measure of Alternatives 2-5 that results in the movement of fishing effort to the north and west of fishing patterns that existed under the no action alternative could possibly change the size and age distribution of the pollock catch. For example, increasing the pollock catch outside the SCA (denoted in figures 4.1.2 through 4.1.7 as a blue line) would tend to increase catches of small, young pollock (<40 cm in length). Growth of pollock is slower to the north and west along the outer shelf of the eastern Bering Sea (Wespestad et al. 1997). Therefore, while more smaller pollock may be caught as a result of implementing the AFA's co-op strategy (in addition to Steller sea lion protective measures), many of those fish caught would be of the same year class as those caught southeast in the SCA. More younger fish are also removed by the fishery in northwest areas, although amounts of juvenile catch are quite low. It is not expected that this effect would significantly affect either the year-class size of pre-recruit pollock or the availability of pollock to sea lions. Further, the result of forming co-ops has, in the recent past, shown that fishermen spend more search time looking for optimal-sized pollock, which may mitigate any potential for increased catch of juvenile pollock.

Derby fishing conditions under Alternative 1 would result in increased daily catch rates of pollock and are likely to result in increased catch of unmarketable pollock. Pollock bycatch ranged from 11% of total pollock catch in 1992 to 1.5% in 1998. Because Alternatives 1 and 2 would not fully remove all derby conditions, these alternatives are likely to have the highest negative direct impacts on pollock. In contrast, Alternatives 3, 4, and 5 rationalize the fishery and remove many aspects of the derby fishery. Under these alternatives, fishermen are likely to increase search time in order to increase recovery rates and maximize efficiency of each pollock fishing trip. Vessels could more successfully avoid small fish because the fishery occurs over longer periods (relative to an open access fishery) and decreased daily harvest rates (NMFS 1999b). Decreased mortality on pollock as a result of increased retention could result in positive impacts to pollock from Alternatives 3-5.

Given that continued pollock fishing under the existing TAC-setting framework as described in the Draft Programmatic Groundfish SEIS (NMFS 2001a) is not expected to jeopardize the capacity of the pollock stock to produce MSY on a continuing basis, is not expected to lead to genetic change in the structure of the population, is not expected to change prey availability, and is not expected to affect pollock habitat, the effects of Alternative 2 through 5 on pollock stocks are considered to be insignificant.

4.3.10 Effects of the alternatives on non-pollock groundfish species

AFA catcher vessels and catcher/processors encounter incidental catch of other groundfish species when engaged in directed fishing for pollock. Many AFA catcher vessels and catcher/processors also participate in other groundfish fisheries in the BSAI and GOA when not engaged in directed fishing for pollock. The effects of groundfish fishing on groundfish species is analyzed extensively in the programmatic SEIS on the groundfish fisheries off Alaska which concludes that groundfish fishing under the current TAC-setting process and management regime is not expected to jeopardize the capacity of the groundfish stocks to produce MSY on a continuing basis, is not expected to lead to genetic change in the structure of groundfish populations, and is not expected to significantly affect groundfish habitat (NMFS 2001a). None of the alternatives to implement the AFA would modify the existing management regime or TAC-setting process for non-pollock groundfish species in the BSAI or GOA. However, because participants in the BSAI directed pollock fishery encounter bycatch of other groundfish species and also participate in other directed fisheries for groundfish in the BSAI and GOA, the alternatives have the potential to affect non-pollock groundfish stocks. The section provides a discussion of the direct and indirect effects on other groundfish species resulting from implementation of the AFA alternatives.

Direct effects to other groundfish species from pollock fishing.

The pollock fishery is recognized as one of the cleanest trawl fisheries in the world with respect to bycatch of non-target species. This is largely due to the behavior of pollock which swim in enormous, dense, schools and generally congregate off the ocean floor where they may be harvested with little incidental catch of other species. Incidental catch of other groundfish in the BSAI directed pollock fishery for each of the three sectors is displayed in Table 4.3.6. Pacific cod is the most prevalent non-pollock groundfish harvested as incidental catch in each of the three sectors. The percentage of non-pollock groundfish harvested in each of the three industry sectors has remained relatively static over the past three years ranging from a low of 0.6% by the inshore sector in 1999 to a high of 1.6% by the catcher/processor sector in 2000.

Table 4.3.6 Incidental catch of non-pollock groundfish in the BSAI directed pollock fishery by industry sector, 1999 - through September 1, 2001.

SPECIES	*Mothership sector*			*Catcher/processor sector*			*Inshore sector*		
	1999	*2000*	*2001*	*1999*	*2000*	*2001*	*1999*	*2000*	*2001*
Alaska plaice	0	0	0	2	15	4	1	1	0
Arrowtooth flounder	23	12	11	167	320	87	33	511	107
Atka mackerel	0	0	3	0	2	0	0	0	39
Eels	0	0	0	1	8	5	0	1	1
Flathead sole	203	151	93	1,031	875	717	368	924	350
Greenland turbot	1	2	0	23	27	14	0	5	3
Grenadier			0	61	30	10	0	0	0
Jellyfish		665	174		1,943	1,052			
Misc. flatfish				0	0	0	484	290	1
Misc. groundfish	3	1	0	3	13	2	169	183	245
Northern rockfish			12	1	23	27	0	0	0
Octopus	0	0		0	0	0			
Pacific cod	284	139	235	1,302	1,014	1,205	1,132	1,677	1,121
Pacific ocean perch	0	0	22	30	7	212	39	0	145
Rex sole	1	0	2	12	5	8	18	4	22
Rock sole	70	103	104	405	724	555	105	348	517
Sablefish			0	0	1	2	5	0	8
Sculpin		7	10	29	104	86			
Sharks	11	13	12	49	52	84	0	2	4
Shortraker rockfish				13	9	3	0	0	0
Skates	59	53	45	176	272	201			
Smelt	0	0	0	8	24	41		0	0
Squid	0	0	0	202	215	150	171	9	398
Starry flounder		1	0	0	9	0	0	1	2
Thornyhead rockfish				1	8	5	0		0
Yellowfin sole	28	48	4	73	379	75	29	263	58
Directed pollock harvest	83,703	92,003	100,83	326,17	367,78	381,10	424,24	484,16	431,40
Grand Total	84,388	93,200	101,56	329,76	373,86	385,64	426,80	488,38	434,42
Non-pollock Total	685	1,197	730	3,590	6,081	4,545	2,555	4,219	3,021
Non-pollock percent	0.81%	1.28%	0.72%	1.09%	1.63%	1.18%	0.60%	0.86%	0.70%

Direct effects from AFA vessel participation in other groundfish fisheries.

The sideboard restrictions contained in all of the AFA-based alternatives are designed to limit the participation by AFA vessels in other groundfish fisheries to the level that the AFA pollock fleets harvested historically from 1995 though 1997. In addition, none of the alternatives would affect the underlying management regime in place for other groundfish fisheries in the BSAI and GOA such as the TAC setting process, authorized fishing gear, time and area closures, and fishing seasons. Theoretically then, the effects of the AFA on other groundfish fisheries would be neutral in that the AFA-based alternatives would simply maintain existing catch levels and harvesting practices by AFA vessels. However, the manner in which the sideboard restrictions are calculated and managed could potentially affect harvest patterns in those fisheries.

Catcher vessel sideboard fishing under Alternative 2. Under Alternative 2, groundfish sideboard limits for catcher/processors and catcher vessels would be a percentage of the current year's TAC for a groundfish species that is equal to the 1995-1997 total catch of each groundfish species or species group by the AFA fleet in question (20+9 AFA catcher/processors or AFA catcher vessels) divided by the 1995-1997 available TAC for that species. Alternative 2 and Alternative 4 both use total catch as the numerator in the sideboard calculation formula which means the respective AFA fleets receive sideboard "credit" for both retained catch and discards that were made from 1995-1997. By contrast, Alternatives 3 and 5 use retained catch as the numerator meaning that the respective AFA fleets only receive sideboard credit for retained catch from 1995-1997 and sideboard amounts are somewhat lower.

In addition, sideboard management under Alternative 2 would be conducted by NMFS through directed fishing closures. Finally, under Alternative 2, cooperatives would have no specific role in the management of groundfish sideboards. This lack of involvement by cooperatives may have the most significant effects on the conduct of groundfish sideboard fisheries, especially with respect to catcher vessel sideboards. During the development of Amendments 61/61/13/8, both AFA and non-AFA catcher vessel owners expressed concern that the rationalization of the BSAI pollock fishery could lead to an intensification of the race for fish in other groundfish fisheries if a race for sideboard fishing developed within the AFA fleet. This could occur because under AFA cooperatives, numerous AFA catcher vessels would no longer needed to participate in the BSAI pollock fishery and would be free to expand their effort into other groundfish fisheries. Absent some mechanism to allocate sideboard amounts among individual cooperatives and vessels, an intense race for sideboard fishing could ensue as each AFA vessel raced to capture its share of the sideboard. To prevent intensifying the race for fish in other groundfish fisheries, the Council voted to require that individual cooperatives develop mechanisms to prevent their member vessels from exceeding their historic levels of participation in each sideboard fishery, as is reflected in Alternatives 3 and 5. Alternative 4 would take this requirement a step further by explicitly diving each sideboard amount among all of the cooperatives.

Because Alternative 2 lacks any mechanism to hold individual cooperatives (and by extension, individual vessels) responsible for managing their sideboard fishing, it could result in an intensified race for fish in the major catcher vessel sideboard fisheries (BSAI Pacific cod, GOA pollock and Pacific cod). This could occur because a significant number of catcher vessels that would normally have been fishing for pollock during January and February of each year under Alternative 1 will be freed up to participate in other fisheries as a result of the development of fishery cooperatives. In addition, the lack of any mechanism to regulate sideboard fishing by individual vessels means that a race to capture the sideboard quota before NMFS closes each sideboard fishery to directed fishing is likely to occur. The environmental effects of such a race for sideboard quotas is difficult to predict. However, an intensified race for fish in sideboard fisheries could result in increased bycatch and less selective fishing practices if both AFA and non-AFA fishermen are forced to race for fish at a higher pace than would have occurred under either the no-action alternative or Alternatives 3-5.

Catcher vessel sideboard fishing under Alternatives 3 through 5. Recognizing that an unrestrained race for sideboard quotas could exacerbate the race for fish in certain sideboard fisheries, the Council adopted a proposal to require that each individual catcher vessel cooperative limit through contractual arrangements the sideboard fishing of its member vessels to the amount that the member vessels contributed to the overall sideboard limit. NMFS would provide the individual cooperatives a breakdown of the percentage of each sideboard quota that was attributable to the vessels in each cooperative and each cooperative contract would be required to contain provisions to limit the member vessels accordingly with the provision that member vessels and cooperatives could exceed their individual limits only if an inter-cooperative agreement was in place to facilitate exchanges between cooperatives. This proposal is reflected in Alternatives 3 and 5. Alternative 4 differs from Alternatives 3 and 5 in that each cooperative would be issued an individual sideboard limit for each sideboard fishery and would be prohibited from exceeding any of its sideboard amounts. Under Alternative 4, NMFS would have the burden of managing and enforcing the individual sideboard limits issued to each cooperative. In contrast, under Alternatives 3 and 5, the burden of enforcing and managing individual sideboard limits would fall to the cooperatives and to an inter-cooperative agreement. While the approach to managing sideboard fishing may differ between Alternatives 3, 4, and 5, the effect is expected to be the same. Namely, the management of sideboard fishing at an individual cooperative (and by extension, individual vessel) level, eliminating the potential for an increased race for fish in major sideboard fisheries.

AFA catcher vessels have been operating under groundfish sideboards since 2000. The emergency interim regulations in effect in 2000 most closely resemble Alternative 3. An inter-cooperative agreement was established which contained a mechanism for individual cooperatives to transfer sideboard amounts among the nine cooperatives. The results of the 2000 fishery are reported in detail in the 2000 Catcher Vessel Intercooperative Report to the North Pacific Fishery Management Council (United Catcher Boats, 2001). A summary of the groundfish sideboard fishing activity in the BSAI and GOA is displayed in Tables 4.3.7 and 4.3.8

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Catcher/processor sideboard fishing. Beginning in 1999, the cooperative of catcher/processor vessels was monitored closely for sideboard species. Co-op managers successfully prevented overharvests of sideboard species for vessels in the co-op for all species except Bering Sea Pacific ocean perch (98 mt overharvest), other red rockfish in the Bering Sea (14 mt overharvest), squid (203 mt overharvest), and herring (171 mt overharvest). Table 4.3.9 displays aggregate catch of sideboard species by AFA catcher/processors in 1999 and 2000 (Pollock Conservation Cooperative and High Seas Catcher's Cooperative (PCC/HSCC) 2000).

Table 4.3.9 Aggregate catch of groundfish sideboard species and PSC by listed AFA catcher/processors, 1999-2000.

Species	*1999*			*2000*		
	Catch	*Sideboard limit*	*Over (Under) sideboard*	*Catch*	*Sideboard limit*	*Over (Under) sideboard*
Pacific Cod	6,561	10,119	(3,558)	3,602	11,034	(7,432
Sablefish - BS	0	3	(3)	1	3	(2)
Atka Mackerel - Eastern	23	0	NA	0	0	0
Atka Mackerel - Central	567	2,383	(1,816)	3	1,314	(1,311)
Atka Mackerel - Western	12	4,995	(4,983)	0	2,747	(2,747)
Yellowfin sole	11,713	41,190	(29,477)	8,589	24,412	(15,823)
Rock sole	995	7,446	(6,451)	2,943	8,362	(5,419)
Greenland Turbot - BS	24	51	(27)	35	58	(23)
Greenland Turbot - AI	3	13	(10)	0	14	(14)
Arrowtooth flounder	209	2,398	(2,189)	355	2,338	(1,983)
Flathead sole	1,221	2,234	(1,013)	1,112	1,522	(410)
Other flatfish	979	17,148	(16,169)	841	9,333	(8,492)
Pacific Ocean Perch - BS	110	12	98	48	22	26
Pacific Ocean Perch - EAI	17	57	(40)	0	52	(52)
Pacific Ocean Perch - CAI	6	53	(47)	0	49	(49)
Pacific Ocean Perch - WAI	0	167	(167)	0	152	(152)
Other Red Rockfish - BS	20	6	14	35	4	31
Sharpchin/Northern - AI	57	305	(248)	5	372	(367)
Shortraker/Rougheye - AI	1	15	(14)	0	14	(14)
Other rockfish - BS	1	12	(11)	14	12	2
Other rockfish - AI	9	29	(20)	0	29	(0)
Squid	206	3	203	285	3	282
Other species	651	1,508	(857)	719	1,439	(720)
Halibut mortality	116	293	(177)	80	286	(206)
Herring	191	20	171	80		
Chinook	4,823			3,184		
Other salmon	2,487			5,485		
Red King crab	612	1,295	(683)	4,040	628	3,412
Other King Crab	396					
Other Tanner Crab	62,103	636,863	(574,760)	40,317	615,634	(575,317)
Bairdi Zone 1	17,989	97,125	(79,136)	17,637	107,485	(89,848)
Bairdi Zone 2	28,718	86,858	(58,140)	3,435	116,550	(113,115)

Source: Joint report of the Pollock Conservation Cooperative and the High Seas Catcher's Cooperative. December 2000.

Discard rates are generally low (less than 20 percent) for Pacific cod, sablefish, and yellowfin sole than for other species on catcher/processors in non-pollock fisheries. Therefore, allowing for catcher/processor restricted sideboard fishing, is not likely to negatively affect these species as much as it might for those species that are discarded at higher rates in the Bering Sea fisheries (greater than 90% discard rates; e.g., arrowtooth flounder, Pacific Ocean perch, other red rockfish).

Effects of the alternatives on non-pollock groundfish species: Conclusions

The effects of groundfish fishing on groundfish species is analyzed extensively in the programmatic SEIS on the groundfish fisheries off Alaska which concludes that groundfish fishing under the current TAC-setting process and management regime is not expected to jeopardize the capacity of the groundfish stocks to produce MSY on a continuing basis, is not expected to lead to genetic change in the structure of groundfish populations, and is not expected to significantly affect groundfish habitat (NMFS 2001a). None of the alternatives to implement the AFA would modify the existing management regime or TAC-setting process for non-pollock groundfish species in the BSAI or GOA. Bycatch of non-pollock groundfish in the directed pollock fishery is negligible and sideboard measures would restrict the participation of AFA vessels in other groundfish fisheries to some level of historic participation that is also roughly equivalent to what their projected levels of participation would be under the no-action alternative. In any event, because the underlying management regime in place for non-pollock groundfish fisheries in the BSAI and GOA would not be affected by any of the alternatives, the extent to which AFA vessels or non-AFA vessels participate in these fisheries is largely an allocative issue and, in and of itself, is not expected to affect the health of non-pollock groundfish stocks. Therefore, the effects of all of the alternatives on non-pollock stocks is considered to be insignificant.

4.3.11 Effects of the alternatives on prohibited species

Direct effects on prohibited species

Halibut, herring, crab, and salmon are among the prohibited species taken in the fisheries subject to the proposed actions. The regulatory measures used to control the bycatch of these species are described in Section 3.2. The proposed action would not change existing PSC limits for these species. Bycatch rates of all prohibited species are very low in the directed Bering Sea pollock fisheries, with the species of greatest interest being salmon and herring which are the most common prohibited species bycatch in the midwater directed pollock fishery. Figure 4.3.1 illustrates the salmon and herring species bycatch by the in the BSAI from 1993-2000 by pollock trawl vessels and shows declining bycatch rates since the early 1990s fro all three species. Since the implementation of the AFA in 1999, both herring and other salmon bycatch rates have decreased while Chinook salmon bycatch rates have increased but remain below historic levels. Table 4.3.10 shows bycatch rates for all prohibited species from 1993 through 2000 and show dramatic declines in bycatch of all crab species beginning in 1998 when bottom trawling for pollock was prohibited.

It is difficult to directly attribute increases or decreases in prohibited species bycatch to the implementation of the AFA because AFA management measures do not mandate any change in fishing patterns. Bycatch rates can be area and time specific. For example, a higher bycatch rate for Chinook salmon can be expected in the vicinity of Unimak Island and the 200 m depth contour during the first four months of the year. The bycatch rate is much lower in other areas of the Bering Sea during that period. To the extent that fishing patterns under the AFA distribute effort away from areas of high bycatch, prohibited species bycatch would be expected to decline.

None of the alternatives would change existing PSC limits or would result in negative PSC or biological impacts on bycatch species, though changes in fishing patterns should be monitored as the fishery evolves in response to new regulations. NMFS expects that pollock co-ops could have provided the infrastructure in 1999 and 2000 to promote reduced prohibited species bycatch rates and overall bycatch amounts experienced by AFA co-op vessels given the latitude these vessels have in self-management of co-op-specific pollock allocations. PSC limitations imposed on AFA vessels are a subset of the overall PSC caps for the groundfish fisheries. Any amount not taken by the AFA vessels is subject to being taken by the non-AFA vessels fishing in the other groundfish fisheries. Therefore, the proposed action would not have any effect on overall prohibited species mortality. Impacts on Pacific herring would be difficult to evaluate regardless because herring stocks fluctuate widely in biomass due to year class strengths and weaknesses.

The direct impacts on halibut from bycatch in the pollock trawl fishery are more likely to affect the commercial halibut fishery, than the stock. Halibut mortality is closely monitored by the International Pacific Halibut Commission and directed fishery catch limits can be adjusted to prevent halibut incidental mortality in the pollock fishery from adversely affecting the long-term productivity of the stock. However, incidentally-caught halibut from the pollock fishery are juvenile fish and the BSAI management area is an important nursery ground for the stock. The bycatch of halibut that are migrating fish could affect the long-term spatial distribution of the Pacific halibut resource.

Pacific salmon and steelhead are important resources to the people of Alaska and principal salmon runs in Western Alaska failed to meet expectations in 1997, 1998, 2000, and 2001. Therefore, the incidental take of these resources is a major concern in pollock fishery management. Salmon bycatch, in most cases, is quite low in the BSAI pollock trawl fishery. Most of the chinook bycatch taken in the BSAI pollock trawl fishery in 1998 was taken late in the Summer/Fall season with rates of bycatch ranging from 0 to 0.89 salmon per mt of groundfish in the bottom trawl fishery and 0 to 0.33 salmon per mt of groundfish in the pelagic trawl fishery. In 1999, bycatch rates of chinook salmon dropped and ranged from 0 to 0.10 in the bottom fishery and 0 to 0.07 in the pelagic trawl fishery. In 2000, bycatch rates ranged from 0 to 0.15 in the bottom trawl fishery and 0 to 0.03 in the pelagic trawl fishery. Rates of bycatch of other salmon in the pollock fisheries in 1998-2000 (roe season) were very low, and did not exceed 0.3 salmon per mt of groundfish. Nevertheless, the salmon industry is concerned about any incidental catch of salmon in any of the groundfish fisheries. The salmon PSC limits for the BSAI have been in place since 1995, although modifications have been considered.

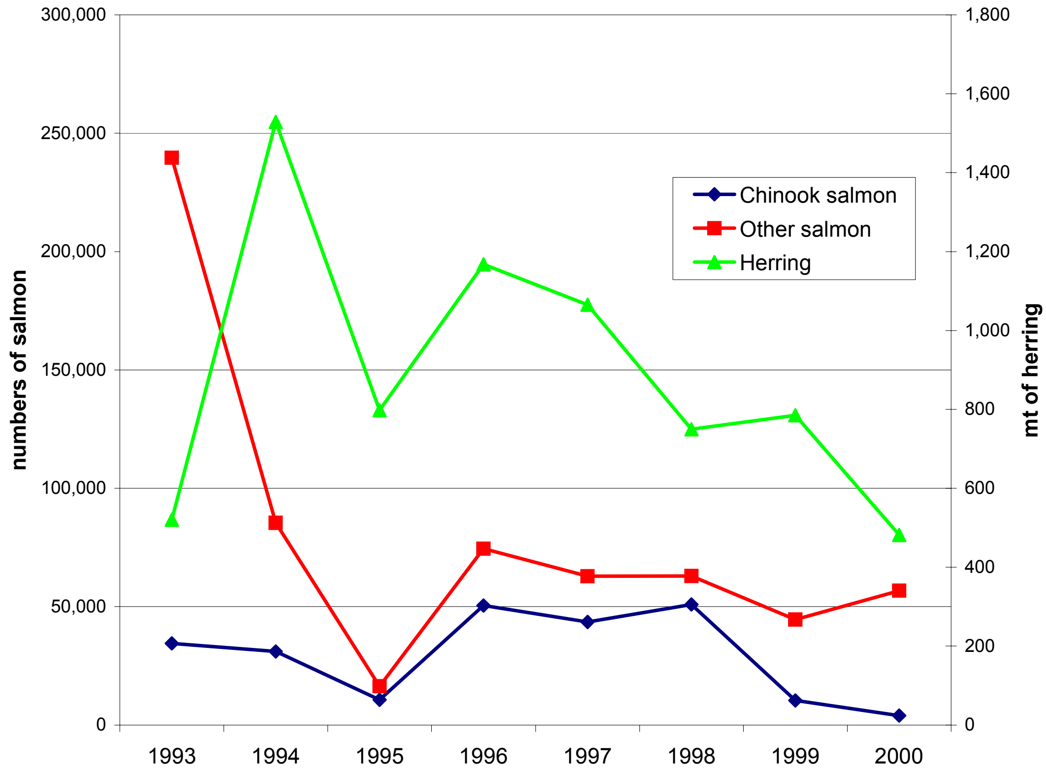

Figure 4.3.1 Bycatch of salmon and herring in the BSAI pollock fishery, 1993 - 2000.

Table 4.3.10 Prohibited species bycatch in the BSAI directed pollock fisheries 1993-2000. Herring and halibut are expressed in mt; all others refer to numbers of animals.

Year	*Chinook salmon*	*Other salmon*	*Herring*	*Bairdi zone 1*	*Bairdi Zone 2*	*Opilio*	*Red king crab*	*Halibut*
1993	34,435	239,604	520	494,428	1,153,516		43,665	1134
1994	31,073	85,380	1,529	61,366	309,657		38,584	858
1995	10,638	16,317	798	105,821	48,171		3,588	421
1996	50,438	74,486	1,168	78,824	11,901		5,872	462
1997	43,490	62,859	1,065	10,854	12,749		137	280
1998	50,914	62,936	750	17,816	37,461	81,986	13,950	335
1999	10,331	44,587	785	665	3,204	3,204	91	273
2000	3,968	56,715	482	69	1,464	5,208	0	339

Source: NMFS annual catch reports.

Listed salmon stocks. After reviewing the current status of Snake River fall chinook, Snake River spring/summer chinook, Puget Sound chinook, Upper Columbia River spring chinook, Upper Willamette River chinook, Lower Columbia River chinook, Upper Columbia River steelhead, Upper Willamette River steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, and Snake River Basin steelhead, the environmental baseline for the action area, and considering the effects of the proposed fishery, it is not expected that the proposed fishery and the cumulative effects would jeopardize the continued existence of listed salmon stocks. No critical habitat has been designated for these species; therefore, none will be affected by the proposed fisheries. Further, it is not expected that there would be increased impacts on previously listed salmon species as a result of any of these alternatives.

Crab bycatch. Time and area closures, PSC limits, and gear restrictions are used to control crab bycatch in the groundfish fisheries. Crab PSC limits, as stated above, are a function of crab abundance, and represent about 1% or less of the estimated annual abundance. These alternatives would not affect the king and snow and Tanner crab stocks because the fishery is currently restricted and these measures would not alter those bycatch reduction measures that are currently in place.

Pollock cooperative efforts to reduce salmon bycatch. In February 2001, the pollock intercooperative group composed of representatives of all catcher vessel and catcher/processor cooperatives announced the development of an "other salmon" (primarily chum salmon) bycatch management program for the Bering Sea pollock fishery. The goal is to implement a rate-based program for reducing chum salmon bycatch by restricting pollock harvest in areas of chum bycatch to vessels with low bycatch rates as an incentive to promote cleaner fishing practices. The pollock cooperatives are the key component of this program. By promoting bycatch reduction on a co-op by co-op basis, co-ops are given incentives to develop clean fishing practices. These and other similar industry efforts to reduce bycatch are facilitated by the AFA which provides industry with much greater autonomy to chose when and where fishing activities will occur.

Effects of the alternatives on prohibited species bycatch: Conclusions

Since bottom trawling for pollock was prohibited in 1998, bycatch of crab and halibut in the BSAI directed pollock fishery have declined to negligible levels (Table 4.3.10). Chinook salmon, "other" salmon and herring are the primary remaining prohibited species of concern in the BSAI directed pollock fishery. Bycatch rates of Chinook salmon, "other" salmon, and herring in the BSAI directed pollock fishery have been low historically and none of the AFA-based alternatives are expected to result in increases of prohibited species bycatch. Bycatch of salmon and herring in the directed pollock fishery is already regulated by existing fishery-wide caps that are low enough to prevent negative effects on salmon and herring stocks. In addition, the emergence of fishery cooperatives is expected to provide industry with additional ability to further reduce bycatch of salmon and herring. Therefore, the effects of the alternatives on prohibited species bycatch are expected to be insignificant.

4.3.12 Effects on forage species

Bycatch amounts of some of the forage species have been recorded in the BSAI groundfish fisheries in previous years. Smelts have been recorded more regularly than some of the other groups, however other species have also been recorded. Table 4.3.11 provides data on forage species catch in the pollock fishery by year which show relatively negligible bycatch rates. NMFS does not anticipate changes in the catch of forage species resulting from any spatial or temporal change in the pollock fisheries resulting from the preferred alternatives or any of the other alternatives that were considered. The pollock TAC will not be affected by this action, should it be finalized and impacts on forage species as a result of changes in annual TAC specifications will be analyzed in the EA and other analytical documents that accompany that annual specifications. Therefore, the effects of all of the alternatives on forage species are expected to be insignificant.

Table 4.3.11 Catch (mt) of forage species reported by processors in the 1998-Spring 2000 pollock trawl fisheries.

Species	*Catch in 1998*	*Catch in 1999*	*Catch in Spring 2000*
Pacific sandfish (Trichodontidae)	0	0.244	0
Gunnels (Pholidae spp.)	4.40	37.05	0.001
Pricklebacks, warbonnets, eelblennys, cockscombs, shannys (Stichaeidae sp)	0.11	0.02	0.001
Smelt, General	7.13	4.15	8.47
Eulachon smelt (Osmeridae)	2.55	0.36	0.02
Capelin smelt (Osmeridae)	0.08	1.45	0
Lanternfishes (Myctophidae)	0	0	0.001
Deep-sea smelts (Bathylagidae)	0	0	2.45
Total	14.26	43.27	10.94

4.3.13 Effects on seabirds

Information voids for various aspects of seabird ecology make it difficult to predict impacts of fishery management on seabirds. A summary of the information voids was presented in the Draft Programmatic SEIS, (NMFS 2000a) followed by a description of the current management regime at that time and then by an analysis of the effects of the Draft Programmatic SEIS alternatives on seabirds. The Draft Programmatic SEIS analysis on seabirds forms the basis and foundation of current knowledge for this analysis. The alternatives in this SEIS range from no action, which would allow the fishery to revert to the pre-AFA inshore/offshore regime in effect from 1991 through 1998 to AFA-based Alternatives 2 through 5 which vary in the details of their approach to implementing various aspects of the AFA. The main difference between each of the alternatives is with respect to the degree of autonomy given to fishery cooperatives and the flexibility of individual vessel owners to join and change inshore catcher vessel cooperatives.

As noted in Section 4.1.1.3 of the Draft Programmatic SEIS (NMFS 2001a), declines in some bird populations have been related to declines in forage fish prey availability. The cause of the forage fish decline is not clearly understood. It may be long-term climatic regime changes or shifts, ecosystem changes related to commercial fishing or a combination of these causes. However, this is not readily discernible. Thus, discerning the potential impact of the indirect effects of fishery competition or disturbance on seabird foraging success is confounded. AFA measures that slow down, spread out, or otherwise reduce the intensity of the BSAI pollock fishery might coincidentally enhance the foraging success of seabirds.

This section takes each of the five alternatives in turn and analyzes the direct effects and the indirect effects on seabirds, focusing on a few broad taxonomic groups. Because of special concern for endangered and threatened species, analysis of the alternatives on ESA listed bird species is included.

Effects to consider

Section 4.3.3 of the Draft Programmatic SEIS provided rationale for the consideration of the following potential fishery effects on the following seabird taxonomic groups (NMFS, 2001a). The direct and indirect fishery effects that may impact some species of seabirds are:

- Direct Effects:
  - Incidental take (in gear and vessel strikes)

- Indirect Effects:
  - Prey (forage fish) abundance and availability
  - Benthic habitat
  - Processing waste and offal
  - Contamination by oil spills
  - Nest predators in islands
  - Plastics ingestion

As discussed in Section 4.3.4 of the Draft Programmatic SEIS, whether or not a fishery management action will affect seabirds depends on numerous factors: the seabirds life history and foraging ecology, factors influencing forage availability, how seabirds respond to changes in forage availability, and how seabirds interact directly or indirectly with fishing vessels. The Draft Programmatic SEIS analysis found that of the seven effects considered, some were less pronounced or more difficult to measure than others. Fishing vessels can affect seabirds whether or not they are engaged in fishing or processing activities. Three of the seven effects would be categorized as indirect, non-fishing effects–contamination by oil spills, nest predators on islands, and plastics ingestion. These effects have not been measured for vessels fishing in the BSAI and GOA. The number of fishing vessels is a factor for each of these effects and has been noted that there has been a decline in fishing and processing vessels in the BSAI and GOA since 1995. To the extent that vessel operators are in compliance with all Federal and State laws and policies that regulate the prevention and control of oil spills, fuel transfers, plastics disposals, and introduction of non-native species (i.e., rats), then we expect that these three effects are minor. Thus, in the context of other fishery-related effects, the Draft Programmatic SEIS analysis concluded that the effects of fishery-related oil spills, nest predators on islands, and plastics ingestion to be insignificant at the population level for all seabird species, including the short-tailed albatross and the spectacled and Steller's eiders. These conclusions remain valid for all of the alternatives in this EIS.

In addition, this EIS has found the effects of the BSAI pollock fishery on benthic habitat to be insignificant primarily because pelagic trawl gear is mandated by regulation and used exclusively in the BSAI directed pollock fishery. By extension, the secondary effects of changes to benthic habitat on seabirds is also considered insignificant. This EIS considers the three remaining fishery effects of the alternatives on seabirds: incidental take, prey availability, and processing waste and offal. To the extent that vessel traffic/presence near seabird colonies has the potential for immediate disturbance of birds at the colonies and birds foraging for available prey in waters near the colonies, this potential effect is treated along with the indirect fishery effect on prey availability.

Seabird groups to consider

In the Draft Programmatic SEIS, the impacts of the effects of the alternatives were analyzed on the following seabird species or species groups:

- Northern fulmar
- Short-tailed albatross
- Other albatrosses (Laysan's and black-footed) and shearwaters
- Piscivorous seabird species
- Eiders (spectacled and Steller's)
- Other seabird species

Given the noted information gaps in our knowledge, it is not likely that the fishery effects on most individual bird species are discernable. For the following reasons, some individual species are considered. The northern fulmar is considered because it is one of the most abundant species that breeds in Alaska colonies. Due to special management concerns for animals listed under the ESA, the effects of the alternatives on the short-tailed albatross, spectacled eider, and Steller's eider will be considered in this analysis. 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). For biological reasons (e.g., foraging behavior, locomotion, distribution) some birds are more likely to be directly or indirectly effected by the alternatives than others. The intensity, significance, and direction of effects on each seabird species also differs according to the particular set of management actions contained in the alternative regime.

Criteria for evaluating effects

The Draft Programmatic SEIS developed a scoring system for relating the effects of management actions on seabirds (Table 4.3.5 in NMFS 2001a). This scoring system has been adapted to evaluate the significance of effects of the AFA alternatives on seabirds (Table 4.3.12).

Table 4.3.12 Scoring system for relating effects of the alternatives on seabirds.

Effects	Score				
	-2	-1	+0	+1	+2
Incidental take (in gear and vessel strikes)	Take number and/or rate increases substantially.	Take number and/or rate increases minimally.	Take number and/or rate is the same.	Take number and/or rate decreases minimally.	Take number and/or rate decreases substantially.
Prey (forage fish) availability	Prey availability is substantially reduced.	Prey availability is minimally reduced.	Prey availability is the same.	Prey availability is minimally increased.	Prey availability is substantially increased.
Processing waste and offal	Availability of processing wastes is substantially increased.	Availability of processing wastes is minimally increased.	Availability of processing wastes is the same.	Availability of processing wastes is minimally decreased.	Availability of processing wastes is substantially decreased.

Direct effects of the alternatives on seabirds

Incidental take. The most prominent direct effect of the alternatives on seabirds is the incidental catch by fishing gear and vessel strikes. While the vast majority (almost 90%) of fishing vessel takes are from longline gear, trawl gear takes are also reported. Section 3.5.4.2 of the Draft Programmatic SEIS examined the incidental catch of seabirds in trawl fisheries and concluded that trawls primarily catch seabirds that dive for prey. The principle bird species reported in trawl hauls were alcids, northern fulmars, and gulls. Small numbers of other species were also caught as reflected in Table 4.3.13.

There is evidence that some forms of trawling may make fish vulnerable to diving birds by disturbing or injuring the fish. Black guillemots (Ewins 1987) and great cormorants (*Phalacrocorax carbo sinensis*) in the North Atlantic Ocean (Camphuysen 1999) are two species that may have learned to take advantage of such disruptions.

Vessel strikes. Onboard observations of birds (including Laysan's albatross) colliding with the trawl transducer wires (sometimes called third wire) have been made. These wires are typically deployed midship from a davit on midwater trawl vessels fishing for pollock and carry the transducer net sounder cable down to the head of the trawl net. Any birds killed by such collisions would most likely not be recorded in observers' samplings of the trawl haul in that it is unlikely that such dead birds would make their way into the trawl net. This potential interaction was noted in the November 4, 1998, letter from the NMFS Alaska Regional Administrator to the USFWS Field Supervisor of the Office of Ecological Services, that initiated the Section 7 consultation for the 1999–2000 groundfish longline fisheries. NMFS determined that the groundfish trawl vessels that deploy such a cable "may affect" short-tailed albatross. Although collisions with short-tailed albatrosses have not been observed or reported, NMFS and USFWS staff felt the potential was there, given that the closely related Laysan's albatross has been observed colliding with the wires. The December 2, 1998, response from USFWS noted that this "may affect" determination constituted an active informal Section 7 consultation with no statutory deadlines. NMFS is initiating efforts to research the issue to determine the extent of use of trawl third wires in the trawl fleet and specifics of the bird/vessel interactions. Solutions may be as simple as hanging streamers from the third wire (G. Balogh, USFWS, Anchorage – personal communication).

Although observers have reported birds in flight striking vessels, bird-strike data have not yet been statistically analyzed. Some birds that strike vessels fly away without injury, but others are injured or killed. Bird strikes are probably most numerous during the night; birds are especially prone to strike vessels during storms or foggy conditions when bright deck lights are on, which can cause the bird to be disoriented. The proximity of the vessels to seabird colonies during the breeding season is also a factor (V. Byrd, USFWS – personal communication). Collisions of large numbers of birds occasionally occur, as in the case of approximately 6,000 crested auklets that were attracted to lights and collided with a fishing vessel near Kodiak Island during the winter of 1977, or in the central Aleutians in 1964 when approximately 1,100 crested auklets were attracted to deck lights on a processor and collided with structures on the vessel (Dick and Donaldson 1978). Species that most commonly strike vessels include storm-petrels, auklets, and shearwaters. Albatrosses have been observed striking the vertical cables from which sonar transducers of trawlers are suspended. Little information is available on the problem of transducer cables.

Please see table of contents for figure or table.

Direct effects of the alternatives. Given that the BSAI pollock fishery is fully utilized and the annual TACs do not vary dramatically from year to year and are would not be affected by any of the alternatives, the level of incidental takes and vessel strikes in the BSAI directed pollock fishery is not expected to vary substantially under any of the alternatives assuming that incidental takes and vessel strikes are proportional to fishing effort. Therefore, the direct effects of the alternatives is considered to be insignificant to seabird populations as a whole.

Indirect effects: Prey (forage fish) abundance and availability

Section 4.3.3 of the Alaska Groundfish Fisheries Draft Programmatic SEIS presents a complete discussion of the effects of prey abundance and availability on seabirds (NMFS, 2001a). Based on the Draft Programmatic SEIS analysis, the indirect fishery effects on prey abundance and availability were considered insignificant to populations of non-piscivorous seabirds and to have an unknown effect on piscivorous seabirds.

As noted in Section 4.3.3 of the Draft Programmatic SEIS, the most prominent of the indirect effects of the alternatives is the potential that the spatial and temporal constructs of fisheries prosecution may indirectly effect the abundance and distribution of the prey species that seabirds depend on (NMFS, 2001a). Although detailed conclusions or predictions cannot be made because of lack of scientific understanding and the complexity of ecosystems, the present level of understanding would suggest that management measures leading to increases in abundance and availability of the forage fish or other prey species that different seabird species depend upon, could be beneficial to seabird populations. Conversely, management measures that lead to decreases in the abundance or availability of the forage fish or other prey species that seabirds depend upon could be detrimental to seabird populations.

Given the vast foraging areas available to non-breeding albatrosses and shearwaters, it is unlikely that they are impacted by these indirect effects. Likewise, it is unlikely, or less likely, that planktivores such as petrels, most auklet species, and phalaropes are impacted by these effects. These birds that feed on zooplankton are much more likely to be affected by changes in the primary productivity of the ecosystem, (i.e., bottom-up effects such as climatic changes, rather than top-down effects). Birds that breed in Alaska and prey on forage fish are more likely to be impacted by indirect fishery effects on prey abundance and availability. These key bird groups are: murres, kittiwakes, gulls, fulmars, rhinoceros auklets, puffins, and murrelets.

Localized depletion of prey species around seabird colonies could be particularly detrimental during the chick-rearing period for the breeding seabirds. For instance, the recent reductions of the populations of kittiwakes (and also of fur seals and Steller's sea lions) at the Pribilof Islands suggest that declines in the abundance of prey near these islands has had a negative impact on these important constituents of the Bering Sea marine ecosystem. However, because pollock of all ages are mobile, it is unclear how changes in management practices could ensure adequate supplies of pollock of appropriate size (age) classes to meet the needs of central place foragers such as breeding seabirds. In addition to age 0 and age 1 pollock, other prey of importance that declined around the Pribilof Islands were capelin and possibly myctophids.

The spatial configuration of juvenile pollock in certain areas frequented by foraging piscivorous seabirds may be explained by interactions between pollock cannibalism and climate conditions. Cannibalism among pollock is an important population regulation mechanism. Warm years are characterized by high (larval) transport and subsequent high spatial separation between adults and juveniles, low rates of cannibalism, and good recruitment. Conversely, cold years are characterized by low transport, high rates of cannibalism, and poor to average recruitment. This cannibalism-transport model may be a practical descriptor of eastern Bering Sea pollock recruitment (Wespestad et al, 2000). In general, the majority of breeding piscivorous seabirds forage within 40 to 60 km of their colonies, particularly during the chick-rearing phase.[15] Northern fulmars are an exception in that during the incubation period in particular, they are known to forage out to 100 km and more.[16] Black-legged kittiwakes and thick-billed murres also forage out at distances of 100 km in shallow waters off the Pribilof Islands (Schneider and Hunt, 1984). Note, seabirds usually show asymmetrical distribution around the colonies because foraging distribution is not entirely related to distance (Schneider and Hunt, 1984). Prey type and availability are influenced by oceanographic environments, such as distance from shelf break, currents, and water depth. Thus, birds at the Pribilofs might have to fly farther than birds in the Aleutians.

Of the various seabird species or species groups analyzed, only the breeding piscivorous species are likely to be potentially impacted by fishery-induced effects on prey abundance and/or availability. Due to increasing population trends, short-tailed albatross and northern fulmars do not appear to be prey-limited. Additionally, the ability to forage over extremely vast areas and the migratory habits of the other albatross species and shearwaters make them unlikely candidates for food availability impacts. Given that there is insufficient information about the potential effects of fishery harvest on forage fish abundance and availability, the Draft Programmatic SEIS alternatives could have unknown effects on piscivorous seabird populations that breed in Alaska. The potential indirect fishery effects were considered insignificant to the populations of short-tailed albatross, and spectacled and Steller's eiders (NMFS, 2001a).

To the extent that management measures under any of the alternatives result in less fishing in the immediate vicinity of seabird colonies and surrounding foraging waters [less than 100 km; most of the breeding piscivorous seabirds feed out to 40 km (about 22nm)] during the breeding season of May through August, immediate physical disturbance to the colonies and nearshore forage areas and potential indirect effects on forage fish prey species available to breeding seabirds would be reduced. To the extent that nearshore waters of the colonies are exploited by the BSAI pollock fishery, the potential for indirect fishery effects exists. However these spatial effects are much more likely to result from Steller sea lion protection measures implemented under Amendments 70/70 than from implementation of the AFA. Nevertheless, given that there is insufficient information about the potential effects of fishery harvest on forage fish abundance and availability, all of the alternatives could have unknown effects on piscivorous seabird populations that breed in Alaska. For the reasons noted in the Draft Programmatic SEIS and summarized in this section, the potential indirect fishery effect on prey abundance and availability of the alternatives are considered insignificant at the population level for short-tailed albatross, spectacled and Steller's eiders and all other remaining non-piscivorous seabird species.

Indirect effects: Availability of processing wastes and offal

Section 4.3.3 of the Draft Programmatic SEIS presents a complete discussion of the effects of prey abundance and availability on seabirds (NMFS, 2001a). Based on the Draft Programmatic SEIS analysis, the indirect fishery effects on prey abundance and availability were considered insignificant to most seabird populations.

The volume of offal and processing wastes probably changes approximately in proportion to the total catch in the fishery. Whereas some bird populations may benefit from the food supply provided by offal and processing waste, it also acts as an attractant that may lead to increased incidental take of some seabird species. Many seabird species around the world have been documented to benefit from fishery discards and processing waste as a supplemental food source (Tasker et al, 2000; Phillips et al, 1999; Furness et al, 1992; James et al, 2000). For instance, the number of seabirds potentially supported by fishery waste in the North

[15] K. Kuletz, "Personal Communication,"USFWS, 1011 E. Tudor Rd., Anchorage, AK 99501.

[16] S. Hatch, "Personal Communication."

Sea is estimated to be roughly 5.9 million individuals in an average scavenger community (Garthe et al, 1996). Research and analysis is needed to ascertain how much benefit seabirds of the North Pacific derive from discards and offal and to then balance that with the adverse impacts associated with the incidental take of seabirds in fishing gear as a result of vessels attracting birds via the processing wastes and offal that are discharged. It could be that the northern fulmar, the most populous of breeding seabird species in Alaska, one that exhibits a stable or overall increasing population trend, the most frequently taken species in the groundfish fisheries, and a species known to benefit from fishery discards in the North Atlantic, experiences a similar benefit from North Pacific fisheries. Based on these assumptions, the availability of fishery processing wastes could indicate a conditionally significant beneficial effect.

An analysis that examined discards and fish processing offal from the commercial fisheries in the BSAI and GOA and population trends of animals that might be scavengers (including seabirds) found that there appeared to be no relationship between offal and discard production and bird population trends (Queirolo et al, 1995). This was a qualitative analysis based on the examination of the direction of population trends in kittiwakes and found that in instances of changing trends, the shifting of fishing distribution relative to the summer bird foraging areas did not occur at a time that could explain the changing population trend.

This indirect effect for all five alternatives potentially has both beneficial and detrimental impacts and overall could be considered insignificant at the population level for most seabird species, including the short-tailed albatross and the spectacled and Steller's eiders.

4.3.14 Effects on the ecosystem

In this section, the alternatives are analyzed with respect to various ecosystem-level measures that might indicate the impacts of the alternatives from a broader ecological viewpoint. A review of ecosystem-based fishery management measures implemented for Alaska groundfish fisheries can be found in Witherell *et al.* (Witherell et al. 2000). An evaluation of how well the status quo management regime achieves ecosystem-based management objectives is contained in the Draft Programmatic SEIS (NMFS 2001a).

Effects on predator-prey relationships

Fisheries can remove predators, prey, or competitors and thus alter predator-prey relationships relative to an unfished system. Studies from other ecosystems have been conducted to determine whether predators were controlling prey populations and whether fishing down predators produced a corresponding increase in prey. Similarly, the examination of fishing effects on prey populations has been conducted to evaluate impacts on predators. Finally, fishing down of competitors has the potential to produce species replacements in trophic guilds (see reviews of all these effects in (Hall 1999)). Evidence from other ecosystems presents mixed results about the possible importance of fishing in causing population changes of the fished species' prey, predators, or competitors. Some studies showed a relationship, while others showed that the changes were more likely due to direct environmental influences on the prey, predator or competitor species rather than a food web effect. Fishing does have the potential to impact food webs but each ecosystem must be examined to determine how important it is for that ecosystem. A review of fishing impacts to marine ecosystems and food webs of the North Pacific under the status quo, and other alternative management regimes, was provided in the Draft Programmatic SEIS (NMFS 2001a).

Fishing can selectively remove fish eating predators then move down the food web and begin removing the next trophic level down such as plankton feeding fish. This process is known as fishing down the food web (Pauly et al. 1998). Trophic level of the fish and invertebrate catch from the BSAI, and GOA was estimated from the 1960s to the present (Livingston et al. 1999; Queirolo et al. 1995) to determine whether such fishing down effects were occurring. Trophic level of the catch in all three areas has been relatively high and stable over the last 30 or more years.

Fishing vessels and vessels supporting fishing operations have the potential to disrupt predator-prey relationships through the introduction of nonindigenous species. These introductions occur when ship ballast water containing live organisms is obtained outside a region and is released into fishery management areas. Vessels also have organisms fouling their hulls that can be transported between regions. These organisms have the potential to cause large alterations in species composition and dominance in ecosystems (Carlton 1996).

Fishing patterns under the alternatives are expected to differ primarily with respect to temporal dispersion of effort and secondarily with respect to spatial distribution of effort (see discussion of scenarios in Section 4.1). Concentrated removal of key prey species such as pollock has been a concern in the status quo regime, especially with respect to effects on Steller sea lions. For this reason, the effects of Alternative 1 on predator-prey relationships is considered conditionally significant negative relative to the AFA-based alternatives given the expectation that it would result in increased temporal/spatial concentration of the BSAI pollock fishery. The effects of Alternatives 2 through 5 on predator-prey relationships is considered unknown.

Effects on energy flow and balance

Fishing may alter the amount and flow of energy in an ecosystem by removing energy and altering energetic pathways through the return of discards and fish processing offal back into the sea. The recipients, locations, and forms of this returned biomass may differ from those in an unfished system. A mass-balance model of the eastern Bering Sea (Trites et al. 1999) provides some information on fishing removals relative to total system production and the distribution of biomass and energy flow throughout the system in recent times. The trophic pyramids (distribution of biomass at various trophic levels) indicate that biomass and energy flow are distributed fairly well throughout the system (Trites et al. 1999). These show that the Bering Sea is a more mature system compared to other shelf systems. A more mature system is one that is less disturbed (Odum 1985). Total catch biomass (including non-groundfish removals) as a percentage of total system biomass (excluding dead organic material, known as detritus) was estimated to be 1%, a small proportion of total system biomass. Fishery removal rates are based in the most basic sense on the amount of surplus production (the excess of reproduction and growth over natural mortality) (Hilborn and Walters 1992) for fish stocks. Because there is great variability among stocks with regard to the amount of this excess production, it is likely more important that removals stay within the bounds of each individual stock's excess production (a topic that is considered in the individual stock impacts sections). From an ecosystem point of view, total fishing removals are a small proportion of the total system energy budget and are small relative to internal sources of interannual variability in production.

Fisheries can redirect energy in the system by discarding and returning fish processing wastes to the system. These practices take energy and potentially provide them to different parts of the ecosystem relative to the natural state. For example, discards of dead flatfish or small benthic invertebrates might be consumed at the surface by scavenging birds, which would normally not have access to those energy sources. Before the improved retention requirements for pollock and cod were mandated, total offal and discard production at that time was estimated at only 1% of the unused detritus already going to the bottom (Queirolo et al. 1995) . No scavenger population increases were noted that related to changes in discard or offal production amounts. The annual consumptive capacity of scavenging birds, groundfish, and crab in the eastern Bering Sea was determined to be over ten times larger than the total amount of offal and discards in the BSAI and GOA. Finally, it appeared that the main scavengers of fish processing offal, which primarily consisted of pollock, were also natural pollock predators.

Discard rates dropped even further after the implementation of retention requirements for all pollock and cod in groundfish fisheries. Managed groundfish species discards dropped below 10% of the total catch (down from about 15% in the eastern Bering Sea and Aleutian Islands and 20% in the GOA, respectively) in 1998. The mandated retention of managed flatfish species (yellowfin sole and rock sole in the BSAI and shallow water flatfish in the GOA) in 2003, which make up the bulk of the remaining discards of managed species, may cause the total discard amounts to decrease. Discards are estimated to decline to 7% of the total catch in the BSAI but would remain constant at about 17% of the total catch in the GOA, a reflection of the discard level observed in1999.

Discards and offal production can cause local enrichment and change in species composition if discards or offal returns are concentrated. Some evidence of those effects have previously been cited (Thomas 1994) in areas with inadequate tidal flushing (Orcas Inlet in Prince William Sound and in Dutch Harbor) but not in the deep water disposal site in Chiniak Bay off Kodiak Island (Stevens and Haaga 1994). Local ocean properties (water flow and depth) and amount of water discharged per year could be important factors determining the effect of nearshore disposal on local marine habitat and communities. Changes to the processing plant at Dutch Harbor dramatically reduced the amount of offal and ground discards discharged. Improved retention could be causing some increases in the amount of local enrichment due to disposal of increased offal from shoreside processing of newly retained fish. However, increase in offal production for the Bering Sea, if all pollock, cod, rock sole and yellowfin sole were to be retained, would amount to an increase of about 6% (NMFS 1996a) and would not likely cause a change in water quality.

A mass-balance model of the eastern Bering Sea (Trites et al. 1999) showed that total catch biomass (including non-groundfish removals) as a percentage of total system biomass (excluding dead organic material, known as detritus) was estimated to be 1%, a small proportion of total Bering Sea system biomass. From an ecosystem point of view, total fishing removals are a small proportion of the total system energy budget and are small relative to internal sources of interannual variability in production. Thus, total removals, which are unchanged under all of the alternatives, would have an insignificant effect on the environment.

Total offal and discard production prior to 1994 was estimated at only 1% of the unused detritus already going to the bottom (Queirolo et al. 1995). The annual consumptive capacity of scavenging birds, groundfish, and crab in the eastern Bering Sea was determined to be over ten times larger than the total amount of offal and discards in the BSAI and GOA, and the main scavengers of fish processing offal, which primarily consisted of pollock, were also natural pollock predators. Since the implementation of full retention requirements and minimum utilization standards for BSAI pollock in 1998, the largest potential source of energy redirection (discarding of whole fish and processing waste) has been reduced and is expected to be further reduced as a result of increased recovery rates and increased inshore processing under the AFA-based alternatives. Combined evidence regarding the level of discards relative to natural sources of detritus and no evidence of changes in scavenger populations that are related to discard trends suggest that all of the alternatives would have insignificant ecosystem impacts through energy removal and redirection.

Effects on biological diversity

Fishing can alter different measures of diversity. Species level diversity, or the number of species, can be altered if fishing removes a species from the system. Fishing can alter functional or trophic diversity if it selectively removes a trophic guild member and changes the way biomass is distributed within a trophic guild. Fishing can alter genetic level diversity by selectively removing faster growing fish or removing spawning aggregations that might have different genetic characteristics than other spawning aggregations. Large, old fishes may be more heterozygous (i.e., have more genetic differences or diversity) and some stock structures may have a genetic component (see review in(Jennings and Kaiser 1998), thus one would expect a decline in genetic diversity due to heavy exploitation.

The scientific literature on diversity is somewhat mixed about what changes might be expected due to a stressor. Odum (1985) asserts that species diversity (number of species) would decrease and dominance (the degree to which a particular species dominated in terms of numbers or biomass in the system) would increase if original diversity was high, while the reverse might occur if original diversity was low. Genetic diversity can also be altered by humans through selective fishing (removal of faster growing individuals or certain spawning aggregations). Accidental releases of cultured fish and ocean ranching tends to reduce genetic diversity (Boehlert 1996). More recently, there is growing agreement that functional (trophic) diversity might be the key attribute that lends ecosystem stability (see review by (Hanski 1997). This type of diversity ensures there are sufficient number of species that perform the same function so that if one species declines for any reason (human or climate-induced), then other species can maintain that particular ecosystem function and less variability would occur in ecosystem processes. However, measures of diversity are subject to bias and how much change in diversity is acceptable is not really known (Murawski 2000).

Localized extinctions due to fishing are rare but some evidence exists that this may have occurred to some skate species in areas of the North Atlantic (see review in (Greenstreet and Rogers 2000). These extinctions could be thought of as a decrease in species level diversity or the actual number of species in an area. Elasmobranchs such as shark, skate, and ray species may be vulnerable to fishing removals and direct impacts. No fishing induced extinctions have been documented for any fish species in Alaska during the last 30 years or so. Taxonomic work on some fish species (e.g., skates) is ongoing and minimal survey and systematic work is being done on other ecosystem components, such as benthic invertebrates, that could be impacted by fishing activities.

Diversity may not be a sensitive indicator of fishing effects (Jennings and Reynolds 2000; Livingston et al. 1999). Studies of other more heavily fished systems, such as the North Sea, Georges Bank, or Gulf of Thailand have shown declines in diversity (Hall 1999; Jennings and Reynolds 2000) related to fishing, and the diversity declines were due to direct mortality of target species.

Evidence so far in highly fished areas such as the North Sea suggests that there is little evidence of genetically induced change in selection for body length in cod after 40 years of exploitation (Jennings and Kaiser 1998). Genetic diversity has not been assessed under Alternative 1, but heavy exploitation of certain spawning aggregations can be inferred and heavier exploitation on older, more heterozygous individuals would have the tendency to reduce genetic diversity in fished versus unfished systems. Thus, some change in genetic diversity has possibly occurred in the BSAI and GOA, but the magnitude of the impacts are not known. The North Sea work indicates the impacts might be minimal (Rice and Gislason 1996). Genetic assessment of pollock populations and subpopulations in the North Pacific shows some genetic differences among stocks but has not demonstrated any genetic variability across time within stocks that might indicate fishing influences (Bailey et al. 1999).

No fishing induced extinctions of groundfish or other marine species have been documented in the last 30 years or so. No fishing-induced changes in functional (trophic) diversity under the current management regime have been detected (NMFS 2001a). Thus, functional diversity was considered to be a non-significant effect on the status quo environment. Genetic diversity changes due to fishing on spawning aggregations or removal of larger fish have not been quantitatively assessed, but because research on more heavily fished areas indicates impacts are minimal all of the alternatives were judged to have a insignificant impact on biological diversity.

4.4 Economic and socioeconomic effects of the alternatives

The primary focus of this section is a discussion of the economic impacts of the five alternatives under consideration in this EIS. Section 4.4 is divided into five major components. The first component will detail the economic impacts of the BSAI pollock allocations and the harvesters and processors that are eligible to participate in the fishery. The second component focuses on the impacts of the cooperative structures. Economic impacts of the harvesting and processing (primarily crab) sideboards are the third component discussed. Economic impacts of the monitoring and enforcement system are discussed in the fourth section. The fifth section is a discussion of community impacts.

4.4.1 Pollock allocations and eligible participants

This section provides a description of the economic impacts that the allocation and participation changes may cause. The five alternatives outlined earlier in this analysis will set the parameters for the discussion.

Two aspects of the fishery will be the focus in this section. The first is the actual percentage of the BSAI pollock TAC that will be allocated to each sector. The second part of the discussion describes which vessels will be allowed to harvest the BSAI pollock allocated to the three industry sectors defined in the AFA.

Allocation of BSAI pollock fishery among industry sectors

The allocation of BSAI pollock among industry sectors changed in 1999 with the implementation of the AFA. Between 1992 and 1999 (prior to implementation of the AFA), the BSAI pollock fisheries had been managed under the inshore/offshore allocation regime first implemented under Amendments 18/23 to the FMPs and extended under Amendments 38/40. The inshore/offshore regime allocated 7.5% of the BSAI pollock to CDQ fisheries. The remaining TAC was then allocated 35% inshore and 65% offshore. Under Alternative 1 (no action) the 35/65 inshore/offshore allocation split that was in place from 1992-1998 would continue unchanged. Pollock allocations to each sector under each of the remaining AFA-based alternatives (Alternatives 2 through 5) based on the allocation formula prescribed in the AFA and are identical. The AFA prescribes these allocations and does not provide the Council with the latitude to change any of the percentages allocated to the three industry sectors or the CDQ fisheries. The Council considered a wide range of alternative allocation schemes in 1998 while inshore/offshore Amendments 51/51 were under development, prior to the passage of the AFA. A comprehensive analysis of alternative allocation schemes is contained in the EA/RIR/IRFA prepared for Amendments 51/51 (NPFMC 1999e).

Alternative 1. Alternative 1 would keep the BSAI pollock allocations that have been in place since the 1992 B-season. This allocation would allow the inshore sector to process 35% of the available BSAI pollock TAC and the offshore sector to process 65 percent, after 7.5% of the TAC had been deducted for CDQ fisheries.

Information presented in this section of the document is primarily taken from the inshore/offshore 3 analysis presented to the Council in 1998. Some of this same information was presented to Congress, by various groups supporting the AFA, as background information during the formation of the Act. Therefore, because this is the information that was used as the basis for making inshore/offshore and AFA decisions, it is presented again in this section of the document to describe the status quo.

Assuming a TAC of 1.1 million mt, which approximates the Bering Sea subarea TAC in recent years, and a 35/65 split of the pollock TAC, the inshore sector would be allowed to process 356,125 mt of pollock excluding any pollock harvested in the CDQ fisheries. The three motherships listed in the AFA would process about 101,750 mt and offshore catcher processors would process about 559,625 mt, if they maintain the same proportions[17] of the offshore processing as they did in 1996. CDQs would account for the remaining 82,500 mt of BSAI pollock.

The total amount of each product produced will vary depending on our assumption regarding how much pollock each sector will process, because each industry sector may have different markets and/or utilization rates. The fillet catcher processor sector, for example, is projected to produce nearly 18,000 mt of deep skin fillets under a 1.1 mt TAC (Table 4.4.1). By definition the fillet catcher processors will produce no surimi. Motherships[18], on the other hand, are expected to produce no fillets and just less than 20,000 mt of surimi. Changing the allocation between these two sectors will have substantial impacts on our estimates of the various products produced. Though motherships may add fillet equipment to their vessels under the right market conditions, predicting when a mothership might add equipment to produce fillets is well beyond our current knowledge base and is not the focus of this analysis. However, the United States General Accounting Office (GAO) has completed a document on changes in fillet production resulting from the AFA. A copy of that report is available through the GAO (General Accounting Office (GAO) 1999).

Alternative 1 product mix assumptions

1. Processors within a sector will continue to process products in the same relative proportions as they did in 1996.

2. Sectors will continue to have the same utilization rates as 1996 (**Use caution when comparing product projections across industry sectors).** The methods for estimating total catch differs between shorebased and at-sea processors, and therefore utilization rates may not be directly comparable.

At the bottom of Table 4.4.1 is a section on the products produced from pollock harvested under the CDQ program. This production is based on a 7.5% allocation of the TAC. Alternatives 2 through 5 increase the CDQ allocation to 10 percent. Therefore the production may be expected to increase by about 33 percent. This assumes that CDQ pollock were already being processed in a slower and more rational manner, and having cooperatives in place would not cause dramatic changes in the production process for the CDQ fishery.

The product mix from 1996 is presented as the baseline information. Inshore CDQ products were not broken out in this table, because the NMFS Weekly Production Reports cannot separate products made from pollock caught in non-CDQ and CDQ fisheries. One reason they cannot be separated is the mixing of fish that may occur during that week's processing. Pollock taken as bycatch in the Pacific cod fishery or in an open access pollock target fishery may be mixed with CDQ fish. If CDQ and non-CDQ fish are processed during the same week, it is not possible to determine the product that came from fish harvested in the CDQ and which did not. To breakout the inshore CDQ pollock products in Table 4.4.1, the utilization rate for the combined open access and CDQ fishery was applied to the projected CDQ harvest.

[17] In 1997 and 1998 the mothership sector actually increased their percentage of the pollock that was processed by the offshore sector. Those data are reported in a later section of this document.

[18] Motherships are the three vessels listed in the AFA as being eligible to process BSAI Pollock. The three motherships are the Excellence, Golden Alaska, and Ocean Phoenix.

Table 4.4.1 Estimated product mix under Alternative 1 (36/65 inshore/offshore).

Insh./Off. Class	Who Caught the Fish	Surimi	Minced	Fillet/Block and IQF	Deep Skin Fillet	Meal	Oil	Roe
Non-surimi C/P	Self Caught	-	6,420	3,882	15,477	-	-	1,539
	Catcher Vessels	-	1,243	912	2,239	-	-	163
Non-surimi C/P Total		-	7,663	4,794	17,716	-	-	1,702
Surimi - C/P	Self Caught	49,618	13	1,080	6,282	10,695	337	5,042
	Catcher Vessels	7,022	-	26	651	1,341	-	438
Surimi - C/P Total		56,640	13	1,105	6,933	12,036	337	5,480
Catcher Processor Total[1]		**56,640**	**7,675**	**5,899**	**24,649**	**12,036**	**337**	**7,182**
Mothership Total[1]		**19,819**	**-**	**-**	**-**	**4,520**	**318**	**969**
Inshore Total[1]		**64,252**	**2,365**	**8,311**	**6,702**	**25,092**	**7,667**	**3,978**
Grand Total		**140,711**	**10,040**	**14,210**	**31,351**	**41,649**	**8,322**	**12,128**
Non-surimi C/P	CDQ Fishery[3]	-	3,059	3,191	2,662	-	-	346
Surimi – C/P	CDQ Fishery	3,993	10	150	1,027	338	-	481
Mothership	CDQ Fishery	1,301	-	-	-	264	-	274
Inshore	CDQ Fishery[2]	1,897	70	245	198	741	226	117

[1] Use caution when comparing production across industry sectors.
[2] The utilization rates from the combined open access and CDQ catches were used to estimate this production
[3] CDQ production is assumed to remain constant under any of the allocation alternatives
Note: This estimate assumes a 1.1 million metric ton TAC, with 7.5% allocated to CDQ fisheries.

Ex-vessel prices. Ex-vessel prices were discussed in detail in section 3.7 of the EA/RIR/IRFA prepared for Amendments 51/51 FMPs (NPFMC 1999e). That document provides a detailed description of how the inshore and at-sea ex-vessel prices were determined. The same methodology was used for this analysis. The text box imbedded in this section contains a summary of the ex-vessel prices that are used in to make projections of revenue. Because the at-sea price is set as a percentage of the shoreside price, any allocation to catcher vessels delivering at-sea will result in less gross revenue than if the same amount of fish were delivered shoreside. However, it is important to remember that revenues are only half of the equation. Catcher vessels that choose to deliver at-sea likely do so for a reason. If they are operating their vessel to maximize profits, which is a reasonable assumption, they must either have the option of delivering more fish or they have a lower cost structure when delivering at-sea. It is possible they may realize both of these benefits. The additional fish and/or lower costs would then counteract the lower price and potentially yield equal or greater profits for those catcher vessels. It should be pointed out that without information on the catcher vessel's cost structure, it is not possible to determine if this would actually be the result.

> **Offshore ex-vessel price assumption:** The price of pollock delivered to catcher processors or motherships is assumed to be 87.5% of inshore ex-vessel price. The inshore price used in this analysis is \$0.0850; therefore the offshore price equals \$0.0744. We have also assumed that the quantity of pollock harvested does not impact the ex-vessel price.

Gross revenue. Catcher vessels generate revenue by selling the pollock they harvest to processors. All of the pollock allocated to the inshore and mothership sectors will be harvested and delivered to those processors by catcher vessels.

Catcher/processors sometimes supplement their harvesting capability by taking deliveries from catcher vessels. Catcher vessels harvested approximately 10% of the pollock processed by catcher processors in 1996. Only that portion of the catcher processor allocation that is harvested by catcher vessels will be included in our estimates of catcher vessel gross revenue. Pollock that were caught and processed by catcher processors are included in the column titled "Own Harvest", but the revenue fields are intentionally left blank. The ex-vessel revenue fields were left blank because catcher processors both catch and process their own fish. Therefore, no ex-vessel revenues are generated in this mode of operation.

If the inshore/offshore allocation regime had continued, there would be no change in the expected gross revenue catcher vessels would be projected to receive (it is the same allocation). That is reflected in the "Change from Status Quo" line of Table 4.4.2 below. The second line from the bottom reports the total revenue catcher vessels are expected to receive from each sector, based on the price assumptions used in this analysis. Those projections indicate that catcher vessels would earn almost $93 million. Inshore processors would have paid catcher vessels about $67 million, motherships about $17 million, and catcher processors about $9 million.

Table 4.4.2 Impacts on catcher vessel's gross revenue under Alternative 1 (status quo).

			Catcher Processors		
	Inshore	*Motherships*	*CV Deliveries*	*Own Harvest*	*Total*
Allocation Percentages	**35%**	**10%**	**5.5%**	**49.5%**	**100%**
Sector's Allocation (mt)	356,125	101,750	55,963	503,663	1,017,500
Change from Status Quo [1] (mt)	-	-	-	-	-
Est. Ex-vessel Revenue/Ton of Raw Pollock	$ 187	$ 164 [2]	$ 164 [2]	n/a	n/a
Est. Total Ex-vessel Revenue (Million $)	$ 66.7	$ 16.7	$ 9.2	n/a	$ 92.6

The sector's allocation was calculated using the following formula: (allocation % *1,100,000mt * 0.925)

[1]Status quo allocation assumes that catcher processors harvest 55%, motherships 10%, and inshore 35%. NMFS 1996 Blend data also showed that about 10% of pollock processed by catcher processors was delivered to them by catcher vessels.
[2] Mothership and catcher/processor ex-vessel revenue per ton is assumed to be 87.5% of the inshore revenue.

First wholesale prices. FOB Alaska prices for each product form (excluding oil) and sector are discussed in detail in the I/O 3 amendment package (BSAI Amendment 51). Prices from I/O 3, summarized in Table 4.4.3 below, are multiplied by the products reported in the product mix table (Table 4.4.1) to estimate gross revenues at the first wholesale level.

Table 4.4.3 Pollock first wholesale prices.

	Wholesale Prices per Metric Ton of Product		
Product Form	*Inshore*	*Catcher/processors*	*Motherships*
Surimi	$ 1,808	$ 1,907	$ 1,907
Fillets, Blocks, IQF	$ 2,116	$ 2,116	$ 2,116
Deep Skin Fillets	$ 2,734	$ 2,734	$ 2,734
Minced[1]	$ 1,146	$ 931	$ 931
Roe	$ 9,965	$ 13,294	$ 13,294
Meal	$ 661	$ 639	$ 639

Source: Production and Revenue/Price Data Reported to NMFS (1991, 1994) and ADF&G (1996) in the Commercial Operators Annual Report (COAR).
Note: To protect the confidentiality of processors, fillet prices are based on combining inshore and offshore data.
[1]Mince prices for 1991 and 1994 were not estimated. APA provided the 1996 offshore mince price as only one At-sea company reported mince prices to ADF&G. If APA and ADF&G data were combined the average 1996 offshore minced price would be $992/mt.

Processor's gross revenue at first wholesale. Gross revenue can be estimated by multiplying the first wholesale revenue per ton of raw pollock by the number of tons processed. This method does not provide detail on the contribution of each product form to total revenue, but it does allow the reader to easily calculate total revenue within a processing sector. The box below lists the revenues per ton used in this analysis. These values were derived using the following formula:

Gross Revenue per Ton = $\Sigma(P_i * Q_i)/R$; *where;*

Pi = the first wholesale price of product I by the sector during 1996
Qi = the quantity of product I the sector produced in 1996
R = tons of raw pollock processed by the sector in 1996

This method of estimating gross revenue is relatively simple. Prices are assumed to remain fixed at 1996 levels. Constant first wholesale prices mean the amount of product produced has no impact on the price. This assumption was necessary because of the limited information available on pollock demand. The most recent attempt to study pollock price and quantity relationships was conducted by Herrmann *et. al.* (Hermann et al. 1996) However the literature in this area is sparse at best, and given current data constraints no reliable model could be developed within the time line of this analysis.

Table 4.4.4 First wholesale gross revenue (millions $) -FOB Alaska: Alternative 1 (35% inshore and 65% offshore).

Insh./Off. Class	Who Caught the Fish	Surimi	Minced	Fillet/Block and IQF	Deep Skin Fillet	Meal	Roe	Total
Non-surimi C/P	Self Caught	$ 0.0	$ 6.0	$ 8.2	$ 42.3	$ 0.0	$ 20.5	$ 77.0
	Catcher Vessels	$ 0.0	$ 1.2	$ 1.9	$ 6.1	$ 0.0	$ 2.2	$ 11.4
Non-surimi C/P Total		$ 0.0	$ 7.1	$ 10.1	$ 48.4	$ 0.0	$ 22.6	$ 88.3
Surimi - C/P	Self Caught	$ 94.6	$ 0.0	$ 2.3	$ 17.2	$ 6.8	$ 67.0	$ 187.9
	Catcher Vessels	$ 13.4	$ 0.0	$ 0.1	$ 1.8	$ 0.9	$ 5.8	$ 21.9
Surimi - C/P Total		$ 108.0	$ 0.0	$ 2.3	$ 19.0	$ 7.7	$ 72.8	$ 209.8
Catcher/processor Total[1]		**$ 108.0**	**$ 7.1**	**$ 12.5**	**$ 67.4**	**$ 7.7**	**$ 95.5**	**$ 298.2**
Inshore Total[1]		**$ 116.2**	**$ 2.7**	**$ 17.6**	**$ 18.3**	**$ 16.6**	**$ 39.6**	**$ 211.0**
Mothership Total[1]		**$ 37.8**	**$ 0.0**	**$ 0.0**	**$ 0.0**	**$ 2.9**	**$ 12.9**	**$ 53.6**
Grand Total		**$ 261.9**	**$ 9.9**	**$ 30.1**	**$ 85.7**	**$ 27.2**	**$ 148.0**	**$ 562.7**
Non-surimi C/P	CDQ Fishery[3]	$ 0.0	$ 2.8	$ 6.8	$ 7.3	$ 0.0	$ 4.6	$ 21.5
Surimi - C/P	CDQ Fishery	$ 7.6	$ 0.0	$ 0.3	$ 2.8	$ 0.2	$ 6.4	$ 17.4
Mothership	CDQ Fishery	$ 2.5	$ 0.0	$ 0.0	$ 0.0	$ 0.2	3.6	$ 6.3
Inshore	CDQ Fishery[2]	$ 3.4	$ 0.1	$ 0.5	$ 0.5	$ 0.5	$ 1.2	$ 6.2

[1] Use caution when comparing gross revenues across industry sectors. See Amendment 51 to the BSAI for additional discussion.
[2] The utilization rates from the combined open access and CDQ catches were used to estimate the quantity of products produced for the inshore sector
[3] CDQ production is assumed to remain constant under any of the allocation alternatives
Note: These estimates assume a 1.1 million metric ton TAC, with 7.5% allocated to CDQ fisheries.

Table 4.4.4 contains estimates of each processing sectors' gross revenues under Alternative 1. This table reports values at a somewhat aggregated product level. The additional detail was included so the reader could readily see the contribution of each product form. However, the same totals would be estimated if the revenues per ton, in the text box, were multiplied by the tons of pollock allocated to the sector.

The total first wholesale revenue generated by all processing sectors, is estimated to be $562.7 million. Combined revenues of the Non-surimi and Surimi catcher/processor sectors totaled $298.2 million, motherships generated $53.6 million, and the inshore processing sector $211.0 million. Surimi brought in the most revenue for each of the processing sectors. However, in the Non-surimi catcher/processor sub-sector, deep-skin fillet production generated the most revenue for that specific group of vessels.

PSC bycatch. Bycatch of prohibited species is always a sensitive issue. However, the pollock fishery has some of the lowest bycatch rates in any of the North Pacific fisheries. Minimal amounts of halibut and crab are taken in the midwater portion of this fishery. Herring and salmon bycatch is of more concern. Yet, if the amount of pollock harvested is considered, only about one kilogram of herring is caught for each metric ton of pollock, and over 20 mt of pollock are harvested for each chinook salmon caught. Estimates of what PSC bycatch is projected to be under Alternative 1 are reported in Table 4.4.5. These numbers would likely be impacted by changes in pollock seasons resulting from Stellar Sea Lion protections. However, additional information on their impacts to the open access fishery would be required before projections could be made with any degree of certainty.

Table 4.4.5 PSC bycatch by processing sector: Alternative 1.

Alternative 1	*Halibut mort.*	*Herring*	*Red king crab*	*Other king crab*	*Bairdi tanner*	*Other tanner*	*Chinook*	*Other salmon*
	mt	*mt*	*1,000s*	*1,000s*	*1,000s*	*1,000s*	*1,000s*	*1,000s*
C/Ps (non-surimi)	118.4	46.6	4.6	0.0	18.9	19.3	5.4	3.9
C/Ps (surimi)	121.3	672.7	0.9	0.1	57.7	22.8	13.3	33.0
Motherships	18.5	27.7		-	0.1	0.2	7.8	16.8
Inshore	43.6	433.6	0.1	0.1	7.1	17.8	25.1	18.9
Total	301.8	1,180.6	5.6	0.2	83.8	60.1	51.6	72.6

Alternatives 2-5. Alternatives 2 through 5 are indistinguishable from one another in terms of their impacts on TAC allocations among the sectors, except for the treatment of the incidental catch allowance (ICA) . The CDQ and sector level allocation percentages were prescribed in the Act and the Council was not given the authority to make changes to those allocation percentages.

Information presented for these alternatives will use the same price and product mix data that was used for Alternative 1. However, it must be noted that product mixes are expected to change with the implementation of cooperatives. This is expected because processors will have more time to process pollock under a cooperative structure. The extra time should allow processors to make a better product and extract more usable products from the pollock harvested. Because 2000 is the first year that cooperatives are in place for all sectors of the pollock industry, projections using data from the open access fisheries will not reflect changes caused by the AFA. These projections may not be representative of the fishery under cooperatives. For example, preliminary 1999 data from the catcher/processor fleet indicates they were able to increase their pollock utilization rates by about 20% as a result of the AFA.

Ex-vessel prices are also expected to change under Alternatives 2 through 5. Again, the prices used to make projections in this section are from years prior to the implementation of cooperatives and may not be representative of fishery prices when cooperatives are in place. Prices from official data sources will not be available until the middle of 2001 for the 2000 fishing seasons. Given this lag in the time it takes for data to be made available, it is unrealistic to wait for those data for use in this analysis. It should be noted that informal discussions with members of the pollock industry have indicated that the ex-vessel prices during the 2000 A-seasons were much higher[19] than they were in 1998. The individuals that provided that information also indicated that the price of roe was the primary reason for the higher ex-vessel prices. If roe was the primary reason for the higher A-season prices, this trend may not carry over into the fall fisheries. Currently there is not enough information available to determine what caused the high roe prices in 2000. However, the higher prices are likely a result of vessels being given the opportunity to harvest roe when the quality is highest under the cooperative structure, lower roe supplies on the world market, a stronger Japanese economy than in the recent past, and perhaps other factors.

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[19] Ex-vessel prices in the A-season were reported to be between 15 and 20 cent per pound, depending on the processor that was buying the pollock. Prices reported in this analysis for the 1998 seasons were 8.5 cents for inshore pollock and 7.4 cents for pollock delivered to offshore processors.

Proponents of the AFA would likely argue that all sectors of the BSAI pollock industry are economically better situated as a result of the Act. This is likely true[20], otherwise members of the pollock industry would be trying have the Act overturned, and to date there have been no efforts at a sector level to repeal the Act. Some individuals, typically with limited pollock histories, have opted not to file the required application to join the AFA sector where they would be eligible (primarily inshore catcher vessels), but overall no sector has elected not to form cooperatives. This seems to be a good indication that members of the BSAI pollock fishery, in general, would rather operate under the AFA system than the old system of management.

CDQ allocation. The allocation of BSAI pollock to the CDQ program was increased from 7.5% of the overall TAC to 10% under Alternatives 2-5. Increasing the CDQ allocation by 2.5% of the overall TAC (a 33.3% increase in their allocation) should benefit the program's participants. CDQ organizations should realize increased revenues, which can be used to further their business plans aimed at improving the living standards of the communities they represent.

If we assume that the remainder of the BSAI pollock fishery has limited impacts on the prices CDQ groups are paid for their pollock, then the revenue increase realized by the groups should be close to 33 percent. This seems to be a reasonable assumption, because the AFA does not change the overall structure of the CDQ program, and fishermen and processors should still be willing to pay about the same amount for CDQ pollock as they would have before the allocation was increased and the fishery structure changed.

Incidental Catch Allowance. The ICA is relevant only when considering Alternatives 2 through 5. ICAs are not an issue under Alternative 1. Pollock are only allocated to CDQ, inshore, and offshore components under Alternative 1, because there are no other sectors that have incidental pollock catches under the open access system that need to be accounted for with a pollock ICA.

Under Alternative 2 the ICA would be approximately 5% of the TAC. These fish would be harvested by members of the AFA and non-AFA fleets in their prosecution of BSAI fisheries where pollock is taken as bycatch. Alternatives 3, 4, and 5 would set-aside 3% of the BSAI pollock TAC as an ICA, and it would only be counted against the catch of non-AFA vessels. The remaining 2% would be split among the inshore, mothership, and catcher/processor sectors at the same percentage as their overall AFA allocation.

Allocating an additional 2% of the BSAI pollock TAC to each sector gives them more flexibility in harvesting the pollock, when compared to Alternative 2. If they are able to reduce pollock bycatch in other fisheries, or they opt not to harvest all of their sideboard species, they would be allowed to take the residual pollock in their directed pollock fishery. Providing the AFA vessels more freedom to determine how to use their pollock allocation should benefit their overall operations, and not cause any substantial harm to the non-AFA fleet. This is most likely to be the case if some of the pollock is taken in the directed fishery when vessel owners decided not to harvest all of the sideboard species they were allocated.

Two percent of the BSAI pollock fishery in 2000 was equivalent to about 20,500 mt. At the first wholesale level that amount of pollock is likely worth close to $10 million. It is not expected that the entire $10 million would be revenue increases, since some of the pollock harvested in non-pollock target fisheries would have been sold. Therefore, even if all 2% of the pollock were taken in the directed fishery, it would not likely increase the overall amount of pollock being sold by the entire $10 million that is projected.

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[20] It should be noted that members of the mothership sector have voiced concerns that they received a smaller allocation than they had harvested in the recent past, but received no direct compensation for their loss. The analysts agree that they indeed received a slightly smaller allocation than they had accounted for in the past (see the mothership section). However, the benefits of operating in a cooperative structure should offset that amount of fish that was lost when the allocation percentages were changed.

Inshore sector allocation. Alternative 1 represents an open access fishery where there is no allocation to groups (cooperatives and open access) within the inshore sector. Therefore, allocations among inshore vessels are not relevant. The TAC would be divided among the inshore and offshore sectors, but no further allocations would be made within those groups.

The economic impacts on members of the inshore sector are those reported in the inshore/offshore 3 analysis (NPFMC 1999e) and the biological opinion developed to study the interrelationships between pollock and stellar sea lions (NMFS 1999d). While neither of those analyses was able to quantify the costs and benefits of this allocation, they both indicate that participation in the inshore sector has been relatively stable since inshore/offshore was implemented in 1992, which implies that most of the members of the sector were profitable enough to stay in business. However, the race for fish is felt to have lead to overcapitalization in the inshore sector which results in inefficiencies in the production of pollock products.

The inshore sector's allocation of BSAI pollock was increased from 35% of the overall TAC (after CDQ was taken off the top) to 50 percent, under Alternatives 2 through 5. This equates to a 39% increase in the inshore sector's overall allocation[21]. Along with that increase in their allocation the inshore sector took on a $75 million loan, which must be repaid to the Federal Government. Repayment of the loan is based on a formula outlined in the Act where the inshore sector pays 0.6 cents for each pound of BSAI pollock harvested. This repayment fee decreases the value of the inshore sector's allocation over the time period that the loan is being repaid.

It is difficult to determine how individuals within the inshore sector will fair under Alternatives 2 through 5 relative to Alternative 1. Vessel owners, in general, that wish to remain in the fishery will be better off because the sector is allocated 39% more pollock. However, each individual's situation will be depend on their pollock allocation and sideboard allotment within their cooperative. Some vessels may have had limited catch histories during the qualifying years and may receive a relatively small pollock allocation compared to their long-term catch history or their relative catching power. The owners of these vessels may not be as well off as under Alternative 1, even though the inshore sector has a larger overall allocation under Alternatives 2-5.

Mothership sector allocation. Members of the mothership sector were allocated 10% of the BSAI pollock TAC, under the AFA, after CDQ pollock were subtracted. Members of the mothership sector have indicated that they received a smaller AFA allocation than they had been harvesting/processing in recent years. Because of the size of the allocation, some members of this sector have stated that they have received fewer benefits from the AFA than either the inshore or catcher/processor sectors.

Blend data from NMFS shows the mothership sector accounted for 11.6% of the directed BSAI pollock fishery in 1998. The 1.6% difference in TAC (11.6% minus10 percent) would have equated to over 16,000 mt had the AFA been in place during 1998. Given a first wholesale price of $525 at metric ton, that equates to about $8.5 million. Dividing those revenues among the three processors in the fishery equates to $2.8 million per processor, had they been allocated 11.6% of the TAC instead of 10 percent. This increase would have had to come at the expense of either the catcher/processor or inshore sectors.

[21] Members of the inshore sector would argue that a portion of this increase was purchased from the offshore sector though a federal grant and an industry funded loan. The purpose of reporting these numbers is to show the actual increase in the their allocation (accounting for the larger CDQ allotment) while acknowledging that they must repay a loan that results in a tax of 0.6 cent per lb of pollock landed.

Currently there are 19 catcher vessels in the mothership sector. If it is assumed that they are paid about \$0.0744 per pound[22] for pollock, these vessels would have generated about \$132,000 less revenue, on average, by harvesting 10% of the TAC versus 11.6 percent.

The revenue numbers reported above do not take into account cost savings or price increases that may have resulted from AFA. Information on the cost structure of the firms before and after the AFA went into effect and information on the impact that AFA has on ex-vessel and first wholesale prices would be required to make those estimates. That information is currently not available. However, the Halverson report (Appendix D) concluded that while the mothership sector may have benefitted less from the AFA than the inshore or catcher/processor sectors, they may still be better off under a cooperative structure than under the open access race for fish.

Catcher/processor sector allocation. Members of the catcher/processor sector were allocated 40% of the BSAI pollock TAC under Alternatives 2 through 5. This allocation was then sub-divided into pollock for harvest by catcher/processors and catcher vessels that have delivered to catcher/processors. The catcher/processors are allocated 91.5% of the sector's quota to harvest with their own vessels and the catcher vessels that deliver to catcher/processors are allocated the remaining 8.5 percent.

The economic impacts of the 29% reduction in pollock allocation is likely offset by benefits derived from the buyout and retirement of vessels from the catcher/processor sector and their ability to form cooperatives under the AFA. Therefore, while the allocation received by the catcher/processor sector is considerably lower under AFA, other components of the Act likely mitigate those losses, and the catcher/processors may be able to generate greater profits under the AFA even with the smaller allocation.

Seven catcher vessels are allowed to harvest 8.5% of the catcher/processor sector's allocation and it must be delivered to catcher/processors listed in the Act for processing. These seven vessels seem to have faired quite well under the AFA. Other members of industry have labeled this group of vessels the "magnificent seven" recognizing that they are in a favorable position. The seven catcher vessels in this sector have opted to lease much of their allocation back to the catcher/processors for harvesting (HSCC/PCC 2000). This arrangement allows the catcher vessels to be paid for fish harvested by someone else. The prices paid to these vessels have been rumored to be much higher than the 1998 prices paid inshore. When the reduced costs and the higher ex-vessel prices are considered, it is reasonable to assume that the catcher vessel sector, operating within the catcher/processor sector allocation, is better off under the AFA relative to Alternative 1.

Identification of eligible participants (permit requirements)

Under Alternatives 2-5, participants in the BSAI pollock fishery are required to apply to NMFS to obtain an AFA permit before they can harvest or process BSAI pollock. Separate permits are required for catcher vessels, catcher/processors, motherships, and inshore processors. These permits would not be required under Alternative 1. Regulations under Alternative 1 would continue to stipulate that all entities must obtain a valid Federal Fisheries Permit and harvesting vessels must possess a valid LLP permit.

Alternatives 2 through 5 add the additional requirement that participants in the BSAI pollock fishery obtain an AFA permit from NMFS. The costs of filling out the paper work for an AFA permit are relatively minor, and those additional costs are not expected to impact any of the participant's decisions to enter the BSAI pollock fishery. As of August 24, 2000 there are three motherships, eight inshore processing plants, 21 catcher/processors, and 109 catcher vessels holding AFA permits.

[22] The price of \$0.0744 per pound is the 1996 ex-vessel price reported earlier in this section of the analysis and was the price used in the inshore/offshore 3 analysis.

Vessels and processors must meet the criteria specified in Section 208 of the Act to obtain an AFA permit. If a vessel or processor does not meet the criteria specified in that section of the AFA, they are ineligible to harvest or process BSAI pollock in the directed fishery.

The only group whose composition may change before December 1, 2000 (when the application period permanently closes) is the catcher vessel sector, and if changes do occur they are most likely to take place in the inshore catcher vessel sector. Section 208 of the AFA defines the criteria that vessels must meet to be eligible to fish BSAI pollock as an inshore catcher vessel. The qualification criteria for inshore catcher vessels listed in Section 208(a) of the AFA is:

> *(a) CATCHER VESSELS ONSHORE.—Effective January 1, 2000, only catcher vessels which are—*
> *(1) determined by the Secretary—*
> *(A) to have delivered at least 250 metric tons of pollock; or*
> *(B) to be less than 60 feet in length overall and to have delivered at least 40 metric tons of pollock, for processing by the inshore component in the directed pollock fishery in any one of the years 1996 or 1997, or between January 1, 1998 and September 1, 1998;*
> *(2) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and ap-proved by the Secretary; and*
> *(3) not listed in subsection (b), shall be eligible to harvest the directed fishing allowance under section 206(b)(1) pursuant to a federal fishing permit.*

Initial estimates indicated that more inshore catcher vessels meet these requirements than have applied for an AFA permit. It is speculated that these vessels have not applied because they have a limited BSAI pollock catch history during the qualifying years, and the costs that would be imposed on them through harvesting sideboards out-weigh the benefits of harvesting BSAI pollock they would receive through their cooperative or in the open access fishery. With our current information it is not possible to determine how many additional vessels may apply for, and be issued, an AFA permit before the application deadline closes. However, the conditions that caused those vessel's owners not to apply for the 2000 fishery will continue to exist, so it is unlikely that many of those vessels will submit an application prior to the cut-off date.

4.4.2 Cooperative structure

Cooperative structure has been a major source of contention during the AFA discussions at the Council, particularly within the inshore sector. Within the inshore sector, the debate has focused primarily on how much autonomy the catcher vessel sector will have. Independent owners of catcher vessels have lobbied for the AFA to be amended to grant catcher vessels greater freedom, in terms of where they may deliver their pollock catch. Processors in the inshore sector, on the other hand, have argued that the AFA should be maintained as written regarding where catcher vessels may deliver their harvested fish. Each of the situations discussed above are covered in one of the alternatives being considered in this analysis. The cooperative structure of the mothership and offshore cooperatives are basically unchanged from those prescribed in the AFA, under Alternatives 2 through 5.

Inshore cooperative structure

Two interrelated issues have been the focus of the inshore cooperative structure debate. Both issues stem from the passage in the AFA that defines a "qualified catcher vessel". That passage of the AFA ties catcher vessels to a particular processor and does not allow vessels to retire from the pollock fishery and remain in a cooperative.

Paragraph 210(b)(3) of the AFA defines "qualified catcher vessel" for the purposes of determining which vessels are eligible to be in a particular inshore cooperative:

(3) QUALIFIED CATCHER VESSEL.—For the purposes of this subsection, a catcher vessel shall be considered a "qualified catcher vessel" if, during the year prior to the year in which the fishery cooperative will be in effect, it delivered more pollock to the shoreside processor to which it will deliver pollock under the fishery cooperative in paragraph (1) than to any other shoreside processor.

The AFA definition of a qualified catcher vessel effectively ties individual vessels to a specific processor and prevents catcher vessels from joining any other cooperative until they have spent a year in the open access portion of the fishery. This provision, along with the requirement that a cooperative deliver at least 90% of its catch to its designated processor, "locks in" a vessel's catch history for the processor to which it delivered the previous year. As a consequence of these two provisions of the AFA, any time an inshore cooperative forms, the associated processor receives a market share guarantee equal to at least 90% of the previous year's deliveries from cooperative vessels.

The definition of "qualified catcher vessel" is also the provision of the AFA that has the effect of requiring that catcher vessels "spend a year in open access" before switching cooperatives. Nothing in the AFA specifically prohibits vessels from switching cooperatives from year to year without spending a year in the open access fishery. However, as a practical matter, it may be difficult or impossible for a vessel to participate in a cooperative and deliver to one processor during one fishing year while at the same time "qualifying" to join a cooperative associated with a different processor for the subsequent fishing year. To do so requires that the vessel spend one year fishing in the open access fishery while delivering to the processor of its choice so that the vessel becomes a qualified catcher vessel for the new cooperative for the subsequent fishing year.

Alternative 2 would treat this issue as was done in the emergency interim rule published January 5, 2000 (65 FR 380). The emergency rule established an inshore cooperative permit application process whereby each inshore cooperative must apply for its allocation of pollock on an annual basis. Cooperative contracts may be single-year or multi-year. However, the cooperative must apply for its allocation annually and must certify annually that the cooperative meets all the requirements contained in the AFA and other relevant regulations.

A definition of "qualified catcher vessel was set out in regulation at paragraph 679.4(l)(6)(ii)(C) of the emergency interim rule to implement this provision of the AFA. The definition contained in the emergency interim rule mirrors the statute as closely as possible. The regulatory definition is as follows:

. . .For the purpose of this paragraph, a catcher vessel is a qualified catcher vessel if:
(i) it delivered more pollock harvested in the BSAI inshore directed pollock fishery to the AFA inshore processor designated under paragraph (l)(6)(ii)(B) of this section than to any other shoreside processor or stationary floating processor during the year prior to the year in which the cooperative fishing permit will be in effect; [50 CFR 679.4(l)(6)(ii)(C)*]*

Under Alternative 2, "more pollock" simply means more than zero. The AFA does not establish any minimum amount of pollock that must be delivered to a processor for a vessel to qualify to join the cooperative that is associated with that processor and NMFS has not established any minimum threshold level. A vessel owner wishing to join a cooperative must simply certify in the annual cooperative application that the vessel in question "delivered more pollock harvested in the BSAI inshore directed pollock fishery to the [designated] AFA inshore processor than to any other shoreside processor or stationary floating processor during the year prior to the year in which the cooperative fishing permit will be in effect*."*

However, the regulations do make two clarifications to the term "more pollock" to clarify ambiguities in the statute. First, the regulations specify that only BSAI pollock is used to determine a vessel's qualification to join a cooperative (as opposed to including GOA pollock landings as well). Second, the term "directed pollock fishery" is added to the term "more pollock" to clarify that, for the purpose of cooperative qualification. NMFS is concerned with amounts of pollock taken in the directed pollock fishery and not incidental catch of pollock caught in other fisheries. This clarification is necessary to prevent a vessel's pollock bycatch in other fisheries from inadvertently affecting its cooperative qualification.

To count pollock bycatch could create the unintended effect of restricting the ability of catcher vessels to deliver non-pollock groundfish to other markets. Under the IR/IU program, catcher vessels are required to retain all incidental catch of pollock in other groundfish fisheries up to the 20% MRB for pollock. As pollock is a common bycatch species in the Pacific cod fishery and other groundfish fisheries, AFA catcher vessels fishing for Pacific cod may land significant amounts of pollock as incidental bycatch which will be counted against the pollock incidental catch allowance not the vessel's cooperative quota. To count this pollock towards an AFA catcher vessel's cooperative qualification could have significant unintended consequences.

The AFA makes no restrictions on either the delivery or processing of non-pollock groundfish species in the BSAI. Consequently, AFA catcher vessels fishing for Pacific cod are free to deliver their Pacific cod and associated incidental catch of pollock to any processor, not just one of the eight AFA processors that are authorized to receive pollock harvested in the directed pollock fishery. If an AFA vessel's cooperative qualification is based on all catch of pollock and not just pollock harvested in the directed fishery, then an AFA catcher vessel fishing for Pacific cod and delivering to a processor other than its AFA pollock processor could inadvertently find itself qualified for the wrong cooperative in the next fishing year, especially if the vessel has arranged or "leased" its pollock shares to other members of the cooperative. In the absence of this clarification, an active AFA catcher vessel delivering sideboard species to a non-AFA processor could inadvertently find itself ineligible to join any inshore cooperative because the processor to which it delivered more pollock than any other processor may be a non-AFA processor.

If NMFS had interpreted the qualified catcher vessel definition in the AFA to refer to all pollock and not just pollock harvested in the directed pollock fishery, then cautious cooperatives and AFA processors may feel compelled to require that AFA catcher vessels deliver all non-pollock groundfish to their designated AFA processor just to prevent inadvertent pollock bycatch from affecting the vessel's cooperative qualification. If this occurs, then non-AFA processors could be severely disadvantaged because they will be unable to compete with AFA processors for Pacific cod deliveries by AFA catcher vessels. Nothing in the AFA suggests that Congress intended to place restrictions on the harvest or processing of species other than pollock. Furthermore, Section 210 of the AFA is concerned only with the allocation of the directed fishing allowances of pollock and not management of incidental pollock bycatch in other fisheries.

Under the emergency interim rule, cooperative permits are issued annually and each cooperative must qualify annually for its allocation of pollock. Under the AFA and under the emergency interim rule, a vessel's qualification to join a particular cooperative is based on its having delivered more BSAI pollock to the cooperative's designated inshore processor than to any other inshore processor during the year prior to the year in which the cooperative fishing permit will be in effect. A vessel that has retired and that did not make any deliveries during the year prior to the year in which the cooperative permit will be, therefore, not qualified to join the cooperative.

Under alternatives 3, 4 and 5, the definition of qualified catcher vessel would be revised to allow inactive vessels to retire from the pollock fishery while still maintaining membership in a cooperative, while at the same time continuing to restrict active vessels to holding membership in the cooperative associated with the processor to which they delivered more pollock in the previous year. To accomplish this the Council established separate cooperative qualification standards for "active" and "inactive" vessels. Doing so required that the Council establish definitions of "active" and "inactive" vessels and then establish separate qualification criteria for these two vessel classes.

The following definition was established for "inactive" vessels. "Inactive vessel" means the vessel did not participate in the BSAI directed pollock fishery in the previous year. The Council then established a separate qualification criteria for "inactive" vessels. An inactive vessel is a qualified vessel if it delivered more pollock harvested in the BSAI inshore directed pollock fishery to the cooperative's designated AFA inshore processor than to any other AFA inshore processor during the last year in which the vessel participated in the BSAI pollock fishery.

Allowing catcher vessels to retire enables harvesting capacity to be removed from the BSAI pollock fishery. Therefore Alternatives 3, 4, and 5 provide the opportunity for the BSAI pollock fishery to be further rationalized, which gives the vessel owners the ability to make business decisions regarding the vessels should continue fishing and those that should be removed. Since it is likely that less efficient vessels would be removed from the pollock fishery, under Alternatives 3, 4, and 5, these alternatives should enable vessel owners to generate higher profits by lowering their fishing costs.

Fewer vessels in the fishery will lead to fewer employment opportunities overall, but those that work aboard vessels that harvest the additional quota should be offered more compensation. If that is the outcome, the jobs that remain will represent closer to full time employment and a higher standard of living for the crew members that remain in the fishery. Crew members that lose their jobs as a result of fewer vessels working in the fishery will, of course, be disadvantaged. However, it is not possible to determine what the opportunity costs are for the crew members that were displaced from the fishery. Trade-offs between fewer jobs that offer more compensation and more jobs that offer lower total compensation will occur any time regulatory changes create the opportunity for capital to be removed from fisheries.

Pollock allocations among cooperatives. Alternative 2 does not include any adjustments to the formula used to allocate pollock among inshore cooperatives. Pollock would be allocated to cooperatives based strictly on the 1995-97 catch history of the member vessels divided by the total catch of pollock in the inshore sector from 1995-97. Vessels that participated in the offshore sector during 1995 and 1996 and vessels that missed a year of fishing during the 1995-97 time period would be disadvantaged under Alternative 2, relative to Alternatives 3 through 5, because they will be allocated a smaller percentage of the pollock TAC.

Under Alternatives 3 through 5 cooperatives would be allocated pollock based on the member vessels best 2 out of 3 years (1995-97), divided by the aggregate best 2 of 3 years for all AFA vessels in the inshore sector. In addition, vessels that delivered more than 499 mt of pollock to the catcher/processor sector, from 1995-97, would be allowed to include those landings in their inshore catch total. These two measures benefit vessels that were unable to, or elected not to, participate in the inshore (or mothership) BSAI pollock fishery exclusively during the years from 1995-97.

Some inshore pollock catcher vessels have made deliveries to both the inshore and offshore sectors during the qualifying years. Catcher vessels with histories split between the mothership sector and the inshore sector are able to fish both histories pursuant to the AFA. However, catcher vessels that made deliveries to both the inshore sector and to catcher/processors, lose the catch history that was delivered to the catcher/processor sector. This occurs because the AFA does not specifically create a mechanism for inshore catcher vessels to obtain credit for catch history delivered to catcher/processors. The AFA states in Section 210(b)(4) that

> *"any contract implementing a fishery cooperative under paragraph (1) which has been entered into by the owner of a qualified catcher vessel eligible under section 208(a) that harvested pollock for processing by catcher/processors or motherships in the directed pollock fishery during 1995, 1996, and 1997 shall, to the extent practicable, provide fair and equitable terms and conditions for the owners of such qualified catcher vessel."*

This language seems to place the burden of compensating members of a cooperative on the cooperative itself. If each inshore processor forms a separate cooperative, the burden of compensating members may be more onerous on some cooperatives than others. For example, a cooperative that did not have any members with catch history in the catcher/processor sector would not need to "pay" any compensation, but a cooperative that had several members with offshore catch history could require substantial compensation "payments" by its members.

While the AFA states that both the catch delivered to catcher/processors and motherships would be eligible for compensation, the AFA allows catcher vessels to operate in both the inshore and mothership sectors, if they qualify for both. Some members of industry have indicated that the focus should only be on the lost catch in the catcher/processor sector. Vessels in the inshore sector that had deliveries to motherships during the qualifying years would simply lose that catch history if they did not meet the minimum requirements to be part of the mothership sector.

Section 210(b)(1) states that only catch delivered to the inshore sector will be considered by the Secretary when determining the amount of quota to be allocated to the inshore cooperative(s). Vessels will be disadvantaged in joining a cooperative if a substantial portion of their history was delivered to catcher/processors in the years used to determine catch history. As an example, a catcher vessel fishes for a catcher/processor in 1995 and 1996 and then fishes for a shore plant in 1997. That catcher vessel is not eligible under the AFA to make any future deliveries to catcher/processors, because 1997 was the only year of eligibility for catcher vessels delivering to catcher/processors. The vessel is likely eligible to fish for the inshore sector, but when cooperatives are formed they will only receive credit for the fish delivered in 1997, while many of the other members will receive credit for 1995, 1996, and 1997. As a result, the catcher vessel in this example will be disadvantaged because of business decisions they made on where to deliver pollock.

In developing Amendments 61/61/13/8, the Council authorized the development of a discussion paper to outline *"options for compensation to inshore catcher vessels with catch history delivering to catcher/processors that is no longer available to them under AFA"*. It was determined by the Council that the problem faced by these vessels could be addressed by a modification to the criteria which the Secretary uses to determine how much quota is allocated to each cooperative. Section 213(c)(3) of AFA provides that the Council may modify *"the criteria required in paragraph (1) of Section 210(b) to be used by the Secretary to set the percentage allowed to be harvested by such catcher vessels."*

The following revision to the formula set out in section 210(b)(1)(B) was recommended by Midwater Trawlers Cooperative (MTC) and would appear to remedy this problem:

> ". . . *the Secretary shall allow only such catcher vessels (and catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) to harvest the aggregate percentage of the directed fishing allowance under Section 206(b)(1) in the year in which the fishery cooperative will be in effect that is equivalent to the aggregate total amount of pollock harvested by such catcher vessels (and by such catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) in the directed pollock fishery for processing by the inshore component, together with the amount harvested by such vessels for processing by catcher/processors in the offshore component during 1995, 1996 and 1997, relative to the aggregate total amount of pollock harvested in the directed pollock fishery for processing by the inshore component together with the aggregate total amount harvested by all catcher vessels (excluding those eligible under 208(b)) for processing by catcher/processors in the offshore component during such years and shall prevent such catcher vessels (and catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) from harvesting in the aggregate in excess of such percentage of such directed fishing allowance."*

This modification would allow a catcher vessel with catch history based on deliveries to catcher/processors, that is otherwise lost under the AFA, to bring that catch history into an inshore cooperative while sharing the burden among all members of the inshore sector. The modification does not change any AFA sector's total allocation, it simply redistributes the inshore allocation among the qualified catcher vessels.

Preliminary data indicates that 66,764 mt of pollock were delivered to catcher/processors by 42 different AFA catcher vessels from the inshore sector. The four vessels making the most deliveries accounted for 35,783 mt of the catch, or about 53% of the total.

A total of 1,126,275 mt of pollock were delivered by AFA inshore catcher vessels to inshore processors during the years 1995-97. Including the catch delivered to catcher/processors will result in the total amount of pollock in the inshore quota pool to increase. The adjustment that including these deliveries make can be calculated by dividing the deliveries to catcher/processors by the total quota pool yields the compensation, or "adjustment", payment that catcher vessels would be required to make (Table 4.4.6).

Table 4.4.6 Compensation for inshore catcher vessels that had pollock deliveries to catcher/processors from 1995-97, break points are based on total catch.

Pollock to C/Ps	*Number of Vessels*	*Pollock Catch*	*Avg /Vessel*	*Cum. Total*	*Inshore Adjustment*
≥5,000 mt	3	31,745	10,582	31,745	-2.74%
3,000-4,999 mt	5	18,279	3,656	50,024	-4.25%
2,000-2,999 mt	2	Conf.	Conf.	Conf.	Conf.
1,000-1,999 mt	3	Conf.	Conf.	58,727	-4.96%
500-999 mt	3	2,109	703	60,835	-5.12%
250-499 mt	11	3,831	348	65,148	-5.47%
<250 mt	15	1,400	93	66,764	-5.60%

The AFA prescribes the criteria for determining which catcher vessels are eligible to participate in the inshore and mothership cooperatives in Section 208 (a) and Section 208 (c) of the Act, respectively. Those sections of the AFA do not require that all three years of catch history be used to determine the amount of pollock catcher vessels would be allowed to take with them into a cooperative.

Alternatives 3 through 5 allow catcher vessels in the inshore sector to use their best two years of pollock catch history during the three-year qualification window. The impacts of that option are depicted in the chart below. It will make about half of the vessels better off and the other half of the inshore fleet will be worse off as a result of using 2 of 3 years catch history. In terms of who wins and loses, the winners are those vessels with inconsistent catch histories, and the losers are the vessels that made approximately equal amounts of landings each year. The tails of the graph represent the vessels with the largest catch histories. In terms of tons and percent of TAC, they are the biggest winners and losers. Vessels with smaller catch levels, whether they had consistent or inconsistent catch histories, and vessels with somewhat varied catch histories are depicted in the middle portion of the chart. Allowing catcher vessels in the inshore sector to use their best 2 out of 3 years and to be credited for their offshore deliveries (if they were greater than 499 mt) reduces the chances of a vessel's catch history being substantially eroded by missing a fishery or spending some of the years in the offshore sector.

Cooperatives are allowed to distribute the catch among their group as they decide internally. However, these alternatives prescribe the amount of BSAI pollock each cooperative will be allocated. NMFS must then determine each cooperative's allocation based on the inshore sector allocation defined in the AFA and the modification to the Act made under each of the alternatives. The Council felt that the best 2 of 3 year formula reflected in Alternatives 3 through 5 provided a more equitable method of distributing pollock among the inshore cooperatives. Members of the Council felt that those alternatives account for hardships encountered by members of the inshore sector, and it was more equitable to provide relief for those hardships than to take no action.

The inshore sector, in general, supported compensating vessels that would have otherwise received a substantially smaller pollock allocation, which may have resulted in these vessels being made worse off under the AFA than they would have under Alternative 1. Advisory Panel and public testimony was unanimous in favor of this change, and the Council adopted this change without objection. However, because it is not possible to determine how much pollock individual vessels would catch in the future under Alternative 1, we cannot directly compare how vessels would fare under Alternative 1 and any of the cooperative allocation alternatives. Table 4.4.7 provides a summary of the current allocation to cooperatives that would be expected under Alternatives 3 through 5.

Table 4.4.7 2001 Bering Sea Subarea inshore cooperative allocations.

Cooperative name and member vessels	*Sum of member vessel's official catch histories*[1]	*Percentage of inshore sector allocation*	*Annual co-op allocation*
Akutan Catcher Vessel Association ALDEBARAN, ARCTURUS, BLUE FOX, CAPE KIWANDA, COLUMBIA, DOMINATOR, DONA MARTITA, EXODUS, GLADIATOR, GOLDEN DAWN, GOLDEN PISCES, HAZEL LORRAINE, INTREPID EXPLORER, LESLIE LEE, LISA MELINDA, MAJESTY, MARCY J, MARGARET LYN, NORDIC EXPLORER, NORTHERN PATRIOT, NORTHWEST EXPLORER, PACIFIC RAM, PACIFIC VIKING, PEGASUS, PEGGIE JO, PERSEVERANCE, PREDATOR, RAVEN, ROYAL AMERICAN, SEEKER, SOVEREIGNTY, TRAVELER, VIKING EXPLORER	265,244	29.889%	180,769
Arctic Enterprise Association ARCTIC EXPLORER, BRISTOL EXPLORER, OCEAN EXPLORER, PACIFIC EXPLORER	50,008	5.635%	34,080
Northern Victor Fleet Cooperative ANITA J, NORDIC FURY, PACIFIC FURY, GOLDRUSH, EXCALIBUR II, HALF MOON BAY, SUNSET BAY, COMMODORE, STORM PETREL, POSEIDON, ROYAL ATLANTIC, MISS BERDIE	72,024	8.116%	49,086
Peter Pan Fleet Cooperative AMBER DAWN, AMERICAN BEAUTY, ELIZABETH F, OCEAN HOPE 1, OCEANIC, OCEAN LEADER, TOPAZ, WALTER N	15,309	1.725%	10,433
Unalaska Cooperative ALASKA ROSE, BERING ROSE, DESTINATION, GREAT PACIFIC, MESSIAH, MORNING STAR, MS AMY, PROGRESS, SEA WOLF, VANGUARD, WESTERN DAWN	106,714	12.025%	72,727
UniSea Fleet Cooperative ALSEA, AMERICAN EAGLE, ARGOSY, AURIGA, AURORA, DEFENDER, GUN-MAR, NORDIC STAR, PACIFIC MONARCH, SEADAWN, STARFISH, STARLITE, STARWARD	210,922	23.768%	143,749
Westward Fleet Cooperative A.J., ALASKAN COMMAND, ALYESKA, ARCTIC WIND, CAITLIN ANN, CHELSEA K, HICKORY WIND, FIERCE ALLEGIANCE, OCEAN HOPE 3, PACIFIC CHALLENGER, PACIFIC KNIGHT, PACIFIC PRINCE, VIKING, WESTWARD I	163,750	18.452%	111,598
Open access AFA vessels	3,463	0.390%	2,359
Total inshore allocation	887,435	100%	604,800

[1]Under 679.62(e)(1) the individual catch history for each vessel is equal to the vessel's best 2 of 3 years inshore pollock landings from 1995 through 1997 and includes landings to catcher/processors for vessels that made 500 or more mt of landings to catcher/processors from 1995 through 1997.

Given the above discussions it seems that Alternatives 2 through 5 are superior to Alternative 1. Allocations that allow the formation of cooperatives should result in a more rational BSAI pollock fishery. Less efficient vessels have been retired from the BSAI pollock fishery, and vessels that are more efficient are allowed to harvest those fish. These factors result in the same amount of fish being harvested at a lower cost, by safer vessels, or other factors that are determined by vessel owners to be beneficial to the operation of a rational business.

Alternative 2 differs from Alternatives 3 through 5 in how the ICA is treated and the allocation of pollock to cooperatives in the inshore sector. Allowing AFA vessels to determine the best way to use pollock reserved for bycatch needs will likely be beneficial to the AFA fleet. Alternatives 3 through 5 also allow inshore catcher vessels to use their best two of three years (1995-97) to determine their historical catch which is the basis for allocating pollock among inshore cooperatives. Alternatives 3 through 5 also allowed catcher vessels that made more than 499 metric tons of pollock deliveries to catcher/processors during the qualifying period to be compensated for that harvest. Therefore, Alternatives 3 through 5 provide, presumably, a more equitable distribution of pollock within the AFA sector while imposing few if any additional costs to the non-AFA sector, relative to Alternative 2.

Mothership cooperative structure

Provisions outlined in the AFA resulted in a single cooperative being formed in the mothership sector. Catcher vessels in that sector are not bound to a single processor, however, there are only three motherships allowed to process BSAI pollock harvested from the mothership sector's allocation. One of the three motherships is reportedly owned by the catcher vessels that deliver to it, so it is unlikely that those catcher vessels would change processors. That leaves two other motherships that can take pollock deliveries from catcher vessels in this sector.

Overall, the options these vessels have regarding where to make deliveries are limited, but there have been no serious discussions of changing the cooperative structure. Therefore, it is presumed that both the catcher vessels and the processors are relatively content with the cooperative structure in the mothership sector prescribed by the AFA (also used in alternatives 2 through 5).

Alternatives 2 through 5 will result in the same allocation to catcher vessels. Therefore the differences among alternatives are when Alternative 1 is compared to the other options. There would be no cooperatives under Alternative 1. All catcher vessels and catcher/processors would race with each other to see how much of the TAC available to the offshore sector (65 percent) they could catch and process. Under Alternatives 2 through 5 the available TAC is allocated 10% to catcher vessels delivering to motherships and 40% to the catcher/processor sector (both catcher vessels and catcher/processors). The 10% available to catcher vessels delivering to motherships is allocated to each catcher vessel based on it's best 3 years out of the 4-year period from 1995-98 catch relative to the other catcher vessel harvests delivered to motherships during that time period. Allocating each catcher vessel their portion of the harvest eliminates the need for those vessels to race for their share of the quota. The benefits they are able generate by not competing for pollock are the improvements resulting from the cooperative structure.

While the benefits resulting from allowing fishermen to harvest the TAC under a allotment system are generally accepted[23], the economic impacts of the AFA mothership cooperative system cannot be quantified. However, it is assumed that the cooperative structure is preferred by this sector relative to the open access race for fish. This assumption is based on public testimony provided to the Council, the fact that there have been no serious attempts to change the mothership sectors cooperative structure, and the literature that is available comparing open access fisheries to ones that operate under a rights based system.

[23] The NRC Publication "Sharing the Fish", released in 1999, states that IFQ type programs generate benefits by, "...matching harvesting and processing capacities to the resource, slowing the race for fish, providing consumers with a better product, and reducing wasteful and dangerous fishing". That sentence goes on to say that this value "has been demonstrated repeatedly."

Offshore (catcher/processor) cooperative structure

The cooperative structure in the catcher/processor sector is the same under Alternatives 2 through 5. Alternative 1 does not include cooperatives, so the discussion of cooperative structure under that alternative is irrelevant. Alternatives 2 through 5 allow the catcher/processors and catcher vessels that deliver to catcher/processors to form separate cooperatives. Both cooperatives were then allowed to form an inter-cooperative agreement to ensure that the harvesting and processing of fish in the catcher/processor sector is conducted in a rational manner.

Offshore cooperatives are the only cooperatives that were in place during the 1999 fishing season. The results of the first fishing season that took place under cooperatives were presented to the Council in a report prepared jointly by the two cooperatives (PCC/HSCC 2000) comprising that sector. In general the cooperatives seem to have been successful, both in terms of managing the various quotas and reducing excess capacity in the catcher/processor sector of the BSAI pollock fishery. The reports did not provide specific economic data. Therefore, information on the cost structures and profitability of the participants in the fishery cannot be determined. Communication with members of industry suggests that both the catcher/processors and catcher vessels were more profitable under the cooperative structure in 1999 than they were in 1998, under the old system that required them to race for fish (Alternative 1), but quantifying the change between Alternative 1 and the other alternatives is not possible. All that can be stated with confidence is that several of the catcher vessels chose to sell their allocation to catcher/processors and some of the companies elected not to use all of their catcher/processor vessels to harvest their pollock allocation. This consolidation of harvesting capacity seems to indicate that less efficient fishing and processing vessels were removed from the fishery so that costs could be reduced or a better/higher valued product could be produced.

4.4.3 Harvest and processing limitations (sideboards).

Harvesting and processing limits were placed on AFA eligible vessels and processors to protect entities that are not involved in the BSAI pollock fisheries from those that were advantaged by the Act. Sideboard limits differ among sectors of the BSAI pollock industry. Various alternatives for implementing sideboards will be discussed in this section, and to the extent possible their economic impacts presented.

This document considers only the five specific alternatives that have been discussed in detail in the earlier sections. Other alternatives considered by the Council during their deliberations on implementing the AFA can be found in the EA/RIR prepared by the Council for the emergency interim rule to implement AFA measures for the year 2000.

Groundfish harvesting sideboards

Groundfish harvesting sideboards are not applicable to Alternative 1. Under the open access "race for fish", members of industry cannot choose to fish a species any time they wish during the year, since other fishermen would be allowed to harvest the entire allocation before they started. Therefore, individuals cannot maximize participation in other fisheries by postponing (or otherwise altering) their pollock fishing. Imposing harvesting sideboards are unnecessary in that case. The fishery will be harvested as it always has, with vessel owners deciding which fisheries to participate in given other regulatory constraints and knowing that they are competing against other fishermen for a share of the harvest.

The AFA recognized that rationalizing the BSAI pollock fishery, while other fisheries were being managed as they have been in the past, would create opportunities for vessel owners to alter the way they fish for BSAI pollock in order to maximize their revenues in other fisheries. Because of this structural change, the Act provided guidance that flexibility gained in the prosecution of the BSAI pollock fishery should not be used to disadvantage participants in other fisheries. To help ensure that participants in other fisheries are not disadvantaged, the amount of groundfish (other than BSAI pollock) that AFA vessels could harvest was limited. The options for limiting groundfish harvests by AFA vessels (sideboards) considered in this analysis are included under Alternatives 2 through 5, with separate options considered for catcher vessels and catcher/processors.

Catcher/processors. AFA catcher/processors listed in the Act are restricted from harvesting any GOA groundfish. This restriction is included within each of the Alternatives 2 through 5. Catcher/processors will forgo the economic benefits they generated in the past, from fishing in the GOA, for the right to become members of the AFA BSAI pollock fleet. Because the catcher/processors were willing to forgo the opportunity to fish the GOA, it is assumed that they were able to increase revenues sufficiently from fishing in the BSAI under the AFA to make up for lost revenues in the GOA.

The amount of harvest that was retained by AFA catcher/processors in the GOA was reported to be less than 3,500 mt in 1997, less than 2,100 mt in 1996, and less than 2,000 mt in 1995 (based on NMFS Blend data). Offshore vessels are precluded from processing any GOA pollock and 90% of the GOA Pacific cod under inshore/offshore regulations. These limitations are the major reasons for the relatively small catch histories that the catcher/processor sector has had in the GOA in recent years.

Since the AFA catcher/processors have had relatively small amounts of catch in the GOA during the 1995-97 time period, primarily as a result of inshore/offshore regulations, giving up their rights to the remaining GOA fisheries should not impose a substantial economic burden to the members of that fleet. It will also ensure that the amount of catch previously taken by these vessels will be available to the non-AFA fleet or AFA catcher vessels in the GOA that are exempt from the sideboard processing caps.

Alternatives 2 and 4 would base the BSAI harvesting sideboard caps on the total catch of all 29 listed catcher/processors. Alternative 2 differs from Alternative 4 in that Alternative 2 excludes bycatch taken in the pollock fishery while Alternative 4 includes bycatch taken in the directed pollock fishery. Bycatch in the directed pollock fishery was included in Alternative 4 because that option manages the harvesting sideboard amounts as hard caps. [24]

NMFS currently is monitoring 2000 AFA sideboards in the aggregate for the catcher/processor sector of the pollock fleet. At the beginning of the fishing year, NMFS closes a suite of BSAI fisheries to AFA-listed catcher/processors because the sideboard amounts for these fisheries were determined to be inadequate to support a directed fishery. Since 1999, the fisheries that NMFS has determined have sufficiently large catcher/processor sideboards to support a directed fishery are Akta mackerel, Pacific cod, rock sole, other flatfish, and yellowfin sole. Each year NMFS will be challenged to determine which species have sideboard caps sufficient to support a directed fishery. Then NMFS must close the species to directed fishing when it appears that the remaining cap would be required for use as bycatch in other directed fisheries.

The groundfish fisheries of greatest economic value and interest to AFA catcher/processors are probably Pacific cod, yellowfin sole, Atka mackerel, and rock sole. Of these, Atka mackerel sideboard percentages are established in statute and the Council has not considered any alternative approaches to Akta mackerel

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[24] Hard caps refer to how the caps would be administered by NMFS. Under a system of hard caps, all fisheries that take a species as bycatch would be closed when any cap has been reached. In the case of species like squid, if the squid harvested as bycatch in the pollock fishery were not included in the sideboard cap, the pollock fishery would be closed well before the pollock allocation could be harvested. This alternative was included to show that if NMFS is to monitor the sideboard caps as hard caps, the only realistic management alternative would be to set the caps using total catch in all fisheries.

sideboards than those established in the AFA. The sideboard amounts and management approach for the other groundfish species would vary depending on the alternative. Table 4.4.8 presents catch histories for the eligible AFA catcher/processor fleet (section 208 listed vessels) and catch histories for the combined eligible and ineligible vessels (section 208 and section 209 listed vessels) for Pacific cod, yellowfin sole, and rock sole and compares the effect of using different methods to calculate and manage sideboards. Target fishery categories are determined using NMFS blend data which assigns mutually exclusive target categories based on weekly retained catch summaries.

In order to compare how different sideboard alternatives would affect the fishing opportunities of listed AFA catcher/processors relative to the no-action alternative, the resulting sideboard amount is compared against three different baselines, the 1995-1997 total and retained catch by section 208 listed vessels and the 1995-1997 total catch by section 208 listed vessels in each individual target fishery category. Comparing the resulting sideboard against each of these baselines shows that all of the alternatives allow listed AFA catcher/processors to substantially exceed their historic level of participation in each of these three fisheries. For example, Alternative 3, the preferred alternative, would allow AFA catcher/processors to harvest 207% of the Pacific cod that these same vessels retained in 1997, 135% of their total catch of Pacific cod in 1997, and 239% of their 1997 total catch of Pacific cod in the Pacific cod target fishery. All of the sideboard alternatives would allow AFA catcher/processors to exceed their historic harvest of these principle groundfish species because all of the sideboard formulas under consideration include the 1995-1997 catch by the ineligible vessels listed in section 209 of the AFA even though such catch histories were extinguished by section 209 of the AFA.

Please see table of contents for figure or table.

Information in Table 4.4.9 indicates that cap amounts are sufficient to open directed fisheries for the Pacific cod, Atka mackerel, yellowfin sole, rock sole, and other flatfish fisheries under Alternative 3, where NMFS would mange the caps using directed fishery closures. The fisheries that would be opened on January 20 of each year under Alternatives 2, 3, and 5 will likely be the same. However, the amounts of the caps will differ, and therefore the revenues generated under the caps could change depending on the alternative selected.

Once the directed fishery portion of a cap is reached, under Alternatives 2, 3, and 5, the remaining fisheries that take this species as bycatch would remain open. NMFS would have taken bycatch needs into account when determining the point at which the directed fishery was closed, and in theory sufficient bycatch reserves would remain once the directed fishery is closed. Under alternative 4, the sideboard amounts would be managed as "hard" caps, meaning that once a cap is taken, the vessels would need to stop participating in any directed fishery where that species would be taken as bycatch. Hard caps are very strict and have the potential to close down all fishing by an entity, including pollock, once they reach a species' sideboard cap.

Alternative 3 is based on the retained catch (discards are excluded) of the 29 listed catcher/processors in fisheries other than the BSAI pollock fishery. Alternative 5 is basically the same except it also includes catch that was retained in the BSAI pollock fishery. Catcher/processors will be issued smaller caps, by the amount of their discards, than they would have had under Alternatives 2 and 4, respectively. The cap amounts under Alternatives 3 and 5 will differ because of the amount of catch retained in the directed pollock fishery.

Table 4.4.9 indicates that Alternative 4 would result in the largest sideboard caps, and Alternative 3 the smallest caps, in general. Options 2 and 4 result in caps of similar size for most species because of discards in the non-pollock fisheries did not have a substantial impact on the results. The notable exceptions were some flatfish species and species like squid that are seldom retained, but the majority of the bycatch occurs in the pollock fishery. However, because Alternative 4 is managed using hard caps the directed fisheries are more likely to be closed before all of the caps are reached if bycatch is higher than expected.

Squid is as an example of how some sideboard species could result in very restrictive hard caps under specific circumstances. Mid-water pollock fisheries take squid as unavoidable bycatch. Managing the sideboard species using hard caps will require NMFS to close a cooperative's pollock fishery once they have harvested their squid cap. If squid bycatch were particularly high in a year the pollock fishery could be closed well before the sector's allocation was taken, even under an alternative that resulted in a cap close to their historic bycatch amount (i.e., Alternative 4).

Catcher/processors would be expected to exceed the squid sideboard cap even sooner if the cap was based on their total catch in non-pollock fisheries, but the catch of squid from all directed fisheries, including pollock, counted towards the cap. Sideboard data presented in Table 4.4.9 indicates that about 400 mt of squid is taken annually by the AFA catcher/processors (based on the allocation in Alternative 4). Over 99% of the catcher/processor's squid bycatch comes from the directed pollock fishery. Given that there would not be enough squid for bycatch needs in the pollock fishery, vessel owners would be once again forced to race for the sideboard species and would likely receive no benefit from the AFA. In fact they would be worse off, because they would only be able to harvest a small portion of their pollock allocation. Therefore, it would be impossible for the catcher/processor fleet to harvest their pollock allocation under a hard cap system where the cap was based on retained catch or only their catch in non-pollock fisheries. Because these alternatives were not considered viable, they were not selected as alternatives to be studied in this analysis.

As noted above Alternative 4 yields the largest sideboard caps. It is also the only alternative where fisheries are closed when a species taken as bycatch in that fishery reaches its sideboard cap (hard caps). To be a fair system for participants that must operate under hard caps, the size of the sideboards should closely match the amount of bycatch needed to prosecute the fishery in a reasonable fashion. This of course leads to the debate over what is the minimum amount of bycatch needed to operate a fishery. That question is difficult to answer, but it certainly should not require any more fish than were harvested in the past and may very well require less. However, changing circumstances in the BSAI pollock fishery resulting from Steller sea lion protection measures may mean that past bycatch statistics could be unreliable for estimating future bycatch if vessels are forced to fish in different areas or at different times of the year than in the past. For this reason, sideboards based on directed fishing closures rather than total fishery closures may be more appropriate and may more closely approximate the intent of the AFA.

Table 4.4.9 2001 AFA catcher/processor groundfish sideboards (mt).

Target species	*Area*	*1995 - 1997*			*2001 ITAC*	*2001 C/P*
		Total catch	*Avail. TAC*	*Ratio*	*avail. to trawl C/Ps*	*sideboard amount*
Pacific cod trawl	BSAI	13,547	51,450	0.263	40,867	10,748
Sablefish trawl	BS	8	1,736	0.005	663	3
	AI	1	1,135	0.001	531	1
Atka mackerel	Western AI					
	A season[1]	n/a	n/a	0.200	12,904	2,581
	CH limit[2]					1,239
	B season	n/a	n/a	0.200	12,904	2,581
	CH limit					1,239
	Central AI					
	A season[1]	n/a	n/a	0.115	15,540	1,787
	CH limit					882
	B season	n/a	n/a	0.115	15,540	1,787
	CH limit					882
Yellowfin sole	BSAI	123,003	527,000	0.233	96,050	22,380
Rock sole	BSAI	14,753	202,107	0.073	63,750	4,654
Greenland turbot	BS	168	16,911	0.010	5,206	52
	AI	31	6,839	0.005	2,564	13
Arrowtooth flounder	BSAI	788	36,873	0.021	18,709	393
Flathead sole	BSAI	3,030	87,975	0.034	34,000	1,156
Other flatfish	BSAI	12,145	92,428	0.131	23,800	3,118
Pacific ocean perch	BS	58	5,760	0.010	1,471	15
	Western AI	356	12,440	0.029	4,385	127
	Central AI	95	6,195	0.015	2,368	36
	Eastern AI	112	6,265	0.018	2,683	48
Sharpchin/northern	BS			0.078	16	
	AI	1,034	13,254	0.078	6,239	487
Shortraker/rougheye	BS			0.024	99	
	AI	68	2,827	0.024	843	20
Other rockfish	BS	39	1,026	0.038	307	12
	AI	95	1,924	0.049	575	28
Squid	BSAI	7	3,670	0.002	1,675	3
Other species	BSAI	3,551	65,925	0.054	22,525	1,216

[1] The seasonal apportionment of Atka mackerel in the open access fishery is 50% in the A season and 50% in the B season. Unrestricted AFA catcher/processors are limited to harvesting no more than 20 and 11.5% of the available TAC in the Western and Central AI subareas respectively. Unrestricted AFA catcher/processors are prohibited from harvesting Atka mackerel in the Eastern Aleutian Islands District and Bering Sea subarea (paragraph 211(b)(2)(C)).

[2] Critical habitat (CH) allowance refers to the amount of each seasonal allowance that is available for fishing inside critical habitat (50 CFR part 679 Table 21). In 2001, the percentage of TAC available for fishing inside critical habitat area is 48% in the Western AI and 46% in the Central AI. When these critical habitat allowances are reached, critical habitat areas will be closed to trawling until NMFS closes Atka mackerel to directed fishing within the same district.

Catcher vessels. NMFS would use the same management approaches for catcher vessels as they did for the catcher/processor sector described above for Alternatives 2, 3, and 5. NMFS will close directed fisheries to AFA-listed catcher vessels when sideboard amounts are inadequate to support directed fishing and leaving directed fishing open for fisheries where adequate sideboard amounts exist to support directed fishing for those species. Existing observer coverage levels combined with a system of electronic catcher vessel delivery reports should be adequate to monitor the aggregate activity of AFA-listed catcher vessels. In the case of prohibited species, catch by observed vessels would be extrapolated to unobserved catcher vessels fishing for the same species in the same area as is currently being done for all fisheries in which observer coverage is less than 100 percent.

Alternative 2 is based on the aggregate catch of all AFA catcher vessels from 1995-97. The only difference among Alternatives 2, 3, and 5 in the BSAI is the Pacific cod cap. Because the catch of the exempt vessels are included in the sideboard caps under Alternative 2, the overall cap increases by about 6,000mt. In future years the catch of Pacific cod made by these vessels will count towards the overall cod sideboard cap. When the exempt catcher vessel's catch is not included when calculating in the cap (Alternatives 3-5), their catch does not count against the cap.

Exemptions to sideboard caps in the GOA apply to all species, and are included in each of the Alternatives 3 through 5. These exemptions are discussed in more detail in a later section. As in the BSAI, the catch history of vessels that are exempt from the sideboard caps are not included when the caps are calculated, and their catch does not count against the cap in future years. No vessels are exempted from the caps under Alternative 2. In that case the overall caps are increased, but there are more vessels whose catch is counted towards to the cap. These two counter-veiling forces tend to dampen the impact of exempting catcher vessels from the cap.

Therefore, the impact that exempting vessels from the cap has on non-AFA vessels depends on the catch of exempt catcher vessels in future years, relative to their catch during 1995-97. Because that relationship cannot be predicted with any level of certainty, estimating the economic impact of Alternative 2 relative to Alternatives 3-5 is not possible, and may change from year to year.

Alternative 4 will result in slightly larger sideboard caps than either Alternatives 3 or 5. The increase is a result of including discards in each catcher vessel's historic landings. Accurately including discards is difficult because of the manner in which the data are collected. Fishticket reports do not require that discards occurring at-sea be included. Therefore the only way to estimate at-sea discards is through observer data. Because many of these vessels do not carry observers 100% of the time, these estimates often must be extrapolated. This leads to generalizing a vessel's catch by species, which may not accurately reflect its historic fishing patterns. Alternative 4 would require that NMFS estimate historic discards which may not accurately reflect past activity. Discards are among the least reliable estimates made by observers and are difficult to determine on a vessel-by-vessel basis given that catcher vessels do not carry flow scales upon which catch can be measured prior to discarding.

Alternative 4 also allocates sideboard caps to each cooperative. Based on anecdotal information, this is how sideboard amounts are being distributed among cooperatives through the inter-cooperative agreement. Formalizing this process will allow each cooperative to have greater autonomy, but precludes them from trading sideboard caps among cooperatives. Catcher vessels within a cooperative will be allowed to fish their caps without the need to negotiate with the other groups, but restricting their ability to trade sideboard amounts could force a cooperative to stop fishing earlier than would otherwise be required, if they encounter unexpectedly high bycatch amounts of a particular sideboard species.

AFA catcher vessel sideboard amounts are shown in Table 4.4.10 for the BSAI. Estimates of sideboard amounts are included for Alternatives 2, 3, and 5. Alternative 4 is not included in the table because of the difficulties associated with estimating at-sea discards. The resulting amounts would be expected to be slightly larger than those reported for Alternatives 3 and 5. Table 4.4.11 reports the GOA sideboard amounts for

Alternatives 3 and 5. Again, the sideboard amounts for Alternative 4 would be slightly larger than those Table 4.4.11 under Alternatives 3 and 5, and would be apportioned by individual cooperative as opposed to in the aggregate for all catcher vessels. The increased cap is a result of discards being included in the catch estimate. Because there is no accurate way to estimate at-sea discards of non-exempt catcher vessels, that information will not be reported in the table.

GOA sideboard estimates for Alternative 2 are based on the catch of all AFA catcher vessels (exempt and non-exempt). For species where there may be a directed fishery in future years (pollock, Pacific cod, and shallow water flatfish) adding in the catch of the exempt vessels increases the amount of the sideboards by 41 to 64 percent, when compared to the totals listed for Alternatives 3 and 5 (Table 4.4.11). It is important to note that in addition to increasing the size of the sideboard cap, the number of catcher vessels fishing off the cap will also increase by 14. It is not known if the exempt catcher vessels will harvest more than their historic average under Alternative 3 or 5. If they do, they amount taken in total by AFA catcher vessels will increase. This would have negative impacts on the non-AFA fleet. If they do not harvest more than their traditional amount, then the impacts of exempting the catcher vessels from the caps would be negligible.

Given the changes in the sideboard amounts that are expected to occur under each of the alternatives being considered it is unlikely that changing the structure of the sideboard cap formula will cause many (if any) additional fisheries to open. The main difference among the sideboard alternatives is the size of the cap for species that will have directed fisheries. Larger sideboard caps benefit the AFA catcher vessels, but are less effective at protecting the non-AFA fleet which is mandated under the AFA. Any of the alternatives under consideration will provide protection for the non-AFA fleet, but the level of protection will be greatest under the alternatives that allow the AFA fleet to harvest smaller amounts of the TAC for species other than BSAI pollock.

Table 4.4.10 2001 BSAI AFA catcher vessel (CV) sideboards (mt).

Species	Fishery by Area/Season/ Processor/ Gear	Ratio of 1995-1997 AFA CV catch to 1995-1997 TAC	2001 Initial TAC	2001 catcher vessel sideboard
Pacific cod	BSAI			
	jig gear			
	Jan 1 - Jun 10	0.0000	2,087	0
	Jun 10 - Dec 31	0.0000	1,391	0
	hook-and-line CV			
	Jan 1 - Jun 10	0.0006	159	0
	Jun 10 - Dec 31	0.0006	106	0
	Pot gear			
	Jan 1 - Jun 10	0.0006	9,683	6
	Jun 10 - Dec 31	0.0006	6,455	4
	CV < 60 feet LOA using hook-and-line or pot gear			
	Jan 1 - Jun 10	0.0006	741	0
	Jun 10 - Dec 31	0.0006	494	0
	trawl gear			
	catcher vessel			
	Jan 1 - Jun 10	0.7703	24,520	18,888
	Jun 10 - Dec 31	0.7703	16,347	12,592
	catcher/processor			
	Jan 1 - Jun 10	0.0000	24,520	0
	Jun 10 - Dec 31	0.0000	16,347	0
Sablefish	BS trawl gear	0.0006	663	0
	AI trawl gear	0.0608	531	32
Atka mackerel	Eastern AI/BS			
	jig gear	0.0031	72	0
	other gear			
	Jan 1 - Apr 15	0.0031	3,572	11
	Sept 1 - Nov 1	0.0031	3,572	11
	Central AI			
	Jan - Apr 15	0.0001	15,540	2
	inside CH	0.0001	7,148	1
	Sept 1 - Nov 1	0.0001	15,540	2
	inside CH	0.0001	7,148	1
	Western AI			
	Jan - Apr 15	0.0000	12,904	0
	inside CH	0.0000	6,194	0
	Sept 1 - Nov 1	0.0000	12,904	0
	inside CH	0.0000	6,194	0
Yellowfin sole	BSAI	0.0712	96,050	6,839
Rock sole	BSAI	0.0255	63,750	1,626
Greenland Turbot	BS	0.0405	5,206	211
	AI	0.0021	2,564	5
Arrowtooth flounder	BSAI	0.0583	18,709	1,091
Other flatfish	BSAI	0.0558	23,800	1,328
POP	BS	0.1018	1,471	150
	Eastern AI	0.0048	2,683	13
	Central AI	0.0011	2,368	3
	Western AI	0.0000	4,385	0
Sharpchin/Northern	BS	0.0280	16	0
	AI	0.0015	6,239	9
Shortraker/Rougheye	BS	0.0280	99	3
	AI	0.0011	843	1
Other rockfish	BS	0.0379	307	12
	AI	0.0031	575	2
Squid	BSAI	0.3885	1,675	651
Other species	BSAI	0.0283	22,525	637
Flathead Sole	BS trawl gear	0.0490	34,000	1,666

PSC harvesting sideboards

Catcher/processors. Paragraph 679.63(a)(2) of the emergency interim rule implementing sideboards established a formula for calculating PSC cap amounts for unrestricted AFA catcher/processors. These amounts are equivalent to the percentage of prohibited species bycatch limits harvested in the non-pollock groundfish fisheries by the AFA catcher/processors listed in subsection 208(e) and section 209 of the AFA from 1995 through 1997. The sideboard cap amounts are the same for each of the Alternatives 2 through 5, and they use the same formula for calculating sideboards as was defined in Paragraph 697.63(a)(2). However, Alternative 4 would be managed by NMFS as a hard cap, while Alternatives 2, 3, and 5 would be managed through in-season closures. Therefore, Alternative 4 has the potential to be the most restrictive. If a PSC cap is taken, all of the fisheries where that species could be harvested, under Alternative 4, would also be closed to directed fishing for the cooperative reaching the cap. Prohibited species amounts harvested by these catcher/processors in BSAI non-pollock groundfish fisheries from 1995 through 1997 are shown in Table 4. These data were used to calculate the relative amount of prohibited species catch limits harvested by pollock catcher/processors, which was then used to determine the prohibited species harvest limits for unrestricted AFA catcher/processors.

PSC that is caught by unrestricted AFA catcher/processors participating in any non-pollock BSAI groundfish fishery shall accrue against the 2000 PSC limits for the listed catcher/processors. Paragraph 679.21(e)(3)(v) of the emergency interim rule implementing sideboards provides NMFS the authority to close directed fishing for non-pollock groundfish for unrestricted AFA catcher/processors once a 2000 PSC limitation listed in Table 4.4.12 is reached. This is how the PSC sideboards would be managed under each of the Alternatives 2, 3, and 5.

The ratio column in Table 4.4.12 shows the maximum amount of each PSC species that catcher/processors would be allowed to harvest. The PSC species are also caps so the catcher/processors are guaranteed that amount. If the overall PSC cap is taken before they reach the cap both the AFA and non-AFA fleets will be issued closure notices to stop fishing.

Crab or halibut PSC that is caught by unrestricted AFA catcher/processors while fishing for pollock will accrue against the bycatch allowances annually specified for either the mid-water pollock or the pollock/Atka mackerel/other species fishery categories under § 679.21(e).

Table 4.4.11 Unrestricted AFA catcher/processor prohibited species sideboard amounts.

PSC species	*1995 - 1997*			*2001 PSC*	*2001*
	PSC catch	*Total PSC*	*Ratio*	*available to trawl vessels*	*C/P limit*
Halibut mortality	955	11,325	0.084	3,400	286 mt
Red king crab	3,098	473,750	0.007	89,725	628 crab
C. opilio	2,323,731	15,139,178	0.153	4,023,750	615,634 crab
C. bairdi					
Zone 1	385,978	2,750,000	0.140	675,250	94,535 crab
Zone 2	406,860	8,100,000	0.050	1,914,750	95,738 crab

All of the alternatives are based on the amount of PSC species that were caught in the BSAI non-pollock fisheries. Because substantial amounts of halibut and crab are <u>not</u> taken in the mid-water pollock fishery, using only the PSC catch from the non-pollock fisheries should not cause major hardships for the AFA fleet, and should not provide much additional protection for the non-AFA sector. Alternative 4, where NMFS would manage the PSC as a hard cap could potentially be the most restrictive on the AFA fleet. However, if the AFA fleet does harvest pollock as a mid-water fishery, as required under current regulations, the chances of halibut or crab closing down the pollock fishery are limited. Therefore, the economic impacts of all the alternatives (2-5) where sideboard caps are applied should be close to the same.

Catcher vessels. Paragraph 679.63(b) of the emergency interim rule established a formula for calculating PSC sideboards for AFA catcher vessels. PSC bycatch limits for halibut in the BSAI and GOA, and each crab species in the BSAI, for which a trawl bycatch limit has been established, were defined. Those sideboard limits are expressed as a percentage equal to the ratio of aggregate retained groundfish catch by AFA catcher vessels in each PSC target category from 1995 through 1997 relative to the retained catch of all vessels in that fishery from 1995 through 1997. These amounts are listed in Tables 4.4.13 and 4.4.14.

Halibut and crab that is caught by AFA catcher vessels participating in any non-pollock groundfish fishery listed in Table 4.4.13 will accrue against the 2000 PSC limits for the AFA catcher vessels. Paragraphs 679.21(d)(8) and (e)(3)(v) of the emergency interim rule implementing sideboards provide authority to close directed fishing for groundfish (except BSAI pollock) by AFA catcher vessels once a 2000 PSC limitation listed in Table 4.4.13 for the GOA is reached. PSC that is harvested by AFA catcher vessels while fishing for pollock in the BSAI will accrue against either the midwater pollock or the pollock/Atka mackerel/other species fishery categories.

Because PSC sideboards for catcher vessels are based on the amount of groundfish catch that catcher vessels harvested during the qualifying period, Alternatives 3 and 5 will result in the same PSC amount. Alternative 2 will result in smaller PSC caps than reported in Table 4.4.12, because the groundfish harvests of the exempt vessels are not included. Because the same problems exist in determining the relative catch of the exempt catcher vessels, it is not possible to estimate the relative economic impacts of the alternatives. Alternative 4 will result in PSC caps that are slightly larger than those reported in Table 4.4.12, because discards are included in the total catch amount. The size of the increase would depend on the amount of discards that occurred during the qualifying years. That information would need to be extrapolated and is currently unavailable.

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Exemptions to groundfish sideboards. Alternatives 3 and 5 exempt catcher vessels less than 125' LOA from the BSAI Pacific cod sideboard caps if they landed less than 1,700 mt of pollock on average during 1995-97 and had at least 30 landings in the BSAI Pacific cod fishery. In the GOA, catcher vessels less than 125' LOA were exempted from the sideboard caps if they landed less than 1,700 mt of BSAI pollock on average during 1995-97 and made at least 40 GOA groundfish landings.

The catch history of exempt vessels will not be included when NMFS determines the overall sideboard caps. Since their historic catch is not included in the caps, the future catch of these vessels will not count towards the caps nor will they be required to stop fishing when the sideboard cap is reached if the directed fishery is open to non-AFA trawl catcher vessels.

As of August 24, 2000 a total of 12 vessels had applied for the BSAI Pacific cod exemption and 14 vessels for the GOA exemption to groundfish sideboards. Estimating the impacts of exempting these catcher vessels from the sideboard caps is difficult. Because these vessels have relatively small BSAI pollock catch histories they were most likely not full time BSAI pollock participants. If indeed the vessels were not full time BSAI pollock fishermen when that fishery was open to directed fishing, the impacts of exempting them from the sideboards will be less than if they had been full time pollock boats. The requirement that the vessels must have made 30 landings in the BSAI Pacific cod fishery and 40 landings in the GOA were included to ensure that vessels were active participants in those fisheries before being exempted. However, it is possible that vessels that were exempted from the sideboards may find a way to increase effort in those fisheries under the AFA, but the increased effort in those fisheries should not be dramatic given their historic participation patterns.

The Council intended that catcher vessel sideboard caps apply to all AFA vessels eligible under sections 208(a)-(c) of the Act regardless of participation in a cooperative, if they did not meet the above exemption criteria. Any non-exempt vessel determined by NMFS to be eligible to participate in a cooperative will be bound by the sideboard caps outlined by the Council. The Council considered applying these caps only to vessels that participate in a cooperative (exempting vessels that apply for the AFA, but fish in the open access fishery). However, the Council felt that based on the direction given in section 211(c)(1)(A) of the Act, which states that the Council shall recommend measures to *"prevent the catcher vessels eligible under subsections (a), (b), and (c) of section 208 from exceeding in the aggregate the traditional harvest levels of such vessels in other fisheries under the authority of the North Pacific Council as a result of fishery cooperatives in the directed pollock fishery...*", they should apply the sideboards to all eligible catcher vessels to afford protection to the non-AFA eligible vessels. A discussion of this issue is in Chapter 7 of the EA/RIR prepared for AFA sideboard measures (NPFMC 1999d). The section concludes that this decision will likely have the greatest impact on catcher vessels with smaller pollock catches, which were more diversified into other fisheries.

NMFS implemented the AFA to allow vessels 'opting out' of the BSAI pollock fishery entirely (i.e., do not apply for an AFA permit) to be excluded from the sideboards. From an economic and equatability standpoint this makes sense. Vessels that do not apply for AFA eligibility will not be allowed to participate in the BSAI pollock fishery. This may or may not be considered an exemption to sideboards. These vessels are not technically AFA vessels until they apply for their permit, so if they are not AFA vessels it would not be considered an exemption. Regardless of whether it is considered an exemption or not, this regulation will apply to Alternatives 2 through 5.

Crab harvesting sideboards

Crab harvest restrictions placed on AFA catcher vessels are included under Alternatives 2 through 5. For Bristol Bay Red King Crab (BBRKC), the alternatives restrict the AFA eligible vessels to an aggregate amount based on historical participation, much as was done with groundfish sideboards. However, a wider range of years was included to define participation (1991 through 1997 as opposed to only 1995 through 1997), expanding the time period included years of larger harvest by those vessels, and which therefore increased the level of their sideboard limit (from about 9% up to nearly 13% of the available quota). Currently there are 42 AFA catcher vessels holding a permit to participate in the BBRKC fishery. Assuming the BBRKC GHL is 11.2 million pounds, this equates to approximately 35,000 pounds per vessel. If the 1999 price of $6.25 per pound is applied to this catch it equates to over $200,000 per vessel. Allowing the 42 AFA vessels that have participated in the fishery to continue to do so at a limited poundage, should provide protections for the remaining non-AFA vessels. However, the protections will not be as strict as they would have been if the 1995-97 time period were used to estimate the sideboard cap.

The sideboard caps for the bairdi fishery are also managed by limiting the number of AFA catcher vessels that can participate in the fishery as well as the total amount of bairdi crab they may harvest. Recent data indicates that 28 vessels are permitted to harvest bairdi. These 28 vessels will be allowed to take up to the percentage of the GHL they accounted for, in aggregate, over the 1995 and 1996 seasons. Based on information presented in BSAI FMP Amendment 61 it appears that these vessels would account for about 7% of the GHL. Allowing the AFA catcher vessels to harvest up to 7% of the GHL should provide the necessary protection for the non-AFA fleet. It is difficult to make any projection as to what 7% of the GHL will amount to in pounds or dollars. The bairdi fishery is currently closed to fishing and is not expected to open again in the near future. Therefore, since there are no current GHLs to use as a baseline to make projections of the pounds or dollars that this historic catch would equal in future years, this analysis will not include any of those estimates.

Each of the other crab species sideboards limit the number of AFA catcher vessels that are allowed to participate, but not their total aggregate catch. A total of seven vessels are licensed for the opilio fishery, two for the St. Matthew fishery, and one for the Pribilof fishery. Given the relatively small number of AFA catcher vessels eligible to participate in these fisheries, it is unlikely that they will cause substantial negative impacts to the non-AFA vessels in the fleet.

As with the example given in groundfish, there were some AFA vessels that had the majority of their income from fisheries other than pollock - specifically there were three AFA vessels identified that had significant and long-term participation in the opilio crab fisheries. Subjecting these vessels to an aggregate sideboard limit (shared with the other AFA vessels) would have resulted in disproportionate and negative impacts to those vessels - essentially they would lose their ability to continue their historical fishing practices. To mitigate this issue, the alternatives represent a compromise that generally restricted AFA vessels' participation in opilio, but allowed those with a high dependence to continue. Specifically the alternatives only allow AFA vessels to fish opilio if they fished opilio in at least four years between 1988 and 1997; however, if they do qualify they may fish unrestricted along with other crab vessels.

Exemptions to crab harvesting sideboards. Alternatives 3 and 5 provide specific exemptions to the crab processing sideboards for any vessels that can demonstrate participation in all opilio, bairdi, and BBRKC fisheries during the years 1991-97 and that have AFA qualifying histories of less than 5,000 mt. This action is expected to affect only one vessel. By meeting the criteria outlined above, that vessel has demonstrated a long historic dependence upon the crab fisheries. Allowing that vessel to be exempted from the crab harvesting sideboards should not cause any negative impacts to non-AFA crab fishermen, as a result of pollock cooperatives. Given the vessel's historic participation, the vessel's owner would have likely chosen to participate in the crab fisheries instead of pollock even under an open access pollock fishery in the BSAI.

Crab processing sideboards

The crab processing sideboard components of Alternatives 2 through 5 are identical, and are based on the structure defined in the Act under Section 211(c)(2)(A). This section of the Act is specific to shorebased and mothership processors. Recall that catcher/processors are precluded from processing crab under the AFA. The AFA language in the Act under Section 211(c)(2)(A) is as follows:

(*2) BERING SEA CRAB AND GROUNDFISH.—*

> *(A) Effective January 1, 2000, the owners of the motherships eligible under section 208(d)and the shoreside processors eligible under section208(f) that receive pollock from the directed pollock fishery under a fishery cooperative are hereby prohibited from processing, in the aggregate for each calendar year, more than the percentage of the total catch of each species of crab in directed fisheries under the jurisdiction of the North Pacific Council than facilities operated by such owners processed of each such species in the aggregate, on average, in 1995, 1996, 1997. For the purposes of this subparagraph, the term ''facilities''means any processing plant, catcher/processor, mothership, floating processor, or any other operation that processes fish. Any entity in which 10 percent or more of the interest is owned or controlled by another individual or entity shall be considered to be the same entity as the other individual or entity for the purposes of this subparagraph.*

The impacts of crab processing sideboards are not yet fully understood. Public testimony taken during the June 2000 Council meeting showed that harvesters and AFA processors wanted to have the caps removed. Non-AFA processors still supported the caps that were put in place during the opilio season. The main reason that catcher vessels wanted the caps removed was to increase competition for their product so they could potentially receive a higher price. They also felt that the reduced competition lead to longer offload time, which had the weather been worse could have resulted in much higher deadloss.

AFA processors wanted the caps removed so they could purchase additional crab. Some of the AFA processors have added crab processing capacity since the end of the period used to determine processing history. Therefore, in the opilio fishery, the size of the processing sideboard cap is less than they had processed as a sector in recent years. This information was presented to the Council in discussion papers prepared for the June 2000 and September 2000 Council meetings.

Groundfish processing sideboards

The AFA directed the Council to develop protections for non-AFA processors, but did not specify a time frame for implementing those changes. The specific language in the AFA outlining processor sideboards is taken from Section 211(c)(2)(B) and provided below:

> *(B) Under the authority of section 301(a)(4) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(4)), the North Pacific Council is directed to recommend for approval by the Secretary conservation and management measures to prevent any particular individual or entity from harvesting or processing an excessive share of crab or of groundfish in fisheries in the Bering Sea and Aleutian Islands Management Area.(C) The catcher vessels eligible under section 208(b) are hereby prohibited from participating in a directed fishery for any species of crab in the Bering Sea and Aleutian Islands Management Area unless the catcher vessel harvested crab in the directed fishery for that species*

of crab in such Area during 1997 and is eligible to harvest such crab in such directed fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary. The North Pacific Council is directed to recommend measures for approval by the Secretary to eliminate latent licenses under such program, and nothing in this subparagraph shall preclude the Council from recommending measures more restrictive than under this paragraph.

Measures to protect non-AFA processors are being considered in another amendment package, so they are not analyzed in this document. The specific treatment of processing sideboards and excessive share caps may be found in the July 14, 2000 public review draft of the EA/RIR developed for that issue. The reviewer is referred to that document if they wish to obtain further information on those issues.

4.4.4 Effects of the alternatives on monitoring and enforcement

The AFA effectively grants catcher/processors, inshore processor coops, and motherships individual quotas of pollock. Under a system of this sort, participants in the AFA pollock fishery have a strong incentive to maximize the amount of pollock harvested and processed in any given year but are unable to compete for more fish within a fleet-wide quota. Thus, participants in the BSAI pollock fishery have a vested interest in ensuring that catch data do not overestimate the harvest of pollock or sideboard species by that individual vessel or cooperative. Over the past 20 years, numerous individual quota systems have been implemented. Proponents of individual quotas hypothesize that these systems foster resource stewardship among the shareholders in the resource, which leads to increased voluntary compliance with conservation measures. Some have even argued that quota holders should be allowed to set their own catch quotas because of their vested interest in the long-term viability of the resource. Unfortunately, evidence from previously implemented individual quota fisheries have tended to show otherwise, and practices such as high-grading, illegal discarding, and under reporting of catches appears to be common in many quota based fisheries.

Based on experience gained managing the CDQ program, NMFS anticipates that agency or observer estimates of catch will be routinely challenged by industry. This problem is avoided to some extent by allowing vessels and processors to self-report catch, but NMFS must be able to ensure the accuracy of these reports through independent verification and auditable records of the weight of hauls or deliveries and the location of fishing activity. Paragraph 211(b)(6) of the AFA sets out minimum requirements for observer coverage and catch weighing for listed AFA catcher/processors, but defers to NMFS and the Council to develop monitoring requirements for the other sectors of the BSAI pollock fleet.

Thus, implementation of the AFA under any of the alternatives creates new monitoring and enforcement concerns, and an appropriate set of monitoring and enforcement measures has been added to each alternative to address those concerns. The proposed measures for each alternative are summarized in Table 2.8.4 and fully described below.

Observer Coverage. All NMFS certified observers must meet basic requirements for education and training. In order to be Level 2 certified, an observers must have successful prior experience as an observer and complete a Level 2 observer training course. A lead level 2 observer on a catcher/processor or mothership must have completed at least 2 cruises (contracts) and sampled at least 100 hauls on a catcher/processor or mothership; and a lead level 2 observers on a catcher vessel must have completed at least 2 cruises and sampled at least 50 hauls on a catcher vessel using trawl gear.

Because of the vessel or processor specific nature of the AFA, NMFS and the industry need high quality data to effectively manage and conduct the pollock fishery. This has increased observer responsibilities and requires that the data generated by the observer be of uniformly high quality. The AFA specifies that listed catcher/processors must carry 2 observers at all times when fishing for groundfish in the BSAI. NMFS has additionally required that at least one be certified as a lead level 2 observer. Since implementation of the AFA, the quality of data collected by observers has been assessed by a rigorous post-cruise debriefing process and has overall been found to meet the expectation of high quality data at the point of collection. Because of these needs, all alternatives but the no action alternative require that listed catcher/processors and motherships carry two observers 100% of the time. At least one of the observers would be required to be certified as a lead-level 2 observer. Because of the co-op level sideboard accounting required under Alternative 4, that alternative would additionally require that listed catcher vessels carry a NMFS-certified observer 100% of the time. Alternatives 1 and 2 would impose no new observer coverage requirements on inshore processors. All other alternatives would require that each plant provide a level two observers for each 12 consecutive hour period during which the processor takes delivery of or processes groundfish from a vessel engaged in directed fishing for pollock.

Data collection needs for the AFA are nearly identical to those of the CDQ pollock fishery. Further, many of the processors and vessels that participate in the AFA pollock fishery also participate in the CDQ fishery, often on the same fishing trip. Thus, it is logical to have consistent observer coverage requirements for both fisheries. NMFS currently requires that a catcher/processor engaged in CDQ fishing carry two level-two observers, at least one of which must be certified as a lead level 2 observer. These requirements are more stringent than those that NMFS implemented for the AFA pollock fishery. NMFS believes that catcher/processors engaged in pollock fishing are an ideal deployment for training future level-two observers: bycatch is minimal, the boats are spacious and working conditions are good, and a more experienced level 2 observer is onboard to answer questions. This training opportunity for new observers would be unavailable if two level 2 observers were required at all times.

Because of the need to maintain consistency between observer coverage requirements in the AFA and CDQ pollock fisheries, Alternative 3, the preferred alternative, includes a measure to reduce the observer training requirements for catcher/processors and motherships engaged in directed fishing for pollock so that they are identical to the requirements for AFA catcher/processors and motherships.

Vessel Monitoring System (VMS). Under Alternatives 3, 4 and 5, AFA catcher/processors and catcher vessels would be required to carry and use a VMS when harvesting groundfish off Alaska. In October of 2000, NMFS established VMS requirements for trawl vessels engaged in directed fishing for Atka mackerel. These requirements would be extended to AFA catcher/processors. Under these regulations, a listed AFA catcher/processor must carry and use a NMFS-approved VMS transmitter whenever fishing for groundfish off Alaska. These transmitters automatically determine the vessel's location several times per hour using Global Positioning System (GPS) satellites and send the position information to NMFS via a mobile communication service provider. The VMS transmitters are designed to be tamper-resistant and automatic. The vessel owner should be unaware of exactly when the unit is transmitting and will be unable to alter the signal or the time of transmission. NMFS has established criteria for the approval of VMS components. At this time, only one transmitter, the ArgoNet Mar GE, and its associated communications service provider, North American Collection and Location by Satellite, Inc. (NACLS), have been approved by NMFS for use off Alaska.

Catch weighing. Subparagraph 210(b)(6)(B) of the AFA requires that all groundfish harvested by AFA listed catcher/processors be weighed on a NMFS approved scale. Under all alternatives but the status quo, NMFS proposes to extend the existing catch-weighing requirements for catcher/processors and motherships participating in the CDQ fisheries to AFA catcher/processors and motherships. This would implement the following requirements:

- Scales must meet the performance and technical requirements specified in Appendix A to 50 CFR 679. At this time, Marel hf and Skanvaegt International A/S produce scales that have been approved by NMFS for weighing total catch. Marel hf, Skanvaegt International A/S and Pols hf manufacture scales that have been approved for use in observer sampling stations.
- Each scale must be inspected and approved annually by a NMFS-approved scale inspector.
- Each observer sampling station scale must be accurate within 0.5% when its use is required.
- The observer sampling station scale must be accompanied by accurate test weights sufficient to test the scale at 10, 25 and 50 kg.
- Each scale used to weigh total-catch must be tested daily by weighing at least 400 kg of fish or test material on the total catch weighing scale and then weighing it again on an approved observer-sampling station scale.
- When tested, the total catch weighing scale and the observer sampling station scale must agree within 3 percent.

Catch weighing for catcher/processors and motherships is based on the use of scales approved by NMFS. Because NMFS and the State use different standards when approving scales, most NMFS-approved scales are not legal for trade in Alaska and visa versa. NMFS believes that the State should be the primary authority responsible for approving and testing scales in shoreplants and that it is unnecessary for all catch to also be weighed on scales approved by NMFS. Shoreside processors are required, under State regulations, to weigh all catch that is being bought or sold on State-approved scales. These scales must be inspected annually by inspectors authorized by the Division of Measurement Standards and Commercial Vehicle Enforcement. However, State regulations do not provide for inseason testing of scales nor do they require that scales produce a printed record of each delivery, and NMFS believes that these are essential features of an acceptable catch-weighing system. In cooperation with the State, NMFS has developed a catch-weighing system that implements these additional features within the existing framework of State scale inspection and approval:

- Each scale would have to be approved by the State of Alaska annually.
- Each plant would be required to submit a scale testing plan that gives the procedure the plant would use to test each scale used to weigh total catch in the plant. The testing plan would list: the test weights and equipment required to test the scale; where the test weights and equipment are stored; and, the plant personnel responsible for testing the scale. Test amounts for various scale types are shown in Table 1.
- Test weights would have to be certified at least biannually by a metrology laboratory approved by the National Institute of Standards and Technology.
- A NMFS-certified observer or other NMFS-authorized personnel could request that any scale be tested in accordance with the testing plan, provided that the scale had not been tested and found accurate within the past 24 hours.
- Each scale would have to be accurate within specified limits when tested by the plant staff.
- Each scale used to weigh catch would have to be equipped with a printer, and a printout or printouts showing the total weight of each delivery would have to be generated after each delivery had been weighed. The printouts would have to be retained by the plant and made available to NMFS-authorized personnel.

Observer Sampling Stations and Catch Monitoring Plans. Observer sampling stations are designed to provide an environment where an observer can safely and efficiently sample catch on a catcher/processor. They also allow the observer to monitor the flow of fish to ensure than all catch is properly accounted for. They are currently required for catcher/processors engaged in CDQ fishing. Under all alternatives but the

No-Action Alternative, NMFS proposes to require them for AFA catcher/processors as well. NMFS inspects and approves observer sampling stations annually. In order to be approved a sampling station must:

- Be located within 4 m of where the observer collects unsorted catch and reads the display on the scale used to weigh total catch.
- Be located where the observer can monitor the flow of fish between the bins and the scale used to weigh total catch.
- Have a working area of at least 4.5 square meters.
- Have a table for processing samples.
- Provide a NMFS-approved platform scale and test weights.
- Have adequate lighting and well drained floors.
- Provide running water.

NMFS does not require that shoreside processors provide observer sampling stations when participating in the CDQ program. Nor did NMFS develop catch monitoring regulations when implementing the AFA by emergency rule. However, in order to allow for independent verification of catch weight, species composition and haul location data and ensure that all catch is weighed accurately; NMFS believes that a catch monitoring system is necessary for effective monitoring and enforcement of the AFA.

Though the catch-management goals for the AFA pollock fishery are the same for the inshore and offshore sectors, NMFS does not believe that the regulations developed for catcher/processors and motherships are appropriate for shoreside processors for two reasons. First, shoreside processors vary more in size, facilities and layout than do catcher/processors or motherships. Second, the State of Alaska (State) is responsible for approving scales inside its territory and has developed an effective program for their inspection and approval.

The catch weighing and monitoring system developed by NMFS for catcher/processors and motherships is based on the vessel meeting a series of design criteria as described above. Because of the wide variations in factory layout, NMFS believes that a performance based catch monitoring system is more appropriate for shoreside processors. Under this system, each plant would be required to submit a Catch Monitoring and Control Plan (CMCP) to NMFS for approval. The CMCP would detail how the plant will meet the following standards:

- All catch delivered to the plant must be sorted and weighed by species. The CMCP must detail the amount and location of space for sorting catch, the number of staff, devoted to catch sorting and the maximum rate that catch will flow through the sorting area.
- From the observation point[25], an observer must be able to monitor the entire flow of fish and ensure that no removals of catch have occurred between the delivery point[26] and a location where all sorting has taken place and each species has been weighed.
- The observation point must be located where it is convenient to the observer work station. An observer in average physical condition must be able to walk between the work station and the observation point in less than 20 seconds without encountering safety hazards.
- The observer workstation must be located where the observer has access to unsorted catch.

[25] The observation point is a location designated in the CMCP where an observer monitors the flow of fish during a delivery.

[26] The delivery point is the first location where fish removed from a delivering catcher vessel can be sorted or diverted to more than one location. Where catch is pumped from the hold of a catcher vessel or a codend, this would normally be the location where the pump first discharges the catch. Where catch is removed from a vessel by brailing, this would normally be the bin or belt where the brailer discharges the catch.

- An observer work station, for the exclusive use of the observer, must provide: a platform scale of at least 50 kg capacity; an indoor working area of at least 4.5 square, meters, a table, and a secure and lockable cabinet.
- A plant liaison, designated by name, that would be responsible for orienting new observers to the plant, ensuring that the CMCP is implemented, and assisting in the resolution of observer concerns.

The plant would be inspected by NMFS to ensure that the plant layout conforms to the elements of the plan. A CMCP that meets all of the performance standards would be approved by NMFS for one year, unless changes are made in plant operations or layout that do not conform to the CMCP. After one year, NMFS would review the CMCP with plant management to ensure that the CMCP has been implemented and that the performance standards continue to be met.

Table 4.4.13 Summary of the costs of the Preferred Alternative for monitoring catcher/processors and motherships.

	Cost per boat	*AFA C/Ps with scales/stations*	*AFA C/Ps without scales/stations*[1]	*AFA Motherships*
Platform scale purchase	$7,000	0	$56,000	$7,000
Total-catch weighing scale purchase	$45,000	0	$360,000	$45,000
Scale installation	$10,000	0	$40,000	$5,000
Observer sampling station installation	$10,000 to $20,000	0	$80,000	$8,000
Lost fishing days due to scale failure[2]	0.05 days per 100 days	1 days/yr		0.1 days/yr
Time for daily scale test[2]	0.75 hrs/day	1604 hrs/yr		191 hrs/yr
Time for annual scale inspection	8 hrs/yr	160 hrs/yr		24 hrs/yr
Time for annual station inspection	7 hrs/yr	140 hrs/yr		21 hrs/yr
Cost of second observer	$300/day	$872,700		$55,500

[1]As of early 2001 there are only four AFA C/Ps not equipped with scales and observer sampling stations.
[2]Based on 2139 C/P fishing days and 210 mothership fishing days in 2000.

4.4.5 Effects on coastal communities

The domestic groundfish fisheries of the North Pacific and Bering Sea developed, over roughly the last twenty years, within an operational and management environment which tended to reward the largest and swiftest operations. That is, these fishery resources were developed as "open access" assets (i.e., no one holds a 'property' interest in the fish or, more precisely, everyone owns the resource in common). Under these conditions, the "race-for-fish" induced investment in excessive capacity, at all levels of the fishery (e.g., harvesting, primary processing), emphasizing maximum through-put, rather than optimal utilization of catch (and other variable inputs).

At various points in time, estimates of harvesting and processing capacity in, especially the pollock fishery, suggested that perhaps two or three times more capacity exists in this fishery than would be required to "efficiently" harvest and process the TAC. However, because total harvesting and processing capacity had to be sufficient to extract and process the entire TAC, as rapidly as it was made available, the industry built for the "peak", rather than the "efficient", rate of fishing.

Provisions of the AFA will allow movement, by the industry, towards the "rationalization" of the BSAI pollock fishery, by introducing economic incentives for the industry to increase efficiency. Enhanced efficiency will, by definition, result in the need for far less capacity (both harvesting and processing) than is currently present in the fishery. With these efficiency improvements, however, will come costs, as the industry adjusts to significant structural changes.

A "rationalized" fishery will, inevitably, result in retirement and removal of (perhaps significant) excess capacity. Older, less efficient vessels and plants may become surplus and be idled by their owners. Fewer people will be employed as fishermen and processing workers (although those that are, may be employed for a longer duration, each year).

Many of the costs of "rationalization" will be indirect. For example, communities which support and depend upon these commercial pollock fisheries will likely incur substantial adverse economic, socioeconomic, and cultural impacts, as they adjust to changes in the timing and total magnitude of fishery related activities, induced by the AFA. Because much of the economic infrastructure of rural Alaska coastal communities has developed in support of commercial fishing (especially that of groundfish), adverse effects on businesses which supply goods and services to the fleet will also be widespread.

Firms with direct and obvious linkages to the fisheries, such as maritime equipment purveyors, fuel pier operators, cold storage and bulk cargo transhipping firms, to local hotels, restaurants, bars, grocery stores; and air carriers serving these communities, all will be impacted by the proposed structural changes in pollock fisheries, attributable to the AFA. For example, a slower paced "rationalized" fishery will involve significantly less total vessel activity. This means fewer port calls, with reduced demand for goods and service (e.g., fuel, stores, maintenance services). Reduced commercial and retail activity will have a ripple effect, diminishing earnings (and long term economic viability) for these support and service firms, which will, in turn, adversely impact the total size and diversity of the local economic base. With a smaller, less diverse local economy, total employment in the community will likely decline, compounding the economic dislocation. Over all, many of these isolated, rural, fishery-dependent communities will likely experience a significant welfare loss, through a decline in the economic and social quality-of-life for their residents.

Beyond the private sector effects, local government jurisdictions will be adversely impacted, as well. Most of these coast fishing communities rely heavily upon tax revenues (e.g., fish landings taxes, business and property taxes, sales taxes) for operating and capital funds. Diminished activity in the fisheries, translates directly into reduced revenues to these governmental jurisdictions. At the same time, economic and socioeconomic dislocation in the fisheries will increase demands for social services in these rural communities. Further, as populations "adjust" to structural changes in the fishing, processing, and support sectors, emigration will likely impose burdens on school districts, which depend upon State and Federal revenues (based upon per capita enrollment) for economic support. Because few, if any, viable alternative sources of economic activity exist in most of these rural coastal Alaska communities, the prospects for mitigating these adverse impacts, at least in the foreseeable future, do not appear promising.

As the community profiles in Section 3.3 suggest, with the single exception of Seattle, Washington, all of the potentially affected pollock dependent communities are small, physically isolated, largely economically undiversified, with few immediate prospects for alternative economic development opportunities.[27] For most, the size of their permanent full time resident population is small, with significant seasonal population fluctuations, spurred by a highly mobile transient workforce employed in the fisheries, or by firms which

[27] The foregoing is a reasonable characterization of the 65 CDQ villages, as well, although they differ significantly from the non-CDQ communities on many of the following series of attributes.

support or supply services to the fishery. These communities are socially, culturally, and economically divergent, however, each shares a common characteristic; that being, a fundamental dependence upon the fisheries (and especially pollock fisheries) of the region.

Under Alternative 1, were that to be the action adopted (reversion to the pre-AFA management regime), the BSAI pollock fishery would return to a management regime with most of the properties characteristic of 'regulated open access'. For example, while, under this alternative, the two primary sectors (e.g., inshore and offshore) would be allocated separate BSAI pollock TAC amounts, members of each sector would still "race" one another to attain the largest possible share of that sectoral quota apportionment. While arguably representing a slight improvement over total open access, in as much as neither major sector has the ability to "preempt" the other's share of the pollock TAC, this alternative would be expected to produce a number of undesirable and costly outcomes for coastal communities, relative to the suite of alternative options under consideration in the proposed action.

First, by its nature, any form of the open access "race for fish" produces an operational environment within which maximum speed is rewarded, while efficiency and conservation of productive resources are not. The result is an economic environment which provides perverse incentives, encouraging investment in redundant and excessive physical capacity. As was observed in the pre-AFA development of this fishery, under these economic and management "rules-of-the-game", each sector builds a physical plant capable of accommodating "peak" through-put, to facilitate attainment of the largest possible individual share of the sector's common-pool allocation. While collectively irrational, individual investment in additional physical capacity and technology appear to be justified, even made necessary, to sustain or improve the relative performance of the operation, visa vis that of the other members of the sector. But the "sum total" of each individual decision to invest in additional physical plant produces an outcome in which aggregate capacity vastly exceeds that actually needed to exploit the available fish stock. As total capacity (both harvesting and processing) grows, in response to "peak-load" demands, the tendency is for the fishery to be compressed in time (and perhaps space), with, in the case of the BSAI pollock fishery, seasons lasting a matter of days, rather than months (as was the historical case). All potential resource rents are dissipated and the capital stock lies largely idle through longer and longer periods. From the point of view of the individual fishery participants, the system locks them into an undesirable cycle of technical inefficiency and economic waste. This is a well know and widely treated outcome in the literature of economics and fisheries management.

From the point of view of fishery dependent communities, open access development and management of the BSAI groundfish fisheries, and in particular pollock (even in a modified form like that of Alternative 1), can be regarded in some respects as a "double edged sword". For many rural western Alaska communities, participation in the larger "cash economy" has traditionally been marginal and sporadic, at best, and secondary to dependence upon the local subsistence economy, supplemented by state transfer payments. In the rural coastal Alaska villages bordering the north Pacific and Bering Sea, rapid development of the domestic pollock fishery clearly produced new (and, for many, unprecedented) economic opportunities. Large capital expenditures on processing plants, cold storage facilities, stevedore and transshipping services, as well as myriad maritime and related support facilities to service the harvesting, processing, and transshipment sectors, infused millions of dollars into these communities and created employment opportunities where few, if any, had previously existed.

Simultaneously, however, the booming growth placed unprecedented demands on community infrastructure, resulted in the sudden influx of large (often highly seasonal) transient populations, inflated local prices for goods and service, and otherwise altered the traditional social and cultural structure of these small rural Alaska communities.

Because the levels of physical plant (e.g., boats, processing plants) created in the entry-rush were so far in excess of the levels needed to economically (e.g., profitably) utilize the available pollock resource, long term sustainability of these investments was doubtful. Indeed, significant entry, exit and re-entry of capacity in this industry has been characteristic of the development path for several years. In many respects, it was the "unsustainable" pattern of investment in excess capacity which propelled the industry to seek a political solution to these economic "market failures".

In general then, under any form of open access (in a fully subscribed fishery), the greater the growth in "peak-load"(e.g., excess) capacity, the more compressed the fishing season will become. With compression of the season, the more transient and cyclical will be the operational patterns of the primary and secondary economic sectors in the community. A pattern of "flat-out" to "full-stop"operation, keyed to the opening and closing of short duration fisheries, imposes greater economic cost and social burden to the community structure than does, for example, a more constant (albeit lower level), less cyclical pattern of operation. On the basis of these criteria alone, clearly, Alternative 1 represents a potentially inferior management solution, from the point of view of dependent coastal communities, to that of any of the other alternatives under consideration in the AFA action.

That is, from a rural Alaska coastal community perspective, any of the alternatives to the "open access" Alternative 1 provide the potential for greater local economic stability, increased efficiency through better utilization of all productive inputs (including those supplied by the community), and reduced cyclical-load stress on community infrastructure resources.

On the other side of the equation, however, are the probable adverse community impacts which may accompany the inevitable transition "from" the over capitalized, highly seasonal, volatile operational patterns which developed under the pre-AFA race-for-fish management regime, "toward" a more fully economically rationalized and sustainable operational and management pattern. That transition will not be costless, as capacity (expressly designed and intended for compressed, peak-load utilization) becomes surplus under a slower, more operationally stable and sustainable pattern. To the extent that the firms which make up the direct support sectors and tertiary service sectors of these communities have also "invested" in physical plant designed to accommodate compressed, peak-load operation, they too will incur costs in "right-sizing" for the new management regime. There is some early anecdotal evidence that this may be happening. Under the administrative provisions of the AFA, a significant number of catcher/processor vessels (i.e., nine of twenty-nine) were removed from the fishery, beginning in the 1999 season. At the same time, this sector was permitted to organize under a collective operating cooperative structure which allowed it to operate with even fewer active vessels than were technically authorized to fish under the Act. It has been reported (in the local Unalaska press) that these two actions, in combination, significantly reduced demand for support and allied services in the port of Dutch Harbor/Unalaska, in the 1999 and 2000 fishing years.

The absence of detailed cost, net revenue, capital investment and debt structure data for the several and various elements of the local coastal communities, dependent upon pollock fishing and processing, precludes a quantitative analysis of the probable net economic impacts of such a change. Nonetheless, one may draw insights from history. In the early 1980s king crab landings declined precipitously throughout the region and many of these communities suffered a severe community-wide economic recession (some have characterize the decline as a severe economic depression). It was largely the development of the pollock and other groundfish fisheries which reinvigorated the local economy, after extensive recapitalization and often wrenching economic, social, and cultural adjustments.

From the point of view of the affected coastal communities, the differences between Alternatives 2 through 5 are largely distributional. For example, the presence or absence of "cooperatives" in the inshore sector, as well as the specific form they take (e.g., Dooley-Hall) will influence the rate at which cost savings (and thus economic benefits) accrue, through improvements in operational efficiencies (e.g., rationalization) in the pollock fishery. However, the form, mechanism, and degree of inter-cooperative mobility, and the resulting distributional changes in fishing and processing patterns (if any), cannot be readily anticipated. Furthermore, given the limited number of processing plants (fixed under AFA) and their geographic concentration, the small number of port facilities capable of accommodating the commercial fleet, etc., it appears likely that, once again from the unique perspective of the group of directly dependent communities, there isn't a substantial difference among these alternative co-op structure proposals with respect to the expected community economic impact. An empirical assessment of any long term impacts attributable to one or the other forms of cooperative structure is difficult to undertake, due to the fact that "co-ops" are such a new feature of this fishery. The at-sea catcher/processor co-op is in just its second year of existence, while the mothership co-op and inshore co-ops are in their first year.

Likewise, the presence or absence of sideboard restriction, and the specific form they may take, while of considerable economic and operational importance to the potentially affected operators, should produce primarily 'distributional' effects, from the stand point of the identified communities; effects most of which cannot be anticipated, *a priori*.

Specific attributes of either the programmatic co-op structure or the sideboard configurations, adopted in the final action, could produce some redistribution of fish tax revenues, as among the various primary landing communities. Such changes could have significant implications for these municipalities, because State and local fish taxes often represent a substantial (for some communities majority) source of operating funds. Once again, however, it is not possible with available information to quantify the potential economic and socioeconomic impacts, should one or more of the alternative forms of co-ops (or sideboard regimes) result in realignment of fishing relationships and/or patterns.

4.5 Regulatory Impact Review

4.5.1 Introduction

This section is a Regulatory Impact Review (RIR) of proposed alternative regulations for the implementation of the provisions of the AFA. As noted below, an RIR is required for federal actions under the terms of Executive Order (E.O.) 12866. The RIR should evaluate the significance of a proposed federal action using the criteria in E.O. 12866. It should provide a benefit and cost analysis for significant proposals.

Statutory Authority

The AFA provisions would be implemented by proposed Amendments 61/61/13/8. Sections 1.1 to 1.3 of the EIS contain a detailed description of the statutory authority for the Fisheries Management Plans and for the proposed amendments.

What is a Regulatory Impact Review (RIR)?

This Regulatory Impact Review provides the analysis of Amendments 61/61/13/8 required under E.O. 12866. The following statement from the E.O. summarizes the requirements of an RIR:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach. (Clinton, §1(a), page 51735).

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;

- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order. (Clinton, §3(f), page 51738).

Purpose of and Need for the Action

U.S. OMB guidelines for analyses under E.O. 12866 state that:

> In order to establish the need for the proposed action, the analysis should discuss whether the problem constitutes a significant market failure. If the problem does not constitute a market failure, the analysis should provide an alternative demonstration of compelling public need, such as improving governmental processes or addressing distributional concerns. If the proposed action is a result of a statutory or judicial directive, that should be so stated. (OMB, Section 1.)

The actions entailed in Amendments 61/61/13/8 are a response to (1) a statutory directive, and (2) a significant market failure. Amendments 61/61/13/8 incorporate the relevant provisions of the AFA into the FMPs and establish a comprehensive management program to implement the AFA. They are thus a response to a statutory directive.

Moreover, they are also a response to a significant market failure. Unregulated access to common property can be a significant market failure within the meaning of the OMB guidelines (OMB, Section 1). Unregulated access is a serious problem in many fisheries and has been a problem in the BSAI pollock fisheries.[28] It often costs far more to harvest and process fish in common property fisheries than would be necessary if alternative regulations were in place. Under some circumstances, the economic costs of harvesting and processing the fish may come to equal the economic benefits. The pollock fishery is widely believed to use more capital, labor, and other inputs than are necessary to harvest and process the allowable catch. The implementation of the AFA cooperative system in 1999 and 2000 provides evidence that the fishery was heavily over-capitalized and reduced in value due to the race for the fish. Some of this evidence is summarized in the benefit-cost analysis in Section 4.5.2. Unregulated common property fisheries can also endanger the fish stocks that are being exploited, although regulations in place in this fishery probably provide adequate protections.

Much recent economic analysis of common property problems is concerned with why private institutions are unable to solve the problems themselves. Influential articles by R.H. Coase have directed attention to the "transactions" costs that must be incurred to deal with the common property problem, and towards the relation of these costs to the benefits that might flow from solving the problem. The transactions costs are the costs of getting people together, and of negotiating and enforcing an agreement.[29]

One of the purposes of the AFA is to address the common property nature of the fisheries by reducing the transactions costs to fishermen of organizing to address the common property problems. It does this by eliminating barriers to the formation of fisheries cooperatives (co-ops) by fishermen, and by allowing fisheries managers to specify portions of the total allowable catch that may be harvested by the cooperatives. The co-op approach to management is a novel aspect of the AFA.

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[28] Pollock harvesting and processing in the BSAI are extensively integrated. "Fishery" is used in this RIR as shorthand to refer to both harvesting and processing.

[29] The key article by Coase is "The Problem of Social Cost" (1960). Libecap (1981) provides a good example of this approach in a comparative study of the role of transactions costs in the evolution of property rights in hardrock mining, grazing, fisheries, and oil field unitization.

Description of the Fishery

Chapter 3 of this EIS provides detailed descriptions of the physical environment for this fishery, the nature of the biological resources impacted by the fishery, and the important features of the human environment. The discussion of the human environment in Section 3.3 provides a history and profile of the BSAI pollock fishery, a profile of the non-AFA groundfish fishery, and a description of affected fishing communities. The reader is referred to Chapter 3 for a detailed description of the fishery and the fishing communities. Key elements of Chapter 3 are summarized below.

The BSAI pollock fishery has four important sectors, catcher/processors, catcher vessels, inshore pollock processors, and motherships.

Catcher vessels catch and deliver fish; they are not equipped to process it on board. They deliver product to inshore processors, motherships, and to catcher/processors. Vessels in this sector range from under 60 feet to 193 feet, although most are from 70 to 130 feet. The AFA has established, through minimum landings criteria, the list of trawl catcher vessels eligible to participate in the BSAI pollock fishery. Most of the 107 eligible vessels are homeported in the Pacific Northwest, although some have homeports in Alaska, particularly in the Kodiak or Aleutian Islands areas. About a third of the fleet are owned by onshore processing plants. Most of these vessels participate in a variety of BSAI fisheries, including pollock, Pacific cod, and crab, as well as in GOA fisheries for pollock and cod.

There are six land-based and two floating processors eligible to participate in the inshore sector of the BSAI pollock fishery. The land based processors have produced surimi, fillets, roe, meal, and a minced product, while the floating processors have fillets, roe, meal, and a minced product, but limited amounts of surimi. Three of the land based processors are located in Dutch harbor/Unalaska, and one each are located in Akutan, Sand Point, and King Cove. The two floating processors typically anchor in Beaver Inlet in Unalaska to do their processing. As noted above, about a third of the catcher vessels are owned by onshore processors.

Motherships process, but do not harvest, fish. The three motherships currently eligible to participate in the BSAI pollock fishery range in length from 305 to 688 feet LOA. Motherships contract with a fleet of catcher vessels that deliver raw fish to them. As of June 23, 2000, a total of 20 catcher vessels were permitted to make BSAI pollock deliveries to these motherships. Motherships are dependent on BSAI pollock for most of their income, although small amounts of income are also derived from the Pacific cod and flatfish fisheries in Alaska.

Catcher/processors, or factory trawlers, harvest and process fish. In some instances they accept deliveries from catcher vessels and process that fish. The pollock catcher/processing fleet has two fairly distinct components: the fillet fleet, which concentrates on fillet production, and the surimi fleet which produces a combination of surimi products and fillets. Both sectors also produce pollock roe, minced products and, to varying degrees, fish meal.

- Vessels in the surimi fleet range between 224-286 feet. Some of these vessels can harvest over 400 mt tons of fish a day and produce over 100 mt tons of products. There were 12 surimi processors operating in 1999. While these vessels do harvest and process species other than pollock, 85-90% of the wholesale value of their product consists of pollock products. Surimi accounts for about half of the wholesale value for this fleet and fillets for about 30%.
- Vessels in the fillet fleet range from 210 to 296 feet, but are typically smaller than the surimi vessels. This fleet is more diversified in terms of species, but less diversified in terms of products. It produces mainly fillets, and to some extent roe and minced products. Fillet production tends to require

somewhat larger fish, forcing this fleet to fish lower in the water column and creating greater incidental catches of non-pollock species. Four of these vessels were operating in 1999.

Gross revenues for all the sectors in this industry, taken together, have ranged from about $600 million (in 1998) to about $800 million (in 1995).[30]

Roughly 60 to 70% of Alaska pollock is made into surimi, a fish paste that can be used to make kamaboko (a traditional Japanese food) and numerous other products. In the United States, surimi is used to make products such as imitation crabmeat.[31] With approximately 10 surimi plants in the United States, most of the surimi is produced by at-sea and shore based processors in Alaska for Asian markets (primarily Japan). There are two secondary processing surimi plants in Washington State—the Icicle kamaboko facility and a facility owned by Trident.

Perhaps 15% of the total pollock harvest is made into deep skin blocks (fillets with the skin and fat removed), primarily for the U.S. fast food market (almost exclusively McDonald's). Most processing for this market occurs at the primary processing level. Approximately 3 to 5% of the total pollock harvest results in individually quick frozen blocks for the U.S. food service industry. This product serves as a substitute for other whitefish fillets. The remainder of the harvest is typically made into traditional blocks that can be used in the European market. The demand for traditional blocks is totally dependent on the price and availability of other whitefish, although pollock is not typically viewed as a desired substitute.

The demand for traditional surimi products, such as kamaboko, appears to be declining in Japan. One possible reason is that much of the demand comes from older Japanese. Younger generations in Japan and many other Asian countries appear to prefer western foods more than the older generations. However, surimi can be used in the production of a variety of foods. The net effect of a decline in demand for kamaboko is not known. However, the effect is not likely to be decline in overall demand or production of surimi. Instead, the effect is more likely to be a shift in how surimi is used and where it is shipped.

Description of the alternatives

The five alternatives considered for this action have been described in detail in Chapter 2 of the EIS. Chapter 2 characterizes the alternatives on the basis of sectoral allocations, vessels allowed to participate in the fishery, co-op structure, sideboard rules, and monitoring and enforcement requirements. Each alternative is described in the terms of the same characteristics, making it easy to compare their details. Tables 2.8.1 through 2.8.4 provide a tabular summary of the alternatives. Persons interested in a detailed description should refer to that chapter.

This section will provide a brief summary of key points distinguishing the alternatives. It will focus on co-op structure and sideboard issues and aspects of the alternatives that are important for the benefit-cost analysis. The five alternatives may be summarized as follows:

Alternative 1. The theme of Alternative 1 is to continue with the inshore/offshore management regime that was in place before passage of the AFA. Alternative 1 is discussed in detail in Section 2.3 of the EIS.

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[30] Estimated from data in 2000 Groundfish SAFE document. Product of the percent of pollock harvested in the BSAI (from Table 17) and the aggregate first wholesale gross for Alaska (from Table 36).

[31] This discussion of markets is based on PSEIS, pages 3.10-109 to 3.10-110.

Under this alternative, NMFS would take no action to implement the provisions of the AFA. Management of the BSAI pollock fishery would return to the inshore/offshore management regime that governed the fishery from 1990 until the passage of the AFA in October 1998. While this alternative is clearly contrary to the statutory requirements of the AFA, it is included for analytical purposes to provide a baseline against which the economic effects of the AFA may be compared.

There would be no co-ops under this alternative. It is assumed that the common property race for the fish would continue. The fishery might closely resemble the fishery as it was in 1998. This outcome is discussed in Section 4.1.1 of the EIS.

Alternative 2. The theme of Alternative 2 is to meet the minimum statutory requirements of the AFA without additional modifications. Alternative 2 is described in detail in Section 2.4 of the EIS. Section 4.1.2 of the EIS also clarifies important differences between Alternative 2 and AFA Alternatives 3 to 5.

Alternatives 2 through 5 all anticipate and facilitate the creation of pollock co-ops. However, Alternatives 3, 4 and 5 do so to a greater extent than Alternative 2. Alternatives 3 to 5 contain features which make co-ops more attractive to the inshore sector, comprised of catcher vessels delivering inshore, and the eight inshore processing operations.

Under Alternative 2 the catcher/processor and mothership sectors of the pollock fishery would operate under fishery co-ops but the inshore sector may continue under open access conditions, within the overall limits on vessel and processor participation contained in the AFA. Alternative 2 would *not* contain measures recommended by the Council under Amendments 61/61/13/8 to facilitate formation of inshore co-ops. These measures (which are present in Alternatives 3 to 5) include:

- Basing the inshore co-op allocation formula on the best 2 of 3 years fishing history from 1995-1997
- Providing "compensation" for inshore vessels with more than 499 mt of offshore landings from 1995-1997
- Providing sideboard exemptions for catcher vessels less than 125 ft, with less than 1700 mt of annual pollock landings from 1995-1997, and with 20 landings in the BSAI Pacific cod fishery and or 30 landings in the GOA groundfish fishery during 1995-1997.
- Requiring that all co-ops manage their sideboard fishing to assure that smaller vessels with significant histories of participating in sideboard fisheries are not displaced by larger vessels in a race for sideboard species.

These measures are intended to encourage the formation of co-ops by making them more attractive for several classes of inshore-qualified vessels. Without these measures it is probable that some or all of the existing inshore co-ops would find it difficult or impossible to reach the "80% of qualified vessels" threshold required under the AFA to become an authorized inshore co-op and receive an allocation of pollock. In the absence of these measures, which were recommended by the Council under Amendments 61/61/13/8, it is probable that significant numbers of inshore catcher vessel owners would refuse to join inshore co-ops, in the belief that they would have greater fishing opportunities if they remain in the open access sector of the fishery. This would jeopardize the ability of the remaining vessels in each existing co-op to reach the required threshold.

If no inshore co-ops were able to form under Alternative 2, the fishery might be very similar to the fishery in 1999, when there were co-ops in the catcher/processor sector, but not in the inshore catcher vessel sector. However, if some inshore co-ops were able to form under Alternative 2 then the projected fishing patterns under Alternative 2 would fall somewhere between the patterns observed in 1999 and the pattern in 2000, when eight co-ops and the Intercooperative Agreement were formed in the inshore catcher vessel sector.

The catcher/processor sideboards in this alternative are those set out in the AFA. Catcher vessel and processor sideboards are the simplest options identified by the Council.

Alternative 3. The theme of Alternative 3 (which has been identified in the EIS as the preferred alternative) is to foster the development of co-ops and intercooperative agreements with NMFS-industry co-management of pollock and sideboard fishing. Alternative 3 is described in detail in Section 2.5 of the EIS.

This alternative contains the features in the bulleted list above, that were missing under Alternative 2. It is thus much more likely that inshore catcher vessels will form co-ops under Alternative 3. In fact, in 2000, when the BSAI pollock inshore fishery was operating under rules very similar to those in Alternative 3, eight inshore co-ops were formed and were able to integrate their operations through an intercooperative agreement, as described below.

This alternative also allows inshore catcher vessel co-ops to let retired catcher vessels maintain co-op membership without making qualifying landings in the year prior to the year in which the co-op will be in effect. An inactive vessel could maintain membership in the co-op to which it delivered the majority of its pollock during its last active year in the BSAI inshore directed pollock fishery. This makes it easier for the co-ops to retire excess fishing capacity.

Alternative 3 incorporates provisions that make it difficult, although not impossible, for catcher vessels to change co-op membership. Catcher vessels are only "qualified" to join the cooperative that is associated with the processor to which the vessel delivered the majority of its pollock in the previous year. A vessel can switch cooperatives by leaving the cooperative system for a year, fishing in an open access fishery, and then joining the cooperative delivering to the processor that bought the majority of its pollock in its year in the open access fishery. The rules also permit other approaches to switching cooperatives. For example, a cooperative can deliver up to 10% of its pollock to another processor in a year. If the cooperative designates a single vessel to make those deliveries, it is possible that that vessel could deliver the majority of its product to another processor and could switch processors in the following year.

Under Alternatives 2, 3, and 5 there is an administrative "gap" between the annual species TAC specifications prepared by NMFS and the NPFMC, and the nature of the quota issued to the individual inshore co-ops. Annual specifications divide the overall TAC for a species between different components of the fishing fleet, *and* among different areas and seasons. However, under this AFA alternative, the overall TAC for a species is divided between different components of the fishing fleet (the co-ops), *but not* among the different areas and seasons. This raises the possibility that co-ops may race for the fish in unusually attractive areas and seasons.

In order to bridge this administrative "gap", the inshore catcher vessel cooperatives created the intercooperative agreement in a private contract in January 2000. This private, consensual agreement provides for the allocation, monitoring and compliance with pollock allocations and groundfish sideboard limits and PSCs, and for the establishment and monitoring of sideboard transfers between the cooperatives. Under the Intercooperative Agreement the industry itself performs a number of the functions that might otherwise be entrusted to the government, and cooperates with NMFS in co-management of the fishery. It is anticipated that if Alternative 3 is adopted, this private arrangement among the inshore cooperatives would continue.

Sideboard rules for alternatives 2, 3 and 5 have fundamental similarities, that distinguish this family of alternatives from Alternative 4. Under these approaches, NMFS identifies the aggregate amount of fish allocated to the fleet as a sideboard. NMFS then deducts from these sideboards, the amounts of fish that experience suggests the fleet will need for by-catch in various fisheries. What remains, is allocated for targeted sideboard harvests. NMFS in-season managers monitor targeted sideboard fisheries (such as that for Pacific cod) and will close the fisheries when the targeted allocation is taken. Fisheries in which sideboards have been allocated as by-catches can proceed; in fact, NMFS does not close these fisheries when the sideboard by-catch is taken. Under these alternatives, sideboards are generally based on *retained* harvests of sideboard species by the vessels in a base period from 1995-1997.

Alternative 4. The theme of Alternative 4 is "maximum autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level." Alternative 4 is described in detail in Section 2.6 of the EIS.

Under Alternatives 2 to 3 and 5, NMFS would have in-season management responsibilities. NMFS would monitor fleet harvests of pollock and sideboard allocations, and would close directed fishing to AFA listed catcher vessels when pollock allocations and sideboard amounts were inadequate to support directed fishing. Existing observer coverage levels and catch reporting systems should be adequate to monitor the aggregate activity of AFA-listed catcher vessels. In the case of prohibited species, catch by observed vessels would be extrapolated to unobserved vessels fishing for the same species in the same areas as is currently being done for all fisheries in which observer coverage is less than 100 percent. It is assumed that the Intercooperative Agreement would play an important coordinating role for the inshore co-ops under Alternatives 3 and 5.

Under Alternative 4, however, these in-season management activities, preformed by NMFS under the other alternatives, will be largely transferred to the individual cooperatives. Under Alternatives 3 and 5, NMFS allocates pollock and sideboard specifications to inshore co-ops without sub-allocating them by management area or season, even though regulations impose area and season limits on harvest. In the absence of the Intercooperative Agreement, this would create common property competition for highly valued area and season fishing opportunities (such as for roe pollock in January). However, under Alternative 4, sub-allocations of each groundfish sideboard amount would be issued to each co-op, and each co-op would be responsible for ensuring that its member vessels do not exceed any sideboard amount. NMFS will monitor harvests, and intervene to enforce harvest and side-board limits following fishing activity, should a cooperative exceed its allocations. However, this approach raises some important issues. These were discussed in an earlier review of sideboard measures (NPFMC 2000d), page 257):

> *Managing sideboards at the individual co-op level poses significant additional burdens compared to managing aggregate sideboards for the fleet as a whole. In the first place, NMFS cannot possibly manage multiple species sideboards at the individual co-op level through traditional in season management measures such as closures in the Federal Register. The responsibility for sideboard management at the individual co-op level would have to be the legal responsibility of the co-op itself and not NMFS, similar to the management of pollock shares by individual co-ops. Second, the monitoring of individual catch limits at the co-op level raises the same monitoring concerns present in the CDQ program and discussed above with respect to the monitoring of pollock shares by co-ops. For this reason, NMFS believes that management of sideboards at the individual co-op level requires the same monitoring and observer coverage levels required by the CDQ program (e.g. 100 percent observer coverage for all trawl vessels greater than or equal to 60 ft LOA and full retention of groundfish catch and salmon PSC). This additional monitoring is especially important for PSC species which are discarded at sea. Extrapolation of PSC rates from observed to unobserved vessels at the co-op level is probably not possible given the small numbers of vessels involved in each co-op and the incentives to misreport PSC catch in the absence of an observer.*

In some respects, Alternative 4 is like Alternatives 3 and 5. It allows inshore catcher vessel co-ops to let retired catcher vessels maintain co-op membership. This makes it easier for the co-ops to retire excess fishing capacity. It is harder for catcher vessels to shift co-op membership under this alternative than under Alternative 5, however.

Alternative 5. The theme of Alternative 5 is increased market freedom for independent catcher vessels. The tables in Chapter 2 provide more details on this and the other alternatives in a comparative format.

Alternative 5 is very similar to Alternative 3. The main difference is that Alternative 5 allows active inshore catcher vessels to switch between co-ops without spending a year in the open access fishery. Under Alternative 5, the AFA definition of "qualified catcher vessel" is eliminated. As noted earlier, under the existing language of the AFA, catcher vessels are only "qualified" to join the cooperative that is associated with the processor to which the vessel delivered the majority of its pollock in the previous year. This definition makes it harder to move catcher vessels between cooperatives and their associated processors. As noted earlier, vessels could comply with this requirement by spending a year in the common property fishery, or by working with other members of their cooperative (under the rule permitting 10% deliveries to a processors not affiliated with the cooperative) to establish a record of deliveries elsewhere. However, the elimination of the definition of "qualified catcher vessel" would reduce the difficulties and uncertainties associated with moving catcher vessels between cooperatives. Under Alternative 5, the AFA requirement that 80% of the qualified catcher vessels join an inshore co-op before being authorized by NMFS would be eliminated.

4.5.2 Benefit-cost analysis

This section provides a benefit-cost analysis of the proposals. For reasons noted in the sub-sections that follow, it has not been possible to make quantitative or monetary estimates of the benefits and costs of these alternatives.[32] However, the alternatives can be distinguished somewhat by the extent to which they are likely to lead to increased net benefits. Where alternatives can be distinguished in this way, their potential for increased net benefits has been described.

Benefits and costs have been examined under five distinct headings:

- Fishing and fish processing costs and profits
- Benefits to U.S. consumers and revenues from foreign users
- Management expenses
- Safety
- Impacts on other fisheries

A final summary section provides a tabular comparison of the potential impacts across alternatives.

A benefit-cost analysis is focused on aggregate net benefits to the nation. However, a program which has positive net benefits for the nation may leave some persons or groups worse off than before. For equity reasons, it is common to accompany a benefit-cost analysis with a distributive analysis that looks at the net

[32] NMFS guidance for RIRs provides, "At a minimum, the RIR and RFAA should include a good qualitative discussion of the economic effects of the selected alternatives. Quantification of the effects is desirable, but the analyst needs to weigh such quantification against the significance of the issue and the available studies and resources." The acronym RFAA refers to Regulatory Flexibility Act Analyses. (NPFMC, 2000d, page 2).

benefits of a proposal to different groups. Moreover, the Regulatory Flexibility Act (RFA) requires an examination of the impacts on small entities in a Final Regulatory Flexibility Analysis (FRFA). Section 4.5.3 of the RIR contains a distributional analysis that evaluates the program impacts on key groups. Section 4.6 provides a FRFA.

Fishing and fish processing costs and profits

The cooperative system is expected to increase the overall profitability of BSAI pollock fishing and processing. This section provides a qualitative discussion of the reasons to expect profits to increase. Some preliminary quantitative information is provided. However, for reasons discussed below, it has not been possible to estimate the amount by which profits would be increased. This topic is addressed under the following headings:

- Impact of reallocation
- Impacts of co-ops and sideboards
- Variations across the alternatives
- The impact of foreign ownership in fishing and processing

Impact of reallocation. The AFA requires significant changes in the allocation of pollock among industry sectors. The impact on net benefits resulting from changing the BSAI pollock allocation percentages is unknown. This issue was studied in detail during the Inshore/Offshore analyses that were conducted by the Council during the 1990's. Inshore/Offshore 3 (NPFMC 1999e) being the most recent example. However, it was never possible to determine which sector generated the most net benefits to the nation. Alternatives proposed in this package include two options. Alternative 1 would allocate 7.5% to CDQ groups off the top and then allocate the 65% of the remaining TAC to the offshore sector (catcher/processors and motherships) and 35% inshore. Alternatives 2 through 5 would allocate 10% of the BSAI pollock TAC to CDQ groups and set-aside about 5% for bycatch needs in other fisheries. The remaining TAC would then be divided 40% to the catcher/processor sector, 10% to the mothership sector, and 50% to the inshore sector. Given limitations in determining the costs and revenues of each of the groups all that can be said with certainty is that the CDQ groups and the inshore sector receive a larger percentage of the BSAI pollock fishery under Alternatives 2 through 5.

Impacts of co-ops. The AFA reduced the transactions costs of private action to eliminate problems flowing from the common property status of fisheries resources. The AFA defined and limited the universe of potential participants in the fishery, created relatively homogenous groupings of operations within the fishery, and provided the legal structure for the formation of the co-ops within those groupings. The co-ops, and other institutions (such as the Intercooperative Agreement) that emerged from the AFA, have led to significant rationalization of fishery production. This has led, and will almost certainly continue to lead, to operational economies for the pollock fishery in the BSAI.

These economies flow from the elimination of excess capital and labor from fishing and fish processing, and from more effective coordination and use of vessels, plants, and workers. These economies will be greater for alternatives that allow relatively greater reductions in capacity, and for those options that provide relatively more flexibility for cooperatives in their operations.[33]

[33] Alternatives differ in the way they distribute the benefits of the AFA between the different parts of the industry. For example, Alternative 3 is likely to provide more benefits from the cooperatives to inshore processors than is Alternative 5. Alternative 5 is likely to provide more benefits to catcher vessels delivering inshore than Alternative 3. Concerns over the allocation of the benefits created by the AFA played an important role in the design of the program and the choice of the preferred alternative. Distributional

In order to estimate the dollar value of the benefits flowing from these changes it is necessary to have information on operating costs, and on how operating costs change as effort is removed from the fishery. It would also be necessary to predict the ultimate configuration of the industry. The absence of significant cost information for this industry and the difficulty of predicting its ultimate configuration under the different alternatives, makes it impossible to project monetary estimates of the benefits. Nevertheless, economic theory provides strong arguments that the co-ops established under the different alternatives will lead to rationalization in the fishery and increased net benefits. Moreover, the catcher/processors operated under a co-op arrangement in 1999 and the entire fishery operated under co-ops in 2000, so that there is now a significant body of experience that sheds light on the issue. The theory and experience permit a ranking of the alternatives with respect to likely net benefits.

Experience in 1999 and 2000 indicates that the cooperatives are taking advantage of the program to remove excess fishing capacity. Loy estimates that of 129 cooperative vessels operating in 2000, 31 were essentially removed from the fishery, for a reduction of 24% in fleet size ((Loy 2001). Loy's estimates of the numbers of boats transferring most or all of their quota are shown below in Table 4.5.1.

Table 4.5.1 Boats transferring most or all of quota (Loy's estimates) in 2000

Sector	***Cooperative name***	***Eligible boats***	***Boats Transferring most or all of quota***
Offshore sector	Pollock Conservation Cooperative	19	5
	High Sea's Catcher' Cooperative	7	7
Inshore Sector	Akutan Catcher Vessel Association	27	9
	Arctic Enterprise Association	4	0
	Northern Victor Fleet Cooperative	10	2
	Peter Pan Fleet Cooperative	5	0
	Unalaska Fleet Cooperative	11	2
	UniSea Fleet Cooperative	14	1
	Westward Fleet Cooperative	12	3
Mothership Sector	Mothership Fleet Cooperative	20	2

Source: (Loy 2001).

The cooperative system also allows cooperatives to make more effective, coordinated, use of the vessels remaining in the cooperatives. This is expected to reduce costs and increase revenues in many ways:

- The end of the race for the fish allows operations to fish more slowly and to process more carefully. The result is likely to be an ability to obtain more added value from harvested fish. In 1999, the first year of the cooperatives, the vessels in the catcher/processor sector were able to increase utilization of harvested pollock resources by about 20%. (At Sea Processor's Association 1999).

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impacts on the different parts of the industry are discussed in Section 4.5.3.

- Reports from catcher/processors suggest that, freed from the “race for the fish” the operators have been harvesting fewer fish per tow. This reduces bruising in the flesh, and may have contributed to improved roe quality.

- Operations are able to trade quota allocations between vessels within a given cooperative. This makes it possible to harvest allocations from the vessels that can do so at least cost in a given time and place.

- The increased flexibility offered by the cooperative system also allows fleets to respond more rapidly to market cues. This was an advantage to the catcher/processor sector in early 1999, when this flexibility allowed them “to respond to increased demand and rising fillet prices by increasing fillet production while decreasing surimi production.” ((General Accounting Office (GAO) 1999))

There are, however, factors built into the AFA that will probably prevent the industry from fully maximizing the net benefits from of the fishery. A recent NMFS report ((NMFS 2001b) describes these as follows:

> *Although the AFA has eliminated the race for fish and the associated perverse incentive to increase fishing capacity, incentives to maintain existing capacity remain for several reasons. First, the AFA sunsets in 2004; therefore, there are risks involved with retiring excess fishing and processing capacity. Second, the current rules governing cooperatives in the inshore sector will tend to limit consolidation of processing that would eliminate excess processing capacity. Third, inter-annual transfers among vessels of catch histories and the associated shares of the TAC for the inshore sector are prohibited; therefore, there is a strong incentive not to retire catcher vessels.*

Variations across the alternatives. It is possible to rank the alternatives with respect to their likely relative net benefits, even without monetary estimates. The characteristics of the alternatives that free the fishing operations from the common property race for the fish, and that minimize the operational constraints placed on private sector decision making are assumed to increase private sector profitability.

Alternatives 3 and 5 differ in that there are fewer restrictions on moving catcher vessels between co-ops under Alternative 5 than Alternative 3. Eliminating the definition of “qualified catcher vessel” would be likely to reduce the transactions costs of moving catcher vessels between co-ops and make it easier to do so. This should facilitate optimal utilization of vessels and increase the net benefits to the nation.[34]

Halvorsen *et al.* argued that freeing of vessels to move between co-ops would be functionally equivalent to implementing a system of individual quotas in the fishery. Noting that individual quotas “score highly on efficiency grounds,” they indicate that rules similar to those in Alternative 5 would be more efficient than those in Alternative 3 (Appendix D, page D-31). Halvorsen *et al.* point out, however, that Alternatives 3 and 5 have different distributional implications with respect to the benefits that are generated. Inshore processors appear to do relatively better under Alternative 3, while catcher vessels delivering inshore appear to do better under Alternative 5. (Appendix D, page D-33). Matulich *et al.* note the costs associated with moving catcher vessels between cooperatives, but argue that these may not be an “impediment” to the movement of catcher vessels between cooperatives. Acquisitive processors could offset the burden to a vessel operator of a year in a competitive fishery by providing long term contracts, higher prices, minimum-gross earnings guarantees,

[34] As noted in the summary of the cost and benefit analysis, there are important limitations to the use of an efficiency based “net benefits” criterion for decision making. In this case the political decision to choose Alternative 3 as the “preferred alternative” incorporated a consideration of distributional criteria as well as of efficiency criteria.

and signing bonuses (Matulich, *et al.* page 12). They argue that inshore processors can encourage catcher vessels by agreeing to share the higher costs associated with the transfer. It is implicit in their discussion that the costs still exist, but they are shared by the inshore processors.[35]

Alternative 1, which does not permit the formation of co-ops, almost certainly provides the fewest benefits to the industry. Alternative 2, which extends AFA co-ops to the catcher/processor and mothership sectors, but possibly not to the inshore catcher vessel sector, probably provides more net benefits than Alternative 1, but fewer than Alternatives 3 to 5. Alternatives 3 and 4 make it much more likely that inshore catcher vessels and processors will be able to form co-ops, and thus are likely to provide more net benefits to the sector than Alternative 2. They do not contain Alternative 5's provisions allowing catcher vessels to switch relatively easily between co-ops. They may thus provide fewer overall benefits overall to the sector than Alternative 5. Finally, Alternative 4 requires a substantially more costly monitoring regime than any of the other alternatives without clearly identifiable additional benefits. Therefore, Alternatives 3 and 5 are likely to produce more net benefits than Alternative 4. Table 4.5.2 summarizes the factors that differentiate the alternatives.

Table 4.5.2 Impacts of the alternatives on changes in commercial productivity (shaded boxes mean the profit increasing factor is present in the alternative)

Factor	***Alternative***				
	1	2	3	4	5
Co-ops or no co-ops		■	■	■	■
Intercooperative Agreement flexibility	n.a.		■	■	■
Vessel entry limitations		■	■	■	■
Can inshore co-ops idle excess capacity?	n.a.		■	■	■
Vessels tied to a processor	n.a.				■
Provisions that increase annual monitoring costs	n.a.	■	■		■
Provisions to encourage inshore co-op formation	n.a.		■	■	■

The impact of foreign ownership in fishing and processing. Benefits and costs of alternatives that accrue to residents of other countries are not usually considered in a benefit cost analysis. In the current instance, program benefits accruing to foreign owners or stockholders of fishing and fish processing businesses should not be counted as net benefits in the benefit-cost analysis.

Foreign owners play an important part in pollock harvesting and processing. The 1998 Inshore-offshore analysis found that three foreign countries, Japan, Norway and South Korea, had some degree of involvement in plants, catcher vessels, or catcher/processors (NPFMC 1999e). Of the eight inshore processing plants, four (including the two inshore processing vessels) were fully owned by the U.S. Four were owned by Japanese interests. Of the fishing vessels themselves:

[35] As noted, it is possible under Alternative 3 for catcher vessels to switch between co-ops without spending a year in open access. NMFS records show that five vessels appear to have done so between 2000 and 2002. Only one of these switched between co-ops associated with the same processing company's plants. Clearly, even if they increase the costs of arranging the transaction, the program rules do not preclude changes in co-ops from one year to another.

- 77 of the 91 inshore catcher vessels were fully U.S. owned;
- 16 of 37 catcher/processors were fully U.S. owned;
- 42 of 50 offshore catcher vessels were fully U.S. owned;
- 1 of three motherships was fully U.S. owned.

Ownership patterns can change rapidly, and the AFA has changed the vessels eligible to participate in the BSAI pollock fishery. However, foreign owners are still believed to be important in the fishery; four of the eight inshore processing plants are still believed to be owned by Japanese nationals. The quoted figures are still believed to be useful as indicators of the extent of foreign ownership in the BSAI pollock fishery.

Section 202 of the AFA increases the minimum U.S. ownership requirements for U.S.-flag fishing vessels from 50 to 75 percent. If profits were being generated by participants in the fishery, then ensuring that more of those profits flow to U.S. citizens will increase net national benefits in the short run. This will likely increase net national benefits. Recall that benefits flowing to citizens outside the U.S. are not included in a net benefit calculation. However, forcing the sale of foreign owned assets to U.S. residents may make it more expensive to attract foreign investment into the U.S. in the future. This could create an offsetting cost.

The significance of Section 202 of the AFA may be offset to some extent by its Section 213(g), which exempts vessel owners from the increased ownership provisions if the provisions are found to be inconsistent with treaties signed by the U.S. governing foreign investment in the U.S. A number of owners have applied for exemptions arguing that the provisions of Section 202 are inconsistent with treaties of "Friendship, Commerce, and Navigation" (FCN) signed by the United States with Japan, Korea, and Denmark. These owners have argued that the FCN treaties generally guarantee foreigners "national treatment." These owners argue that the term "national treatment" means that the foreign investors covered by the treaty are to be treated as if they were U.S. nationals with respect to their investments. If many foreign owners are found to be protected by FCN treaties, Section 202 may have little impact.[36]

Benefits to U.S. consumers and revenues from foreign users

The end of the "race for the fish" will make it easier for fishermen and fish processors to address the needs of their different markets. For example, a GOA study of the catcher/processor co-ops in operation in 1999 has pointed to increased industry flexibility to respond to short run market changes: "...because the American Fisheries Act allowed the catcher/processors of the offshore sector to form a cooperative and end their race for fish, this sector was able to respond to increased demand and rising fillet prices by increasing fillet production while decreasing surimi production." (General Accounting Office (GAO) 1999).[37]

The same GAO report also generalizes longer run implications associated with investment: "The race for fish induced processors to emphasize surimi production because it is the fastest way to process large quantities of fish caught at one time. Because the act provided the framework of a cooperative for the catcher/processors of the offshore sector, this segment of the industry was able to end its race for fish and produce products with higher value. In addition, because the cooperative guaranteed each member a certain amount of fish, members could invest in machinery capable of producing the higher-valued fillets and could

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[36] Fourteen vessels currently have petitions for FCN exemptions pending before the Department of Transportation's Maritime Administration.

[37] The AFA contains provisions reallocating pollock TACs among fishing fleets. During the debate over the AFA, the concern was raised that this reallocation might reduce fillet production, hurting U.S. users and consumers. Both this GAO study, and a subsequent study in 2000, tried to answer this question. Neither study found a reallocation of this sort to be a problem.

slow down by fishing only when their fill-processing machines needed additional fish." (General Accounting Office (GAO) 1999).

The same GAO report also reports on information provided by processors that the elimination of the race for the fish has allowed companies to increase the yields from pollock harvests. Processors are now able to concentrate on the production of less valuable products such as oil and fishmeal. The end of the race for the fish also was said to give catcher/processors "more time to search for the size of fish most conducive to the products processors want to produce." (General Accounting Office (GAO) 1999). A subsequent GAO report points to improved product quality as a result of the cooperative system: "Another benefit has been that vessels can now justify catching fewer fish per trip. Catching fewer fish per trip improves product quality and utilization by reducing bruising and damage to the fish." (General Accounting Office (GAO) 2000).

These reports suggest that the costs of producing certain products have been reduced. These appear to include the costs of low valued products such as meal and oil, and the costs of products that were relatively difficult to produce, such as fillets or undamaged fish. A reduction of the costs of these products should allow the industry to increase their production, providing welfare benefits to U.S. consumers and increasing net revenues from sales abroad. Both of these things are net benefits to the U.S. and should be included in the benefit-cost analysis. Unfortunately the data and models are not available which would permit the estimation of the net benefits from these sources. Market models are not available, nor are models which could be used to estimate how the industry would respond to changes in relative product prices.

However, as with other aspects of the benefit-cost analysis, it is possible to provide a rough ranking of several of the alternatives. Rankings are based on the extent to which the alternatives permit the formation of the co-ops from which the benefits flow. Alternative 1 maintains the pre-existing over-capacity and race for the fish in all sectors. It therefore is assumed to produce the fewest benefits. Alternative 2 permits co-ops in the catcher/processor sector, but is not as friendly to inshore co-ops as Alternatives 3 to 5. It produces somewhat more benefits that Alternative 1, but fewer than Alternatives 3 to 5. It is hard to differentiate between Alternatives 3 to 5; these are therefore ranked at the same level.

Management expenses

Management expenses include the increased costs incurred by the government for management and enforcement of the different alternatives. Moreover, the alternatives may also involve increased costs for compliance by the fishing and fish processing industry.

Under Alternative 1 (the non-AFA alternative), the BSAI pollock fishery would be subject to the same catch measurement and monitoring requirements currently in place for other groundfish fisheries off Alaska. These include observer coverage requirements based on vessel size and the tonnage processed by quarter by inshore processors. Neither vessels or processors would be subject to specific scale or catch measurement requirements for the non-CDQ pollock fishery other than those requirements that apply to BSAI groundfish fisheries generally.

Successful implementation of the individual co-op quotas and the sideboard measures required by the AFA under Alternative 2 (the minimal AFA alternative), necessitate an increased level of monitoring and recordkeeping and reporting relative to the no-action alternative. At a minimum, two observers and flow scales are necessary on catcher/processors and motherships to allow NMFS to monitor and manage the fisheries using total catch information rather than back-calculated product information. Two observers are also necessary at AFA inshore processors to provide 24 hour coverage and monitoring of inshore co-op landings. In addition, management of the AFA system of multiple inshore pollock quotas and catcher vessel sideboards requires an electronic shoreline reporting system that provides vessel-by-vessel landings information on a daily basis. These requirements are discussed in more detail in Section 2.4.4.

Alternative 3 (the Preferred Alternative), requires more catch measurement and monitoring than Alternative 2. Under Alternative 3, all AFA catcher vessels and catcher/processors that engage in directed fishing for pollock in the BSAI would be required to install and operate a NMFS-approved vessel monitoring system (VMS). Moreover, Alternative 3 would require a comprehensive approach to monitoring inshore catch weighing. The details of these enhanced monitoring requirements are discussed in Section 2.5.4.

Alternative 4 requires a substantially greater degree of monitoring on board AFA catcher vessels compared to the other alternatives due to the subdivision of each groundfish and PSC sideboard amount at the co-op level. Under Alternative 4, NMFS may no longer use fleet-wide observer estimates of discards and PSC bycatch to monitor individual co-op sideboard allocations. Consequently increased catcher vessel observer coverage and increased retention requirements are necessary. Monitoring measures under Alternative 4 include those for Alternative 3, as well as 100% observer coverage when fishing for any groundfish species in the BSAI and GOA. Further, all groundfish harvested by AFA vessels would have to be weighed on NMFS approved scales.

Management expenses for Alternative 5 are essentially equivalent to those for Alternative 3. The main difference between these two alternatives is that inshore catcher vessels will find it easier to switch between co-ops under Alternative 5. This is not expected to affect management costs.

These considerations permit a ranking of the five alternatives by increasing management expense, as follows:

- Alternative 1 (no AFA)
- Alternative 2 (minimal statutory implementation of AFA)
- Alternatives 3 and 5 (preferred and catcher vessel flexibility alternatives)
- Alternative 4 (maximum co-op autonomy)

Safety

Commercial fishing is a dangerous occupation. From 1991 to 1998, occupational fatality rates in groundfish fishing off of Alaska were 46/100,000. This occupational fatality rate is about 10 times the national average (Lincoln and Conway 1999). Part of the reason is that fishermen who compete for fish in a common property fishery are often compelled to fish at times and places that are not very safe if they want to take a share of the fishery total allowable catch. Moreover, higher costs and lower revenues in a common property fishery may lead to lower profits margins and, indirectly, to less investment or attention to issues of safety.

This suggests that the introduction of the co-op system will allow fishermen more flexibility in their harvest and permit a greater consideration of safety issues. In addition, the program should increase the profitability of the fishery and lead, indirectly, to increased investment in safety. These factors should reduce risks of death, injury, and property loss in the BSAI pollock fishery.

Reports from the 1999 and 2000 fishing seasons indicate that the pollock fishery is being conducted in a safer manner under the co-ops. The GAO reports that the pollock fishing industry views itself as safer. The GAO report noted, “Deep-sea fishing in the Bering Sea has historically been a hazardous occupation, and the hazards are increased when vessel operators believe they must operate in extremely bad weather to land a share of the catch. Because the cooperative agreements give members specific shares of the catch, vessels can now avoid fishing in such weather conditions. (General Accounting Office (GAO) 2000). As older, less efficient, vessels are withdrawn from the fishery, the average safety of the remaining vessels may be rising. In a recent news story, John Iani, Vice-President of UniSea, an important onshore processing firm, reported the retirement of the 165 foot *Pacific Monarch* by the UniSea Fleet Cooperative. Iani was quoted as saying, "It was a neat deal...The *Pacific Monarch* was old and kind of run down and a little bit dangerous to be fishing." (Loy 2001).

These safety benefits are enjoyed by vessel owners as well as fishermen. As noted above, a significant number of the catcher vessels delivering inshore are owned by shore based processing firms. Therefore these firms will also receive a direct benefit from any reductions in the risk of an accident.

Increased safety reduces the risk of death, injury, and property loss to fishermen. Substantial evidence indicates that people are willing to pay for and thus place a value on reductions in these risks. The value associated with the reduction in these risks is a benefit associated with the co-op system. The data necessary to estimate the size of this benefit is not available. Estimation would require information about the change in the risk of an accidents associated with the different alternatives, information about the change in the risk of injury or an occupational fatality given an accident, and information about the values placed on changes in these risks. None of this information is available for the BSAI pollock fishery.

While it is impossible to estimate the values placed on the reduced risks for the different alternatives, it is possible to look at these alternatives and to some extent identify those that are more likely to lead to reduced risks. In general, alternatives that go further towards eliminating the race for the fish, increasing profits, or permitting the retirement of vessels, may be expected to contribute more to fishing safety. On these grounds, Alternative 1 is provides the fewest safety benefits, followed by Alternative 2. Alternatives 3 to 5 seem to present lesser levels of risk, and larger benefits, but it would be hard to distinguish between them.

Impacts on other fisheries

The introduction of co-ops raised concerns among fishermen in other fisheries that the rationalization of the pollock fishery would (1) free up excess fishing and processing capital that could be exported to other fisheries, and (2) would permit a more organized harvest of pollock and allow vessels and processing plants continuing in the pollock fishery to reallocate at least some of their time and capacity to other fisheries.

To protect the fishing and processing operations involved in other fisheries, the AFA provided for an elaborate system of "sideboards" or restrictions on what pollock qualified vessels and plants could harvest and process in other fisheries. These sideboard regulations, and the ways they vary across alternatives, are described in detail in Chapter 2 of the EIS. In general, the sideboards work to limit AFA harvests of sideboard species to the proportions of the harvests of these species taken by the AFA sectors in the period 1995 to 1997. The alternatives do vary somewhat with respect to the exemptions to these limitations, and there are variations in the computations used to relate sideboard limits to harvests during that period.

The efficiency impacts of the sideboards on other fisheries are difficult to determine and may not be large. An earlier EIS/RIR/IRFA on sideboard issues summarized the situation as follows:

> Overall the catch of non-pollock species by AFA vessels may be somewhat reduced by these amendments, because the groundfish sideboards are based on landed catch history and the crab sideboards are more restrictive than the current LLP program in most cases. Yet given the open access nature of these fisheries and the capacity that exists in other fleets, any harvest forgone by the AFA fleet will almost certainly be harvested by members of the non-AFA fleets. Differences among

the alternatives for effecting sideboards do have the potential for distributional gains and losses; primarily these are trade-offs between the AFA and non-AFA vessels. While relative operating costs and other factors would affect the "net" results of such trade-offs, the basic intent of the sideboards is to maintain the status quo, in terms of the distribution of harvest between AFA and non-AFA vessels, and therefore inter-sectoral "net" impacts would be expected to tend towards neutral.

The effects of the alternatives on prohibited species are discussed in detail in Section 4.3.3 of the EIS. Halibut, herring, crab, and salmon are among the prohibited species taken in the fisheries subject to the proposed actions. The regulatory measures used to control the bycatch of these species are described in Section 3.2.1.

The proposed action would not change existing PSC limits for these species. Bycatch rates of all prohibited species are very low in the directed Bering Sea pollock fisheries, with the exception of salmon bycatch in the mid-water pollock fisheries. The pollock co-ops and the end of the race for pollock may well provide the AFA fleets with the opportunity to reduce PSC by-catch rates, and the infrastructure (in terms of the co-op management and information sharing) to exploit those opportunities. If so, PSC bycatch rates may decrease for AFA vessels. PSC limits imposed on AFA vessels are a subset of the overall PSC caps for the groundfish fisheries. Any amount not taken by the AFA vessels is subject to being taken by the non-AFA vessels fishing in the other groundfish fisheries. Therefore the proposed action would not have any effect on overall prohibited species mortality, and would not affect the fisheries exploiting the PSC stocks. Impacts on Pacific herring would be difficult to evaluate regardless because herring stocks fluctuate widely in biomass due to year class strengths and weaknesses.

Summary of the benefit-cost analysis

Table 4.5.3 summarizes the information from the different parts of the benefit-cost analysis. Although the analysis has been qualitative, the results permit a partial ranking of the different alternatives. Alternative 1, the fishery prior to the AFA, produces the smallest benefits. Moreover, it is precluded under the terms of the AFA. Of the four alternatives that are legal under the AFA, Alternative 2, minimum implementation, has the lowest net benefits. The problems with this alternative flow from the relatively large costs it imposes on the formation of the co-ops in the inshore catcher vessel sector. This raises questions about the ability of this sector to rationalize its part of the pollock fishery through the formation of co-ops. Alternative 4 appears to produce higher net benefits than Alternatives 1 and 2 because it tends to facilitate inshore co-ops, but it may produce lower net benefits than Alternatives 3 and 5 because of the high monitoring costs it would impose on industry.

Table 4.5.3 suggests that Alternative 3, has smaller net benefits than Alternative 5. Nevertheless, Alternative 3 has been designated as the Preferred Alternative. Benefit-cost analysis is only one element in a public decision making process. Benefit-cost analysis is based on specific assumptions that not all persons may hold. Issues other than social efficiency may be important to many persons. For these reasons this benefit-cost analysis is supplemented with an analysis of the distributional implications of the alternatives in Section 4.5.3 of this RIR, an analysis on the impacts on small business, non-profit, and government entities in the accompanying FRFA, and a discussion of the impacts on the environment, and especially on endangered species, in the EIS. In addition to these concerns, this benefit-cost analysis has been qualitative, and has incorporated a margin of error that makes it impossible to say for certain that Alternative 3 has smaller net benefits than Alternative 5.

Moreover, Alternative 3 is a political compromise that was determined by legislative and Council processes. It incorporates compromises among interest groups that were essential to bringing the AFA and the implementing regulations into existence. In particular, the difference between Alternatives 3 and 5 reflects a decision about the allocation of AFA benefits between inshore processors and inshore catcher vessels. The Council, for reasons of fairness and stability, chose not to change the terms of this agreement after it had been reached. Thus Alternative 3 is the Preferred Alternative, although it may not absolutely maximize net benefits as interpreted in benefit-cost analysis.

Please see table of contents for figure or table.

4.5.3 Distributional impacts

A benefit-cost analysis, like the one conducted in Section 4.5.2, examines net benefits accruing to the nation from the different alternatives. In that analysis benefits and costs accruing to residents of other countries are ignored, but benefits accruing to U.S. residents are considered together.

Alternatives that provide net benefits to the nation may well impose net costs on specific groups. These distributional considerations may well provide important qualifications to a positive net benefit result in the cost-benefit analysis. Therefore this section looks at the net impacts accruing to nine categories of users:

- Inshore processors
- Catcher vessel delivering inshore
- Catcher vessels delivering to motherships
- Catcher vessels delivering to catcher/processors
- Motherships
- Catcher/processors
- Small entities
- Local communities
- Operations in other fisheries

Inshore processors

The inshore pollock processors are described in detail in Section 3.3.2 of the EIS. There are six land-based and two floating processors eligible to participate in the inshore sector of the BSAI pollock fishery. Co-ops may be formed around each of these processors if at least 80% of the qualified catcher vessels (those that delivered more pollock to that processor than to any other processor in the preceding year) enter into the cooperative agreement. In many cases the processors own catcher vessels, and are thus integrated back into the fishing sector. AFA processors are subject to processing sideboards on BSAI king and tanner crab.

Alternative 1 does not provide for co-ops. Alternative 2 provides for co-ops, but the costs of co-op formation are relatively high compared to the costs in Alternatives 3 to 5. It is not clear whether or not the inshore industry would have been able to form co-ops under Alternative 2. Alternatives 3, 4 and 5 provided favorable conditions for co-op formation. Alternative 4, had high monitoring costs. Alternative 5 contains provisions allowing catcher vessels to change co-ops (and associated processors) more easily than Alternatives 3 and 4. This is expected to have increased the bargaining power of the catcher vessels and their co-ops with respect to the inshore processors. Thus, the inshore processors are expected to obtain relatively more of the benefits from the AFA under Alternative 3, relatively fewer under Alternative 5.

Table 4.5.4 Summary of the benefits and costs of the proposals to inshore processors.

Alternative	*Pros*	*Cons*
1		Processing fish from common property fishery. Also impacted by common property fishery in their capacity as the owners of many vessels.
2	It is possible that some inshore co-ops will emerge under this regime. To the extent they do, some elements in this sector may benefit.	Alternative 2 does not encourage inshore co-ops. Considerable doubt if many will emerge. To the extent they don't , "Cons" comments for Alternative 1 apply.
3	This option contains elements which encourage the formation of inshore co-ops. Based on experience in 2000, this option should relieve many of the common property problems in this fishery. This sector should see substantial benefits from processing and vessel ownership. This sector will probably enjoy a larger proportion of the benefits than under Alternative 5 because of the constraints placed on the movement of catcher vessels between co-ops.	
4	This sector should enjoy many of the benefits provided by the ability to form inshore co-ops.	Higher monitoring expenses for this alternative make it less attractive to inshore processors than Alternatives 3 or 5.
5	This sector should enjoy many of the benefits provided by the ability to form inshore co-ops.	This sector probably will not enjoy as many benefits as under Alternative 3, since inshore catcher vessels will have more ability to shift between co-ops under this alternative. The result should be that relatively more of the benefits from co-ops will be enjoyed by inshore catcher vessels and relatively less by inshore processors.

Catcher vessels delivering inshore

The interests of inshore processors and of the inshore catcher vessels that deliver pollock to them are broadly parallel under Alternatives 1 to 4 since alternatives that reduce the costs of forming co-ops will tend to benefit both parts of this sector. However, they are in direct conflict in Alternative 5.

Alternative 5 contains provisions which allow inshore catcher vessels to shift more easily from one processor's co-op to another. These provisions, modeled on the so-called "Dooley-Hall Proposal" debated by the Council, would alter the balance of market power somewhat between the catcher vessels and the processors, and would be expected to lead to the catcher vessels obtaining a somewhat larger share of the overall benefits flowing to the inshore sector from the ability to form co-ops.[38]

[38] This was the conclusion of Halverson *et al.* (See Appendix D)

Table 4.5.5 Summary of the benefits and costs of the proposals to inshore catcher vessels

Alternative	*Pros*	*Cons*
1		Common property fishery in all sectors. This is probably the least attractive alternative.
2	It is possible that some inshore co-ops will emerge under this regime. To the extent they do, some elements in this sector may benefit.	Alternative 2 does not encourage inshore co-ops. There is considerable doubt if many will emerge. To the extent they don't , "Cons" comments for Alternative 1 apply.
3	This option contains elements which encourage the formation of inshore co-ops. Based on experience in 2000, this option should relieve many of the common property problems in this fishery.	
4		Higher monitoring expenses for this alternative make it less attractive to inshore catcher vessels than Alternatives 3 or 5.
5	This sector should enjoy the benefits provided by the ability to form inshore co-ops. In addition, under this alternative, inshore catcher vessels will have more ability to shift between co-ops. The result should be that more of the benefits from co-ops will be enjoyed by inshore catcher vessels and less by inshore processors. This conclusion does not apply to inshore catcher vessels owned by processing companies.	

Catcher vessels delivering to motherships

The AFA lists 19 vessels that are qualified to deliver pollock to motherships and lists criteria under which one more vessel can be qualified. Of these twenty vessels, one has sunk. Fifteen of these vessels also qualify as AFA inshore catcher vessels.

The AFA reduced the allocations of mothership pollock allocations. Where a similar allocation reduction to the catcher/processors was compensated to some extent by the buyback of a significant portion of the catcher/processor fleet, there was no buyback in the mothership sector.

Table 4.5.6 Summary of the benefits and costs of the proposals to catcher vessels delivering to motherships

Alternative	*Pros*	*Cons*
1		This alternative continues the common property fishery and the race for the fish. This probably provides catcher vessels delivering to catcher/processors the lowest net benefits of all the alternatives.
2	Catcher vessels delivering to motherships are allowed to form a co-op under these alternatives. There is little variation in these requirements across these alternatives. All are better than Alternative 1.	
3		
4		Higher monitoring expenses for this alternative make it less attractive to catcher vessels delivering to motherships than Alternatives 2, 3 or 5.
5		

Catcher vessels delivering to catcher/processors

The AFA identifies seven catcher vessels that will be able to deliver to catcher/processors. Under the AFA these seven vessels will receive 8.5% of the catcher/processor vessel sector pollock allocation. During 1999, these seven vessels leased a significant part of their quota allocations to the catcher/processors directly. In 2000 these catcher vessels leased all of their pollock allocation to the catcher vessels and did not participate directly in the directed pollock fishery.

These vessels participate in a common property fishery under Alternative 1. The benefits of co-ops are available to them under Alternatives 2 to 5.

Table 4.5.7 Summary of the benefits and costs of the proposals to catcher vessels delivering to catcher/processors

Alternative	*Pros*	*Cons*
1		This alternative continues the common property fishery and the race for the fish. This probably provides catcher vessels delivering to catcher/processors the lowest net benefits of all the alternatives.
2	These alternatives are more attractive to the catcher vessels delivering to the catcher/processors than Alternative 1. All of them allow these catcher vessels to rationalize their fishery through the formation of a co-op. While they each involve a reallocation of pollock away from the catch-processor sector, the reallocation is the same for each alternative. It is probable that a buyback program to reduce the catcher/processor fleet, and the opportunity to form co-ops, more than compensate this fleet for its loss in pollock allocation. Most of the differences between these alternatives affect the mothership and inshore catcher vessel fishery rather than the catcher/processors.	
3		
4		Higher monitoring expenses for this alternative make it less attractive to catcher vessels delivering to catcher/processors than Alternatives 2, 3 or 5.
5		

Motherships

Mothership activity is described in Section 3.3.2 of the EIS. Motherships process, but do not harvest, pollock. The AFA specifically lists three vessels (EXCELLENCE, GOLDEN ALASKA, and OCEAN PHOENIX) that may operate as motherships in the BSAI pollock fishery. Twenty catcher vessels (19 listed by name in the AFA, and one meeting AFA criteria) may deliver to the motherships. Deliveries are made by transferring unsorted codends from catcher vessels to motherships via towing cables. The AFA allows catcher vessels delivering to motherships to form co-ops. If at least 80% of the mothership sector catcher vessels enter into a co-op, then the three AFA motherships are also eligible to join the co-op. These conditions were all met in 2000.

Table 4.5.8 Summary of the benefits and costs of the proposals to motherships

Alternative	*Pros*	*Cons*
1		This alternative continues the common property fishery and the race for the fish. This probably provides catcher vessels delivering to motherships the lowest net benefits of all the alternatives.
2	Catcher vessels delivering to motherships are allowed to form a co-op under these alternatives. If 80% of the catcher vessels are allowed to join, then the three motherships may join as well. There is little variation in these requirements across these alternatives. Thus, for this sector, there is little difference among them. All are better than Alternative 1.	
3		
4		
5		

Catcher/processors

Catcher/processor activity is described in Section 3.3.2 of the EIS. The AFA lists by name the 20 catcher/processors authorized to fish in the directed BSAI fishery for pollock. These vessels can accept deliveries of pollock from seven named catcher vessels. The AFA allows the catcher/processors to form a joint co-op with the catcher vessels, or for the two groups to form two separate co-ops and to coordinate their activities with an intercooperative agreement. The later approach was used in 1999 and 2000. Co-ops cannot be formed under Alternative 1, but can be formed under Alternatives 2 to 5. The rules governing the catcher/processor sector co-ops do not change much between Alternatives 2, 3, 4 or 5.

Table 4.5.9 Summary of the benefits and costs of the proposals to catcher/processors

<table>
<tr><th>Alternative</th><th>Pros</th><th>Cons</th></tr>
<tr><td>1</td><td></td><td>This is the least attractive alternative for catcher/processors; it is the only alternative which leaves them in a common-property fishery.</td></tr>
<tr><td>2</td><td rowspan="4">These alternatives are roughly equally attractive to the catcher/processor sector. All of them allow the catcher/processors to rationalize their fishery through the formation of a co-op. While they each involve a reallocation of pollock away from the catch-processor fleet, the reallocation is the same for each alternative. It is probable that a buyback program to reduce the catcher/processor fleet, and the opportunity to form co-ops, more than compensate this fleet for its loss in pollock allocation. Most of the differences between these alternatives affect the inshore catcher vessel fishery rather than the catcher/processors.</td><td></td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td></td></tr>
<tr><td>5</td><td></td></tr>
</table>

Small entities

Section 4.6 of this chapter is an FRFA prepared to meet the requirements of the Regulatory Flexibility Act (RFA) of 1980, and the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996. The FRFA contains a through review of the impacts of the AFA proposals on small businesses, small governmental jurisdictions, and on small non-profit organizations.

Local communities

Four places that are adjacent to the fishing areas have been particularly important in supporting the fishing fleets and in inshore processing. These are Unalaska (Dutch Harbor), Akutan, Sand Point, and King Cove. All of these communities are small entities within the meaning of the RFA and SBREFA. The FRFA included in this document as Section 4.6 of this chapter contains a discussion of the issues raised for these local communities. The FRFA expects the communities of Unalaska and King Cove to benefit from the AFA. Sand Point may be a net loser if pollock deliveries are redirected from there to Akutan. Akutan itself does not have a local community affected by the proposals. The reader should turn to Section 4.6 of this chapter for the details.

Operations in other fisheries

On balance the introduction of the sideboards should keep the AFA fleet from expanding into other fisheries. In some instances, AFA vessel activity may actually be constrained.

Table 4.5.10 Summary of the benefits and costs of the alternatives to other fisheries.

Alternative	*Pros*	*Cons*
1		This is the no AFA option - there are no sideboards on the AFA qualified vessels under these options.
2	These four alternatives incorporate the sideboards which, as noted earlier, may impose a net reduction in AFA vessel activity in other fisheries. The end of the race for the fish and the introduction of the co-op infrastructure may allow AFA vessels to reduce PSC by-catch	
3		
4		
5		

4.5.4 Evaluation of significance

As noted in Section 5.1.2, E.O. 12866 requires that the Office of Management and Budget defines a "significant regulatory action" is one that is likely to:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;

- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

While it was impossible to estimate the value of the net benefits from the various alternatives, it is possible to speculate about their likely magnitude. As noted earlier, in the description of the fishery, gross revenues at the first wholesale level, ranged between $600 and $800 million dollars per year. In an open access fishery, a considerable part of these would have been competed away from excess entry of capital and labor, and overuse of the capital and labor that entered the fishery. Economic theory suggests that excess entry and activity may have been enough to compete away most of the economic profits the fishery was capable of generating.

There is a widespread expectation that the AFA and its cooperative structure will eliminate a large proportion of the excess entry and activity and bring about large cost savings. As described earlier, one recent review of vessel entry suggests that by 2000, the first year in which the fishery was completely covered by the AFA program, about 24% of the vessels had left the fishery or transferred most of their quota. Given the approximate size of industry gross revenues, quoted above, and the magnitude of rationalization that appears to be taking place under the AFA, the choice between Alternative 1 and Alternatives 2 to 5, could reach an annual affect on the economy of $100 million.

Whether or not changes in net benefits to the US economy reach $100 million annually, several elements of the preferred alternative directly affect in a material way “a sector of the economy,” “productivity,” and “competition” (each identified as a criterion of concern in the E.O.). The pollock industry is affected in a material way, pollock industry productivity should be increased dramatically, and the competitive situation in the pollock industry should be affected by the introduction of the co-ops.

The alternatives do not appear to create inconsistency with or interfere with actions planned by other agencies.

Neither do they appear to, “Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof...”

The use of the cooperative approach to rationalize the fishery, anticipated in the AFA, is unusual in U.S. fisheries management, and does appear to, “Raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this Executive Order.”

4.6 Final Regulatory Flexibility Analysis (FRFA)

As described in Chapter 1, the AFA mandated several changes in the BSAI pollock fishery. Those changes are described in detail in Chapter 1 as are the Alternatives considered in this analysis. Changes included altering the ownership requirements for US fishing vessels, modifying BSAI pollock allocation percentages for the various industry sectors, defining the vessels and processors that are eligible to participate in the BSAI pollock target fishery, and developing measures to protect other fisheries from potential incursions which could result from the pollock allocations and fishery cooperatives in the pollock fisheries.

The U.S. ownership requirements were increased from 50 to 75 percent. This has caused some companies to reorganize their ownership structure. In general, this provision appears to have had the greatest impact on corporations that own two or more of the larger fishing vessels, and has caused the largest at-sea processing company to reorganize. The three motherships (OCEAN PHOENIX, GOLDEN ALASKA, and EXCELLENCE) that operate in the BSAI pollock fishery were grandfathered in under the old ownership requirements, unless they harvest fish. If they ever do harvest fish, they would then be required to meet the AFA's 75% U.S. ownership requirements.

Section 208 of the AFA defines the vessels and processors that are eligible to apply for AFA membership. Those vessels and processors listed in the AFA or those that have been determined by NMFS to meet the qualification criteria specified in the Act, may participate in the directed BSAI pollock fishery. Those vessels and processors that qualify under the AFA have been broken down into categories of small and large entities. Participants will be discussed in more detail later in this section of the document. However, in summary, all of the inshore and mothership processors that met the AFA requirements are considered to be large entities. All catcher/processors are also considered to be large entities. Slightly less than half of the catcher vessels are considered to be small entities. All of the CDQ groups would be considered small entities. Finally, all of the Alaskan communities that are home to the shorebased processors and directly affected by this amendment are considered small government jurisdictions.

Many of the participants in the non-AFA fisheries, as well as some participants in the AFA fisheries to be regulated by the sideboard measures, are small, independently owned businesses. The AFA required that the non-AFA participants be protected from spillover effects of the AFA. In certain cases the AFA was explicit with regard to the nature of those protections, while in other cases considerable latitude was given to the Council. While the general purpose of these "sideboard" measures is to maintain the status quo distribution of harvest activities in the various fisheries, the Council developed a considerable range of alternatives to effect that intent. As described earlier in Chapter 4 (and in detail in Chapters 6 and 7 of Amendment 61/61/13/8), the alternatives and options will have differing impacts on the fishery participants. The differential impacts to small entities resulting from the Council's final decisions on the AFA amendment package will be discussed later in this section.

Finally, the AFA specifies the structure under which inshore pollock cooperatives will be formed. This structure was, and still is, the subject of considerable debate. In February 1999 the Council requested development of an analysis of "the economic and policy issues associated with the formation of processor/catcher vessel (and mothership/catcher vessel) cooperatives under the AFA, including the alternatives outlined in the independent catcher vessel proposal with a preliminary report to the Council in June of 1999 and a final report in October 1999". During staff discussions it became apparent that this issue was intertwined with both implementation issues related to cooperative structure and with mandatory considerations under the Regulatory Flexibility Act (RFA). A contract was initiated with economists from the University of Washington and Oregon State University to explore these issues. That information, along with a review of legal issues associated with cooperative formation, was reviewed by the Council in late 1999 and could result in actions which change the cooperative structure from that described in the AFA. This section contains an initial analysis of these issues related to cooperative structure as well as other issues impacting small entities which resulted from the AFA.

4.6.1 Statement of problem

Several years following "Americanization"of the commercial Bering Sea Pollock fishery in US EEZ waters, a problem of over capitalization materialized in the form of excessive fishing capacity. This was associated with expansion of domestic fishing effort, due in part, to an open access fishery management policy. The ensuing "race for fish" fostered economic inefficiencies in both this fishing sector specifically and the nation generally in terms of optimal operational practices and resource utilization, respectively. To address the problems and allocation conflicts in this fishery, Congress passed the American Fisheries Act in October 1998, which included changes to the U.S. ownership requirements, specific allocations of pollock harvesting and processing by industry sectors, limitations on the participants in these sectors in other fisheries, as well as the authority to form fishery cooperatives. The potential operational advantages associated with these measures could impact other, non-pollock harvesters and processors. The Act mandates the Council to enact measures to protect those harvesters and processors by placing limits (sideboards) on the activities of the AFA-eligible harvesters and processors. The overall AFA amendment package is the focus of this discussion.

4.6.2 Objective statement of proposed action and its legal basis

With regard to commercial fishing vessels operating in the directed BSAI pollock fishery, the American Fisheries Act of 1998 establishes the legal basis for achieving the objective of reducing excessive fishing capacity and management regulatory conditions that could contribute to the creation of an environment capable of fostering operational inefficiencies in this fishery (Division C, Title II of P.L. 105-277), including limiting entry into the fishery, cooperative formation, allocations of pollock, and development of sideboard measures. Mitigation of potential adverse impacts to non-AFA fishermen and processors is also mandated by the Act.

4.6.3 Description of each action (non-mutually exclusive alternatives)

The following actions implemented under authority of the AFA attempt to meet the objectives described above.

- reduce harvest capacity through a vessel buyout program (AFA, Section 207),
- revise allocation of sector specific directed fishing allowances - including the CDQ fishery (AFA, Section 206),
- restrict legal eligibility to specific vessels and processors that may participate in the BSAI commercial pollock fishery (AFA, Section 208 - eligibles, Section 209 - ineligible vessels), and
- develop provisions for the establishment of fishery cooperatives (AFA, Section 210) among participants in specific harvest allocation sectors (AFA Section 206), that are eligible to operate in the BSAI commercial pollock fishery through cooperative association in the follow cooperative groupings:
- Offshore catcher/processor cooperative,
- Offshore catcher/processor - catcher vessel cooperative,
- Mothership - catcher vessel cooperative, and
- Shoreside processor - catcher vessel cooperatives
- an inter-cooperative agreement to regulate the interaction of the cooperatives.

- sideboard measures which restrict the activities of AFA-eligible vessels in non-pollock fisheries.

This amendment package focuses on the overall AFA structure by comparing various management configurations. The full list of alternatives and options considered in this analysis is contained in Chapter 1. The economic impacts of those alternatives are discussed in previous sections of Chapter 4.

4.6.4 Reasoning for, and focus of, an FRFA

To ensure a broad consideration of impacts and alternatives, this FRFA has been prepared pursuant to 5 U.S.C. 604, without first making the threshold determination of whether or not this proposed action would have a significant economic impact on small entities. NMFS interprets the intent of the RFA to address negative economic impacts, not beneficial impacts, on small entities and thus such a focus exists in these analyses that are explicitly designed to address RFA compliance.

In determining the scope, or 'universe', of the entities to be considered in an FRFA, NMFS generally includes only those entities, both large and small, that can reasonably be expected to be directly or indirectly affected by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis.

4.6.5 Requirement to prepare an FRFA

The RFA first enacted in 1980 was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a federal regulation. Major goals of the RFA are:

1. to increase agency awareness and understanding of the impact of their regulations on small business,
2. to require that agencies communicate and explain their findings to the public, and
3. to encourage agencies to use flexibility and to provide regulatory relief to small entities.

The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action.

On March 29, 1996, President Clinton signed the Small Business Regulatory Enforcement Fairness Act. Among other things, the new law amended the RFA to allow judicial review of an agency's compliance with the RFA. The 1996 amendments also updated the requirements for a final regulatory flexibility analysis, including a description of the steps an agency must take to minimize the significant economic impact on small entities. Finally, the 1996 amendments expanded the authority of the Chief Counsel for Advocacy of the Small Business Administration (SBA) to file *amicus* briefs in court proceedings involving an agency's violation of the RFA. The central focus of the IRFA should be on the qualitative economic impacts of a regulation on small entities and on the alternatives that might minimize the impacts and still accomplish the statutory objectives. The level of detail and sophistication of the analysis should reflect the significance of the impact on small entities. Under 5 U.S.C., Section 604 of the RFA, each FRFA is required to address:

(1) a succinct statement of the need for, and objectives of, the rule;

(2) a summary of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments;

(3) a description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available;

(4) a description of the projected reporting, recordkeeping and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and

(5) a description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.

4.6.6 What is a small entity?

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) and small government jurisdictions.

Small businesses. Section 601(3) of the RFA defines a 'small business' as having the same meaning as 'small business concern' which is defined under Section 3 of the Small Business Act. 'Small business' or 'small business concern' includes any firm that is independently owned and operated and not dominate in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor. A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the form is a joint venture there can be no more than 49% participation by foreign business entities in the joint venture."

The SBA has established size criteria for all major industry sectors in the U.S. including fish harvesting and fish processing businesses. A business involved in fish harvesting is a small business if it is independently owned and operated and not dominant in its field of operation (including its affiliates) and if it has combined annual receipts not in excess of $ 3 million for all its affiliated operations worldwide. A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $3 million criterion for fish harvesting operations. Finally a wholesale business servicing the fishing industry is a small businesses if it employs 100 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when (1) A person is an affiliate of a concern if the person owns or controls, or has the power to control 50% or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) If two or more persons each owns, controls or has the power to control less than 50% of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern. Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors or general partners controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint venturers if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

Small organizations. The RFA defines "small organizations" as any nonprofit enterprise that is independently owned and operated and is not dominant in its field.

Small governmental jurisdictions. The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of less than 50,000.

4.6.7 Description of fleet, fishery, & industry directly and reasonably indirectly impacted by proposed action

BSAI pollock catcher vessel fleet

A total of 112 catcher vessels have applied for AFA status and are eligible to harvest BSAI pollock in the directed fishery. Seven of the vessels are qualified in the offshore (catcher/processor) delivery sector, 100 in the inshore sector, and 20 in the mothership sector (15 catcher vessels are eligible to deliver pollock in both the inshore and mothership sectors and would be double counted if the totals for the three sectors were summed). Of the 100 inshore catcher vessels, 37 appear to be owned by small entities because they are independently owned and their company appears to have gross annual receipts of $3 million or less. The remainder of the vessels are either considered to be affiliated with a processor that is a large entity or their owner has more than one catcher vessel and the combined gross earnings from those vessels is thought to be greater than $3 million annually. Those 37 vessels appear to be owned by about 29 different unique and unrelated entities. Therefore, 29 small businesses that appear to own catcher vessels operating in the inshore sector of the BSAI pollock fishery.

Twelve catcher vessels operated in the offshore sector (mothership or catcher/processor) exclusively, while 15 operated in both the mothership and inshore sectors. The 15 catcher vessels that are permitted to operate in both the inshore and mothership sectors were included in the inshore sector discussion above. Of the remaining twelve vessels, seven operated in the catcher/processor sector and five in the mothership sector.

Two of the seven catcher vessels that deliver to catcher/processors are owned by companies that also own catcher/processors. Those catcher vessels are considered to be part of a large entity. The five remaining catcher vessels are thought to be independently owned. The total harvest of those vessels appear to be at levels that would generate less than $3 million on an annual basis. The companies owning those vessels are therefore considered to be small entities.

Of the five catcher vessels that operate only in the mothership sector, four appear to have an ownership or control linkage with the mothership to whom they deliver pollock. The remaining vessel appears to meet the definition of a small entity.

Since the catcher vessel fleet cuts across all of the sectors of the BSAI pollock fishery, the were described above. The analysis will now focus on the inshore, mothership, and catcher/processor sectors that were allocated a portion of the BSAI pollock fishery. The catcher vessels will also be discussed in terms of their role in the sector overall as will the other components of each of the sectors.

Inshore sector vessels. Establishment of inshore fishery cooperatives among predetermined groups of catcher vessels and a corresponding shoreside processor will establish distinct sets of entities, large and small, and their potential for inter-related economic affects resulting from such affiliation. The inshore sector is comprised of catcher vessels, inshore processors, and the communities that are home to the inshore processors. An attempt to summarize these relationships and numerically identify the number of affected small entities in the inshore sector is provide below in Table 4.6.1.

Table 4.6.1 Estimated number of entities/catcher vessels impacted by establishing inshore catcher vessel cooperatives under AFA.

Cooperative Delivery Processor	*Large Entity Coop*	*Estimated # of Catcher Vessels Associated with Large Entities*	*Estimated # of Catcher Vessels Associated with Small Entities*	*Neighboring Small Government Jurisdictions (Economically Impacted Entity)*	*Neighboring Small Government Jurisdiction (NOT Economically Impacted)*	*Small Non-profit Org.*
Peter Pan	1	2	**7**	King Cove		-
Trident[b,d]	2	23	**14**	Sand Point	Akutan*	-
Alyeska[c]	1	8	**3**	Unalaska		-
UniSea	1	9	**4**	"		-
Westward[c]	1	10	**4**	"		-
Icicle[a]	1	9	**3**	N/A		-
Open Access	N/A	2	**2**	-	-	-
<u>TOTAL</u>						
Large Entity	7	63	**0**	**0**		?
Small Entity	0	0	**37**	**3**		?

Source: Includes information provided by the Independent Catcher Vessels Association. January, 1999.
a Floating processor with no direct neighboring community impact.
b There are two processing facilities associated with one parent corporation (Trident) and could be interpreted as one "shoreside processor" assuming "person" as defined in the Magnuson-Stevens Act.
c These companies are subsidiaries of one larger corporation and therefore could be considered as one single "shoreside processor".
* CDQ community claiming no direct economic impact associated with neighboring shoreside plant .
[d] The plant in Sand Point is AFA eligible even though no catcher vessels are linked to it through a cooperative. Therefore that community would be more likely than others to experience negative impacts.

In total, approximately 32 small entities, including the owners of 37 catcher vessels delivering to eight inshore processors and three (3) neighboring communities, are expected to be directly impacted by the establishment of AFA cooperatives within the inshore component of the BSAI directed pollock fishery. The significance of these impacts on small independent catcher vessel businesses will depend primarily on their ability to better plan their fishing seasons under cooperatives as well as the contractual relationship between such vessel and their delivery processor as moderated by their collective cooperative agreement and cooperative by-laws.

Four of the 8 inshore processors operating as part of the BSAI pollock fishery are either wholly owned subsidiaries or close affiliates of Japanese multi-national corporations. Due to their affiliation with large foreign entities with more than 500 employees worldwide, none of these processors is considered as a small entity. The remaining 4 inshore processors are owned by U.S. companies that employ more than 500 persons in all their affiliated operations, and therefore cannot be considered small entities. Three of the 4 processing plants are owned by the same company. The fourth plant is owned by a company that also owns several other processing plants in Alaska and Washington as well as some harvesting vessels. Therefore, none of the inshore processors in the BSAI pollock fishery appear to meet the RFA small entity definition.

The ability to better plan their fishing season under a cooperative structure should benefit the catcher vessels associated with small entities. This is expected to be true under each of the alternatives 2 through 5. Better planning of their fishing season should allow them to reduce operating costs and increase profits relative to Alternative 1.

Costs could be reduced in one of two ways under Alternatives 2 through 5. The first would be to simply operate in a more efficient manner. Under Alternative 1, each catcher vessel had to compete for its share of the inshore BSAI pollock TAC. Therefore, it made since to purchase backup parts for all of their critical equipment to ensure that down time during the season is minimized. When vessels have rights to harvest a given percentage of the quota, purchasing all of the extra equipment makes less since. The loss of fishing time under the cooperative system is less costly because other members of the sector cannot harvest their share of the pollock TAC. Therefore there cost of purchasing extra parts and materials makes less economic sense. Another way catcher vessel owners could reduce costs is to remove excess harvesting capacity from the fishery. Vessel owners could do this by leasing their pollock to other members of their cooperative and retiring their vessel. Alternatively, if a person owns more than one vessel, they could harvest the pollock on a the other boat(s) they own. Both of these outcomes are expected to occur under Alternatives 2 through 5.

If conventional cooperative motives exist between processor and catcher vessel business members to foster mutually beneficial economic relationships, implementation of any of the cooperative alternatives would not be expected to significantly impact a substantial number of these small entities. Indeed, the action would be a net gain for cooperative members and their neighboring communities. Conversely, if the processor associated with the cooperative choose to exploit its position as the sole- purchaser of pollock from cooperative co-members that operate as catcher vessels (under Alternatives 2 through 4) then it would be highly probable that a substantial number of small entities would be significantly impacted by implementing such fishery cooperatives. This could be partially offset by the transfer allowance established under AFA Section 210(b)(6) for up to 10% of pollock harvested under such cooperative to be processed by another eligible shoreside processor as defined under Section 208(f) of the AFA. Since we are unable to predict with certainty how the balance of power will shift as a result of the various alternatives being considered, the relative impacts of the alternatives on small entities cannot be determined. However, a report was prepared at the Council's request to study this issue (Halverson, 2000). The basic finding of that report was that decreasing a catcher vessel's delivery alternatives would likely result in them having less bargaining power to negotiate prices. Therefore they would likely receive a lower exvessel price under Alternatives 2 through 4 than they would under Alternative 5. The lower prices would have the greatest impact on catcher vessels that were not linked to the processor through ownership and the crew members that are paid based on the vessel's revenue.

Alternative 5 would give inshore catcher vessels the most freedom to negotiate prices with the most processors. They would be more likely to receive a higher price for their pollock in this system as a result of greater demand from more the processors biding against each other. Under Alternatives 2 through 4, the catcher vessels in a cooperative can deliver 10% of their pollock to another AFA inshore processor. This clause provides some improvement in bargaining power for the catcher vessels though their negotiating position is not as great as under Alternative 5. Also under these alternatives there may be incentives for processors to try and lure catcher vessels away from another processor through incentives or the promise of higher prices. The extent to which these situations exist or could exist in the future are unknown. To the extent that they do exist, they would help mitigate the difference in bargaining power under these alternatives. The No Action Alternative (Alternative 1) would result in no cooperatives. That option would likely make the small entity catcher vessels worse off than any of the cooperative based alternatives. However until empirical data become available, likely after cooperatives have been in operation for two or more years, these questions cannot be definitively addressed.

Mothership sector vessels. Recall that there is only one catcher vessel in this sector that would be considered a small entity that was not already accounted for in the inshore sector. None of the three motherships are considered small entities since they are linked to their catcher vessel fleet through ownership, or they are linked through ownership/lease to other inshore processors.

The small entity operating only in the mothership sector and those that operate in both the mothership and inshore sectors are likely better off under any of the alternatives that would implement cooperatives (Alternatives 2 through 4) relative to the No Action Alternative (Alternative 1). This result is expected even though their sector is allocated a smaller percentage of the overall BSAI pollock TAC than they had harvested prior to the implementation of the AFA[39], which means they would likely have harvested and processed more of the BSAI pollock TAC under Alternative 1. However, the benefits of operating under a cooperative system are expected to outweigh the difference in pollock they would receive under the various alternatives that were considered. It should also be noted that the section of the AFA which sets those allocation percentages cannot be changed through the Council process.

Catcher vessels in this sector can deliver BSAI pollock to any of the three eligible motherships. Therefore issues regarding catcher vessel market freedom has not been an issue in this sector. One of the most important AFA impacts to this sector (other than the BSAI pollock allocation percentages) was the sideboard restrictions. Sideboards limit the amount of species other than BSAI pollock that these vessels can harvest. The options under consideration include setting caps at the cooperative level as well as having a single cap for all catcher vessels. Setting caps at the cooperative level means that NMFS would allocate caps to each cooperative instead of the catcher vessel sector as a whole. Once a cap was reached the would be required to stop fishing for that species. Setting caps this way would ensure that each cooperative would receive their historical percentage of sideboard species without negotiating with other cooperatives. However, it would also prevent them from trading sideboard species freely between cooperatives. Therefore, once the allocation is settled among the cooperatives, a single sideboard allocation to all catcher vessels provides them the greatest freedom to trade sideboard species between cooperatives. Therefore, Alternative 3 (the Council's Preferred Alternative) provides the greatest flexibility for members of this sector when determining how to harvest their sideboard species. It also prevents catcher vessels that operate in the inshore and mothership sectors from needing to track separate sideboard allocation for each of the cooperatives. Because of the freedom to trade sideboard amounts under Alternative 3, that alternative is expected to be most beneficial to small entities. However, if they are unable to secure their historic amount of sideboard harvest rights under Alternative 3, they may be better off under Alternative 4 which allocates sideboard harvest rights to each cooperative based on its member vessel's fishing history.

Catcher/processor sector vessels. The AFA names 20 catcher/processors that are owned by 9 different companies as eligible to participate in the BSAI pollock fishery. Further the AFA stated that any catcher/processor that harvested at least 2,000 mt of BSAI pollock in 1997 and was not included in the list of catcher/processors would be eligible to harvest and process up to 2,000mt of BSAI pollock a year. Only one vessel met this criteria. Therefore a total of 21 catcher/processors owned by 10 different companies were eligible to harvest BSAI pollock according to AFA definitions used in Alternatives 2 through 4. Since the passage of the AFA, one catcher/processor named in the Act has sold its harvesting and processing rights to other members of the sector and left the fishery. So, currently there are 19 catcher/processors (owned by 8 companies), plus one catcher/processor limited to 2,000mt of BSAI pollock annually that may harvest pollock from that sector's allocation.

[39] Data indicates that in 1998 the mothership sector accounted for about 11% of the BSAI pollock TAC. Their allocation under the AFA was 10% of the TAC.

All of the Catcher/Processors listed in the AFA are considered to be large entities with annual receipts in excess of $3 million or by being affiliated with other entities that would be considered large.

In addition to the catcher/processors, the 7 catcher vessels discussed earlier are eligible to deliver 8.5% of the sector's allocation to these eligible catcher/processors for processing. All seven of the catcher vessels (the two catcher vessels that were considered to be part of a large entity and the 5 catcher vessels that were considered to be small entities) leased their BSAI pollock harvest rights to catcher/processors within the sector. Therefore in 2000 none of the AFA catcher vessels in the catcher/processor sector harvested any BSAI pollock. But they did receive compensation for allowing the catcher/processors to harvest their fish. The catcher vessels likely agreed to this arrangement because it was more profitable than harvesting the fish themselves.

Communities and groups.

Communities. Two neighboring small government jurisdictions (communities) that would be expected to have beneficial economic impacts associated with establishment of AFA inshore fishery cooperatives are Unalaska (Dutch Harbor) and King Cove. Impacts on these communities would be linked with benefits that would result from such AFA cooperatives by the establishment of a stable long-term supply of pollock to their neighboring shore-based processing plant. Such economic stability is expected to translate positively to these two neighboring communities (noting that the Regulatory Flexibility Act is designed to mitigate *adverse* impacts in any case).

The impacts of the AFA on Sand Point may be negative. This community still receives some pollock deliveries from the BSAI, but the Trident plant in Sand Point is not associated with a cooperative. Vessels that had historically delivered to that plant had delivered more pollock to Trident's Akutan plant and were therefore eligible to join that cooperative. So, currently only pollock deliveries that account for less than 10% of another cooperative's allocation and pollock harvested by the four vessels in the open access portion of the fleet may delivered to the Sand Point plant. This means that the long-term flow of BSAI pollock into the Sand Point community is less stable than under the status quo. However, Trident will likely still utilize the plant for BSAI pollock when needed to keep the plant operating efficiently, and taxes generated from that processing will still flow to the city of Sand Point.

The community of Akutan is not identified as a small community that would be impacted by AFA fishery cooperatives. This determination is based on materials provided in 1995 to the North Pacific Fishery Management Council, NMFS, and the State of Alaska by the Aleutian Pribilof Island Community Development Association on behalf of Akutan. The Council, State of Alaska, and NMFS, agreed these materials sufficiently documented no significant impacts were accrued by the community of Akutan from the presence of the neighboring Trident Seafood processing facility. This claim of no significant economic linkage between the Trident facility and the community of Akutan directly resulted in a 1996 regulatory change that included Akutan as an eligible participant in the CDQ program.

CDQ groups. A total of six groups of Western Alaskan Communities comprise the CDQ program. These groups are considered small entities by NMFS and the Small Business Administration. No negative impacts should have been realized by these groups as a result of the AFA. The overall allocation to the CDQ program is increased from the 7.5% of the BSAI TAC (Alternative 1 - status quo) to 10% annually under Alternatives 2 through 5. The change amounts to a 33% increase in the overall CDQ pollock allocation. That increase is equal to 25,000mt when the BSAI TAC is 1 million metric tons. In revenue terms, if CDQ groups receive 8.5 cents per pound for their pollock allocation, it equates to an annual increase in revenues of over $4.6 million. On average, that is equal to an annual increase of more than $750,000 per CDQ group.

In addition to the increased CDQ allocation, the more stringent U.S. ownership requirements under Alternatives 2 through 5 have caused at least one of the largest pollock companies to restructure their ownership. During the restructuring process, the company formerly know as American Seafoods sold 20% of the entity to a CDQ corporation. Therefore, changing the ownership requirements has allowed some small entities to increase their ownership stake in the BSAI pollock fishery. If profits are being generated in the fishery, which we assume they are, this is also a benefit to the CDQ groups, since they would share in the profits generated by the company.

Cooperatives. In the context of an RFA analysis, a fish harvesting concern is a small entity if it has annual receipts not in excess of $3 million or it is not dominant in its field (defined in 13 CFR part 121, Standard Industrial Code categorizations). Previous sections of this chapter addressed the issue of defining a small entity specifically. An individual catcher vessel operating in the open access directed pollock fishery would typically meet this criteria. Generally, speaking, a fishery cooperative also is a small entity if it meets this same criteria. However, in the case of AFA cooperatives, both criteria would be exceeded and therefore an AFA cooperative would not be considered a small business concern (and all cooperative participants *could* lose their 'small entity' status for RFA purposes).

For AFA participants, membership in a cooperative could modify their previous small entity categorization into what becomes a large entity (the cooperative) due to their collective organized affiliation, as defined by the Small Business Administration. An AFA fishery cooperative, and its collective membership, is expected to have gross annual revenues in excess of $3 million and will be dominant in its field. Therefore, once becoming a cooperative member, a catcher vessel may no longer hold the "small business entity" status in the context of an Initial Regulatory Flexibility Analysis. However, the AFA allows catcher vessels to enter and exit a cooperative. As a result, the type of cooperative they leave and/or enter will impacts their economic viability. It is in this context that various types of fishery cooperatives are reviewed for their ability to minimize the negative impacts on small entities associated with this AFA action associated with inshore catcher vessels and processors (again assuming they retain their status as small entities).

Summary of potentially impacted small entities.

The small entities that could be negatively impacted by the AFA include approximately 43 catcher vessels owned by 35 different unique entities, three rural Alaskan communities that are home to shorebased processing plants, and six CDQ groups. Passage of the AFA is expected to have positive impacts on the catcher vessels, CDQ groups, and at-least two of the three communities. The community of Sand Point may have been negatively impacted since no cooperative was formed around the processing plant in their community. All other members of the BSAI pollock fishery also appear to benefit from implementation of cooperatives.

The following table summarizes small and large entities that are currently participating in the BSAI pollock fishery. It includes all of the vessels, processors, and communities that were discussed in greater detail in the previous sections.

Table 4.6.2 Estimated number of entities (businesses or communities) in each sector of the BSAI pollock fishery.

Entities	*Number Considered Small*	*Number Considered Large*	*Unknown*	*Total*
CVs[a] Delivering to Inshore processors	29[b] , (37)[c]	14[b] , (63)[c]	0	43
CVs Delivering to Motherships only	1	4	0	5
CVs Delivering to C/Ps	5	2	0	7
Motherships	0	3	0	3
Catcher/Processor Companies	0	9	0	9
Inshore Processors	0	6	0	6
Communities	3	0	0	3
CDQ Groups	6	0	0	6
Fishing Support Companies	unknown	unknown	??	??
Total (known)	41	38[d]	??	79

[a]This total also includes those companies whose vessels were members of both the inshore and mothership sectors.
[b]The number of entities that own vessels
[c]The number of vessels owned
d The total number of large entities maybe over estimated since some of the owners would appear in more than one of the sectors discussed above.
Note: The number of vessels in the fishery is greater than the number of business because some companies own several vessels.

4.6.8 Discussion of the potential negative effects of AFA inshore cooperatives on catcher vessel owners classified as small entities

In the absence of sufficient corrective measures, potential will exist for adverse economic impacts to be incurred by independent catcher vessels participating in an AFA inshore cooperative. As designed under Alternatives 2 through 4 (including the Council's Preferred Alternative), an inshore cooperative is established with only one shoreside processor operating as their primary pollock buyer. This shoreside processor is affiliated with, but may not be a member of that inshore cooperative. The shoreside processor is also an independent business concern and is not collectively owned by cooperative member catcher vessels. Therefore, it is not assumed that profit-sharing would exist between the processor and catcher vessels in a given cooperative. Inshore cooperatives, which require catcher vessels to deliver to a single shoreside processor (other than under the rules that allows them to deliver 10% of their cooperative's allocation to another processor), can create an economic environment that reduces price competition for pollock harvested by cooperative members. The risk of this kind of biased pricing activity within a cooperative association could be reduced if Alternative 5 were selected to give catcher vessels greater market freedom. This is important because without a competitive ex-vessel market for pollock landed by catcher vessel members, an economic incentive is created for the processor to increase its own profits at the expense of catcher vessel cooperative members. Specifically, the processor could increase profits by lowering its operating cost through offering catcher vessel cooperative members a price lower than the going market price otherwise determined by conditions of supply and demand in a competitive pollock ex-vessel market. The downward shift in prices is similar to what would occur if ex-vessel market demand were reduced. Offsetting this incentive for processors to exploit their cooperative catcher vessels may be the potential need to renegotiate cooperative terms annually and the provisions of the Council's sideboards which allow catcher vessels to move between processor cooperatives, from year-to-year, if they so desire.

Alternatives 2 through 4 all require catcher vessels to deliver pollock to the processor associated with their cooperative. Those alternatives would all be expected to result in approximately the same balance of market power between processors and catcher vessels in the inshore sector. A more complete description of the implications of market power under various cooperative structures can be found in the report prepared for the Council by Dr. Halverson. (Halverson et al. 2000). A short summary of that document is provided here. The potential exists for significant negative impacts on small independent catcher vessels wishing to transit through open access for one year to switch cooperatives (this assumes that one of the Alternatives 2 through 4 are in place) if larger vessels choose not to fish in their cooperative and compete in the open-access directed pollock fishery. This would occur if the larger catcher vessel held a low catch history and the cost of cooperative membership (e.g. high price of leasing sufficient pollock allocation from other cooperative members) is greater than the perceived expense associated with harvesting an equivalent amount in the open access fishery. If those catcher vessel operators who choose not to participate in their designated cooperative happen to possess harvest capacities that are significantly larger than other catcher vessel that have substantial catch histories, but, for one reason or another, choose not to enter into a cooperative, then in an open access setting, on an initial trip by trip basis, the larger vessels could out compete the smaller independent catcher vessels. This could further penalize the independent catcher vessel owners that choose not to join their designated AFA cooperative. Therefore, even with the option to fish in the open access fishery as an alternative to joining a cooperative that is bound to a low-price processor, the open access option has significant economic risk due to their potential inability to compete with the larger catcher vessels on a trip by trip basis as a result of a difference in harvest capacities.

It should also be noted that many of the largest catcher vessels in this fishery are wholly-owned by the very inshore processors which will be negotiating cooperative agreements with the small independent vessel operators. This would negatively impact the competitive position of the smaller independent CV, because there would exist a lower quantity of pollock available in the open access fishery. The effect of reduced pollock harvest opportunity in the open access fishery would result from the existence of other catcher cooperatives having memberships of catcher vessels that retain legally defensible catch allocations created under the AFA action and thus correspondingly reduced the open access "pool" of available pollock. There is no *a priori* means of quantitatively predicting if this outcome will emerge, much less how significant it might be, if it does. However, the Council monitor this over time, to assure that unanticipated adverse impacts on small entities do not result.

The AFA mandated that protections for other fisheries be developed as a part of the overall program. These "sideboards" on AFA vessel participation in other fisheries are designed to allow non-AFA vessels and processors to continue operating at historic levels. Non-AFA participants underlying concern was that cooperatives would give the BSAI pollock fishery participants greater flexibility in their operations which could lead to pollock vessels fishing when and where they previously were unable to because of conflicts with their pollock seasons. Because of the limited entry aspects of the AFA, non-AFA vessels would be restricted from participating in the BSAI pollock fishery and the would have increased competition in their fisheries as the pollock vessels rationalized their operations.

Alternatives 2 through 5 all contain differing sideboard provisions. A discussion of the various sideboard alternatives is provided earlier in Chapter 4. Each of the alternatives limit the overall amount of species other than BSAI pollock that AFA members can harvest, but differ in terms of the sideboard amounts and how they are managed. Alternatives (2, 3, and 5) which exclude discarded fish in determining the catcher vessel sideboard amounts result in smaller caps. However those sideboard alternatives are managed by NMFS through directed fishery closures. Meaning that once a predetermined level of catch is reached by the AFA fleet, directed fishing for that species is closed. That species may still be harvested as bycatch in other fisheries and all other species where sufficient harvest levels remain under the caps may still be targeted. Under Alternative 4, the initial sideboard caps are larger because fish that were discarded during the time period used to determine the cap levels were included in the calculation. Even though the cap amounts are larger, they are likely to be more restrictive because they are managed as "hard caps" by NMFS. That means that when the cap is reached that fishery and all other fisheries that would take that species as bycatch would be closed. The BSAI pollock fishery could even be closed before a cooperative's allocation is harvested under a system of hard caps. If that were to occur, it could have a substantial impact on the small entities in the pollock fisheries.

Pacific cod and GOA pollock tend to be the most important sideboard species for AFA catcher vessels that are considered small entities. NMFS has determined that sideboard amounts for a few other species are adequate to open directed fisheries for AFA vessels. However, those fisheries are of relatively minor importance to most vessels relative to their pollock and cod fisheries.

Sideboards will limit the opportunity for expansion by small entities in the AFA sector. However, those limitations will preserve the historic harvesting and processing opportunities of other small non-AFA entities. Without those limitations the potential exists for the AFA fleet to substantially harm those vessels. Therefore, sideboards balance the costs and benefits gained by AFA catcher vessels. Overall the AFA catcher vessels would likely benefit from any of the Alternatives 2 through 5, relative to Alternative 1, even with the sideboards imposed.

4.6.9 Mitigation of negative impacts

Inshore cooperative structure

Members of the Independent Catcher Vessel Association (ICVA) operate boats in the BSAI directed pollock fishery. ICVA representatives perceive their members will incur negative economic impacts as a result of constraints imposed under Alternatives 2 through 4. The AFA requires catcher vessels to sell at least 90% of their pollock allocation to the processor associated with their fishery cooperative as defined under the AFA. ICVA has expressed concern about the negative economic impact on inshore catcher vessels that could result from such potential constraints on the competitive ex-vessel price of pollock landed and sold within the current AFA inshore cooperative design. At its February 1999 meeting in Anchorage, the Council heard public testimony from independent catcher vessel owners recommending Council consideration of specific measures to reduce negative economic impacts of this action on their sector of small entities. Specifically the measure calls for Council action to change the AFA language to allow independent catcher vessels to develop cooperatives among themselves (Alternative 5). This modification would also eliminate the restriction on independent catcher vessel owners to sell their catch to a specific shoreside processor. The objective of such action is to allow independent catcher vessel owners the opportunity to work collectively as members of a fishery cooperative to maximize the economic returns for the individual allowable catch of pollock established under the AFA. The objective could be realized with the proposed establishment of greater flexibility among catcher vessels to land and sell their pollock to a shoreside processor offering the highest available ex-vessel market price.

The economic implications of this action on independent catcher vessels would be positive. It would also allow them to both retain the exclusive harvesting privilege associated with their cooperative's collective pollock allocation as well as provide for their ability to accept the highest ex-vessel price for such pollock landings as offered by an eligible shoreside processor. Conversely, this option could result in unstable supply of pollock to shoreside processors that, during certain time periods, are unable to match ex-vessel price offers made by other shoreside processors. This could occur when various value-added products with different profit margins (e.g. surimi versus fillets) are being produced for different markets by different shoreside processor and thus enabling their offering a significant price differential to independent catcher vessels. Access to this price differential (selling to different plants at different times) would benefit independent catcher vessel but could impose direct negative economic impacts on shoreside processors and indirect negative impacts on small entities dependent on such processors. Based on SBA definition of small entities, shoreside processors are not considered likely candidates for consideration under the RFA with regard to negative impacts of this mitigating measure. However, the 37 inshore catcher vessels that are considered small entities would be indirectly impacted by negative economic consequences of this action. Therefore, consideration of establishing independent catcher vessel cooperatives as a measure mitigating against negative impacts of the current AFA legislation, to some degree becomes a trade-off between reducing direct affect incurred by such catcher vessels while increasing the potential for indirect affects incurred by shore-based small entities; shoreside processors notwithstanding. Potentially significant economic and institutional efficiencies could be further achieved if inshore catcher vessel operators were allowed to establish cooperatives comprised of memberships which they choose themselves. This is in contrast to the existing inshore AFA cooperative structure requiring cooperative membership strictly as a function of historical landings to a given processor. Establishment of more efficient long-term cooperative relationships would exist among members if they are based on commonly shared objectives as well as on economic efficiencies of scale create by business affiliation decisions. Sales to a specific processor is a less than optimal index of commonality in operational objectives among a sub-set of inshore catcher vessels. Freedom to establish group membership through independent choice is an important design characteristic for establishing fishery cooperatives with permanence in a free-market system. The long-term viability of cooperatives has traditionally proven most successful when they are naturally organized among members who share commitment and loyalty based on their inherent commonalities such as business focus, institutional structure, operational philosophy, geographic relationship, or cultural orientation. Such factors should be given due consideration when managers seek to foster the development of inshore pollock fishery cooperatives that will realize long-term benefits to both the fishery participants specifically, and to the nation in general.

The current AFA cooperative structure does not allow a catcher vessel to change its cooperative affiliation from year to year and retain its harvest allocation concurrently. To change cooperative membership (and ex-vessel buyer affiliation), the catcher vessel may be required to fish in the open-access fishery for one year (AFA Section 210(b)(5)) in order to deliver the majority of their BSAI pollock to a new processor. For this open-access year, the AFA does not allow the vessel to retain its harvest privilege of pollock "quota share". It must compete for its share of pollock in the race scenario of the open-access fishery. Should the vessel owner choose to join an AFA cooperative the following year and sell to the cooperative's designated shoreside processor, the harvest privilege for the catcher vessel would be reauthorized. This open-access transition year requirement creates economic and resource inefficiencies associated with the catcher vessel's harvest allocation amount. It is probable that this same amount of pollock would be harvested over a shorter time period in the open-access fishery than if harvested under a cooperative arrangement. As a result, open-access pollock harvests would generally yield lower recovery rates and create conditions for less than optimal market prices due to the surge in supply. Furthermore, per unit operating costs would likely be higher for the open-access operation than what could be expected under a more flexible inshore cooperative structure. Generally speaking, the transition year constraint imposed by the AFA on inshore catcher vessel owners who seek to shift their vessel's membership between AFA cooperatives, will create the potential for more, rather than less, inefficiencies in the inshore component of the BSAI directed pollock fishery.

Sideboard exemptions

Alternatives 3 and 5 include sideboard exemptions for catcher vessels less than 125 feet length overall that had limited participation in the BSAI pollock fishery during the qualifying years. These exemptions cover the BSAI Pacific cod fishery and the GOA fisheries. A total of 12 vessels qualify for the exemption in the BSAI Pacific cod fishery and 14 vessels qualify for the GOA sideboard exemption. The majority of the vessels that qualify for these exemptions are considered to be small entities. The exemptions were included under Alternatives 3 and 5 to limit any harm to small independent catcher vessels that would result from the implementation of sideboard measures. These vessels, by definition, have limited amounts[40] pollock catch, so the alternatives were included to ensure that qualification for the AFA program did not limit their ability to compete in the fisheries which they have depended upon in the past. During discussions of these alternatives at the Council level it was stated that many of these vessels only participated in the BSAI pollock fishery when their other fisheries were closed or were not economically viable. This is one of the reasons the BSAI pollock participation levels were included in the exemption requirements. These pollock harvest levels were thought to represent vessels that were less reliant on the pollock fishery than those that participate in the pollock fishery as their primary and preferred fishery.

Exempting these vessels ensures that they will be able continue their annual fishing rounds as they have in the past. Had they not been exempted from the sideboard fisheries, the AFA harvest cap for those fisheries could have reached prior to their being able to participate in them as they had and their overall business may have been harmed.

Sideboards were also required under Alternatives 2 through 5 for the BSAI crab fisheries, with some important differences which further restrict the AFA vessels' participation, but which also include some mitigating measures for small entities in that sector. For Bristol Bay Red King Crab (BBRKC) and bairdi (which is currently closed due to low stock size) fisheries Alternatives 3 through 5 restricts the AFA vessels eligible to participate in the fishery to an aggregate amount based on historical participation, much as with groundfish. For the other crab fisheries there is no aggregate limit for the AFA vessels, however, only those AFA vessels with the required crab history are permitted and allowed to participate. Alternative 2 limits only the numbers of AFA vessels that can participate in the BSAI crab fisheries, it does not limit their overall catch. This differs from Alternatives 3 through 5 which also limit the amount of BBRKC and bairdi crab the qualified vessels are allowed to harvest. Like most sideboard measures, the crab sideboards represent trade-offs between groups of vessels each of which are comprised of both small and large entities.

As with the example given in groundfish, there were some AFA vessels which actually had the majority of their income from fisheries other than pollock - specifically there were three AFA vessels identified in the which had significant and long-term participation in the opilio crab fisheries. Subjecting these vessels to an aggregate sideboard limit (shared with the other AFA vessels) would have resulted in disproportionate and negative impacts to those vessels - essentially they would lose their ability to continue their historical fishing practices. To mitigate this issue, the Council chose a compromise which generally restricted AFA vessels' participation in opilio, but allowed those with a high dependence to continue.

AFA qualification criteria

Alternatives 2 through 5 each contain different AFA qualification requirements for vessels less than 60 feet length overall and those greater than or equal to 60 feet. Vessels less than 60 feet were required to deliver at least 40 metric tons of BSAI pollock to be processed in the inshore sector during any one of the calendar years from January 1, 1996 through September 1, 1998. Vessels that are greater than or equal to 60 feet length overall must have delivered at least 250 metric tons of BSAI pollock to be processed in the inshore sector during any calendar year of the qualifying period (January 1, 1996 through September 1, 1998). This differential qualification criteria for the AFA program was setup to benefit small independent fishing companies. Some of those companies rely on BSAI pollock as a critical part of their annual fishing cycle. Without the lower qualification criteria they may have been harmed by the selection of any of the alternative that would implement the AFA (Alternatives 2 through 5).

[40] These vessels had to average less than 1,700mt of BSAI pollock over the qualifying years for the program.

Vessels excluded from the pollock fisheries

Through analysis of the eligibility requirements, combined with testimony to the Council from affected individuals, it has become apparent that at least two (possibly three) vessels with history in the BSAI pollock fisheries have been excluded from future participation in that fishery by the eligibility requirements contained in the AFA. While these vessels have historical participation, they did not participate in the qualifying (January 1, 1996 through September 1, 1998) period at levels required by the Act. While these vessels do not comprise a 'substantial number' of small entities (relative to the total which qualify under the more general license limitation or to the total number of AFA-eligible vessels), the exclusion could be expected to have a significant, negative impact on their operations, to the extent that pollock fishing in the BSAI historically contributed a large portion of their total fisheries income.

Measures to mitigate impacts of this exclusion

The list of eligible vessels (in Section 208 of the AFA) is one of the two sections of the AFA that the Council cannot alter. The exclusion of the vessels mentioned above, while of concern to the Council, is not an issue for which the Council can evaluate or consider mitigating alternatives. Only Congress, through amendment to the AFA, could effect such a change. Therefore, the exclusion is not being analyzed as part of the Alternatives considered; rather it is being mentioned as part of an overall package, comprised of both Council actions and Congressional mandates, which is being implemented through this regulatory package. A potentially compensating factor is that they will not be subject to sideboard restrictions in other fisheries, and can therefore attempt to make up any lost revenues by increasing participation in other fisheries. Also, since they have not participated in the pollock fishery at levels that would qualify them for the program, it is unlikely that they been very reliant on the BSAI pollock fishery in the recent past. Other mitigating measures are beyond the purview of the Council and therefore were not considered as potential amendments.

4.6.10 Recordkeeping and reporting requirements (R&R)

Additional recordkeeping and reporting requirements would be expected as a result of the creation of several inshore cooperatives that each independently utilize its own unique quantity of pollock catch as an aggregate of the individual allocation of its member catcher vessels. The new recordkeeping and reporting requirements would be required to be submitted to NMFS by the fishery cooperative management, not by each individual catcher vessel operating as a cooperative member. Therefore, this additional recordkeeping and reporting requirement would not adversely impact small entities. Inshore AFA cooperatives would not qualify as small entities as defined by the Small Business Administration.

The proposed sideboard measures are not expected to require additional recordkeeping or reporting for the small entities identified; rather, the burden of accounting for the sideboard limits will fall to NMFS. Participation in pollock cooperatives may necessitate additional paperwork burdens for these entities within the structure of the cooperative agreements in terms of catch and bycatch allocations and accounting for those allocations; however, such participation would be voluntary and is outside the scope of the sideboard provisions. Processor sideboard provisions, depending on the level at which they are implemented, could entail additional recordkeeping and reporting for those processors, but they are not defined as small entities for purposes of the FRFA, nor have decisions been made yet with regard to processor sideboards.

4.6.11 Comments on the IRFA

The IRFA for AFA Amendments 61/61/13/8 was published as part of the draft EIS for Amendments 61/61/13/8. No comments were received that addressed any aspect of the IRFA. Several comments were received that addressed some of the economic conclusions of the Regulatory Impact Review contained in section 4.5 and that challenged the conclusion that Alternative 5, which is designed to provide increased market freedom for catcher vessels, would generate the greatest net economic benefit for the nation. All comments received on any aspect of the draft EIS/RIR/IRFA for AFA Amendments 61/61/13/8 are printed in their entirety and responded to individually in Chapter 8 of this document.

4.6.12 Summary and conclusions

Cooperative structure

Independent catcher vessel operators participating in the inshore component of the BSAI directed pollock fishery will be affected, both positively and negatively, by the establishment of AFA fishery cooperatives. However, as the alternatives are currently designed, independent catcher vessels could be expected overall to be better off under the AFA cooperative structure when compared with their experience under the open-access fishery of recent years. The primary benefit to catcher vessel participation as an AFA inshore cooperative member is that the vessel owner receives some assurance for the option of catching a specific amount of pollock equal to the vessel's catch history as determined by NMFS. The primary disadvantage is that this allocation may not be optimized for its economic value if the alternative selected results in a system that does not foster a competitive ex-vessel market. Furthermore, the potential catch would likely be reduced for independent catcher vessels that do not join an AFA cooperative.

No catch allocation is granted to catcher vessels whose owners choose not to participate in an AFA cooperative. Therefore, they must operate in the open access fishery that will, in all probability, be composed of a smaller "pool" of allowable catch. This reduction in allowable catch in the open access pollock fishery will occur in the amount equal to the reserved catch allocations granted by NMFS to catcher vessel operations that do choose to join an AFA cooperative. As a result, non-cooperative catcher vessels with smaller catch capacities may be disadvantaged in the open-access fishery. This condition could be exacerbated in the event that catcher vessels with small catch histories, but with large per-trip harvest capacity, choose not to join a cooperative and intentionally target pollock in the open-access harvest "pool". Given the predicably shorter open-access fishery resulting from a reduced available catch, the smaller the per-trip harvest capacity of an inshore independent catcher vessel, the less successful its operation would be in the open access fishery created under the AFA. Given their expected annual gross revenues of less than $3 million, about 35 owners of catcher vessels in the fishery impacted by the proposed action are small entities. Furthermore, because NMFS cannot quantify the exact number of small entities that may be indirectly affected by this action, or quantify the magnitude of those effects, NMFS cannot make a finding of non-significance under the RFA, with regard to issues of inshore cooperative.

Sideboard measures

Sideboard limits are established to limit the amount of species other than BSAI pollock which can be harvested by AFA-eligible vessels. Generally these limits freeze in place the current distribution of catch between AFA and non-AFA vessels. More restrictive sideboard options considered would negatively impact the small entities involved in the AFA fleet, relative to other options, though it is uncertain whether such differences would be significant. More lenient sideboard options would generally benefit the AFA fleet, though it would be at some expense to the remaining (non-AFA) fleet, many of whom are also small entities. In essence, the degree of sideboard limits represents a trade-off in impacts to two sectors of small entities, as is the case with most allocation-based management actions.

While the differences in sideboard options likely are not significant, particularly given the mitigating measures included, they do affect a substantial number of small entities. In combination with the cooperative structure issues described in this section, it is impossible to make a finding of non-significance with regard to the collective actions in this amendment package.

Rationale for preferred alternative

The benefit-cost analysis prepared as part of the Regulatory Impact Review and set out above in section 4.5 suggests that Alternative 3, has less net benefits than the independent catcher vessels proposal reflected in Alternative 5 due to the increased benefits to independent catcher vessels expected under Alternative 5. Nevertheless, Alternative 3 has been designated as the "preferred" alternative. Benefit-cost analysis is only one element in a public decision making process. Benefit-cost analysis is based on very specific assumptions that not all persons may hold. Issues other than social efficiency may be important to many persons. For these reasons this benefit-cost analysis is supplemented with an analysis of the distributional implications of the alternatives, and an analysis on the impacts on small business, non-profit, and government entities in the accompanying Initial Regulatory Flexibility Analysis. In addition to these concerns, this benefit-cost analysis has been qualitative, and has incorporated a margin of error that makes it impossible to say for certain that Alternative 3 has smaller net benefits than Alternative 5.

Moreover, Alternative 3 is a political compromise that was developed in legislative and Council processes. It incorporates compromises among interest groups that were essential to bringing the AFA and the implementing regulations into existence. In particular, the difference between Alternatives 3 and 5 reflects a decision about the allocation of AFA benefits between inshore processors and inshore catcher vessels. In postponing action on the independent catcher vessel's proposal reflected in Alternative 5, the Council chose not to change the terms of this agreement after it had been reached, but indicated that it could take the issue up again at any point if evidence suggested that independent catcher vessels were harmed as a result of the co-op structure contained in the AFA. Thus Alternative 3 is the preferred alternative, although it may not absolutely maximize net benefits as interpreted in benefit-cost analysis.

4.7 Environmental justice considerations

This section analyzes the social impacts of the final actions on minority and low-income populations. Additional social impacts are discussed in Section 4.0 under each alternative. The Draft Programmatic Alaska Groundfish SEIS (NMFS 2001a) has additional information regarding communities and community profiles for communities that depend to some extent on the harvesting of BSAI pollock.

4.7.1 Introduction

Concerns regarding environmental equity are generally termed Environmental Justice. Environmental Justice can also be defined as "the determination of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, and /or socioeconomic status" (Bryant, 2001). Environmental Justice issues encompass a broad range of impacts including those on the natural and physical environment and related social cultural and economic effects. Executive order 12898 (Environmental Justice, 59 Fed. Reg. 7629 [1994]) requires each federal agency to achieve environmental justice by addressing "disproportionately high and adverse human health and environmental effects on minority and low-income populations."

In order to determine whether Environmental Justice concerns exist, the demographics of the relevant area are examined to determine whether minority populations or low-income populations are present and could be disproportionately impacted by the proposed alternatives. 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 community or population, as well as the specific ties of that community or population to the resources (or access to resources) that will be changed by the alternative.

There is no standardized methodology for identification or analysis of environmental justice issues. The demographics of the affected area should be examined to determine whether minority populations, low income populations are present if so, a determination must be made as to whether the implementation of the alternatives may cause disproportionately high and adverse human health or environmental effects on the minority populations, or low income populations present.

In determining what constitutes a low-income or minority 'population' CEQ guidance, with specific regard to minority populations states: "if 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 determination of low-income populations, a similar approach has generally been adopted when preparing NEPA documents (King, 2001). The U.S. 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[41] state that, unlike NEPA, the trigger for analysis under Executive Order 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."

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[41] NOAA *Environmental Review Procedures for Implementing the National Environmental Policy Act* (Issued 06/03/99)

4.7.2 Community variations and data limitations

The population structure of the regions vary considerably. As discussed below, there is a relationship between the percentage of Alaska Native population and commercial fisheries development. Specifically, communities that have developed as large commercial fishing communities becoming less Native in composition over time compared to other communities in the region. There are many variables involved, but most communities noted the relationship is quite straightforward. The fishery has also had an impact on the male-female population balance for some of the Alaskan communities that are the focus of intensive groundfish processing. This is due to the fact that processing workers reside within these communities for varying durations, and that this workforce is predominately male. 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. The differences in the male/female and Native/non-Native population segments are, to a degree, indicative of the type of articulation of the directly fishery-related population with the rest of the community.

Interpretation of these data, in terms of engagement with the community, is less straightforward for some regions than for others. As detailed in the regional discussions, communities are engaged in, and dependent upon, the fishery in quite different ways through resident catcher vessel fleets, onshore processing facilities, and locally associated catcher-processor (and/or mothership) entities. While no consistent data are available, field observations would tend to indicate that ownership and crew demographics of the residential catcher vessel fleet for the relevant Alaska groundfish communities tend to mirror the community demographics at large. This situation would also appear to hold true for the smaller vessel catcher processor sectors based in the various Alaska regions. For the larger vessel catcher-processor and mothership sectors, those are to a large degree associated with the Washington region (with the caveat that ownership patterns have been changing in recent years and the percentage of Alaska based ownership in general and Alaska CDQ ownership in particular has increased, as discussed at length elsewhere in this document), and crews tend to be drawn from a wide area rather than a particular community. These factors are discussed in a separate section below. For the large processing plants that utilize groundfish, the demographics of the workforce and the relation to the 'host' communities tend to be more complex, have substantial environmental justice implications, and are discussed at length below.

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. A further complication for attribution of socioeconomic impacts to a regional base is the fact that for many workers in many of the sectors, groundfish-related work is performed in a region or community that is separate from where they have a number of other socioeconomic ties. It is not uncommon for fishery related workers to spend relatively little money in their work region and to send pay 'home' to another community or region. In this sense, regional employment is indicative of a volume of economic activity, if not a specific level of labor activity directly comparable to other industries. The importance of this flow varies from region to region and from sector to sector, but is most apparent within communities that are most heavily engaged in the processing aspect of the groundfish fishery. 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. One of the current limitations of U.S. Census data however, is that not all of the 2000 data relevant to this environmental justice analysis have been released. Ethnicity by housing type (e.g., by ethnicity by group quarters and non-group quarters), particularly useful for examining resident processing workforce numbers in Alaska coastal communities for this analysis, is not available, so data from the 1990 U.S. Census are presented, keeping with the established practice of using federal census data for environmental justice analysis. Unfortunately for this analysis, however, the groundfish fishery has changed a great deal since 1990 in many ways, including the size and distribution of the workforce. This being the case, the 1990 census data were supplemented with data gathered from industry sources that characterize their workforce demographics for 2000. These data suggest that the workforce has come to include a much larger minority population component than was the case a decade earlier and reflected in the 1990 census information.

Some caution must be given, however, in the comparison of the two different 1990 and 2000 resident workforce related data types. That is, in order to supplement the dated 1990 U.S. Census data that is being used to infer the structure of the locally present or resident fishery associated workforce, industry was asked to provide 2000 workforce demographics for their individual groundfish processing operations.[42] It is

[42] During discussion of the environmental justice analysis for the Steller sea lion SEIS at the October, 2001 meetings of the North Pacific Fishery Management Council in Seattle, the question was raised during the Advisory Panel discussion of whether or not environmental justice provisions applied to non-U.S. citizens, and the implication of this question for the analysis, given that a substantial number of resident aliens work in the local seafood processing plants. If it is assumed that Executive Order 12898 is premised on the application of the equal protection clause, then it should not matter whether the affected population consists entirely or primarily of citizens or resident aliens. A long line of Supreme Court cases holds that the Equal Protection Clause of the U.S. Constitution applies to resident aliens (See Kim Ho Ma v. Ashcroft, 257 F. 3d 1095, 1108-09 and fn. 23 [July 27, 2001]). Although a distinction has been drawn concerning the extent to which constitutional protections may apply to non-resident aliens who are seeking admission to the U.S. but are not yet present within its borders, the clear weight of authority holds that once an alien is present within the borders of the United States, regardless of whether his or her entry was legal or illegal, he or she has constitutional rights, including the right to equal protection of the laws (Id. at 1109). Importantly, the Environmental Protection Agency (EPA) defines environmental justice to mean the "fair treatment of people of all races, cultures, and incomes" and guidelines include: "Conducting our programs, policies, and activities that substantially affect human health and the environment in a manner that ensures the fair treatment of *all people*, including minority populations and/or low-income populations; Ensuring *equal enforcement* of protective environmental laws for all people, including minority populations and/or low income populations" (http://www.epa.gov/swerosps/ej/html-doc/ejmemo.htm, emphasis added). Further, the EPA Environmental Justice " F.A.Q." answers the question of "What is Environmental Justice?" by stating it is 'To ensure that *all people*, regardless of race, *national origin* or income are protected from disproportionate impacts of environmental hazards" (http ://es.epa.goc/oeca/main/ej/faq.html, emphasis added). Additionally, data gathered by the United States Bureau of the Census often constitute the statistical foundation for examining the environmental justice implications of government decisions, and the decennial census remains the most widely used source of data to characterize populations based on race or ethnicity (Gerrard, 1999). The methodology of the Census, i.e., where all persons are counted, argues strongly for the inclusion of foreign nationals in the environmental justice analysis. By way of background, the first U.S. decennial census in 1790 established the concept of "usual residence" as the main principle in determining where people were to be counted. This concept has been followed in all subsequent censuses. Usual residence has been defined as the place where the person lives and sleeps most of the time, and is not necessarily the same as the person's voting or legal residence. Also, noncitizens who are living in the United States are included, regardless of their immigration status (foreign nationals who are visiting the country only briefly or reside in foreign embassies are not counted). There have been acknowledged difficulties with counting persons of questionable residency status, and on March 13, 2000, the Immigration and Naturalization Service issued a memo outlining the guidelines for the INS' operations during the 2000 census. In general, the INS has taken the position that all foreign nationals, even those who are in the United States illegally, should participate in the census. However, is generally believed that past census counts have undercounted the nation's illegal alien population. In order to prevent this during the 2000 census, the INS issued these guidelines, to ensure that no information gained through the census will be obtained or used by the INS against illegal aliens. Moreover, according to the comprehensive text *The Law of Environmental Justice* (Gerrard, 1999) both EPA and the General Service Administration (GSA) guidance documents generally concur with CEQ's data collection and environmental assessment strategy, and both go further in their own recommendations. In addition to identifying the proportion of the population of individual census tracts that are composed of minority individuals, EPA suggests that its analysts also attempt to identify whether "high concentration 'pockets' of minority populations are evidenced in specific geographic areas." EPA cautions that traditional census-based population tract data may miss high "pockets" of minority or low-income communities. Census data have proven unreliable in some cases, "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. As such, and because census data rely on self-reporting, these data are not always "consistent" and are "prone to undercounting" minority and low-income populations "due to a perceived reluctance for certain population to divulge information." EPA thus recommends that census data be supplemented with data from other sources, such as local agencies; locality specific questions, interviews, and research; outreach to community groups; geographical information system (GIS), or other mapping systems. In this specific SEIS instance, industry provided data are used to identify such 'pockets' of minority populations within various groundfish communities that are relevant to the analysis of the proposed alternatives. (Further details on Alaska residency versus non-state residency are discussed in Appendix F(1), but are not relevant here, due to the fact that EO 12898 is a federal and

important to note that these data were not collected using a methodology similar to that used for the U.S. Census data, and this should be taken into account in the interpretation of the information. 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 or not 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. Further, in each relevant Alaska region, these data are supplemented with age and sex data from the 1990 and 2000 U.S. Census that allow a cross-check on the both the gross and relative changes in the ‘industrial’ population segment in the communities.

The situation is markedly different for the greater Seattle area. Seattle is, in absolute terms, the community most engaged in the groundfish fishery among many of the important indices of involvement, but it is also the least engaged in terms of the relative importance of the fishery to the overall population and economy of the community. Summary information relevant to environmental justice considerations is presented at the end of this section.

The CDQ region presents yet another type of environmental justice context, through the nature of the demographic and economic structure of this region, and the nature of the participation of this region and its communities in the fishery through the various mechanisms of the CDQ program as it has been implemented in different subregions by different CDQ groups.

4.7.3 Community profiles

General community population attributes

The communities with the strongest direct engagement in, and dependence upon, the BSAI pollock fishery are Unalaska, Akutan, Sand Point, and King Cove. In this section, community level information relevant to environmental justice analysis is summarized.

Table 4.7.1 provides ethnicity information from the 2000 census for each of the four communities.[43] As shown, 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. (Akutan, while having a relatively low Alaska Native population percentage is arguably the ‘most traditional’ Aleut community, however, as noted 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 Unalaska (behind whites) and King Cove (behind Alaska Natives), and the 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. Each is

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not a state directive.)

[43] As a methodological note, community populations vary quite a bit throughout the year as seasonal workers are brought in to the smaller Alaska communities to provide an adequate workforce for peak seafood processing demand. U.S. Census data do not take yearly averages, but rather represent a one time count. During the 1990 census, for example, information for rural Alaska communities was collected during the months of January through April1990 according to the Institute for Social and Economic Research at the University of Alaska. Although these data cannot represent the complexity of groundfish community the population dynamics, they do represent the best available data set that is comparable across communities and regions.

summarized briefly below. 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.

Table 4.7.1 Summary of 2000 census data on ethnic composition in affected communities.

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%
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 Pac 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%

Source: U.S. Bureau of Census.

* '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).

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. Not surprisingly, in the latter half of the 20th century, population fluctuations have coincided with periods of resource exploitation and scarcity.[44] For example, the economic and demographic expansion associated with the King crab boom in the late 1970s and early 1980s brought many non-Aleuts to Unalaska, including Euro-North Americans, Filipinos, Vietnamese, Koreans, and Hispanics. The Euro-American population shows a distinct change over the years, comprising around 30 percent of the population in 1970, over 60 percent in 1980 and 1990, and then back to 44 percent in 2000. The growth of Asian/Pacific Islander population (over 30 percent by 2000) is closely associated with the increasingly residential nature of the seafood processing sector workforce. Apart from the War years, prior to the growth of the current commercial-fisheries-based economy, Unalaska was an Aleut community. Since this development, however, the change over the period of 1970 - 1990 is striking. In 1970, Aleut individuals made up slightly over 60 percent of the total community population (and Alaska Natives accounted for a total of 63 percent of the population). In 1980, Alaska Natives, including Aleuts, accounted for 15 percent of the population; by 1990, Aleuts comprised only 7 percent of the total community population (with Alaska Natives as a whole accounting for 8 percent of the population). Overall representation was similar in 2000. This population shift is largely attributable to fisheries and fisheries-related economic development and associated immigration.[45]

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[44] The most dramatic population shift of this century, however, was brought about by World War II. The story of the War, and the implications for the Aleut population of Unalaska and the other Aleut communities of Unalaska Island, is too complex and profound for treatment in this limited community profile. It may be fairly stated, however, that the events associated with World War II, including the Aleut evacuation and the consolidation of the outlying villages, forever changed the community and Aleut sociocultural structure.

[45] The fact that there is a "core" Aleut population of the community with a historical continuity to the past also has implications for contemporary fishery management issues. These include the activities of the Unalaska Native Fisherman Association and active local involvement in the regional CDQ program. While neither of these undertakings exclude non-Aleuts, Aleut individuals are disproportionately actively involved (relative to their overall representation in the community population).

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 of the shoreplants in the region, but it is also the site of a village that is geographically and socially distinct from the shoreplant. This 'duality' of structure has had marked consequences for the relationship of Akutan to fishery. 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 based upon the fact that 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 (i.e., 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 Aleutian Pribilof Island Community Development Association (APICDA) and others, Akutan was successful in a subsequent attempt to become a CDQ community and obtained that status in 1996. This action highlights the fundamentally different nature of Akutan and Unalaska. Akutan, while deriving economic benefits from the presence of a large shoreplant 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. While US 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 and one quite different from either Unalaska or Akutan. 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 Scandinavian, European, and Aleut fishermen. 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, although their structural relationships to the fishery have diverted since the passage of the American Fisheries Act (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.

The following two tables present information on income, employment, and poverty for the relevant groundfish communities of the region. These tables are based on 1990 U.S. Census data as the comparable 2000 data has not been released as of the time of this writing. Although these data are somewhat dated, they do provide useful comparative information. Table 4.7.2 displays median household and family income. As shown, the range is large for the communities shown. For example, median family income in both King Cove and Unalaska is approximately double the comparable figure for Akutan. This does not reflect the entire range for the region, however, as several communities in the region without commercial groundfish development (Adak, Atka, False Pass, and Nikolski) have lower median family income. In 1990, King Cove had the highest median family income in the region at $63,419 and Nikolski the lowest at $17,250.

Table 4.7.2 Household income information, selected Alaska Peninsula/Aleutian Island region communities, 1990.

Community	Housing Units	Occupied HU	Vacant HU	Total Households	Average Persons Per HH	Median HH Income	Family Households	Median Family Income
Akutan	34	31	3	31	3	27,813	19	31,875
King Cove	195	144	51	144	3	53,631	118	63,419
Sand Point	272	242	30	242	3	42,083	159	43,125
Unalaska	682	575	107	575	3	56,215	299	61,927

Source: US Bureau of Census

Table 4.7.3 displays data on employment and poverty information for the relevant communities for 1990. As shown, there is virtually no unemployment in these communities, no doubt due in large part to the presence of fishery related employment opportunities. Percentage of poverty varies between the communities, but these communities again do not represent the range of regional variation. In 1990, Atka had the highest unemployment in the region at 25.7 percent, whereas Cold Bay, False Pass, Nelson Lagoon, and Nikolski had no employment as all members of the workforce (a subset of the total population) that were seeking employment were actually employed. This figure is somewhat misleading as in some communities a large portion of the adult population may not be working and not seeking employment. In 1990, Nelson Lagoon was the extreme example of this with 81 percent of the adults not working. In 1990, percent of poverty in the region ranged from zero percent in Cold Bay to 42 percent in St. George. Data do not vary consistently with the presence or absence of commercial fishery development as might be expected. For example, Atka shows a very high rate of unemployment and percent of adults not working, yet there is a smaller percentage of persons in poverty than in Akutan, a community with an unemployment rate of less that one percent. This is attributable, in part, to the fundamentally different natures of the communities, with Atka being a small village and Akutan being a community with a large processing facility adjacent to the traditional village site. False Pass, Nelson Lagoon, Nikolski, and St. George, none of which have fish processing facilities, all have over 50 percent of the adults in the community not working. 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 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.

Table 4.7.3 Employment and poverty information, selected Alaska Peninsula/Aleutian Island region communities, 1990.

Community	Total Persons Employed	Unemployed	Percent Unemployment	Percent Adults Not Working	Not Seeking Employment	Percent Poverty
Akutan	527	2	0.4%	7.4%	40	16.6%
King Cove	276	5	1.8%	24.0%	82	10.0%
Sand Point	438	13	2.9%	32.1%	194	12.5%
Unalaska	2,518	26	1.0%	7.8%	186	15.3%

Source: US Bureau of Census

Population attributes of the resident groundfish fishery workforce

Beyond the overall population 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 associated with at least some of the alternatives would be felt among the local seafood processing workers, and these workers do not represent a random cross-section of the community demography. One method to examine the relative demographic composition of the local processing workforces is to utilize group quarter housing data from the U.S. Census (keeping with the established practice of using U.S. Census data for environmental justice analysis). This information is presented by community in the following series of tables. Unfortunately, ethnicity by housing type for the 2000 census has not yet been released at the time of this writing. The group ethnicity by housing type data in the following tables are therefore drawn from the 1990 census (and a subsequent section supplements this information with industry provided figures for 2000, see below). This is supplemented by age and sex data from the 1990 and 2000 U.S. Census to provide a cross check of census (and industry provided) data and the population structure over this period as well. (This approach is applied to other regions subsequently discussed as well.)

Table 4.7.4 provides information on group housing and ethnicity for Unalaska. Group housing in the community is largely associated with the processing workforce. As shown, 52 percent of the population lived in group housing in 1990. Also as shown, the total minority population proportion was substantially higher in group quarters (49 percent) than in non-group quarters (31 percent). With the population growth seen in association with the development of the commercial fishing industry, Unalaska's population has had significantly more men than women. Historically, this has been attributed to the importance of the fishing industry in bringing in transient laborers, most of whom were young males. Table 4.7.5 portrays the changes in proportion of males and females in the population for the years 1970, 1980, 1990, and 2000. Census data from the period 1970-1990 showed a climb in median age from 26.3 years to 30.3 years and then a further jump to 36.5 years in 2000. This is commonly attributed to the relative size of the workforce in comparison to resident families.

Table 4.7.4 Ethnicity and group quarters housing information, Unalaska, 1990

	Total Population		Group Quarters Population		Non-Group Quarters Population	
Unalaska City	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
White	1917	62.06	870	53.90	1047	70.98
Black	63	2.04	55	3.41	8	0.54
American Indian, Eskimo, Aleut	259	8.38	20	1.24	239	16.20
Asian or Pacific Islander	593	19.20	434	26.89	159	10.78
Other race	257	8.32	235	14.56	22	1.49
Total Population	3089	100.00	1614	100.00	1475	100.00
Hispanic origin, any race	394	12.75	337	20.88	57	3.86
Total Minority Pop	1252	40.53	795	49.26	457	30.98
Total Non-Minority Pop (White Non-Hispanic)	1837	59.47	819	50.74	1018	69.02

Source: Census 1990 STF2

Table 4.7.5 Population by age and sex, Unalaska: 1970, 1980, 1990, and 2000.

	1970		1980		1990		2000	
	N	%	N	%	N	%	N	%
Male	98	55%	858	65%	2,194	71%	2,830	66%
Female	80	45%	464	35%	895	29%	1,453	34%
Total	178	100%	1,322	100%	3,089	100%	4,283	100%
Median Age	26.3 years		26.8 years		30.3 years		36.5 years	

Source: US Bureau of Census

Table 4.7.6 provides information on group housing and ethnicity for Akutan. Group housing in the community is almost exclusively associated with the processing workforce. As shown, 85 percent of the population lived in group housing in 1990, which represents the extreme of the four communities considered in this region. Also as shown, the ethnic composition of the group and non-group housing segments were markedly different, with the non-group housing population being predominately (83%) Alaska Native, and the group housing population having almost no (1%) Alaska Native representation. Table 4.7.7 shows the population composition by sex in 1990 and 2000, and is clearly indicative of a male-dominated industrial site rather than a typical residential community.

Table 4.7.6 Ethnicity and group quarters housing information, Akutan, 1990.

	Total Population		Group Quarters Population		Non-Group Quarters Population	
Akutan	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
White	227	37.52	212	42.32	15	17.05
Black	6	0.99	6	1.20	0	0.00
American Indian, Eskimo, Aleut	80	13.22	7	1.40	73	82.95
Asian or Pacific Islander	247	40.83	247	49.30	0	0.00
Other race	29	4.79	29	5.79	0	0.00
Total Population	589	100.00	501	100.00	88	100.00
Hispanic origin, any race	45	7.44	45	8.98	0	0.00
Total Minority Pop	342	56.53	298	59.48	73	82.95
Total Non-Minority Pop (White Non-Hispanic)	247	40.83	203	40.52	15	17.05

Source: Census 1990 STF2

Table 4.7.7 Population by age and sex, Akutan: 1990 and 2000.

	1990		2000	
	N	%	N	%
Male	449	76%	549	77%
Female	140	24%	164	23%
Total	589	100%	713	100%
Median Age	NA		40.2 years	

Source: US Bureau of Census

Table 4.7.8 provides information on group housing and ethnicity for King Cove. As for the other communities, group housing in the community is largely associated with the processing workforce. As shown, 42 percent of the population lived in group housing in 1990. Also as shown, ethnicity varied between the group and non-group housing, with the non-group housing population being 67 percent Alaska Native and 6 percent Asian or Pacific Islander and the group housing population being 39 percent Alaska Native and 58 percent Asian or Pacific Islander. The male to female ratio shown in Table 4.7.9 is also consistent with a transient workforce.

Table 4.7.8 Ethnicity and group quarters housing information, King Cove, 1990.

	Total Population		Group Quarters Population		Non-Group Quarters Population	
King Cove	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
White	127	28.16	57	30.16	70	26.72
Black	6	1.33	6	3.17	0	0.00
American Indian, Eskimo, Aleut	177	39.25	1	0.53	176	67.18
Asian or Pacific Islander	125	27.72	109	57.67	16	6.11
Other race	16	3.55	16	8.47	0	0.00
Total Population	451	100.00	189	100.00	262	100.00
Hispanic origin, any race	53	11.75	53	28.04	0	0.00
Total Minority Pop	331	73.39	139	73.54	192	73.28
Total Non-Minority Pop (White Non-Hispanic)	120	26.61	50	26.46	70	26.72

Source: Census 1990 STF2

Table 4.7.9 Population by AGE AND SEX, King Cove: 1990 and 2000.

	1990		2000	
	N	%	N	%
Male	292	65%	472	60%
Female	159	35%	320	40%
Total	451	100%	792	100%
Median Age	NA		34.9 Years	

Source: US Bureau of Census

Table 4.7.10 provides information on group housing and ethnicity for Sand Point. As shown, 21 percent of the population lived in group housing in 1990, which is low for the four communities detailed within this region. Also as shown, almost no Alaska Natives live in group quarters, while few Asians live outside of group quarters. As shown in Table 4.7.11, the significant male to female imbalance seen in other communities is present in Sand Point as well.

Table 4.7.10 Ethnicity and group quarters housing information, Sand Point, 1990

Sand Point	Total Population		Group Quarters Population		Non-Group Quarters Population	
	Number	Percent	Number	Percent	Number	Percent
White	284	32.35	48	25.40	236	34.25
Black	4	0.46	4	2.12	0	0.00
American Indian, Eskimo, Aleut	433	49.32	3	1.59	430	62.41
Asian or Pacific Islander	87	9.91	80	42.33	7	1.02
Other race	70	7.97	54	28.57	16	2.32
Total Population	878	100.00	189	100.00	689	100.00
Hispanic origin, any race	78	8.88	58	30.69	20	2.90
Total Minority Pop	601	68.45	146	77.24	455	66.04
Total Non-Minority Pop (White Non-Hispanic)	277	31.55	43	22.76	234	33.96

Source: Census 1990 STF2

Table 4.7.11 Population by age and sex, Sand Point: 1990 and 2000.

	1990		2000	
	N	%	N	%
Male	557	63%	593	62%
Female	321	37%	359	38%
Total	878	100%	952	100%
Median Age	NA		36.5 Years	

Source: US Bureau of Census

Industry provided data

Information on 2000 workforce demographics was obtained for four of the six major groundfish shoreplants in the Alaska Peninsula/Aleutian Islands region, as well as one of the two floating processors that are classified as inshore plants. Communities cannot be discussed individually because of confidentiality concerns. However, the total combined reported workforce of 2,364 persons was classified as 22.5 percent white or non-minority, and 77.5 percent minority. Reporting shoreplants 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. However, all of the shoreplants in any region that provided detailed data have workforces that are 5 percent or less African American and 5 percent or less Alaska Native/Native American. 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 four 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 BSAI pollock fishery are those with populations comprised 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 comprised of Alaska Native residents. Further, the workforce at the processing plants that would likely feel the impacts of the alternatives are overwhelmingly comprised of minority workers. While no systematic quantitative data are known, field observations would suggest that for a very substantial portion of the workforce, English is a second language (this is reinforced by data from local schools regarding such as Unalaska, where 47 percent of the entering kindergarten students in 2000-2001 were ESL [English as a second language] students) and languages other than English are the commonly utilized in the workplace among processing crews. These factors, along with limited opportunity to acquire job skills in other economic sectors, would tend to indicate that these populations would be less able to easily acquire alternative employment outside of the seafood industry if there were widespread job reductions as a result of the alternatives. However, information on the level of job turnover/rates of rehire suggest that there is a fair degree of mobility among at least part of this workforce.

4.7.4 CDQ regions

The CDQ region of Western Alaska is an area of environmental justice concern with respect to the potential fishery management alternatives covered by this EIS. The CDQ program was specifically designed to foster fishery participation among, and direct fishery benefits toward, minority populations (87 percent of total population in these villages is comprised of Alaska Native residents) and low-income populations in the economically underdeveloped communities in Western Alaska. 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. Detailed descriptions of the CDQ regions and communities are contained in the Draft Programmatic SEIS (NMFS 2001a).

4.7.5 Summary of the effects of the alternatives

NMFS believes that the most significant economic and social effects will be felt in communities, and will not fall disproportionately on minority or low-income populations. While some fishermen and related industries may face changes in revenues, none are expected to cease operations and the economic effects do not fall disproportionately on minority or low income communities. Further, NMFS believes that the impacts are unavoidable in order to implement the provisions of the AFA. In order to mitigate these impacts, the AFA increased the allocation of pollock to the CDQ program from 7.5% to 10% of the TAC.

The proposed actions to implement the AFA could have social impacts, which are likely to be positive, based on recent fisheries. The impacts of the actions may vary depending on the location of the community and the particular involvement in the fishery (support industries, crew, etc.) Negative impacts may result from increased efficiency in the fishery as a result of slowed catch rates. This would result in slower processing and less need for additional processing staff during certain times. To the extent that processing jobs are lost as a result of the AFA, these impacts could fall disproportionately on minority or low-income populations which participate heavily in pollock processing jobs. While the benefits of the AFA are likely to accrue most heavily to the owners of pollock vessels and processors which are generally not from minority or low income populations. While the other alternatives considered could minimize the social impacts, these alternatives may not meet the objectives of the AFA.

4.8 Energy requirements and conservation potential of alternatives

For each fishery target, there are energy costs associated with traveling to, finding, catching, processing, and delivering the available quota. This, cost can be expressed as an energy use per ton of processed product and is a measure of the energy efficiency of the fishery. The energy efficiency varies extensively between target species, gear types, and areas and is primarily a function of the following factors:

Travel distance
Catch per unit effort
Vessel capacity
Gear type
Vessel displacement and available horsepower.

The total energy cost for a given fishery is the energy efficiency multiplied by the tonnage harvested, and fisheries management decisions that affect the amount of quota available for harvest will directly affect the total amount of energy required to harvest that quota. Thus, management regimes that result in lower TACs will result in lowered energy usage for the fishery. However, the energy savings that result from TAC reductions are somewhat illusory because, to the extent that the demand for fish products is inelastic, reducing harvest in one fishery simply serves to increase production in another fishery that 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.

The objective of Alternatives 2 through 5 is to increase the long-term socio-economic benefits of the pollock fisheries off Alaska. Under these alternatives, NMFS would expand the use of rights based fisheries management through increased reliance on cooperative programs. Because total harvest under these alternatives would not be expected to change significantly for most species, total fuel consumption would be expected to be similar to the No Action Alternative. In a rights-based fishery, fishermen are generally unable to increase their profit by increasing harvest and must focus on decreasing costs and increasing product value. To some extent, efforts to decrease costs will reduce fuel consumption. However efforts to increase product value could increase fuel consumption as fishermen seek to optimize product quality.

Any attempt to measure distance traveled by vessels under the AFA relative to fishing under a pre-AFA open access regime is complicated by the simultaneous implementation of Steller sea lion protection measures in 1999 and 2000. As such, any changes in distance traveled over those years is likely to be caused by the need to fish further offshore under the RPAs and the effects of the AFA alone are difficult to isolate. However Figure 4.8.1 displays the distance traveled by a random sample of catcher vessels during the pollock A season from 1997 through 2000. Clearly, the distance traveled during the A season for all vessels increased dramatically from 1999 to 2000.

Please see table of contents for figure or table.

4.9 Cumulative effects of the alternatives

Cumulative effects are linked to incremental policy changes that individually may have small outcomes, but that in the aggregate and in combination with other factors can result in major resource trends in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) ecosystems. This section analyzes Steller sea lion protection alternatives with other factors that affect physical, biological, and socioeconomic resource components of the BSAI and GOA environment.

The concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed by evaluating each action individually. A cumulative effects assessment describes the additive result of the many actions proposed in this SEIS. To avoid the piecemeal assessment of environmental impacts, cumulative effects were included in the 1978 Council on Environmental Quality (CEQ) regulations, which led to the development of the CEQs cumulative effects handbook (Council on Environmental Quality (CEQ) 1997) and federal agency guidelines based on that handbook (e.g., (Environmental Protection Agency (EPA) 1999). Although predictions of direct effects of individual proposed actions tend to be more certain, cumulative effects may have more important consequences over the long term. The possibility of these "hidden" consequences presents a risk to decision makers, because the ultimate ramifications of an individual decision might not be obvious. The goal of identifying potential cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of alternative management actions. This section characterizes the incremental cumulative effects that potentially arise from external factors in combination with the direct and indirect effects.

Methodology

The cumulative effects of groundfish fishing are analyzed in detail in the Alaska Groundfish Draft Programmatic SEIS (NMFS 2001a) and is described in greater detail in Section 4.13.1 and 4.13.2 of that document. The method used is as follows:

- Describe the potential direct and indirect effects of each of the five alternatives;
- Identify external factors such as other fisheries, other types of human activities, and natural phenomena that could have additive or synergistic effects;
- Use tables to screen all of the issues to capture those effects that are potentially cumulative in nature;
- Evaluate the significance of the potential cumulative effects using criteria appropriate to the resource category in question; and
- Discuss the reasoning that led to the evaluation, citing evidence from the peer-reviewed literature.

The advantages of this approach are that it (1) closely follows CEQ guidance, (2) employs an orderly and explicit procedure, and (3) provides the reader with the information necessary to make an informed and independent judgment concerning the validity of the conclusions.

External effects

A cumulative effects analysis takes into account the incremental impact of the proposed action when added to other past, present, and reasonablely foreseeable future actions (40 CFR 1508.7). For the purposes of this SEIS, the definition of other actions includes both human controlled events such as other fisheries, pollution and industrial development, and natural events such as disease, winter mortality, and short and long term climate change.

In order to ascertain the importance of the external impacts in the cumulative case, a comprehensive checklist was produced for each resource category (marine mammals, seabirds, target species, non-target species, prohibited catch species, habitat, socioeconomic characteristics, and ecosystem). Within each resource checklist the effects were divided into the two main categories (1) human controlled events and natural events. Due to inherent differences from natural resources, external effects impacting the socioeconomic category were developed to consider different events and topics.

Information presented in the checklists was obtained from reviewing environmental impact statements, reports and resource studies, and peer-reviewed literature, and was used as a tool in conjunction with information obtained from expert contributors to determine the +, -, or 0 ratings utilized in the tables.

Human Controlled Events. The detailed checklists address the following external actions which could be considered human controlled:

- Effects from other fisheries - Direct catch, bycatch, and direct and indirect mortality from foreign, joint venture (JV), State of Alaska and international halibut fisheries, commercial hunting and harvesting (as applied to marine mammals), and subsistence harvests.

- Anthropogenic effects - pollution, oil and gas activities, logging, creation of infrastructure (ports and harbors), commercial shipping effects, harassment, and introduced mammals (specifically applicable to seabirds).

Historical Fisheries (Foreign Joint Venture, and Domestic): Other fisheries considered in this cumulative effects analysis include foreign fisheries both today and in the past, and past JV fisheries. A very robust foreign groundfish fishery operated off Alaska long before the Magnuson-Stevens Act was passed in April 1976. The United States had little leverage to restrict the large offshore Japanese and Soviet operations during their initial build-up. U.S.-foreign bilateral agreements were the main mechanism for managing the foreign fisheries. By 1972–1973, foreign operations had spread from Alaska south to the Pacific Coast off Washington and Oregon, leaving very depressed stocks in their wake off Alaska. Catches of yellowfin sole in the eastern Bering Sea, for example, had fallen sharply following very large removals by Japan and the Soviet Union. Pacific ocean perch stocks in the GOA were decimated. Pollock catches were increasing rapidly and were thought likely to follow the same pattern as perch and flatfish. When the Magnuson-Stevens Act was passed in 1976, groundfish fisheries were, for all practical purposes, totally foreign. Most measures were designed to lessen their impact on domestic fisheries for halibut and crab. U.S. commercial fisheries were limited mainly to red king crab in the GOA and eastern Bering Sea, herring in coastal waters, salmon, and halibut. Very little groundfish, other than sablefish and small amounts of Pacific cod off southeast Alaska, were taken by the domestic fleet.

By the end of 1985, only minor foreign fisheries, directed on pollock and Pacific cod, were being allowed in the GOA. Foreign harvesting continued in the Bering Sea. Even there, foreign trawling had ended within 20 nautical miles (nm) of the Aleutian Islands, and foreign longlining for cod was restricted to north of 55°N and west of 170°W, depending on ice conditions. Foreign harvests dropped to less than 1 million mt in 1985. In contrast, U.S.- foreign JVs had grown rapidly through the early 1980s. They harvested about 880,000 mt in 1985, using over 100 U.S. trawlers working within some 28 different company arrangements with such countries as Japan, South Korea, Poland, the Soviet Union, Portugal, and Iceland. Completely domestic annual processing (DAP) reached 105,000 mt in 1985, mostly by trawler catcher/processors (a.k.a. factory trawlers).

During the five year period between 1986–1991, the groundfish fisheries became totally domestic. The last years of foreign directed fishing in the GOA and BSAI were 1986 and 1987, respectively. Foreign JV peaked in 1987, and their last years of operation in the Gulf of Alaska and the Bering Sea were 1988 and 1991, respectively. (Source for this entire subsection is Section 2.7.1.)

Current Foreign Fisheries (outside the Exclusive Economic Zone): Agreement between Japan, People's Republic of China, Republic of Korea, Republic of Poland, Russian Federation, and the United States that provides a management structure for the pollock fishery in the central Bering Sea. The Convention was initiated due to concern over the unregulated pollock fishery occurring in the central Bering Sea ("Donut Hole") during the mid- to-late 1980s.

The transboundary nature of pollock in the Bering Sea increases the stock's vulnerability to overfishing. Currently the condition of pollock within the western Bering Sea is difficult to determine due to differences in survey approaches. If significant harvest of juvenile pollock that will recruit to the eastern Bering Sea population occurs in the Russian Exclusive Economic Zone (EEZ) there could be a reduction in the exploitable biomass and yield in the U.S. EEZ. Management decisions made on poor knowledge of the pollock stock could be disastrous for the U.S. and Russian fisheries.[46]

High Seas Drift Net Fisheries: The world community did not consider high seas driftnetting a sustainable fishery. High bycatch, discards, and spoiled catch were associated with high seas driftnetting. United Nations General Assembly Resolution 46/214 banned large-scale high seas drift net fishing beginning in 1993. Nations of the world have for the most part complied with this non-binding resolution. With the exception of a few rogue vessels, this type of fishing is no longer conducted. The U.S. Coast Guard and Canadian Maritime Forces patrol the North Pacific to detect any possible illegal driftnet activity. (Source: http://russia.shaps.hawaii.edu/fishing/)

State of Alaska Fisheries: A summary of the scope of State of Alaska managed fisheries in the Bering Sea and Gulf of Alaska was provided in Chapter 4. Although not managed by the state, the International Pacific Halibut Commission (IPHC) fishery is included on this table.

Commercial and Subsistence Hunting and Harvesting (Marine Mammals): Hunting has had a major impact on populations of marine mammals in both the Bering Sea and GOA (National Research Council 1996). Over the past 200 years, nearly all species have been harvested for commercial an subsistence purposes. Grey whales, bowhead whales, fur seals, walruses, and sea otters have been severely reduced, but their populations are recovering. Species of relatively low commercial value such as Steller sea lions, and several species of seals including harbor seals were not severely depleted by hunting, but have been consistently hunted for their subsistence use.

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[46] C. Pautzke, "Personal Communication," North Pacific Fishery Management Council, 605 W. 4th Avenue, Suite 306, Anchorage, Alaska 99501-2252.

Native Subsistence Fisheries and Harvests: These fisheries have traditionally focused on near-shore species such as salmon, herring, shellfish (molluscan and crustacean), and a few demersal or groundfish species such as cod, halibut, and rockfish. These subsistence fisheries account for small amounts of fish relative to the commercial fisheries, and they continue in the present time.

Other Anthropogenic Effects: Pollution, harassment, and introduced mammals were determined to be not significant at the level of population effects for all resource categories (National Research Council 1996). Oil and gas leasing activities on the outer continental shelf of the GOA and BSAI were considered but are not incorporated into the analysis because such leasing is unlikely in the reasonably foreseeable future. Depending on the resource category, logging, creation of infrastructure (ports and harbors), and commercial shipping effects are considered in the Tier 2 matrices.

Natural Events. Natural events or phenomena considered in the checklists included:

- Climate effects – long and short term remotely forced sea surface temperature anomalies, and interdecadal climactic changes (regime shift);
- Life cycle effects – winter mortality and disease; and
- Trophic interactions – predation, competition and changes in community structure.

Climate Effects: Atmospheric forced sea surface temperature impacts include two principal modes of remotely forced sea surface temperature anomalies: shorter term El Niño/Southern Oscillation (ENSO) events and longer term Pacific decadal oscillations (PDO) (Mantua et al. 1997). These anomalies and their associated environmental changes are discussed in detail in Section 3.1.9.

The regime shift of 1976/1977 is now widely recognized, as well as its associated far reaching consequences for the large marine ecosystems of the North Pacific. The 50–70 year interdecadal variability (a two-regime cycle) has been prevalent from the eighteenth century to the present in North America and the likely cause is essentially an internal oscillation in the coupled atmosphere-ocean system. This suggests that the next climatic regime shift is most likely to occur in the coming decade between 2000 and 2007. Long-term changes in fish populations around the North Pacific have apparently been influenced by climatic change of the same 50–70 year variability. Section 3.1 of this EIS describes the regime changes and associated environmental impacts.

In many cases, the effects of climate shifts are scored as a "+/-" on the Tier 2 matrices. This score indicates that the climate shift could have positive or negative effects depending on the direction of the shift (colder or warmer water) and the species or group under consideration.

Life Cycle Effects: Disease was determined to be not significant at the level of population effects for all resource categories (National Research Council 1996), and therefore is not included on the Tier 2 matrices. In almost all cases, the effects of winter mortality of the species or group in a given resource category is unknown. This effect is also not included in the matrices.

Trophic Interactions: Where information was available, these interactions and how they shape community structure are included in the checklists. The effects are brought forward to the Tier 2 matrices only in cases where an indirect cause/effect relationship could be established for a given resource category.

General methodology used for marine mammal cumulative effects analyses

Marine mammals species or species groups in the BSAI and GOA considered in this analysis include pinnipeds, toothed whales, baleen whales, and sea otters. These categories are discussed individually in Sections 3.2 and 4.3 of this document. A detailed discussion of the approach used for the cumulative effect analyses presented in this section is presented in Section 4.13.1 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a).

The effects of the alternatives must be evaluated for all marine mammals that may directly or indirectly interact with this fisheries within the action area. As stated in the Alaska Groundfish Fisheries Draft Programmatic SEIS, this analytical approach allows for direct comparison of effects among multiple groups of marine mammals, each with varying levels of interaction with the fisheries.

The marine mammals or marine mammal groups which were screen for the cumulative effects analysis include: Steller sea lion, other ESA listed whales, other cetaceans, northern fur seal, harbor seal, other pinnipeds, and sea otters. Descriptions of these species and their important life history characteristics, population status, habitat requirements, prey species, and sensitivities to environmental stresses are discussed in further detail in Section 3.1 of the Alaska Groundfish Fisheries Draft Programmatic SEIS.

Direct and indirect impacts of the alternatives on marine mammals are evaluated in Section 4.3 of this document and rated as either significant, conditionally significant, or insignificant. For this analysis, two direct and two indirect effects are evaluated:

- Direct Effects: Incidental take or entanglement
Effects on Abundance of Prey

- Indirect Effects: Spatial and temporal harvest of prey
Disturbance

The cumulative effects analysis must also take into consideration actions that are external to the groundfish fisheries. A discussion of the external effects screened for cumulative effects analyses is presented in Sections 4.13.1 through 4.13.3. The external effects determined to be applicable to the marine mammals cumulative effects analyses include the following.

Past external effects:

- Foreign Fisheries (Section 2.7 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a) provides a description of the historical foreign fisheries in the region).

- Other Fisheries - joint venture (JV) and domestic groundfish fisheries (also see Section 2.7 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a)), State of Alaska managed fisheries, the International Pacific Halibut Commission (IPHC) managed halibut fishery, west coast drift gillnet fisheries.

- Subsistence harvest - both Alaskan and Russian native harvest

- Commercial harvest of seals and seal lions

- Commercial whaling
- Pollution - includes effects from the Exxon Valdez Oil Spill (EVOS)
- Climate Effects - short-term, long-term, regime shift.

Present and predicted future effects:

- Other Fisheries - State of Alaska managed fisheries (e.g., salmon drift and set gillnet, flatfish, sablefish and Pacific cod, herring roe and bait fishery, crab pot fishery), the IPHC managed halibut fishery, and west coast drift gill net fisheries.
- Subsistence harvest
- Climate effects - short-term, long-term, regime shift.

Not all of the external effects identified apply to all of the mammals species or groups. Discussions focusing on individual species or species groups follow and include information concerning external factors that are specific to the species or group.

The analysis of cumulative effects on marine mammals is conducted on species that were screened from the list of species or species groups discussed in Section 4.2 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). Screening criteria for species to be included in the cumulative effects analysis consisted of the intensity of direct effects and impacts of the groundfish fisheries on these species or species groups, and the potential influence of the management regimes on the identified impacts. Species or species groups which were analyzed in the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a) and found to have very limited interaction with the groundfish fishery and insignificant cumulative effects, were screened from further analysis in this document.

Marine mammals are discussed as individual species for the Steller sea lion, northern fur seal, harbor seal, and sea otter. Species groups are collectively analyzed for other ESA listed marine mammals (listed Great Whales), other cetaceans, and other pinnipeds. Cumulative effect tables are presented to show the relationship of the effect of the fisheries when added to the past, present, and reasonably foreseeable future external actions.

In addition to other Bering Sea fisheries, the long-term harvest of pollock in the Bering Sea by U.S. federally-managed vessels likely incurs cumulative impacts to the Bering sea ecosystem. The general characterization of the impacts of harvest to target and protected species include: 1) changes occurring in the population structure of the target species from fishing effort on those age classes selected by the fishery; 2) changes occurring in food availability to predators of pollock and predation by pollock; 3) shifts occurring in the community structure of the ecosystem as pollock are proportionally either retained by the ecosystem or removed from the ecosystem. Knowledge of these issues in described in Section 3.0 for affected species.

In addition to the U.S. federally-managed Bering Sea pollock fishery, which has been described above, other fisheries affect the Bering Sea ecosystem. Significant fisheries exist in the Bering Sea for crab, Pacific salmon, and halibut which incidentally catch pollock. Further, these fisheries and non-pollock groundfish fisheries harvest resources that compete with pollock and interact with them in the ecosystem.

General methodology used for groundfish cumulative effects analyses

Two direct and two indirect effects are considered for each target groundfish species or species group:

Direct Effects:	Fishing Mortality Spatial/Temporal Concentration of the Catch
Indirect Effects:	Prey Availability Habitat Suitability

Direct and indirect effects on target groundfish species are rated for the no action alternative (Alternative 1) and the proposed AFA-based alternatives (Alternatives 2 through 5). As described in above, the cumulative effect analysis must take into consideration actions that are external, as well as internal, to the groundfish fisheries. A discussion of the external effects screened for cumulative effect analyses is presented above. These effects must include both past effects that have a lingering influence (past influence), present, and predicted future external effects. The external effects determined to be applicable to the target groundfish species and other species cumulative effects analyses include the following:

Past external effects

- Foreign Fisheries (a description of the historical foreign fisheries in the region is provided in Section 4.13.1 of the Alaska Groundfish Fisheries Draft Programmatic SEIS).
- Other Fisheries - Joint Venture (JV) and Domestic groundfish fisheries, State of Alaska managed fisheries, the IPHC managed halibut fishery (see Section 4.13.1 of the Alaska Groundfish Fisheries Draft Programmatic SEIS)
- Subsistence Fisheries
- Seal Harvesting
- Whaling
- Pollution - includes effects from the Exxon Valdez oil spill (EVOS)
- Climate Effects - short-term, long-term, and regime shift.

Present and predicted future effects

- Other Fisheries - State of Alaska (state) managed fisheries (e.g., scallop, flatfish, sablefish, Pacific cod, herring roe and bait fishery, and crab pot fishery), the IPHC managed halibut fishery, and sport fisheries (halibut and salmon).
- Subsistence Fisheries
- Climate Effects – short-term, long-term, and regime shift.

Not all of the external effects identified above are pertinent to all target groundfish species or other species. Discussions focusing on individual species or species groups follow and include information concerning external factors that are specific to the species or group.

4.9.1 Steller sea lions

Table 4.9.1 presents the results of the cumulative effects analysis in matrix form for each alternative plan. AFA-based alternatives 2 through 5 are treated as equivalent and combined into a single table. Discussion and comparison of the results follow.

Past external influences

Past external adverse effects on Steller sea lions are discussed in Appendix J Section 1.2 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). Past effects were identified for foreign fisheries, other fisheries, and commercial harvest. It was not until after the 1950s that large numbers of Steller sea lions were taken in the commercial fisheries in the regions (Alverson 1992). The take of Steller sea lions was substantial during this period with over 20,000 animals believed to have been incidentally killed in the foreign JV fisheries from 1966 to 1988, although data from this period is not complete (Perez and Loughlin 1991).

Other fisheries such as State-managed salmon drift and set gill net fisheries contributed to the overall take of Steller sea lions in the past. Intentional shooting of Steller sea lions also occurred in several near shore fisheries and this continued to some extent after the enactment of the Marine Mammal Protection Act (MMPA) in 1972 until the early 1990s when they were listed as threatened under the Endangered Species Act (ESA) and a ban on shooting at Steller sea lions was enacted (Hill and DeMaster 1999).

Little information is available on the fluctuations of Steller sea lion population prior to the 1960s but it is suspected that decreases in population numbers were likely due to human exploitation (National Research Council 1996). Direct take of Steller sea lions during this early period has been estimated to range between about 300–500 animals annually (Trites 1992). Take of Steller sea lions in commercial fisheries was considerable in the past, with approximately 1,500 per year from 1966 to 1977 and 650 per year from 1978 to 1988. Take of Steller sea lions had dropped dramatically in the 1990s to an average of 26 per year (NMFS 2000c)). It is likely that historic commercial harvests for pelts also have had residual effects on the present day population levels of Steller sea lions in certain areas. However, a drastic decline in Steller sea lion numbers has still occurred in some North Pacific regions since protection for the species was instituted.

Other external human-controlled factors such as oil spills have had effects on Steller sea lions in past years. A number of Steller sea lion haulouts and rookery sites were affected by the EVOS in Prince William Sound in 1989, but insufficient data exists to determine the overall impact of the spill on the population. Entanglement in marine debris is also a source of mortality with an estimated 100 Steller sea lions killed each year.

Present and predicted external effects

Present and predicted external effects on Steller sea lion take include mortality from other fisheries. Based on satellite tracking data, Steller sea lions rarely travel outside the U.S. Exclusive Economic Zone (EEZ); therefore, the probability of Steller sea lion mortality from foreign fisheries is believed to be very low and insignificant (Hill and DeMaster 1999). The contribution to direct mortality of Steller sea lions from other fisheries is also relatively low; for the Prince William Sound drift gillnet fishery, the direct mortality is estimated at 14.5 animals per year for the years of 1990 and 1991 based on observer data (Hill and DeMaster 1999). Reported mortalities from six fisheries which did not employ observers are approximately 6.1 animals per year (Hill and DeMaster 1999). The total take from groundfish fisheries and other fisheries is approximately 30 animals per year (Hill and DeMaster 1999).

External effects of short-term or inter-annual climate changes such as the El Niño are not expected to result in population level effects on Steller sea lion since these animals are relatively long-lived, K-selected species. Long-term climate change or regime shifts can potentially affect Steller sea lions either positively or negatively, depending on the direction of the change. Long-term or inter-decadal climate change has been postulated as a primary factor in the current decline of the Steller sea lion which began in the early 1970s in the eastern Aleutian Islands, and then in the central and western Aleutian Islands and in the western GOA. It is suspected that the steep declines in Steller sea lion numbers were due, in part, to long-term, climate-induced changes in the abundance and distribution of food for juveniles during a critical time in their life (National Research Council 1996). It has been suggested that declines in food availability and in the abundance of high-quality forage fish resulted in food-related stress in several species of marine mammals and seabirds (Anderson and Piatt 1999; Merrick et al. 1987; Piatt and Anderson 1996).

Subsistence harvest is a major source of sea lion mortality in both the BSAI and GOA. Most of the subsistence harvest of Steller sea lions is by Aleut hunters targeting animals from the western U.S. stock in the Aleutian Islands and the Pribilof Islands (Wolfe and Hutchinson-Scarbrough 1999). The mean annual harvest for the years 1993 to 1995 was 412 animals. In recent years, however, Steller sea lion harvest has decreased along with the overall population of sea lions. The subsistence harvest between 1996 and 1998 was approximately 182 animals per year, primarily from the western U.S. stock of Steller sea lions.

Cumulative effects

Incidental take/entanglement: Direct take of Steller sea lions is found to be cumulative based on the external effect of other fisheries and subsistence when added to the numbers of Steller sea lions taken by the groundfish fisheries. The estimated annual incidental take level of Steller sea lions under all of the alternatives is 5 sea lions (with a confidence interval [CI] = 3 - 7 sea lions. If the take ratio is determined based on estimated TAC, the Steller sea lion take would be likely similar as past years since the same amount of fishing effort will occur.

When the annual take from fisheries is combined with the annual subsistence harvest, the total take is about 88% of the PBR of 234 animals as calculated under the MMPA for the western U.S. stock of Steller sea lions (Hill and DeMaster 1999). This level of take of Steller sea lions under the status quo management regime in the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a) was rated as insignificant and consequently, and take under all of the alternatives would also considered insignificant.

Entanglement of Steller sea lions in derelict fishing gear or other materials seems to occur at frequencies that do not have significant effects upon the population. Considering that the overall take including entanglement is below the PBR, the cumulative effect for all of the alternatives is considered to be insignificant.

Effects on prey abundance: Past external adverse influences on abundance and availability of prey for Steller sea lions are discussed in Section 4.13 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a)and included here. Effects have been identified for foreign fisheries and state-managed fisheries, such as salmon and herring, through removal of important prey species of the Steller sea lion.

Temporal/spatial concentration of fishery: Past external adverse effects are identified relative to the spatial and temporal harvest of prey species of Steller sea lions. Currently, to minimize potential indirect interaction with Steller sea lions, the groundfish harvest seasons are managed to occur over broader geographic areas and over seasons that are less contracted in time. Because the development of Steller sea lion management measures over the past 2 years and proposed Steller sea lion management measures under Amendments 70/70 presume the continued effectiveness of the AFA, the effects of reverting to a pre-AFA management regime under Alternative 1 is rated as conditionally significant negative, primarily due to the resulting disruption in Steller sea lion protection that would occur and secondarily due to the potential for increased temporal and spatial concentration of fishing effort.

Present and predicted external influences on spatial and temporal harvest of prey are identified primarily for other fisheries. The effect on the spatial and temporal harvest of prey is considered cumulative and is found to be conditionally significant negative for all alternatives based on uncertainty regarding the actual effects of harvest of Steller sea lion prey species within Steller sea lion foraging habitat. Under Alternatives 2 through 5 which are expected to result in greater temporal and spatial dispersion of fishing effort, this cumulative effect is found to be better than Alternative 1 but still not enough to reverse the expected further decline in the population of Steller sea lions.

Disturbance: Past external influences of disturbance are identified for foreign fisheries and state-managed fisheries. Disturbance of prey by fishing activities is recognized as a potential factor affecting Steller sea lions but is not believed to produce effects at the population level. The limits on fishing activity within critical habitat are expected to offer some level of protection from these disturbances. Disturbance from vessel traffic and acoustic disturbance from trawling is an ongoing condition of these areas, and Steller sea lions appear to be tolerant of at least some anthropogenic effects. Overall, the current level of disturbance related to the groundfish fishery is rated as insignificant.

Present and predicted external effects of disturbance are primarily associated with other fisheries such as State-managed salmon and herring fisheries. The disturbance effect is found to be cumulative but is considered to be insignificant for all of the alternatives.

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4.9.2 Great whales (ESA listed)

Seven species of large whales occur in Alaskan waters are listed under the ESA including: the North Pacific right whale, blue whale, fin whale, sei whale, humpback whale, sperm whale, and bowhead whale. Direct interactions with groundfish fishery vessels have been documented between 1989 and 2000 for three of the seven species: fin, humpback, and sperm whales. There is generally little overlap between baleen whales and the groundfish fisheries. Several cases of entanglements in marine debris also have been reported for humpback and bowhead whales. Four of the seven species listed consume groundfish as part of their diet: fin, sei, humpback, and sperm whales. Cumulative effects are analyzed jointly for all alternatives since the effects are not expected to differ across the alternatives.

Past internal and external effects

As shown in Table 4.9.2, early commercial harvest of whales were found to have a substantial adverse effect on populations of great whales in the BSAI and GOA. Between 1950s and the 1970s, tens of thousands of whales were harvested in the North Pacific. Residual effects of this slaughter remain for most of the species with depressed population with for possibly the gray whales. Other external effects include entanglement in fishing gear from State-managed fisheries such as salmon and herring. Mortality from entanglements are typically in the single digits per year (Hill and DeMaster 1999).

Present and predicted external effects

External effect are presented in Table 4.9.2. Present and predicted external effects are similar to past effects except for mortality from commercial whaling which no longer occurs.

Cumulative effects

Incidental take/entanglement: Past external and residual effects of commercial whales have been demonstrated for all of the great whales in the BSAI and GOA (except for gray whales). Present and predicted external effects are minor since commercial whaling no longer conducted but do include entanglement in west coast drift fisheries and subsistence whaling by Alaska Natives. Direct and indirect effect of the groundfish fisheries is primarily entanglement but this is quite rare for most species doesn’t result in effects at the population level. Therefore, the cumulative effect of take and entanglement is found to be cumulative but considered insignificant to all of the great whale species that occur in the BSAI and GOA.

Effects on prey abundance: There is very little overlap between fish targeted by the groundfish fisheries and species used by the great whales. Some baleen whales consume forage fish, herring and juvenile pollock. Toothed whales diet consists largely of fish and squid and generally do not overlap with groundfish fisheries except for sperm whales which are know to predate fish on longlines. However, interactions with commercial fisheries rarely result in an adverse effect on the whales. Direct and indirect effects of the groundfish fisheries prey of the great whales are not identified for any of the five alternatives considered. Because of a lack of effect of the fisheries on these whales, a cumulative effect on prey abundance was not identified.

Temporal/spatial concentration of fishery: Based on the lack of overlap between the prey of these whales and the groundfish fisheries, no cumulative effect for spatial/temporal harvest was identified.

Disturbance: Past external effects of disturbance was identified for great whales throughout their range from foreign/joint venture fisheries, other fisheries, subsistence and commercial harvest. Present and predicted effect are similar except for commercial whaling which doesn’t occur anymore. Based on the very minimal overlap between the groundfish fisheries, effect of disturbance for all of the alternatives is considered insignificant. This lack of direct or indirect effect resulted in no cumulative effect identified for disturbance.

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4.9.3 Other cetaceans

Other cetaceans is a group of marine mammals consisting of ten species of whales and dolphins occur in Alaskan waters and are protected under the MMPA (but not listed under the ESA) including: the gray whale, minke whale, beluga whale, killer whale, Pacific white-sided dolphin, harbor porpoise, Dall's porpoise and beaked whales (Baird's, Cuvier's and Stejneger's). Only five of these species have been documented to interact to some extent the groundfish fisheries. Interactions between commercial fisheries and a few of these species are well known, particularly predation of longline catch by killer whales. However, interactions which result in harm, other than occasional incidental takes, are essentially unknown. No discernable difference was detected among the five alternative, therefore, effects are discussed together for all of the alternatives.

Past external influences

External effects on this group have also been identified from State-managed fisheries such as salmon drift and set gillnet fisheries, but these effects are likely to be very minor. Little is know of possible past effects of climate change or regime shifts on these species. It is assumed that natural events could have both positive and negative effects, primarily to toothed whale prey. Since these are generally long-lived, K-selected species, short-term climate changes would not be expected to have substantial effects at the population level.

Present and predicted external effects

Present and predicted external influences would be expected to relate primarily to long-term climate change or regime shifts. The effects of these events on whales and porpoise are difficult to predict, but could potentially have either a positive or negative effect.

External effects associated with the status quo are depicted in Table 4.9.3. Many of these effects are the same as those described above with the exception of commercial whaling which is no longer a factor for whale mortality. However, both of these external effects are likely to be very minor.

Cumulative effects

The cumulative effects analysis as described below is depicted in Table 4.9.3.

Incidental take/entanglement: Past external effect from incidental take or entanglement is rare for this group. Records of toothed whale entanglement in derelict fishing gear are almost entirely absent (Laist 1997); therefore, the status quo has essentially no effect in this regard. A single minke whale mortality was reported in the BS/GOA joint-venture trawl fishery (predecessor of the current fishery) in 1989. Absent a contribution from the groundfish fisheries, the effect of take on this group is not found to be cumulative.

Effects on prey abundance: BSAI and GOA groundfish fisheries do not target prey items of baleen whales, thus the fisheries are unlikely to impact the whales through competition for prey. Little overlap occurs with the primary prey species of toothed whales with the possible exception of killer whales. Because of a lack of effect attributable to the groundfish fisheries, a cumulative effect on the prey of this marine mammal group is not identified.

Temporal/spatial harvest of prey: Given the lack of overlap with regard to prey species consumed by whales and porpoise relative to target species of the fisheries, spatial or temporal effects of harvest are not expected. Therefore, the effect is not found to be cumulative.

Disturbance: External factors of disturbance are identified for these whale and porpoise throughout their range. However, disturbances caused by vessel traffic, noise, or fishing gear are likely to be minimal. Given the minimal spatial, temporal, and dietary overlap with groundfish fisheries, the effect is found to be insignificant under the status quo. Present and predicted external factors are identified primarily as other fisheries, but the effects are also expected to be minor. The effect of disturbance is considered cumulative, but the low level of the effect on whales results in it being rated as insignificant.

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4.9.4 Northern fur seal

Past external influences

Past external effects are excerpt from those discussed in Appendix J, Section 1.3 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). Amendments to the groundfish fishery management plans (FMPs) since 1990 have included several that were implemented for improvements in the management of fisheries which have indirect benefits for marine mammals, including the northern fur seal. These included FMP amendments BSAI 13, 27, and 37 and GOA 18 and 30 which dealt with the fisheries observers program for domestic fisheries, and FMP amendments BSAI 28 and GOA 45 which distributed target groundfish efforts both spatially and temporally. FMP amendments specifically approved to benefit marine mammals included BSAI 36 and GOA 39 which established a forage fish category and allocated a zero harvest quota to that category, and FMP amendments BSAI 20 and GOA 25 which reduced the commercial groundfish fisheries effects on Steller sea lions. All of these actions would be expected to have some positive effect on the northern fur seal.

A conservation plan for the northern fur seal was written to delineate reasonable actions to protect the species (NMFS 1993a). Fisheries regulations implemented in 1994 (50 CFR 679.22(a)(6)) created a Pribilof Islands Area Habitat Conservation Zone, in part to protect northern fur seals.

Incidental take of fur seals from foreign and joint venture trawl fisheries from 1978 to 1988 was approximately 22 animals per year (Perez and Loughlin 1991). The now prohibited foreign high seas drift net fisheries killed high numbers of fur seals, ranging annually from an average take in the low thousands up to 5,200 fur seals in 1991 (Hill and DeMaster 1999). Closure of the high seas drift net fishery has likely ended this substantial source of fur seal mortality.

Commercial harvest of fur seals has been a major source of human-induced mortality for over 200 years, and the abundance of fur seals has fluctuated greatly in the past, largely due to this commercial harvest (NMFS 1993a). Commercial harvest of fur seals peaked during 1961 with over 126,000 animals harvested, and the commercial harvest of fur seals ended in 1985 (NMFS 1993a). Residual effects of past commercial harvests on the fur seal population are possible, but recent population declines have overshadowed any potential lingering residual effects. The northern fur seal was listed as a depleted stock under the Marine Mammal Protection Act (MMPA) in 1988. The reason for the listing was the steep decline in numbers and lack of compelling evidence that the fur seal habitat carrying capacity had changed substantially during that time (NMFS 1993a). Under the MMPA, this stock remains listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60% of carrying capacity). The northern fur seal population appears be stable at the present time based on pup counts at breeding rookeries on St. Paul and St. George Islands (NMFS 1993a).

State-managed fisheries such as the salmon drift net fisheries have had a negligible effect on the overall take of fur seals since the average annual take attributed to these fisheries approaches zero.

Present and predicted external effects

Most of the external effects are similar to the past effects except for the commercial harvest of fur seals, an activity which no longer occurs.

Cumulative effects

As summarized in Table 4.9.4, cumulative effects are addressed for direct and indirect effects of fisheries.

Incidental take/entanglement: Past external effect on northern fur seal mortality have been considerable and have contributed to population declines, especially from foreign fisheries and commercial harvest.

Present and predicted external effects include mortality sources while these animals are outside the EEZ and small levels of take in State-managed gillnet fisheries in Prince William Sound, Alaska Peninsula and Bristol Bay.

The incidental take of northern fur seals is uncommon in the groundfish fisheries. The last recorded mortality in any Alaskan groundfish fishery occurred in 1996, when the take rate was one animal per 1,862,573 mt of groundfish harvested. This level of take contributes little to the northern fur seal PBR of 18,244 (Ferrero et al. 2000) and is inconsequential to population trends.

Entanglement in marine debris is more common in fur seals than any other species of marine mammal in Alaskan waters (Laist 1987; Laist 1997). Mortality of northern fur seals from entanglement in marine debris contributed significantly is thought to declining trends in the Pribilof Islands during mid to late 1970s and early 1980s. The contribution of the groundfish fishery is thought to be less than in previous years but continues to affect the fur seal population. Considering the multiple source do debris beyond the control of fisheries managers (i.e., foreign fisheries, international shipping, and shoreside refuse) and effects from the groundfish fisheries are decreasing, effects under all of the alternatives are considered insignificant.

Effects on prey abundance: Past external effect on prey of northern fur seal has likely occurred to some extent from joint venture and foreign fisheries and potentially state- managed fisheries. Present and predicted external effect are likely associated with climate change or regime shifts based on their wide distribution in the eastern Pacific which would make the susceptible to large-scale regional changes in climate.

Trawl closures around the Pribilof Islands, established mainly for the protection of crab stocks, may offer positive benefits for fur seals by limiting prey removals in waters surrounding the Pribilof Island rookeries. However, only northern fur seals that forage close to the islands would benefit by the availability of prey and recent tracking studies show that foraging trips of both adult female and juvenile male fur seals extend well beyond the trawl closure boundaries. Partitioning of foraging habitat by lactating fur seals on the Pribilof Islands indicates that the Pribilof Islands Area Habitat Conservation Zone would primarily benefit females from northwest St. Paul Island and provide less protection to the foraging habitat of females from southwest St. Paul Island or St. George Island.

Catches of squid and small schooling fish in the groundfish fisheries of the BSAI and GOA are very low and are not expected to effect fur seal populations. Fisheries for pollock do not target fish younger than 3 years of age, the preferred size by foraging fur seal (Dorn et al. 1999; Ianelli and Gaichas 1999). The overall catch of pollock smaller than 30 cm is small, and thought to be only 1 to 4% of the number of one- and two-year olds each year in the eastern Bering Sea and GOA (Fritz 1996).

While fisheries do harvest prey of northern fur seals (i.e., pollock and Pacific cod), competition due to the harvest rates of those species may vary depending on several factors. The overall catch of juvenile pollock has tended to be low in recent years and the degree to which adult pollock occur in the northern fur seal diet is not certain. While the potential overlap with fisheries may be moderated by these factors, effects on northern fur seals may yet exist, the relevance of which is not reflected by estimates of biomass removals over large geographical areas. Therefore, all of the alternatives are considered to have conditionally significant negative impacts on northern fur seals, but the case for such effects may be weaker than the case for Steller sea lions.

Effects on availability of fur seal prey was found to be cumulative based primarily overlap of the groundfish fisheries and on the lack of information that food availability is not related recent population declines. The cumulative effect is considered conditionally significant negative. However, the contribution of the groundfish fisheries to this cumulative effect is believed to be minor.

Temporal/spatial concentration of fishery: The competitive overlap between fisheries for Pacific cod and pollock and northern fur seals is influenced by several factors determining whether removals are concentrated in space or time.

- competition may vary depending on the availability of smaller prey in foraging areas.
- 45% 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 used by fisheries.
- fishery harvest rates during summer on adult pollock and Pacific cod in areas used by fur seals are below the annual target rates for the fish stocks as a whole (NMFS 2000c).
- pollock fishery in the Bering Sea (summer season) begins on September 1, late into the fur seal breeding season (June-October).

While these factors lower the probability of adverse impacts stemming from spatial or temporal concentration of fisheries in northern fur seal foraging areas, changes in harvesting activity and/or concentration of harvesting activity in space and time may differentially impact fur seal foraging habitat at both the population and sub-population level. Given the uncertainty in the degree to which fur seals compete with the fishery for adult pollock in fur seal foraging areas where spatial and temporal overlap has been identified, it is assumed that conditionally significant negative effects could occur.

Spatial/concentration harvest of prey is considered cumulative and based on remaining uncertainty as the effect of harvest on fur seal populations. This cumulative effect is considered conditionally significant negative.

Disturbance: The potential for disturbance effects caused by vessel traffic, fishing gear, or noise appears limited for northern fur seals. Interactions with other types of fishing gear, such as trawl nets, also appear limited based on the rare incidence of takes in groundfish fisheries. Disturbance effects on northern fur seal prey are difficult to identify Thus, the measures under all of the alternatives are consistent with efforts to avoid these kinds disturbance effects on northern fur seals. The variability of potential disturbance effects among years and between breeding groups on each island suggests that the intensity of disturbance effects under all of the alternatives are conditionally significant at the population level.

A cumulative effect was identified for disturbance but lacking an indication of an adverse effect from disturbances, the cumulative effect is considered insignificant.

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4.9.5 Harbor seal

Past external influences

Detailed description of past influences on harbor seals are provided in Appendix J, Section 1.2 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). Amendments to the fishery management plans (FMPs) since 1990 include measures implemented to improve management of the fisheries which also had indirect benefits for marine mammals, including the harbor seal. These amendments included BSAI 13, 27, and 37 and GOA 18 and 30 which dealt with the fisheries observer program for domestic fisheries, and BSAI 28 and GOA 45 which distributed target groundfish efforts both spatially and temporally. Amendments specifically approved to benefit marine mammals included BSAI 36 and GOA 39 which established a forage fish category and allocate a zero harvest quota to that category, and BSAI 20 and GOA 25 which reduced the commercial groundfish fisheries impacts on Steller sea lions. All of these actions would be expected to have some positive effect on the harbor seal.

Past external effects on harbor seal are presented in Table 4.9.5. These external effects were screened from a wide variety of potential factors which influenced the harbor seal populations. The dominant influences considered in the cumulative effects analysis include past commercial harvest, subsistence, and other fisheries (foreign joint venture (JV) and state-managed).

Foreign JV fisheries have likely contributed to some level of harbor seal mortality but there is minimal data on the actual effects. Based on the near shore distribution of harbor seals, there was likely negligible interaction between the early foreign fisheries and harbor seals and mortality is believed to have been very low.

State-managed fisheries, primarily salmon set and drift gillnet fisheries, have contributed to harbor seal mortality in the past from direct interaction with fishing activities. Harbor seal mortality in the state-managed salmon drift and set net fisheries has been estimated to average about 31 animals per year over a 6-year period for the Bristol Bay area, one of the most heavily fished areas (Hill and DeMaster 1999). The effect of other state-managed fisheries on harbor seals would be expected to be much lower. These fisheries self-report harbor seal mortality; therefore, the actual take of animals in these fisheries is likely under reported.

Commercial harvest of harbor seals occurred on a regular basis throughout the animal's range until the early 1970s following passage of the Marine Mammal Protection Act of 1972 (MMPA). Both adult seal and pups were harvested for pelts (Pitcher and Calkins 1979). Harvest rates from this early period could have residual effects on the present day harbor seal population in many areas.

Present and predicted external effects

External effects associated with the groundfish fishery are depicted in Table 4.9.5. Most of the present and predicted external effects are similar to the past effects except for the commercial harvest of seals, which no longer occurs. Pollution events such as the Exxon Valdez Oil Spill (EVOS) can also adversely affect harbor seals. These events are very rare and were not considered as major external influences. The predicted effects of all of the alternatives are the same and treated together.

Incidental take/entanglement: Past external effects contributing to incidental take of harbor seals are identified for foreign and joint venture fisheries, state-managed fisheries, the subsistence, and commercial sealing. Incidental take of seals in commercial groundfish fisheries in the GOA and BSAI is uncommon largely due to the near shore distribution of this species. Collectively, harbor seal mortalities attributable to fisheries amount to less than 0.2% of the GOA and southeast Alaska harbor seal PBR for these stocks (Hill and DeMaster 1999). In the BSAI, fisheries-related mortality of harbor seals represents approximately 1% of the PBR of the Bering Sea harbor seal population. These low levels of take are considered insignificant to the population as a whole.

Present and predicted external influences include other fisheries and the subsistence harvest. The near shore distribution of harbor seals results in direct interaction with several State-managed fisheries, such as the Bristol Bay salmon drift and set gillnet fisheries with approximately 27 animals per year. Fisheries in the Prince William Sound, Cook Inlet, and Kodiak set gillnet and Alaska Peninsula drift gillnet and set gillnet fisheries which collectively account for mortality of approximately 10 animals per year (Hill and DeMaster 1999). Approximately 31 animals per year are lost through interaction with GOA fisheries (PBR=868).

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. The annual subsistence harvest from this stock from 1994 to 1996 was approximately 161 animals, well below the PBR (379).

The average annual subsistence harvest from the GOA between 1992 and 1996 was 791 animals, just below the PBR for this stock. The latest available harvest data from1998 (792) is comparable to the average subsistence harvest of harbor seals from previous years (Wolfe and Hutchinson-Scarbrough 1999).

Overall, the effect of take of harbor seals is found to be cumulative due to the additional external mortality as discussed above. The contribution from the groundfish fisheries to total take of harbor seals is quite small relative to the subsistence harvests. However, considering the total take is well below the PBR for this species, the cumulative effect is considered insignificant.

Effect on prey abundance: Past adverse external effects on harbor seal prey availability are identified for foreign fisheries, state-managed fisheries, and the potential effects of climate change or regime shifts. Harbor seals have a relatively diverse diet, but there is overlap with commercial groundfish fisheries, primarily for pollock, Atka mackerel, and Pacific cod. Therefore, harbor seals may be indirectly affected by the BSAI pollock fishery, especially in the Aleutian Islands regions.

The effect of the alternatives on availability of prey was considered conditionally significant adverse, based on the uncertainty of impact on the local level. Overlap in species targeted by harbor seals and the fisheries also occurs with state-managed fisheries such as salmon and herring. Other possible external effects can result from climate change (positive or negative) or effects of a regime shift on prey species availability. With the contribution of external factors, a cumulative effect is identified and is rated as conditionally significant negative.

Temporal/spatial concentration of fishery: Present and predicted external influences on spatial/temporal harvest are identified for other fisheries such as state-managed fisheries. Spatial partitioning between the offshore commercial groundfish harvest and the near shore distribution of harbor seals limits the degree of competition for prey species. Fishery harvests from nearshore areas used as by harbor seals as foraging habitat would have a much greater effect on seals than pelagic fishery removals. Because little overlap exists between the directed pollock fishery and harbor seal foraging, this effect was considered insignificant for all alternatives.

Disturbance: Disturbance by the groundfish fisheries appears to be limited for harbor seals due to their near shore distribution and is likely not a important consideration for harbor seals and is rated as not significant. External effects of disturbance are considered primarily from other fisheries, such as State-managed salmon and herring and the disturbance effects are considered cumulative. However, there is little evidence that suggests this level of disturbance adversely affects harbor seals and, therefore, the cumulative effect is considered insignificant.

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4.9.6 Other pinnipeds

Other pinniped is a species group which includes a variety of marine mammals that have relatively little overlap with the groundfish fisheries but do occur in the BSAI and GOA. Species include in this group include: the ice seals (spotted, bearded, ringed, and ribbon seals), Pacific walrus, and northern elephant seal. Ecological interactions between these species and commercial groundfish fisheries are limited by both spatial separation and differences between commercial harvest targets and the species food habits. The effects on this group are not expected to vary across the 5 alternatives.

Past internal and external effects

The Pacific walrus is the only species which has received special attention from past fisheries management actions. Round Island, is a State of Alaska Preserve and in 1990, fishing regulations prohibit fishing vessel enter within 12 mile of Round Island from April 1 to September 30.

The primary adverse effect on this species group is subsistence, except for the northern elephant seal. Most of the harvest of the ice seals is in the western Bering Sea by Russian hunters. All of the ice seals and walrus are susceptible to climate change due to their dependance on pack ice in the Bering sea.

Present and predicted external effects

Many of the present and predicted external effect are the same as described for the past external effect, all of which are considered minor.

Cumulative effects

Incidental take/entanglement: Past external adverse effects were identified for foreign fisheries in the northern Bering Sea. Subsistence harvest of ice seals and walrus has not appear to had effect at the population level. Subsistence harvest of walrus and seals by Natives hunters in the past has contributed to take of most of these species in the BSAI region, but effects have not been observed at the population level (Hill and DeMaster 1999). Lacking internal effects from the groundfish fisheries, no cumulative effect was found for incidental take/entanglement.

Harvest of prey species: Past external adverse effect on prey of these species has not been identified. Present and predicted effect of the groundfish fisheries are lacking, therefore, the no cumulative effect was identified for effect on prey or temporal/spatial effects of harvest of prey species.

Temporal/spatial concentration of fishery: Present and predicted effect of the groundfish fisheries, given the general lack of spatial, temporal, or dietary overlap, disturbance effects caused by vessel traffic, noise, or fishing gear are likely to be small under all of the alternatives.

Disturbance: Individual animals in the pinniped group venturing into fishing areas could temporarily modify their behavior from disturbance of fishing activities. Disturbance was found to be cumulative based on external factors and very limited overlap of the groundfish with the range of these species but the cumulative effect is considered insignificant.

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4.9.7 Sea otters

The sea otter population in Alaska is neither listed as threatened or endangered under the ESA nor as depleted under the Marine Mammal Protection Agency. Minimal overlap occurs between the sea otter population and the groundfish fisheries.

Past internal and external effects

Past internal and external effects are excerpted from Appendix J, Section 1.2 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). Numerous fishery management actions have been implemented that affect marine mammals, but there have been no direct actions taken to address sea otters. Sea otters are managed by the U.S. Fish and Wildlife Service (USFWS) and are primarily found in relatively shallow water.

Early commercial harvests were found to have had a negative impact on sea otters dating from the mid-1700s. Commercial exploitation for pelts from this time to the late 1800s caused sea otters to nearly become extinct (Bancroft 1959; Lensink 1962). Protective measures instituted in this century have allowed remnant groups to increase and reoccupy much of the historic sea otter range in Alaska (Estes 1980; Kenyon 1969). Residual effects from this early harvest likely persist in several areas. The Alaskan sea otter population has been experiencing severe declines in the central portion of its range in recent years, but the causes of the decline are not fully understood (Estes et al. 1998). The USFWS has proposed that the Aleutian Islands population be listed as a depleted species (November 2000).

Present and predicted effect

The present and predicted external effects on sea otters include other fisheries, subsistence, pollution, and natural factors. Commercial harvest of sea otters is no longer conducted and the effects of foreign and joint venture fisheries are no longer a factor in sea otter mortality.

Cumulative effects of the alternatives

The cumulative effects on sea otters are considered to be the same for all alternatives.

Incidental take/ entanglement: Past effects with residual impacts on current populations of sea otters include the early commercial take of otters and pollution events such as the Exxon Valdez Oil Spill. The numbers of otters killed in that spill ranged into the low thousands (Estes et al. 1998). Sea otter interactions with fishing gear, either passive or active are infrequent (Laist 1997). Incidental take in the groundfish trawl, longline, and pot fisheries during 1990–1995 was very low ranging from zero to two animals per year. Interactions with groundfish fisheries were observed only in the BSAI pot fishery. The total take/entanglement for the sea otter is considered to be insignificant (i.e., less than 10% of the calculated potential biological removal [PBR]). None of the alternatives would be expected to alter these patterns.

Present and predicted external factors that contribute to overall take of sea otters include the subsistence harvest which is approximately 686 animals per year (1996 to 2000) and natural events such as climate change or increased predation from killer whales, hypothesized to be a result of decreased availability of sea lions to killer whales (Estes et al. 1998). Take of sea otters is not found to be a cumulative effect since the contribution of the groundfish fisheries is extremely small, and likely to be zero.

Effects on prey: Past effects on prey availability are not fully understood, but the overlap between prey species of the sea otter and the groundfish fisheries is low. The near shore distribution of most sea otters and their benthic feeding habits limit the effects of the fishery on prey availability, and this effect is determined to be insignificant under all alternatives. Because of this negligible effect from the groundfish fishery, the effect on prey availability is not found to be cumulative.

Temporal/spatial concentration of fishery: Competition for forage between sea otters and commercial fisheries rarely occurs, despite the species geographical distribution in the Gulf of Alaska and the Aleutian Islands. Since their primary prey items are found on the bottom in the littoral zone, to depths of 164 feet (50 m), the majority of otters feed within 0.6 miles (1 km) of the shore. Because of this habitat preference for shallow areas, they do not overlap spatially with groundfish fisheries. The effects are of insignificance for all alternatives. Because of the lack of direct and indirect effect from the groundfish fishery, effect were not found to be cumulative.

Disturbance: Disturbance of sea otters is generally not considered to be an issue of concern in that otters do not appear to be adversely affected by human activity. The effect of disturbance is considered insignificant under all alternatives. The very limited overlap between the groundfish fisheries and sea otters indicates that the effect of disturbance on sea otter population is not cumulative.

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4.9.8 Pollock

The majority of past external effects, and many of the present and predicted effects evaluated in the cumulative effect analysis in this EIS have been examined in the cumulative effect analysis in the Alaska Groundfish Fisheries Draft Programmatic SEIS (Appendix J of (NMFS 2001a)). There are no cases where past external effects and present or predicted external effects for this analysis are expected to be different from the Alaska Groundfish Fisheries Draft Programmatic SEIS.

A summary of the cumulative effects analysis for walleye pollock in the eastern Bering Sea (EBS) and Aleutian Islands is presented in Table 4.9.8. The results of the cumulative effects analysis for EBS pollock are expected to be similar for Aleutian Islands pollock, given the similar findings of the direct and indirect effects analysis.

Past external effects

Numerous fishery management actions have been implemented that affect the pollock fisheries in the EBS and GOA. These actions have been described in more detail in Sections 2.4.1, 2.7, and 4.13.2 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a).

Foreign and JV fisheries are found to have had a negative impact on pollock due to fishing mortality in both the EBS and the GOA. In the GOA, past bycatch of pollock in the shrimp fishery is also identified as an additional adverse effect. The effect of these fisheries on spatial/temporal concentration of the pollock catch is unknown for both the EBS and GOA. These fisheries could have potentially had a positive effect on competition for prey by reducing pollock biomass. Past effects from the shrimp fishery include potentially negative effects from competition for shrimp as prey for adult pollock, and a beneficial effect from reductions in prey competition between shrimp and larval pollock.

In the BSAI, past seal harvests are identified as being a positive beneficial effect on pollock mortality because studies suggest that pollock is a primary prey item of northern fur seals and harbor seals. Pollock are also one of the most common prey in the diet of spotted seals and ribbon seals, which feed on pollock in the winter and spring in the areas of drifting ice (Lowry et al. 1997). Whaling is identified as having a past beneficial effect on mortality for both EBS and GOA pollock stocks. Pollock has been noted as a prey item for fin whales, minke whales, and humpback whales. By removing the large predators, pollock recruitment is favored. The cessation of seal and whale harvests in the BSAI is expected to have had a negative effect on pollock recruitment as seal and whale populations have rebounded.

The effects of pollution on GOA pollock stocks from the EVOS is unknown as far as direct mortality and concentration of the fishery are concerned. However, the event has been identified as having a past adverse effect on spawning habitat and prey availability.

The effects of climate change and regime shift are identified as potentially positive or negative effects on habitat suitability and prey availability. In general, a shift toward warmer waters favors recruitment and survival of pollock and a shifting dominance away from non-groundfish species. Shrimp tended to dominate catches in the EBS and GOA in terms of overall biomass when the Aleutian Low was weak, a phenomenon which corresponds to colder water temperatures. When the Aleutian Low was strong and water temperatures were higher, catch biomass was dominated by cod, pollock, and flatfishes.

Present and predicted future external effects

Foreign and JV fisheries, and shrimp fisheries no longer occur and are not a concern. Commercial whale and seal harvests also no longer occur. Seals and some whale species are currently taken by subsistence hunters and will be in the future, but the level of subsistence harvest is not expected to be a significant external effect. For pollock in the BSAI, the Russian fishery that occurs in the western Bering Sea has been identified as an external effect that could result in increased fishing mortality. Similarly, the State of Alaska groundfish fisheries in the GOA are identified as a present and future source of fishing mortality. However, the magnitude of both of these external effects is likely to be minor for all alternatives. External effects resulting from natural events in the present and future under all alternatives have the same ratings as for past effects.

Cumulative effects

Fishing mortality: Historic fishing mortality from various sources is identified as an external effect with lingering past adverse impacts on both EBS and GOA pollock stocks. The fishing mortality for all alternatives is rated as insignificant because all alternatives would operate under the same TAC-setting process and the over fishing limit (OFL) of the stocks is not reached in any case. The combined direct and indirect effects under the alternatives, in combination with lingering past effects and external effects from State or Russian pollock fisheries have a combined cumulative effect on pollock fishing mortality in each case. However, this cumulative effect is judged to be of insufficient in magnitude to push the fishing effort close to or over the OFL threshold under any alternative. Therefore, cumulative effects are identified for each alternative, but they are rated insignificant.

Temporal/spatial concentration of fishery: No lingering past influence or current direct or indirect effects from spatial and temporal concentration of catch are identified under any alternative for EBS pollock stock. Therefore, there is no finding of cumulative effects for any alternative. Although past external actions that likely affected the stocks are identified, the effects are not observable in the distribution of the present populations ((NMFS 2001a) Appendix J).

Habitat suitability: The EBS stock showed lingering positive effects from the regime shift associated with climate variability in the late 1970s. Natural events related to climate change are identified as contributing to a cumulative effect for the EBS stock, but are not of sufficient magnitude to jeopardize its ability to sustain itself above the Maximum Stock Sustainability Threshold (MSST). Therefore, while a cumulative effect is identified for all alternatives, any effects are rated as insignificant.

Prey availability: Lingering past influences on prey availability are identified for the EBS pollock stock. In general, these effects have been beneficial, however they are collectively rated as insignificant. A cumulative effect has been identified. However, the external factors under each alternative have been determined to be of insufficient magnitude for any cumulative effects to jeopardize either stocks ability to remain above MSST under any of the alternatives. Therefore the cumulative effects rating for all alternatives is insignificant.

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4.9.9 Other groundfish and prohibited species

The major target groundfish species considered in this analysis is pollock. The cumulative effect analysis for the remaining target groundfish and other species has been grouped and simplified because the proposed AFA amendments do not change their management significantly from current management measures, and the results of the direct and indirect effects analysis for the grouped species are essentially the same (see Section 4.3). Detailed information on the remaining target species is provided in Section 3.3 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a).

None of the alternatives evaluated in the cumulative effects analysis includes specific management measures adjusting management measures in effect for other groundfish fisheries or prohibited species management. While catcher vessel and catcher/processor sideboards restrict participation by AFA vessels in other groundfish fisheries, the effects of these measures are considered to have *allocative* rather than *environmental* consequences because the underlying management measures such as fishing seasons, TACs, authorized gear types, and closed areas would not be affected by any of the alternatives. The cumulative effects of groundfish fishing on groundfish and prohibited species are analyzed in detail in Section 4.13 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). The cumulative effects of the Alternative 1 in the Alaska Groundfish Fisheries Draft Programmatic SEIS (continuation of the present management regime) are therefore, incorporated by reference into this document as the predicted cumulative effects of all of the alternatives on non-pollock groundfish and prohibited species.

4.9.10 Seabirds

The seabirds or seabird groups considered in the analysis of cumulative effects include: northern fulmars, short-tailed albatross, other albatross and shearwaters, piscivorous seabirds, and eiders.

Direct and indirect impacts of the alternatives on sea birds are evaluated in Section 4.7 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). For this analysis, one direct and three indirect effects are evaluated:

Direct Effects:	Incidental take (in gear and vessel strikes)
Indirect Effects:	Prey (forage fish) abundance availability Benthic habitat damage Processing waste and offal

The following summaries of cumulative effects for seabirds or seabird groups focus on these four effect categories across Alternatives 1–5. The lack of distinction between alternatives allows effects to be discussed collectively for all seabirds across all alternatives.

Past internal and external effects

The following discussion on past effects is excerpted from the Draft Programmatic SEIS (NMFS 2001a). Past management decisions (FMP amendments) have focused on reducing the amount of seabird bycatch by instituting an observer program in the foreign and domestic fisheries. The program collects quantitative data for decision makers on actual species affected and catch rates (BSAI amendments 13, 27, 37 and GOA amendments 18 and 30). Directed fisheries on forage fish, important food sources for many species of fish-eating seabirds such as fulmars, albatross, shearwater, murres and kittiwakes were prohibited in order to prevent adverse effects on these seabirds (BSAI amendment 36 and GOA amendment 39).

Foreign fisheries have operated in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) from the 1940s to the 1980s. Throughout this period, seabird bycatch or entanglement in fishing gear was an undesired aspect of these fisheries. Attraction to processing waste from foreign processors in the past may also have had an effect on northern fulmar populations but little data is available as to whether the effect of the attraction and supplemental food is positive or negative (Furness and Ainley 1984; Gould et al. 1997).

Seabird bycatch became a major concern for these seabirds, especially in the high seas Japanese drift gillnet fisheries operating in the western North Pacific south of the Aleutian Islands and in the western Bering Sea (National Research Council 1996). Seabird bycatch levels in the 1970s ranged from 700,000 in the early 1970s to 400,000 birds annually in the mid 1970s (King and Sanger 1979). The bycatch was believed to be reduced in the late 1980s with the exclusion of these fisheries from the U.S. Exclusive Economic Zone (EEZ). Ghost nets from this fishery also likely impacted many seabird species. Fulmars were undoubtedly lost to these fisheries but precise numbers killed or overall effects on the population are not known.

Past International Pacific Halibut Commission (IPHC) halibut fisheries and state-managed longline and pot fisheries also had some level of negative effect on fulmars due to entanglement with gear and vessel collisions, but overall effects were likely much less than those due to the groundfish fisheries.

Long-term and short term climate change and regimes shifts have very likely affected fish-eating seabirds fulmar populations in the past. The extent of these effects on seabirds is discussed in the Draft Programmatic SEIS ((NMFS 2001a) --Appendix J, Section 1.2) but actual effects on individual species is largely unknown.

Present and predicted external effects

Most of these present and predicted external effects are the same as those described above with the exception of foreign fisheries (Japanese high seas drift nets fisheries) that are no longer of major concern. The external effects do not change by alternative because these effects are external to the groundfish fishery.

Cumulative effects

Incidental take/entanglement: Past adverse external effects on fulmars include incidental take in foreign and joint venture fisheries, state-managed fisheries and IPHC managed halibut fisheries. Present external factors also contribute to the overall mortality of seabirds including foreign fisheries, other state-managed longline fisheries (cod, sablefish, rockfish), and halibut fisheries (57 individual in 1998). Based on the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a) analysis and given the estimates of seabird incidental catch in the groundfish fisheries using longline gear and of seabird populations in Alaska ((NMFS 2001a), Table 3.3-6), the effects of incidental take were considered insignificant to seabird populations as a whole. The Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a) concluded that northern fulmars were the only species showing a positive linear relationship between fishing effort and numbers of birds hooked. This relationship did not exist for other bird groups (albatrosses, gulls, shearwaters). Approximately 10,000 fulmar are taken as bycatch each year but this is rated as insignificant at the population level.

Incidental take of northern fulmars is found to be cumulative based on the effects of the groundfish fisheries and the external factors of other fisheries. The cumulative effect of incidental take/entanglement under all of the alternatives is considered to be insignificant based on the very large numbers of fulmar in the north Pacific (over one million pair in Alaska). Effect are considered insignificant in the GOA and unknown in the BSAI. The impact of the incidental take in the BSAI and pollock fishery of all seabird species is considered insignificant.

Take of the endangered short-tailed albatross is considered to be a cumulative effect. While very few albatross are taken incidentally in the groundfish fishery and none in the BSAI directed pollock fishery, due to the critically small population size of this endangered species, any mortality is of concern.

Spectacled and Steller's eiders are not likely to be directly effected by the BSAI and GOA groundfish fisheries therefore any effects of incidental take are insignificant (NMFS 2001a). Incidental take of eiders was found to not be cumulative based on a lack of internal effects from the groundfish fisheries.

Effects on prey availability: Past external adverse effects on prey availability and abundance are not identified from other fisheries, but climate change would be expected to have substantial effects, either positive season is the primary factor affecting nesting success of may seabird species. However, the low volume of forage fish caught as bycatch in the groundfish fisheries would likely have little effect on nesting seabirds, including fulmars. Due to increasing population trends, short-tailed albatross and northern fulmars do not appear to be prey-limited. Based on the Draft Programmatic SEIS (NMFS 2001a) analysis, the indirect fishery effects on prey abundance and availability were considered insignificant to populations of non-piscivorous seabirds and to have an unknown effect on piscivorous seabirds. Lacking a clear direct or indirect effect of the groundfish fisheries on seabird prey species (forage fish), a cumulative effect for this factor was not identified for fulmar, albatross, piscivorus seabird or any other seabirds.

Benthic habitat: Past external effects were identified for damage to benthic habitat from foreign fisheries but little is known of the actual damage. Present and predicted effects of bottom trawling on benthic habitat used by eider in BSAI and GOA is not largely known, but in is little overlap in areas of critical habitat for eiders. Damage to benthic habitat would not be expected to affect spectacled or Steller's eiders at a population level. Therefore, the effects of any of the five alternatives on benthic habitat are considered insignificant to spectacled and Steller's eiders. None of the alternatives are expected to affect benthic-feeding species such as scoters, guillemots, cormorants at a population level. Therefore, the effects of any of the five alternatives on benthic habitat are considered insignificant to these benthic-feeding seabird populations. The lack of any indication of an effect from the groundfish fishery, effects on benthic habitat were not found to be cumulative.

Processing waste and offal: Northern fulmars are the primary species that consumes discards and processing waste and have been attracted to fishing vessels or processors over many years. Evaluating the effect of this unnatural food source is difficult because reliable estimates of the intake of this food source relative to total food consumption are unknown for seabirds in Alaska.

For the analysis of present and predicted effects, it is assumed that the volume of offal and processing wastes changes approximately in proportion to the total catch in the fishery, although increased utilization under the AFA-based alternatives could result in marginally lower amounts of processing waste produced at a given TAC level. Direct or indirect effects of processing waste and offal on fulmar populations are not currently understood and are rated as insignificant under the alternatives. External effects are identified from foreign fisheries, state-managed fisheries, and IPHC halibut fisheries as contributing processing waste and offal which might be eaten by fulmars; therefore, the effect is determined to be cumulative. However, based on the lack of evidence of an adverse effect on the seabird populations and the large numbers of fulmars in the BSAI and GOA, the cumulative effect is expected to be insignificant.

4.9.11 Benthic habitat and essential fish habitat

Essential fish habitat (EFH) is currently defined as those waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity. By definition, EFH encompasses both benthic substrates and the water column, including aquatic areas and their associated physical, chemical, and biological properties that are used by fish. Non-benthic EFS incorporates the physical and chemical properties of the water column; its main biological component consists of any non-benthic prey of fish. Habitat areas of particular concern (HAPC) are habitat types or areas that may require extra protection. HAPC is defined on the following criteria: its ecological importance, sensitivity, exposure, and rarity of the habitat.

None of the alternatives evaluated in the cumulative effects analysis includes specific management measures adjusting management measures in effect for other groundfish fisheries in which bottom trawl gear or fixed gear is deployed. While catcher vessel and catcher/processor sideboards restrict participation by AFA vessels in other groundfish fisheries, the effects of these measures are considered to have *allocative* rather than *environmental* consequences because the underlying management measures such as fishing seasons, TACs, authorized gear types, and closed areas would not be affected by any of the alternatives. The cumulative effects of groundfish fishing on benthic habitat and EFH are analyzed in detail in Section 4.13 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS 2001a). The cumulative effects of the Alternative 1 in the Alaska Groundfish Fisheries Draft Programmatic SEIS (continuation of the present management regime) are therefore, incorporated by reference into this document as the predicted cumulative effects of all of the alternatives on benthic habitat and EFH.

4.9.12 Ecosystem

This section examines the potential of the alternatives, in combination with external factors, to produce cumulative effects at the ecosystem level. External effects screened for the cumulative effects analyses are summarized in the introduction to Section 4.9. These external influences fall into two categories: (1) human-controlled events and (2) natural events. The human controlled events considered in the ecosystem analysis are:

Past external effects:

- Foreign fisheries catch & bycatch;
- Joint venture (JV) and domestic fisheries bycatch;
- State fisheries catch and bycatch;
- International Pacific Halibut Commission (IPHC) catch (halibut only);
- Resource development (salmon only);
- Exxon Valdez Oil Spill (herring in GOA only); and
- Commercial shipping.

Present and predicted external effects:

- IPHC Halibut Fishery catch (halibut only); and
- State fisheries catch & bycatch

Natural events considered are:

- Short-term climate change (e.g., the El Niño/Southern Oscillation [ENSO] phenomenon);
- Long-term climate changes (e.g., Pacific Decadal Oscillations and global warming); and
- Regime shifts (influenced primarily by long-term climate changes).

Four categories of conditionally significant cumulative effects on the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands (BSAI) ecosystems were identified for some or all of the alternatives:

- Pelagic forage availability;
- Spatial/temporal concentration of the fishery on forage;
- Introduction of non-indigenous species; and
- Species diversity.

These are the parameters relevant to marine ecosystem diversity and stability that are most likely to be affected by the alternatives acting in combination with the human-controlled and natural external effects listed above.

For the ecosystem analysis, a significant cumulative effect is defined as one that would alter the diversity or stability of the BSAI or GOA ecosystem by (1) affecting predator-prey relationships; (2) adding or removing energy and redirecting pathways of energy flow; or (3) increasing or decreasing biodiversity as measured by species, trophic function, or genetics.

Potential cumulative effects that satisfy significance criteria are labeled as conditionally significant. This term recognizes that our ability to demonstrate existing cumulative effects or to predict such effects in the future is not reliable enough to allow any degree of certainty to be attached to the outcome. Especially at the ecosystem level, available data regarding predator-prey relationships, energy flow and balance, and diversity are insufficient to allow dependable characterization of existing conditions. Predicting future outcomes is inherently unreliable, not only because of our absolute uncertainty about the future, but also because the influence of poorly predictable climatic factors on the BSAI and GOA ecosystems outweighs effects that might result from human activities planned for the reasonably foreseeable future.

Predator-prey relationships

The characteristics of predator/prey interactions with the food web are an important determinant of ecosystem stability and diversity. These interactions can be affected by natural (usually climate-related) conditions and by human activities. Existing resource management policies in the BSAI and GOA have been implemented against the background of a relatively mature and resilient ecosystem that exhibits naturally occurring changes. These baseline patterns and trends, along with their probable forcing agents, must be recognized before any additive or synergistic influences of external factors acting with the alternatives can be identified and evaluated with respect to conditional significance. The following discussion first reviews information about naturally occurring background fluctuations in the BSAI and GOA ecosystems, i.e., changes that are not attributable to human activities and are essentially beyond human control. Second, ways in which human activities can affect predator-prey relationships in the marine environment, including past, present and predicted external influences on the BSAI and GOA ecosystems, are reviewed. Third, potential cumulative effects of the alternatives on predator-prey relationships are examined.

Changes in species composition, population size, guild and community structure, production, recruitment, geographic distribution, and biomass have been documented in the GOA and eastern Bering Sea regions. The factors driving these changes are speculative, but decadal-scale climatic shifts and interannual climatic variations such as the El Niño phenomenon have been suggested as forcing agents (McGowan et al. 1998). For example, increases in zooplankton biomass and in salmon landings documented in the GOA have been correlated with the intensity and location of the winter mean Aleutian low pressure system, which changes on an interdecadal time scale (Anderson and Piatt 1999; Francis and Hare 1994; McGowan et al. 1998; Orensanz et al. 1998; Robards et al. 1999). Beyond such correlations with climatic indices, cause-and-effect relationships between climatic and ecosystem changes have not been proven, but climate-related changes in physical oceanographic factors such as temperature, salinity, current patterns, upwellings, sediment composition, and nutrient supply have been implicated (e.g., (Mueter 1999).

Fluctuations in species composition within guilds and in total guild biomass have been examined to determine if they might be correlated with fishing pressure on predator-prey cycles. Livingston *et al.* (Livingston et al. 1999) found that long-term increases and decreases in the abundance of selected eastern Bering Sea invertebrate, fish, bird, and marine mammal species did not show positive correlations with prey abundance, and that cyclic fluctuations in abundance occurred in both fished and unfished species. These researchers also found that changes in species diversity within guilds related to increases in a dominant guild member (e.g., pollock and rock sole) rather than to decreases in abundance caused by fishing pressure. It was concluded that the eastern Bering Sea ecosystem shows two indicators of stability: (1) the trophic level of the eastern Bering Sea harvest, after rising slightly since the 1950s, appears to be stable as of 1994, suggesting that present harvest levels are sustainable; and (2) the fish populations examined are stable, i.e., fluctuate normally without showing prolonged trends in a particular direction. These findings suggest that the eastern Bering Sea ecosystem is relatively stable and undergoes natural fluctuations that are driven by climatic cycles.

Human actions such as commercial fishing, superimposed on the naturally occurring background fluctuations discussed above, can affect predator-prey relationships in four main ways (see Section 4.9). If changes occur with respect to the amount of food (forage) available to predators at each level (or within each trophic guild) of the food web, the species composition and abundance of the predators can change. If fisheries concentrate their effort on specific locations and at specific times of the year, over-fishing of particular groups of forage fish can occur and in this way alter predator/prey relationships. Removal of top predators, continued by "fishing down the food web" to reduce predator populations at successively lower levels, can deplete predator populations and indirectly change the prey populations exploited by those predators. And the introduction of new prey or, more often, predatory species (mostly invertebrates) from other parts of the world can lead to the introduced species out-competing and ultimately replacing the indigenous ones. Consequently, effects of human activities on BSAI and GOA predator/prey relationships are structured into the following four categories:

- *Pelagic forage availability:* Changing the availability of important forage (prey) species by selectively removing key predator or competing forage species from the food web;
- Spatial and temporal concentration of fishery on forage: Over-fishing of important forage species by concentrating the fishing effort in space (geographic location) and/or time;
- *Removal of top predators:* Removal of predators from the top and from successively lower levels of the food web (fishing down the food web); and
- *Introduction of nonnative species:* Introducing new (i.e., non-indigenous) competitor species into the food web.

Past external influences

Prior to passage and enforcement of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act), overfishing and depletion of groundfish, Pacific herring, and salmonid stocks by U.S., Soviet, and other fleets was considered to be a serious problem in the BSAI (Pautzke 1997). Pelagic forage availability was reduced by concentrated fishing efforts. In the "Donut Hole" in the central Bering Sea during the mid-1980s, for example, both spatial and temporal concentrations on forage occurred as foreign vessels from Japan, South Korea, Poland, and China converged into a localized area to fish pollock after these fleets were displaced from U.S. waters by the growth of U.S. domestic fisheries. Pollock catch rapidly increased in the Donut Hole at the start of this concentrated effort, and then declined even more rapidly

(Pautzke 1997). A large foreign fishery for herring food products existed in the eastern Bering Sea in the 1960s and 1970s, until this activity was eliminated by the Magnuson-Stevens Act (ADF&G 2000b).

Removal of top predators has also occurred. Interceptions of U.S. and Canadian salmon stocks by Soviet and Japanese fleets, including offshore driftnet fisheries for salmon, were and continue to be an additional concern, particularly due to the high bycatch of marine mammals and sea birds by driftnets. Northern fur seals, a top predator species, were harvested until 1985 on the Pribilof Islands. Annual harvests during the period of 1980–1984 ranged between 22,000 and 26,000 seals, and a continuing population decline led to this species being listed as "depleted" under the Marine Mammal Protection Act (MMPA). Only seals needed for subsistence purposes are now taken (Zimmerman 1994). During many years prior to their Endangered Species Act (ESA) listing, Steller sea lions succumbed to direct mortality from illegal shooting.

It has been hypothesized that large-scale removals of whales from 1848 through 1976 caused major cascading effects (National Research Council 1996) from 1950 to 1976, estimated total catches of whales in the BSAI and GOA exceeded 5,700 blue whales, 26,000 fin whales, 74,000 sei whales, 30,000 humpback whales, and 210,000 sperm whales. It is likely that the North Pacific ecosystem is still responding to this perturbation.

Non-indigenous species such as the predatory seastar *Asterias amurensis* have been introduced to the BSAI and GOA environments through ballast water discharges from fishing vessels that participate in the federally managed groundfish fishery and from commercial transport and tourism vessels (see Section 4.9.1). Although there is no available evidence that marine species introduced into Alaskan waters have yet had an adverse effect on predator-prey relationships, there is always the potential that an introduced species could out-compete an indigenous species occupying the same ecological niche and eventually replace or endanger the indigenous species. It is also possible that an introduced species could exploit an unoccupied niche and change the food web by consuming previously unexploited or lightly utilized food sources.

These and other external influences from the past, acting along with the background climatic effects on pelagic forage availability discussed above, are considered to have produced lasting effects on existing predator-prey relationships in the BSAI and GOA. These effects are well recognized and are presently being mitigated through international agreements. For example, there has been an international moratorium on fishing in the Donut Hole since 1993, and the 1994 Convention on the Conservation of the Pollock Resources in the central Bering Sea established a formula for future harvests of pollock if or when renewed stock abundance allows such fisheries. With respect to salmon, the United States and Russia signed a bilateral agreement in 1992 to ban directed salmon fishing in the United States and Russian Exclusive Economic Zones (EEZs). One intent of this agreement is to avoid locations where North American and Asian stocks intermingle. To this end, directed salmon fisheries are permitted within 25 nautical miles (nm) of the baseline from which each 200-mile zone is measured (Pautzke 1997).

Present and predicted external effects

At present, the major influence of other fisheries on pelagic forage availability comes from the Alaskan herring fishery, which is managed by the Alaska Department of Fish and Game (ADF&G). The Pacific herring, a planktivore, is a key component of pelagic and nearshore food webs in the BSAI and GOA and is an important food source for a wide variety of fishes, mammals, and birds. The principal commercial utilization of BSAI herring is for sac roe and for eggs on kelp, primarily for the Japanese market; herring carcasses are retained, frozen, and processed as fish meal. The 1999 harvest of herring for sac roe was approximately 38,000 mt, and the forecast for 2000 is about 40,000 mt (ADF&G 2000c). Subsistence removal of herring for food and bait in southeast Alaska, Prince William Sound, Kodiak, and Unalaska from September 1999 through July 2000 totaled 3,286 mt (ADF&G 2000d).

Space/time closures have recently been implemented to alleviate the effect of concentrated fishing in removing key forage fish. The 1994 international agreement closing the Donut Hole to pollock fishing, discussed above, is one example. Other closures have been implemented in response to the continuing, long-term decline in Steller sea lions and other predator species, with the intent of making a larger portion of forage fish populations available for predation. Paradoxically, both removing and increasing restrictions can lead to spatial and temporal concentrations of fishing effort. The former allows fishing to concentrate in locations and at times is likely to maximize catch per unit effort, whereas the latter, by its very nature, specifies when and where fish can be harvested. Thus closures may reduce concentrated fishing effort in some areas and increase it in others. Because spatial/temporal concentration cannot be avoided, the direct effect of Alternative 1 on forage availability is considered to be conditionally significant adverse. The additive effect of spatial/temporal concentrations by other fisheries and, to a minor extent, by subsistence harvests must reinforce this outcome to an unknown extent. Therefore, a conditionally significant adverse cumulative effect is concluded to result from spatial/temporal concentration of fisheries on forage species.

The potential direct and indirect effects of the status quo management regime in removing top predators through fishing down the food chain is not considered to be significant (see Section 4.9.2 of the Alaska Groundfish Fisheries Draft Programmatic SEIS). Although other fisheries remove salmon and halibut, all predatory species, there is no available evidence that depletions of these predators have interacted with Alternative 1 in an additive or synergistic way to measurably alter predator-prey relationships within the BSAI and GOA food webs. Therefore, any cumulative effect that might result from such interactions is considered to not be significant.

Ballast water is discharged into Alaskan waters by fishing vessels, commercial tankers and cargo ships, and tourist ships. This external influence creates a potential for non-indigenous marine species, particularly invertebrate predators such as *Asterias amurensis*, to be introduced or augmented in the BSAI and GOA (see Section 4.9.1). To date, introduced marine species have not been demonstrated to dominate any ecological niche, thus altering predator-prey relationships, within these two ecosystems.

Cumulative effects

All of the alternatives were concluded to have the potential to produce a conditionally significant cumulative effect on pelagic forage availability. Under the no action alternative and all of the AFA-based alternatives, and with current fishery management policies in effect, total pollock biomass is projected to remain stable in the BSAI. From a cumulative standpoint, a conditionally significant positive effect would occur if the expected increase in pelagic forage availability was enhanced by favorable climatic conditions and regime shifts. On the other hand, because these powerful forcing agents are likely to determine the overall availability of forage species in the GOA and BSAI, the conditionally significant cumulative effect on pelagic forage associated with any of the alternatives could be beneficial or adverse (+/-), or neutral, depending on largely unpredictable climate and regime trends.

With respect to the spatial and temporal concentration of the commercial fishery on forage species such as pollock, climatic trends would not be a major external influence. Instead, the additive or synergistic effect of bycatch mortality by the IPHC, foreign, JV, and domestic fisheries would be more influential. In addition to bycatch removals, the Alaskan herring fishery, which is managed by the Alaska Department of Fish and Game (ADF&G), exerts a substantial influence on pelagic forage availability. The Pacific herring, a planktivore, is a key component of pelagic and nearshore food webs in the BSAI and GOA environments and is an important food source for a wide variety of fishes, mammals, and birds. In light of the annual targeted removal of herring and the loss of other forage biomass through bycatch mortality, spatial and temporal effects of fishing effort are concluded to exert an adverse influence on the overall availability of pelagic forage in the two ecosystems, as represented by (-) in Table 4.9.9. For Alternative 1, a conditionally significant adverse cumulative effect is predicted because this alternative would not ameliorate pre-AFA direct and indirect adverse effects, rated CS(-), of spatial and temporal fishery concentrations on pelagic forage. In contrast, Alternatives 2 through 5 would conditionally reduce spatial and temporal fishing pressures on forage species, as indicated by the CS(+) rating. Because this potential benefit would be offset to an unknown extent through forage removals by other fisheries, as discussed above, no net cumulative effect is predicted.

The potential direct and indirect effects of the five alternatives in removing top predators were not considered to be significant, and although other fisheries remove salmon and halibut, all predatory species, there is no evidence that regulated fishing removals of these predators would interact with any of the alternatives to alter predator/prey relationships within the GOA and BSAI food webs. Therefore, no cumulative effect was predicted for this impact category.

Table 4.9.9 Cumulative effects on predator-prey relationships

PAST EFFECTS

Direct/Indirect Effects	**External Effects**					**Past Influence Y/N**
Category	Human Controlled				Natural Events	
	IPHC Fishery	Foreign Fisheries	JV & Domestic Fisheries	Commercial Shipping	Climate & Regime Shifts	
Pelagic forage availability	-	-	-	0	+/-	Y
Spatial and temporal concentration of fishery on forage	-	-	-	0	0	Y
Removal of top predators	-	-	-	0	0	Y
Introduction of nonnative species	-	-	0	-	0	Y

ALTERNATIVE 1

Direct/Indirect Effects		**External Effects**			**Cumulative Effect Y/N**	**Conditionally Significant Y/N**
Category	Rating	Human Controlled		Natural Events		
		IPHC, Foreign, Domestic & JV Fisheries	Commercial Shipping	Climate & Regime Shifts		
Pelagic forage availability	S(+)	-	0	+/-	Y	Y(+/-)
Spatial and temporal concentration of fishery on forage	CS(-)	-	0	0	Y	Y(-)
Removal of top predators	I	-	0	0	N	
Introduction of nonnative species	CS(-)	-	-	0	Y	Y(-)

ALTERNATIVES 2 THROUGH 5

Direct/Indirect Effects		**External Effects**			**Cumulative Effect Y/N**	**Conditionally Significant Y/N**
Category	Rating	Human Controlled		Natural Events		
		IPHC, Foreign, Domestic & JV Fisheries	Commercial Shipping	Climate & Regime Shifts		
Pelagic forage availability	S(+)	-	0	+/-	Y	Y(+/-)
Spatial and temporal concentration of fishery on forage	CS(+)	-	0	0	N	
Removal of top predators	I	-	0	0	N	
Introduction of nonnative species	I	-[1]	-	0	N	

4.9.13 Energy flow and balance

As discussed previously, high-volume fishing and fish processing can alter the amount and flow of energy in an ecosystem by removing energy in the form of biomass (i.e., large numbers of fish) and by altering pathways of energy flow through the return of discards and processing waste to the sea. When fish are removed from the marine ecosystem, the total energy content of the ecosystem is reduced. And when bycatch and processed wastes are returned to the sea, energy is redirected to different parts of the marine ecosystem relative to the natural state. If the quantities of biomass removed from the sea and/or returned in different form are large enough relative to the total biomass of the ecosystem, the energy balance of the system could be destabilized.

The energy balance and pathways of energy flow within the BSAI and GOA ecosystems are insignificantly redirected by biomass removals and discarded fish bycatch and processing wastes that are returned to the sea. Total fishing removals of groundfish biomass are such a small proportion of the total system energy budget, and are so small relative to interannual variability in production, that variations in biomass removal are insignificant. A similar situation applies to the discarding of bycatch and fish processing wastes to the sea. Available evidence indicates that energy flow pathways are insignificantly re-directed by the discarding of fish processing waste, and estimates regarding the level of discarded material relative to natural sources of detritus indicate that the aggregate of discarded biomass is insignificant in comparison to the background level of dead organic matter, although local concentrations can produce changes in nutrient levels and species composition. For this reason, the direct and indirect effects of energy removal and redirection on the BSAI and GOA ecosystems are concluded to be insignificant. The remaining question is whether the cumulative effect of the alternatives acting in combination with external influences would be large enough to make energy removal and redirection significant. The answer, discussed in the following subsections, is that adding the incremental influence of the alternatives still would not lead to a significant effect on energy flow and balance at the ecosystem level.

Past, present, and predicted external influences

In the past, various commercial fisheries operating in the BSAI and GOA regions have both removed and redirected energy through targeted fishing effort, bycatch discards, and waste processing. In 1996 and 1997, the North Pacific Fishery Management Council adopted BSAI Amendment 49 and GOA Amendment 49, respectively. These measures were intended to reduce the total biomass of discards by requiring improved retention and improved utilization for all groundfish target fisheries. Prior to passage of the amendments, it was determined that four species–walleye pollock, Pacific cod, rock sole, and yellowfin sole–represented approximately 76% of the total discards of allocated groundfish in the BSAI groundfish fisheries and 33% in the GOA fisheries. Accordingly, both amendments required that all vessels fishing for groundfish retain all pollock and Pacific cod as of January 1, 1998, and further require that all rock sole and yellowfin sole be retained starting January 1, 2003. The measures have been effective in reducing discards. In the 1997 BSAI groundfish fishery, for example, a total of 258,000 metric tons (mt) of groundfish was discarded, including 22,100 mt of cod and 94,800 mt of pollock. In 1998, after the first year of passage of BSAI Amendment 49, these amounts were reduced to 4,300 mt of cod and 16,200 mt of pollock.

The second way in which commercial fisheries have influenced BSAI and GOA ecosystem energetics is by redirecting energy flow through the return of dead bycatch and fish processing waste to the marine environment. Fisheries managed by the State of Alaska and by the IPHC remove shellfish, shrimp, king crab, snow crab, Dungeness crab, halibut, sablefish, rockfish, herring, and salmon, with the latter usually predominating in terms of biomass of processing waste discharged back into the ecosystem. Processing waste discharged in 1999 by the top nine seafood processing facilities in Alaska (in terms of weight of seafood processed) covered under a National Pollutant Discharge Elimination System (NPDES) general permit as reported to the U.S. Environmental Protection Agency (EPA) totaled 58,427.2 mt representing an addition of about 23% over the total groundfish waste discharge estimate of 258,000 mt for 1997, at the outset of the Amendment 49 period.

Against natural background levels of total biomass and detritus, this increase is considered to be insignificant in altering ecosystem stability or diversity, and available evidence does not indicate that such alterations have in fact resulted in the BSAI and GOA due to past and current seafood processing waste discharges. It should be noted, however, that such discharges have been found to produce local adverse effects on water quality, anaerobic conditions, and other habitat-related parameters, especially where facilities are grouped in close proximity in sheltered waters. It is also important to be aware that there are many other seafood processing facilities in the BSAI and GOA not covered by the NPDES general permit mentioned above (i.e., that have individual NPDES permits). In the aggregate, these smaller seasonal facilities, which process mostly salmon, may substantially outweigh the combined contribution of the facilities covered by the general permit. Waste discharge data are not readily available on these individual facilities, and their cumulative effect cannot be quantified on the basis of available evidence.[47] Furthermore, not all of these facilities return seafood processing wastes to the sea; some screen the waste to 1 millimeter particles and reduce it to fish meal.

Cumulative effects

Because commercial fisheries operate by removing biomass and returning a portion of it to the sea in different form, they have produced and continue to exert an adverse but non-significant external effect on energy flow and balance within the BSAI and GOA ecosystems, as indicated by (-) in Table 4.10. In the case of energy removal, naturally-occurring climatic trends and regime shifts also have the potential to increase or decrease commercial fishery catch, as indicated by (+/-). In combination with any of the alternatives, these external effects, along with continuing influences from the past, have the potential to produce adverse cumulative effects on energy removal and redirection. The cumulative increase or decrease in total catch biomass under any alternative, however, would not be significant against the background of total BSAI and GOA biomass levels and would be negligible in comparison to the influences that natural forcing agents would exert on these ecosystems in the absence of fishing. With respect to energy removal, therefore, the potential cumulative effects of all alternatives are evaluated as insignificant.

With respect to energy redirection, none of the alternatives would be likely to increase the level of discards back to levels observed before the improved retention and utilization requirements were implemented. Because adverse effects of discards were not observed at the ecosystem level before the new requirements came into effect, it is concluded that the cumulative effects of the alternatives with respect to energy redirection would not be significant against the background of the total BSAI and GOA ecosystem energy budgets. These results are summarized in Table 4.9.10.

[47] F. Kelly, "Personal Communication," memorandum from Florence Carroll (EPA) to Kelly Nixon (URS), Region 10, Environmental Protection Agency, 1200 Sixth Avenue, Seattle, WA 98101.

Table 4.9.10 Cumulative effects on energy flow and balance

Past Effects

Direct/Indirect Effects	**External Effects**					**Past Influence Y/N**
Category	Human Controlled				Natural Events	
	IPHC Fishery	Foreign Fisheries	JV & Domestic Fisheries	Commercial Shipping	Climate & Regime Shifts	
Energy removal (catch)	-	-	-	0	+/-	Y
Energy redirection (bycatch discards and processing waste)	-	-	-	0	0	Y

Alternatives 1 through 5

Direct/Indirect Effects		**External Effects**			**Cumulative Effect Y/N**	**Conditionally Significant Y/N**
Category	Rating	Human Controlled		Natural Events		
		IPHC, Foreign, Domestic & JV Fisheries	Commercial Shipping	Climate & Regime Shifts		
Energy removal (catch)	I	-	0	+/-	Y	N
Energy redirection (bycatch discards and processing waste)	I	-	0	0	Y	N

4.9.14 Biological diversity

Biological diversity, the third index of ecosystem health in addition to predator/prey relationships and energetics, is approached here in three ways. First, the diversity (number) of species in an ecosystem can change if fishing removes all individuals belonging to a single species from the system. Comparative abundance of species, another aspect of species diversity, can change if fishing alters the numbers of individual representatives of one or more species relative to a defined baseline condition. Second, functional or trophic diversity can change if a member of a trophic guild is removed or if the comparative abundance of the guild member greatly increases or decreases. This can change the way biomass is distributed within the trophic guild and can affect the functional contribution of the trophic guild to the total ecosystem. Third, the selective removal of organisms that share a particular characteristic, e.g., rapid growth, can alter genetic diversity within a species. Removal of spawning aggregations also has the potential to alter genetic diversity if the particular aggregation of fish removed from the system is genetically different from other aggregations. In general, the evolutionary advantage of a species increases with genetic diversity, because the population is better prepared to respond to variations in natural conditions such as temperature, salinity, and water quality changes.

Past, present, and predicted external influences

Historical baseline information on fish species diversity in the BSAI and GOA ecosystems is incomplete, and little survey and systematic information has been gathered on other ecosystem components such as the benthic fauna. Although no fishing-related species removals have been documented in these ecosystems during the past 30 years, species with slow growth characteristics or low reproductive potential, such as skates, sharks, and grenadiers, are considered to be at risk, particularly in light of evidence indicating that extinctions or near-extinctions of similar Atlantic species have occurred (Greenstreet and Rogers 2000). Bycatch from commercial fisheries has removed individuals belonging to these sensitive species for many years, and there will continue to be a potential for their gradual depletion, although the new retention and utilization requirements, noted above, will alleviate this trend. Because comparatively little is known about the taxonomic structure of benthic communities of the BSAI and GOA, the direct and indirect effects of trawling and other fishing-related activities on the species diversity of these communities have not been quantified. Finally, climate changes and regime shifts have had the potential to alter species diversity in the past and will continue to exert this influence over the long term as existing resident species are replaced by those better adapted to changing conditions.

During the period of Russian exploration and settlement of the BSAI region, two indigenous species, the Steller sea cow *(Hydrodamalis gigas)*, a species of manatee or dugong, and the spectacled cormorant *(Phalacrocorax perspicillatus)* both became extinct–the sea cow by 1768 and the cormorant by 1850. In both cases, direct mortality from hunting is believed to have been the cause (ADF&G 2000e). The continuing decline in the Steller sea lion population has raised renewed concerns about the possibility of further extinctions. In addition to this and other species listed under the ESA as endangered or threatened, some Alaskan salmon stocks are showing a declining trend that has been speculated to have resulted from over-fishing. Consequently, salmon stocks are treated as separate species under the ESA.

In the GOA, the presence of Atlantic salmon has been recorded in waters off southeast Alaska (McKinnell et al. 1997), and recent studies in Prince William Sound have documented introductions of non-indigenous species there (Hines and Ruiz 2000). There have been 24 non-indigenous species of plants and animals documented primarily in shallow marine and estuarine environments in Alaska, with 15 such species recorded for Prince William Sound. Predators such as the Amur starfish *(Asterias amurensis)*, a Siberian species, have the potential to create major disruptions to benthic communities, but adverse effects of exotic species have yet to be reported for Alaskan waters. Nevertheless, it is a fact that the species diversity of the BSAI and GOA ecosystems has been lastingly, and probably permanently, altered by the introduction of non-indigenous species.

There is no documented indication that the functional, or trophic, diversity of the BSAI and GOA ecosystems has been affected by commercial fisheries, although climatic trends and regime shifts, thought to be the major forcing agents driving these ecosystems, could produce this type of effect. Changes in the relative abundance of species within trophic guilds in the BSAI and GOA have been attributed to natural background fluctuations in recruitment. These changes, however, have been within the historical limits of natural fluctuations and would presumably occur in the complete absence of fishing and other human activities. Livingston et al. (Livingston et al. 1999) investigated the variability and evenness of biomass levels in guilds of the eastern Bering Sea. These workers found no evidence that groundfish fisheries had caused declines in trophic guild diversity for the groups studied. Changes in guild biomass diversity were observed when a dominant guild component (e.g., pollock) changed in abundance, but these changes were related primarily to recruitment rather than to fishing. There appeared to be no significant loss of functional (trophic) diversity. This evidence, while minimal, suggests that future changes in functional diversity are not likely to result from human activities in the BSAI and GOA regions if the pattern of such activities remains similar to present conditions.

Genetic diversity within species, the third type of biodiversity indicator, may have received past influences from American and foreign commercial fisheries. For example, concern about the depletion of pollock stocks in the Donut Hole region of the Central Bering Sea led to an international moratorium on fishing in the region in 1993 and to the 1994 Convention on the Conservation of the Pollock Resources in the Central Bering Sea. The genetic diversity of the BSAI and GOA ecosystems has not been systematically studied, and this data gap prevents establishment of a reliable baseline against which future assessments might be gauged to determine if significant changes have occurred. 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 fished versus unfished systems. As discussed in Section 4.9, it is possible that genetic diversity has already declined in the BSAI and GOA ecosystems as a result of commercial fishing, but this cannot be known in the absence of a baseline. Even in historically heavily fished systems such as the North Sea, there is little evidence that, for example, selection for body length in cod has reduced genetic diversity after 40 years of intensive fishing (Jennings and Kaiser 1998). Genetic assessments of North Pacific pollock populations and subpopulations conducted by Bailey *et al.* (Bailey et al. 1999)have indicated that there are genetic variations among different stocks, but these studies have not found genetic variability across time within the same stocks that might indicate past or current effects from commercial fishing or other external influences. In general, there is little evidence to suggest that genetic diversity is affected by external factors acting on the BSAI and GOA ecosystems.

Cumulative effects

Potential cumulative effects associated with the five alternatives are summarized in Table 4.9.11. Alternative 1, No Action, has the potential to produce conditionally significant adverse direct and/or indirect effects on species diversity, as discussed in Section 4.9. Additive or synergistic effects from past, current, and future fisheries and commercial shipping could increase the severity of the negative impact potentially associated with this alternative, resulting in a conditionally significant adverse cumulative effect. These external influences could include species depletions from targeted catch and bycatch, mechanical disturbance of benthic habitats by bottom trawling, introductions of non-indigenous species that could out-compete and displace native species, and climatic trends or regime shifts that prove unfavorable for some species. On the other hand, favorable climate and regime shifts could completely neutralize these adverse effects, because these natural events are the primary forces driving the BSAI and GOA ecosystems. Accordingly, the conditionally significant cumulative effect on species diversity associated with Alternative 1 could be either adverse or positive (+/-).

With respect to functional (trophic) diversity, Alternative 1 could contribute marginally to a cumulative effect in association with the major ecosystem drivers, climatic trends and regime shifts, if these conditions altered the relative abundance of species within trophic guilds. The external control exerted by climate and regime conditions could either increase or decrease functional diversity. The cumulative component of this effect, however, would not be significant, because it would not differ measurably from the effect of the external factors by themselves.

Similarly, Alternative 1 could produce a cumulative effect on genetic diversity within the BSAI and GOA ecosystems, in combination with adverse effects from commercial fisheries and with either positive or adverse effects of climate and regime. As noted above, it has been speculated that spatial concentration by foreign fishing fleets on walleye pollock in the Donut Hole region of the central Bering Sea may have contributed to the depletion of the local pollock population in the vicinity of Bogoslof Island, leading to an international moratorium on fishing in the Donut Hole since 1993 and to the 1994 Convention on the Conservation of the Pollock Resources in the central Bering Sea (Pautzke 1997). In general, however, there is little evidence to suggest that genetic diversity has been affected by cumulative influences acting on the BSAI and GOA, and it is concluded that this cumulative effect, if any, would not be significant.

Alternatives 2 through 5 are similar, in that they have all been concluded to have a conditionally significant positive direct or indirect effect on species diversity and no significant direct or indirect effects on functional and genetic diversity. With respect to species diversity, the potentially positive influence of any of these alternatives could be offset by adverse effects from IPHC, foreign, domestic, and/or JV fisheries through over-fishing, bycatch mortality, and benthic damage from bottom trawling. and by the tendency of commercial shipping to introduce exotic species through ballast water discharges and the release of hull-fouling invertebrates. Climatic and regime changes, however, could overshadow all such effects, driving species diversity in either direction. Therefore, Alternatives 2 through 5 are concluded to have the potential to produce a conditionally significant cumulative effect that could be either positive or adverse (+/-).

With respect to functional (trophic) diversity, Alternatives 2 through 5 have all been evaluated as having no significant direct or indirect effect by themselves. In combination with climate and/or regime shifts, any of these alternatives could provide a marginal cumulative contribution, but it would not be significant, i.e., measurable against the background influence of the ecosystem drivers.

In the case of genetic diversity, Alternatives 2 through 5 have been concluded to exert a conditionally significant positive effect. Because these alternatives would affect commercial fishery management policy, they could outweigh the existing adverse effects of selective removals of fish and marine invertebrates with optimal market characteristics by these fisheries. Again, however, the major ecosystem drivers–climatic change and regime shifts–would exert the controlling influence. The resulting cumulative effect could be conditionally significant, and either positive or adverse, depending on the relative levels of contribution by all of these factors.

Table 4.9.11 Cumulative effects on biological diversity.

PAST EFFECTS

Direct/Indirect Effects	**External Effects**					**Past Influence Y/N**
Category	Human Controlled				Natural Events	
	IPHC Fishery	Foreign Fisheries	JV & Domestic Fisheries	Commercial Shipping	Climate & Regime Shifts	
Species diversity	-	-	-	-	+/-	Y
Functional (trophic) diversity	0	0	0	0	+/-	Y
Genetic diversity	-	-	-	0	+/-	Y

ALTERNATIVE 1

Direct/Indirect Effects		**External Effects**			**Cumulative Effect Y/N**	**Conditionally Significant Y/N**
Category	Rating	Human Controlled		Natural Events		
		IPHC, Foreign, Domestic & JV Fisheries	Commercial Shipping	Climate & Regime Shifts		
Species diversity	CS(-)	-	-	+/-	Y	Y(+/-)
Functional (trophic) diversity	I	0	0	+/-	Y	N
Genetic diversity	I	-	0	+/-	Y	N

ALTERNATIVES 2 THROUGH 5

Direct/Indirect Effects		**External Effects**			**Cumulative Effect Y/N**	**Conditionally Significant Y/N**
Category	Rating	Human Controlled		Natural Events		
		IPHC, Foreign, Domestic & JV Fisheries	Commercial Shipping	Climate & Regime Shifts		
Species diversity	CS(+)	-	-	+/-	Y	Y(+/-)
Functional (trophic) diversity	I	0	0	+/-	Y	N
Genetic diversity	CS(+)	-	0	+/-	Y	Y(+/-)

4.10 Conclusions with respect to effects of the alternatives on the environment

As noted in Section 4.1, the environmental consequences of proposed Amendments 61/61/13/8 and the alternatives under consideration derive primarily from changes in fishing and processing patterns that are expected to result from the structural and organizational changes resulting from the AFA. The most significant structural change resulting from the AFA is the imposition of a new allocation formula for the BSAI pollock fishery that increases the CDQ and inshore allocations and subdivides the remaining offshore allocation between catcher/processor and motherships. The most significant organization change resulting from the AFA is the emergence of fishery cooperatives which have eliminated the Olympic-style race for fish and has allowed for rationalization of the fishery.

These major structural and organizational changes are expected to affect patterns of pollock fishing and processing in the BSAI. Among the possible changes examined in this chapter are:

- **Effects on pollock fishing patterns.** How will each of the alternatives affect when and where pollock fishermen chose to fish?

- **Effects on fleet composition.** How will each of the alternatives affect the composition of the various pollock fishing fleets?

- **Effects on pollock processing patterns.** How will each of the alternatives affect how pollock processing (i.e. processing locations, product forms, and recovery rates)?

The task of describing how a particular fishery is expected to conduct itself under a comprehensive new set of rules involves some degree of conjecture and speculation. This is because the circumstances that lead fishermen and industry to behave in a certain manner are dependent on such a wide variety of unpredictable factors including such things as weather patterns, sea ice conditions, the migratory patterns of the target species, worldwide market conditions, other regulatory changes, and a host of other factors that are difficult or impossible to predict. Nevertheless, the re-organization of the BSAI pollock fishery under the AFA that is reflected in each of the AFA-based alternatives (Alternatives 2-5) will result in certain predictable changes to fishing and processing practices and these changes will have some predictable environmental and economic consequences.

Sections 4.2 and 4.3 examined the how these projected changes to pollock fishing and processing patterns are expected to affect the physical and biological resources of the BSAI and GOA. Table 4.10.1 displays the major conclusions with respect to environmental impacts of the alternatives. In summary, conditionally negative effects on Steller sea lions and predator-prey relationships have been identified for Alternative 1 primarily as a result of the expected increase in temporal and spatial concentration of fishing effort under Alternative 1. Alternatives 2 through 5 are expected to have conditionally positive effects on Steller sea lions as a result of the expected temporal and spatial dispersion of fishing effort and the expectation that fishery cooperatives will provide increased ability to micro-manage fishing activity at the individual vessel level. This increase in management capacity is expected to facilitate the implementation of Steller sea lion protection measures under Amendments 70/70. For all other components of the environment analyzed, the effects of all of the alternatives was found to be either insignificant or unknown.

Table 4.10.1 Summary of the predicted environmental effects of the alternatives.

Affected Environment	*Alt. 1 (no action)*	*Alt. 2 (AFA baseline)*	*Alt. 3 (preferred)*	*Alt. 4 (Co-op autonomy)*	*Alt. 5 (market freedom)*	*Comments and Summary*
Effects on the physical environment						
Substrate and benthic habitat	I	I	I	I	I	Pelagic trawl gear is mandated in the BSAI directed pollock fishery by regulation. The exclusive use of pelagic trawl gear in the BSAI directed pollock fishery is not expected to have impacts on benthic habitat and EFH
Essential fish habitat (EFH)	I	I	I	I	I	
Effects on marine mammals						
Steller sea lions	CS-	CS+ (relative to the no-action alternative)	CS+ (relative to the no-action alternative)	CS+ (relative to the no-action alternative)	CS+ (relative to the no-action alternative)	Reverting to open access under Alt. 1 could lead to increased spatial/temporal concentration of catch and exacerbate Steller sea lion protection efforts. Formation of co-ops under Alts. 2-5 could decrease the spatial/temporal concentration of catch. Also, the increased ability to micro-manage vessel activity through co-ops is likely to facilitate the implementation of Amendment 70/70 protection measures.
ESA-listed cetaceans	I	I	I	I	I	These species to not prey primarily on pollock and/or their primary range does not overlap significantly with the primary pollock fishing areas.
Other cetaceans	I	I	I	I	I	
Northern fur seals	U	U	U	U	U	A shift in fishing effort northward away from the SCA as a result of Steller sea lion protection measures and the emergence of fishery cooperatives could result in increased pollock removals from Northern fur seal foraging areas around the Pribilof Islands. The effects of this potential northward shift in fishing effort on Northern fur seals is unknown.
Harbor seals	I	I	I	I	I	These species to not prey primarily on pollock and/or their primary range does not overlap significantly with the primary pollock fishing areas.
Other pinnipeds	I	I	I	I	I	
Sea otters	I	I	I	I	I	
Effects on fish and shellfish species						
Pollock	I	I	I	I	I	None of the alternatives would affect total removals of pollock or the TAC-setting process
Other groundfish	I	I	I	I	I	None of the alternatives would affect total removals of other groundfish species or the TAC setting process for those species.
Prohibited species	I	I	I	I	I	Bycatch rates of all prohibited species in the directed pollock fishery are low and are not expected to significantly affect the health of those species under all of the alternatives. The increased ability of co-ops to micro-manage individual vessel activity may enable co-ops to further reduce salmon bycatch.

Affected Environment	***Alt. 1 (no action)***	***Alt. 2 (AFA baseline)***	***Alt. 3 (preferred)***	***Alt. 4 (Co-op autonomy)***	***Alt. 5 (market freedom)***	***Comments and Summary***
Forage species	I	I	I	I	I	Bycatch of forage species is negligible under all of the alternatives
Effects on seabirds						
Non-piscivorous seabirds	I	I	I	I	I	Information voids for various aspects of seabird ecology make it difficult to predict impacts of fishery management changes on seabirds. Effects of spatial/temporal concentrations of prey on piscivorous seabirds considered unknown and insignificant for non-piscivorous seabirds.
Piscivorous (fish eating) seabirds	U	U	U	U	U	
Ecosystem effects						
Predator-prey relationships	CS-	U	U	U	U	Concentrated removals of pollock has been a concern in status-quo regime, especially with respect to Steller sea lions. The effects of a more dispersed fishery under Alternatives 2 through 5 are considered unknown
Energy flow and balance	I	I	I	I	I	Combined evidence regarding the level of discards relative to natural sources of detritus and no evidence of changes in scavenger populations that are related to discard trends suggests that all of the alternatives would have insignificant ecosystem impacts through energy removal and redirection.
Biological diversity	I	I	I	I	I	No fishing-induced extinctions of groundfish or other marine species have been documented in the last 30 years or so. No fishing-induced changes in trophic diversity have been detected under current management regime.

S- Significant Negative
CS- Conditionally Significant Negative
I Insignificant
CS+ Conditionally Significant Positive
S+ Significant positive
U Unknown

Chapter 5: List of preparers

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Kent Lind, Fishery Management Biologist, Sustainable Fisheries Division, Alaska Regional Office, NMFS. Provided overall project management and leadership of the EIS project. Drafted sections in all chapters of the document. Eleven years of fishery management experience in Alaska. *B.A. Reed College, M.S. in marine affairs, University of Washington.*

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Chapter 7: Literature cited

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Chapter 8:   Response to Comments

8.1 Introduction

According to CEQ regulations for implementing NEPA (40 CFR §1503.4), an agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement Possible responses are to:
(1) Modify alternatives including the proposed action.
(2) Develop and evaluate alternatives not previously given serious consideration by the agency.
(3) Supplement, improve, or modify its analyses.
(4) Make factual corrections.
(5) Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

The public comment period for the draft EIS for American Fisheries Act Amendments 61/61/13/8 ran from October 26, 2001, through December 10, 2001 (45 days). Six written comments were received by the end of the comment period. In accordance with 40 CFR 1503.4(b), the comments received are attached to this final statement and are numbered in order of receipt. Each comment letter is summarized responded to individually in section 8.3.

8.2 Comments on the Draft EIS

See bookmarks for comment.

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8.3 Response to Comments

Each of the six comments received on the draft EIS is responded to individually. The individual points in each comment letter have been paraphrased by NMFS in order to respond to each point directly.

8.3.1 Response to comments from Gerry Leape, National Environmental Trust; Andrea Durbin, Greenpeace; and Phil Kline, American Oceans Campaign

Comment 1: The scope of alternatives is inadequate. All of the alternatives in the draft EIS appear to be very similar with only slight differences and seem to focus on minimizing operational burdens for NMFS and for industry rather than on limiting the environmental impacts the fisheries have on the ecosystem.

Response: NMFS believes that the scope of alternatives is indeed adequate. As explained in Section 2.1, the alternatives were constructed to capture the range of options that were proposed by the public during the long development process for Amendments 61/61/13/8. The bulk of public discussion during the development of Amendments 61/61/13/8 focused on two major program components: (1) measures regulating fishery cooperatives, and (2) sideboard protections for other fisheries. This is understandable given that the purpose of Amendments 61/61/13/8 is to implement a statutory program that provides the Council with flexibility to develop alternatives in those two areas but little or no flexibility to modify other aspects of the program. The EIS attempts to capture the range of proposals put forward in these two areas. Other proposals to limit the potential environmental impacts of the BSAI pollock fishery on the ecosystem (but that do not involve AFA implementation directly) are being considered in the larger programmatic SEIS on the groundfish fisheries that is being prepared concurrently.

Comment 2: NMFS offered a "no action" baseline alternative for the purpose of comparison but not a "no fishing" alternative, which is a requirement under NEPA, 40 CFR 1502.14(d)

Response: NMFS disagrees. A "no fishing" alternative is not required under NEPA. This issue is addressed by question 3 of CEQ's "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (46 FR 18027):

> *Section 1502.14(d) requires the alternatives analysis in the EIS to "include the alternative of no action." There are two distinct interpretations of "no action" that must be considered, depending on the nature of the proposal being evaluated. The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan. In this case, alternatives would include management plans of both greater and lesser intensity, especially greater and lesser levels of resource development.*
>
> *The second interpretation of "no action" is illustrated in instances involving federal decisions on proposals for projects. "No action" in such cases would mean the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward.*

The proposed action under Amendments 61/61/13/8 is clearly of the first type described by the CEQ in that it is a statutory program to replace the prior inshore/offshore management regime with an AFA-based management regime for the BSAI pollock fishery. NMFS believes that the most appropriate no-action alternative in this instance is an examination of the BSAI pollock fishery under the previous inshore/offshore management regime which would have remained in effect had the AFA not been passed by Congress. An examination of either a "no fishing" alternative, or the opposite, a completely unregulated fishery, would be a useless academic exercise because neither would occur if the Secretary of Commerce disapproves the proposed action--Amendments 61/61/13/8. Failure to approve and implement the proposed AFA-based management regime would mean that the fishery would revert to the pre-AFA inshore/offshore management regulations that were in place prior to the passage of the AFA.

Comment 3: NMFS should have offered an alternative for "hard cap" sideboard allocations and ensure that they are implemented by closing an entire fishing area if the hard caps are reached. By treating sideboard amounts as hard caps and closing all fishing in the area when the sideboard is reached, vessels may be forced to permanently decrease their bycatch by implementing more selective gear. This requires extremely careful monitoring of bycatch by NMFS rather than by the cooperatives, which is not reliable, and should not be considered only for the purpose of decreasing the burden on NMFS.

Response: Alternative 4 does include "hard cap" sideboard allocations. Cooperatives would be prohibited from exceeding any sideboard amount through directed fishing activities or incidental catch. It would be the responsibility of each individual cooperative to manage its sideboard fishing activities to prevent exceeding any groundfish or prohibited species sideboard amount, whether in a directed fishery or as bycatch. Each individual cooperative would face enforcement action if any sideboard amount was exceeded. It should be emphasized that while cooperatives would, indeed, be responsible for fishing within their sideboard caps, the information used to determine compliance would be data collected by the two NMFS observers operating on each processing vessel using NMFS-certified scales. Observers would report catch and bycatch data directly to NMFS and cooperatives would be evaluated based on the catch and bycatch information reported by observers. Under none of the alternatives does NMFS consider using unverified catch reports submitted by industry rather than observers. For this reason, NMFS believes that the catch and bycatch information generated under all of the alternatives will be accurate and reliable.

Under Alternative 4, the fishery would operate in a manner similar to the multi-species CDQ fishery in that each group would be responsible for it's own fishing activity and could not exceed any quotas or sideboard limits. See figure 2.1.1 for a comparison of the sideboard management approaches.

Comment 4: Basing sideboard allocations on total catch is unacceptable because vessels are then credited for non-selective fishing. Sideboard credit should pertain only to retained catch.

Alternative 3, the preferred alternative does base all sideboard amounts on retained catch. Other alternatives that base sideboard amounts on total catch (such as Alternative 4) were analyzed but not adopted by the Council during the development of Alternatives 61/61/13/8 for some of the reasons mentioned in the comment letter.

Comment 5 NMFS should implement the same stringent 200% observer coverage and monitoring requirements for the inshore and mothership sectors that are currently in place for the offshore sector and require that all fish be weighed on NMFS approved scales.

Response: NMFS agrees. With respect to observer requirements for inshore and mothership processors, Alternative 3, the preferred alternative, would require 200% observer coverage on all inshore and mothership processors at any time that pollock is received or processed from the directed pollock fishery. NMFS believes that this level of coverage will provide comparable levels of monitoring across all sectors.

With respect to scale requirements, the preferred alternative would require that all catch received by motherships be weighed on NMFS-approved scales and all catch received by inshore processors be weighed on State-certified scales. NMFS believes that the State of Alaska Department of Weights and Measures certification and inspection program for inshore processing plant scales is adequate and that a duplicate program to provide for NMFS inspection and certification of scales at inshore processing plants is unnecessary. For this reason, NMFS is proposing to inspect and certify scales used on catcher/processors and motherships, which operate outside the jurisdiction of the State. However, NMFS is proposing to rely on the existing State inspection and certification program for scales at inshore processing plants, providing that each plant is operating in a manner consistent with an approved Catch Monitoring and Control Plan.

Comment 6: Industry should pay for the monitoring costs of the AFA pollock fishery.

Response: Under the preferred alternative, industry would be responsible for paying for all observer coverage costs. In addition, industry would be responsible for any scale installations and plant modifications that are necessary to comply with NMFS scale requirements for catcher/processor and motherships, and catch monitoring and control plans for inshore processors. In addition, industry would also be responsible for installing and maintaining the VMS transponders that would be required on all AFA fishing vessels.

Under the preferred alternative, the only BSAI pollock fishery monitoring costs that are not born by industry are the costs of maintaining a NMFS scientific and management presence in Alaska to fulfill it's mandate under the Magnuson-Stevens Act, and the operational costs born by the USCG when it conducts fishery enforcement activities in the Bering Sea. However, a proposal to completely fund NMFS and USCG activities in Alaska through user fees in the groundfish fisheries is beyond the scope of this proposed action.

Comment 7: There should be an alternative that considers the environmental effects of allowing or not allowing leasing under section 210(c) of the AFA, as discussed in the attached comment letter which also argues that allowing such leasing effectively creates a new IFQ program which is illegal under the Magnuson-Stevens Act.

Response: Subsection 210(c) of the AFA addresses the issue of whether catcher vessels authorized to deliver to catcher/processors may join into a cooperative with the catcher/processors themselves. In a legal opinion on this issue, the NOAA Office of General Counsel concluded that allowing catcher vessels to lease their 8.5% quota to catcher/processors is consistent with the intent of the statute and does not create a new IFQ program. To prohibit leasing arrangements within cooperatives would undermine the intent of the AFA to provide for the decapitalization and rationalization of the BSAI pollock fishery. Leasing arrangements (whereby one vessel fishes pollock quota on behalf of another vessel within the same cooperative) are present and actively used in all of the AFA cooperatives formed to date in all three sectors of the BSAI pollock fishery. The only way to completely eliminate leasing within the context of a limited access program would be to issue each individual vessel a non-transferrable individual fishing quota that could be fished only by the vessel itself. Such a program would amount to a non-transferrable IFQ program and not a fishery cooperative program.

Regarding the issue of environmental effects of leasing. These effects are analyzed within the overall context of the preferred alternative which assumes that leasing arrangements will exist within all three sectors of the BSAI pollock fishery. The EIS concludes that 25% or more of the BSAI pollock fleet is likely to retire as a result of the preferred alternative due to the ability of vessels in all sectors of the fishery to lease pollock quota within cooperatives.

8.3.2 Response to comments from Stephanie Madsen, PSPA

Comment 1. The RIR provides no evidence whatsoever to support the argument that Alt 5 is more efficient than 3.

Response: NMFS believes its conclusion has a reasonable basis. The RIR argues that one of the purposes of the AFA was to allow the industry itself to address the common property fishing problems that had led to a race for the pollock, excess use of labor and capital in the industry, and lower net benefits from the fishery. The AFA would allow the industry to address its own problems by taking steps to reduce the costs to fishermen and processors of organizing to rationalize their own production. Central to this strategy was a reduction in the transactions costs of forming fishing cooperatives. Industry economies would be greater the more flexibility cooperatives had to structure their operations. Alternative 3, which did not provide catcher vessels and processors as much flexibility to move catcher vessels between cooperatives as Alternative 5 was expected to provide fewer benefits. This conclusion is supported by a discussion paper prepared for the Council by economists from the University of Washington ("Discussion Paper on Inshore Cooperatives") which is attached to the EIS as Appendix D. A summary of the comments from the discussion paper on this issue are now included in the RIR.

Comment 2. Table 4.5.3 indicates that Alterative 5 has larger net benefits than Alternative 3. However, the "Summary of the benefit-cost analysis" on page 4-159, says "In addition to these concerns, this benefit-cost analysis has been qualitative, and has incorporated a margin of error that makes it impossible to say for certain that Alternative 3 has smaller net benefits than Alternative 5." These conclusions are internally inconsistent.

Response: NMFS disagrees, and does not believe that there is an internal inconsistency. The quotation is taken from a paragraph discussing why the preferred alternative is not necessarily the most efficient alternative. After discussing the shortcomings of efficiency alone as a decision making tool, the uncertainties associated with the analysis are introduced. The statement is meant to indicate that, while it is likely that one alternative is more efficient than the other, it cannot be so stated with certainty. This qualitative statement performs the same function that a confidence interval performs for a point estimate in a statistical or simulation analysis. In its context it qualifies, but does not contradict, Table 4.5.3, and helps the reader understand why Alternative 3 is preferred to Alternative 5.

Comment 3. The RIR fails to consider all empirical evidence. Despite the apparent constraints under Alternative 3, four vessels have been able to change cooperatives within the rules. Thus Alternative 3 does provide the fishing vessels the market freedom that is necessary for efficiency. The RIR does not mention these cross-cooperative changes. There was no additional consolidation: the central hypothesis is falsified by the facts. Table 4.5.1 suggests consolidation occurred before cross-cooperative acquisition.

Response: NMFS does not agree that the information cited demonstrates that Alternatives 3 and 5 provide equivalent net social benefits. As the RIR notes on page 4-144, the cooperatives provided an opportunity to address the common property externality and the race for the fish in the BSAI pollock fishery by reducing the transactions costs facing fishermen and processors who wanted to organize to exploit the fishery systematically. The institutions incorporated into Alternative 5 should lower transactions costs below those in Alternative 3, and thus produce somewhat greater net benefits. NMFS agrees that five catcher vessels have moved between cooperatives without spending a year in the common property fishery, and that this should have been reported in the RIR. A reference to this shift has been added to the RIR, along with a discussion of the way such a shift can take place within program rules. NMFS does not agree that this contradicts its central assertion that Alternative 5 places fewer difficulties in the way of such a shift than Alternative 3.

Comment 4. There is no discussion of possible efficiency losses that may have resulted in the processing sector. There is no discussion of impacts in the processing sector. This EIS focuses on vessels, with the lone exception in the distribution section. The central concern of processors (wealth redistribution) is ignored.

Response: NMFS has changed its language to make it clearer that many of the efficiency benefits accruing through more efficient operation of fishing fleets could also accrue through more efficient processing operations. NMFS does not agree that the RIR ignores processing or the wealth redistribution concern of processors. The cost-benefit analysis is accompanied by a distributional analysis; as noted in the comment, one section of this compares the net benefits of the five alternatives to the in-shore processing sector. A paragraph in the "Summary of the benefit-cost analysis" also discusses the importance of the allocation of AFA benefits between inshore processors and inshore catcher vessels to the choice of alternatives.

Comment 5. The RIR fails to cite or discuss germane and peer-reviewed literature that was available. Specifically, the RIR fails to utilize the article "Fishery Cooperatives as an Alternative to ITQs: Implications of the American Fisheries Act." by Scott Matulich, Murat Sever and Fred Inaba, Land Economics, 16: 1-16. 2001.

Response: NMFS agrees that it should have utilized the article by Matulich *et al.*. However, use of this article would not have changed the conclusions reached in the RIR. This article uses game theory to discuss conditions under which the AFA, as implemented under Alternative 3, might or might not make both fishing operations and fish processing operations better off. It does not address itself to the efficiency elements of the cooperatives, except indirectly; its primary concern is with how the wealth created by the rationalization of the inshore pollock fishery will be divided between the pollock fishing catcher vessel and inshore processors in response to different program rules. The article is theoretical, drawing to a limited extent on anecdotal information in a postscript. The article does not contradict the conclusions reached in the RIR. However, the article does have material that bears on the discussion, and this has been incorporated into the RIR.

Comment 6. The conclusion of the RIR that Alternative 5 is more efficient is "revisionist" since Alternative 3 was the preferred alternative of the Council and the choice of the Secretary.

Response: NMFS disagrees that the RIR is revisionist. One purpose of an RIR is to summarize the costs and benefits of different alternatives. NMFS has performed a qualitative cost and benefit analysis in this RIR and has attempted to rank the alternatives on the basis of the likely relation between their net benefits. NMFS identified Alternative 3 as the preferred alternative, and discussed the shortcomings of cost benefit analysis as a tool for decision making ("Summary of the benefit-cost analysis" at the end of Section 4.5.2, page 4-159). In the course of that discussion NMFS noted the importance of the compromises between different industry groups that are incorporated into Alternative 3. NMFS has added additional references to this issue at other points in the RIR to add additional emphasis to this point.

8.3.3 Response to comments from John Gauvin, Groundfish Forum

Comment 1. **Section 2.9.1 lists bottom trawling as a possible cause for the decline of the population of spectacled eiders. However, in 1999, the At-sea processors association commented to the USFWS on this issue in response to the proposed rule to establish critical habitat, noting that bottom trawling does not even occur within the area proposed to be designated as critical habitat for spectacled eiders. The USFWS has since corrected this mistaken assumption in the final rule to establish critical habitat for spectacled eiders. We feel that the AFA EIS should correct this assumption as well.**

Response: NMFS agrees. Section 2.9.1 has been revised to eliminate speculation that bottom trawling may be a possible cause for the decline of the population of spectacled eiders.

Comment 2. **Groundfish forum believes that the baseline employment information reported in the draft EIS greatly understates the actual FTE employment attributable to the H&G sector. We estimate that the number of FTEs currently attributable to the H&G sector is 1,535 (supporting documentation attached).**

Response: NMFS has reviewed the employment information submitted by the Groundfish Forum and incorporated it into the sector profiles section to provide a more recent update of employment levels in this sector of the groundfish industry.

8.3.4 Response to comments from Mike Hyde, American Seafoods Company; Michael Coleman, Highland light; and John Bundy, Glacier Fish Company.

Comment 1. **We believe that the Council exceeded its authority when it adopted a catcher/processor sideboard option in Alternative 3 that based sideboard amounts on the retained catch of AFA-listed vessels from 1995-1997. We are opposed to any changes in the way that catcher/processor sideboards are calculated and support the sideboard alternative set forth in Alternative 2. The AFA authorizes the Council to make changes that supersede provisions of the Act only when they are necessary "for conservation purposes or to mitigate adverse effects" caused by the AFA or fishery cooperatives. Nowhere in the draft EIS nor in any of the other documents that have been prepared to date in connection with the AFA amendment package has NMFS ever identified an "adverse effect" that needs to be mitigated or a "conservation" rationale for the proposed change in the AFA's C/P sideboard provisions.**

Response: This comment has been raised at various points in the FMP amendment development process and merits a detailed response. First, the question of whether the Council exceeded its authority (i.e., whether the preferred alternative can be legally approved) is not a NEPA issue but rather, an issue related to the approval/disapproval decision for the amendment package. NEPA does not require that the legal authority for all alternatives be established before they can be included in an analysis. In fact, the CEQ guidelines even call for the analysis of reasonable alternatives that fall outside of the action agency's jurisdiction when appropriate. Consequently, a final determination about whether the preferred alternative is consistent with all applicable law will be made as part of the approval/disapproval decision for the final rule to implement Amendments 61/61/13/8, if the amendments are approved by NMFS and not in the final EIS. The legal basis for such determinations will be set out in detail in the final rule.

Nevertheless, in accepting the amendments for public review, NMFS has preliminarily determined that the preferred alternative is sufficiently consistent with the AFA and other applicable law to merit public review of the FMP amendments, and publication of the proposed rule in the *Federal Register*. In accepting the amendments for public review, NMFS evaluated the statutory language and legislative history of section 211 of the AFA and preliminarily concluded that all of the sideboard alternatives proposed in the EIS are consistent with the language of the AFA. In other words, it is NMFS's preliminary opinion that the preferred alternative does not supersede the AFA, but rather, is based on a different interpretation of the statute than that contained in the comment letter. An explanation of this preliminary determination is outlined below:

Subparagraph 211(b)(2)(B) of the AFA states:

> *"The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from, in the aggregate—*
>
> *(A) exceeding the percentage of the harvest available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total harvest by such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997;*

The first step in interpreting this paragraph is determining what Congress meant by the terms "fishery and "in the fishery." The term "fishery" is used throughout section 211 of the AFA and is used in the title of this section as well: "SEC 211. PROTECTIONS FOR OTHER FISHERIES; CONSERVATION MEASURES." Did Congress intend the term "in the fishery" to mean the directed fisheries for other groundfish species that non-AFA fishermen participate in (the Pacific cod fishery, the rock sole fishery etc.) and that presumably require protection? Or, did Congress intend the term "in the fishery" to mean any harvest of any species of groundfish in the BSAI regardless of whether the vessel was targeting on that species or encountering it as incidental bycatch in another directed fishery. Put another way, is the purpose of this section to protect the *fishermen* who engage in directed fishing for other groundfish species? Or is the intent of this section to protect the other *groundfish* that may be harvested by AFA catcher/processors when operating in the pollock and non-pollock fisheries of the BSAI?

The first interpretation of the term "fishery" implies that Congress was concerned primarily with protecting *fishermen* who engage in directed fisheries for other groundfish species in the BSAI. The second interpretation of the term "fishery" implies that Congress intended to establish AFA catcher/processor catch and bycatch limits for all *groundfish species* found in the BSAI regardless of whether the species is of commercial interest to any other fishermen. The great majority of groundfish species found in the BSAI are of little or no commercial interest and routinely discarded by most fishermen when they are encountered as bycatch. Even though such bycatch is of little interest to other fishermen, Congress has expressed an interest in reducing bycatch in the groundfish fisheries off Alaska in the Magnuson-Stevens Act. However, the question at hand is whether subparagraph 211(b)(2)(B) of the AFA is intended to result in strict bycatch limits for AFA catcher/processors for all groundfish species.

The legislative history of the AFA does not provide a definitive answer to this question. However, in describing the provisions of the AFA in the Senate Conference Report, Senator Frank Murkowski stated:

> *In addition, the bill attempts to ensure adequate protections for other fisheries in the North Pacific and Pacific from any potential adverse impacts resulting from the formation of fishery cooperatives in the pollock fishery. The formation of fishery cooperatives will undoubtedly free up harvesting and processing capacity that can be used in new or expanded ways in other fisheries. Although many of these vessels and processors have legitimate, historic participation in these other fisheries, they should not be empowered by this legislation to gain a competitive advantage in these other fisheries to the detriment of participants who have not benefitted from the resolution of the pollock fishery problems. While we have attempted to include at least a minimum level of protections for these other*

fisheries, it is clear to many of us that unintended consequences are likely. It is therefore imperative that the fishery management councils not perceive the protections provided in this bill as a statement by Congress that these are the only protections needed. In fact, the opposite is true. Although the protections provided for the head and gut groundfish offshore sector from the pollock offshore sector are more highly developed and articulated in the bill, the protections for other fisheries are largely left for the Councils to recommend. Those of us involved intimately in the development of this legislation strongly urge the Councils to monitor the formation of fishery cooperatives closely and ensure that other fisheries are held harmless to the maximum extent possible (Congressional Record, October 20, 1998, S12708).

This statement implies that Congress was intended primarily to protect the fishermen that engage in directed fisheries for other groundfish species and further, that Congress intended to provide substantial deference to the Council in developing sideboard management measures.

In the Senate Conference Report, Senator Ted Stevens stated:

Subsection (a) of section 211 directs the North Pacific Council to submit measures for the consideration and approval of the Secretary of Commerce to protect other fisheries under its authority and the participants in those fisheries from adverse impacts caused by the subtitle II of the American Fisheries Act or by fishery cooperatives in the BSAI directed pollock fishery. The Congress intends for the North Pacific Council to consider particularly any potential adverse effects on fishermen in other fisheries resulting from increased competition in those fisheries from vessels eligible to fish in the BSAI directed pollock fishery or in fisheries resulting from any decreased competition among processors.

Subsection (b) includes specific measures to restrict the participation in other fisheries of the catcher/processors eligible to participate in the BSAI directed pollock fishery (other than the vessel or vessels eligible under paragraph (21) of section 208(e)). While these types of limitations are appropriately for the North Pacific Council to develop, the catcher/processors eligible under section 208(e) may form a fishery cooperative for 1999 before the North Pacific Council can recommend (and the Secretary approve) necessary limitations. The restrictions in subsection (b) would therefore take effect on January 1, 1999 and remain in effect thereafter unless the North Pacific Council recommends and the Secretary approves measures that supercede the restrictions. Subparagraphs (A) and (B) of paragraph (2) prohibit the catcher/processors eligible to participate in the BSAI directed pollock fishery from exceeding the aggregate amounts of targeted species and bycatch in other fisheries that catcher/processors from the BSAI directed pollock fishery caught on average in 1995, 1996, and 1997 (Congressional Record October 21, 1998, S12781).

Again, this statement does not provide a definitive answer to the definition of the term "fishery" but implies that Congress was primarily interested in protecting fishermen rather than restricting bycatch. Senator Stevens states that "Subparagraphs (A) and (B) of paragraph (2) prohibit the catcher/processors eligible to participate in the BSAI directed pollock fishery from exceeding the aggregate amounts of <u>targeted species</u> and bycatch in other fisheries." This statement implies that Congress was concerned primarily about "targeted species" of groundfish in subparagraph (A) which addresses groundfish sideboards, and "bycatch" of prohibited species in subparagraph (B) which addresses prohibited species bycatch limits.

However, regardless of whether Congress intended subparagraph 211(b)(2)(B) to produce directed fishing restrictions in the target fisheries of interest to other fishermen, or absolute catch limits for all groundfish species, NMFS believes it is appropriate to analyze both approaches in the EIS. Furthermore, both approaches are consistent with the intent of the AFA if they result in protections for other groundfish fishermen and do not allow AFA C/Ps to exceed historic catch levels from the 1995-1997 groundfish fisheries.

Under the first interpretation (which is reflected by the "soft cap" approach set out in Alternative 3), sideboards would limit directed fishing by AFA catcher/processors in each BSAI groundfish fishery for which a sideboard amount was specified. Sideboard amounts that are insufficient to support a directed fishery for that species by AFA catcher/processors would result in AFA catcher/processor directed fishing closures for those species. Sideboard management becomes a matter of regulating the directed fishing activities of AFA catcher/processors in groundfish fisheries other than the BSAI pollock fishery. Under this approach, the AFA catcher/processor sideboard limit for a particular groundfish species would be established by determining the total harvest of each groundfish species made by AFA catcher/processors in 1995-1997 *while they were engaged in directed fishing for that species*.

For example, to establish a sideboard directed fishing limit for Pacific cod, NMFS would determine the total harvest of Pacific cod made by AFA catcher/processors in 1995-1997 while those vessels were engaged in directed fishing for Pacific cod, relative to the total directed harvest of Pacific cod during those same years. The problem with this approach, however, is that data limitations make it impossible to determine precisely how much Pacific cod a vessel harvested while engaged in directed fishing for Pacific cod as opposed to how much Pacific cod was harvested as incidental catch while the vessel was engaged in directed fishing for other species. This is because directed fishing determinations are based on how much product a vessel has on board at a given moment in time and NMFS catch data, which is aggregated on a weekly basis, are not discrete enough to make these calculations on an after-the-fact basis.

However, using retained catch totals as proposed under Alternative 3 provides a reasonable approximation of directed fishing activity by the AFA fleet from 1995-1997. Vessels not engaged in directed fishing for a particular groundfish species generally did not retain any of that species, especially prior to 1998 which was the first year that full retention requirements for Pacific cod were implemented. Furthermore, because directed fishing determinations are made based solely on a vessel's retained catch of the species in question, it is reasonable to use retained catch totals to estimate the directed fishing history of the AFA catcher/processor fleet in non-pollock groundfish fisheries.

Under the second interpretation of subparagraph 211(b)(2)(A), which is reflected in the "hard cap" approach set out in Alternative 4, sideboards would be established based on the retained and discarded catch by the AFA catcher/processor fleet in all fisheries from 1995 to 1997. Sideboards would be considered absolute tonnage limits that the AFA catcher/processor fleet could not exceed under any circumstances, even as incidental catch in other fisheries such as the pollock fishery.

Strict enforcement of this approach could result in the complete closure of the BSAI pollock fishery if a sideboard limit is reached and the continued prosecution of the BSAI pollock fishery was expected to result in further bycatch of that sideboard species. For example, Pacific Ocean Perch (POP) co-mingle to some extent with pollock in the water column and are normally encountered at times as a bycatch species in the BSAI directed pollock fishery. The total catch of POP by the AFA catcher/processor fleet while engaged in directed fishing for pollock is normally on the order of several hundred tons per year. Under Alternative 4, the sideboard amount for POP would be based on the historic total catch of POP by AFA catcher/processors from 1995-1997. However, if during any given year, the AFA fleet experienced higher than average POP bycatch rates in the directed pollock fishery and the sideboard level is reached while the pollock fishery is still ongoing, NMFS would be forced to close directed fishing for pollock before the pollock allocation is reached to prevent further pollock fishing activity to result in an overage of the POP sideboard limit. Such a result could have significant economic consequences on the AFA pollock fishery, but would not result in any meaningful protection for other groundfish fishermen because POP is not normally a target species of interest in the BSAI and the species has been closed to directed fishing since the mid-1990s due to low TACs.

In comparing these two approaches, it could be argued that the first approach reflected in Alternative 3 more closely reflects the intent of Congress because sideboard management would focus on limiting directed fishing by AFA catcher/processors in those fisheries for which other groundfish fleets have an interest. The second approach would limit the catch and bycatch by AFA catcher/processors of every groundfish species in the BSAI for which a TAC is established. Many of these species do not support directed fisheries in the BSAI. Rather, they are encountered primarily as bycatch in the pollock, Pacific cod, and flatfish fisheries. Therefore, the effect of this approach would be to establish strict bycatch limits for the AFA pollock fishery without necessarily providing protections for other fishermen. Given that "protections for other fisheries" is the title and stated purpose of section 211 of the AFA, and that bycatch is not raised as a regulatory issue anywhere within the AFA, it could be reasonably argued that of all the alternatives under consideration, Alternative 3 most closely reflects the intent and purpose of the statutory language set out in subparagraph 211(b)(2)(A) of the AFA.

8.3.5 Response to comments from John Henderschedt, Premier Pacific Seafoods

Comment 1. Several vessels were mis-named or mis-identified in the draft EIS.

Response: The corrections identified in the comment letter have been made to the final EIS.

Comment 2. The characterizations of mothership processing capacity and crew size in chapter 3 are inaccurate.

Response: This discussions of mothership processing capacity and crew size have been revised to reflect the information submitted in the comment letter.

Comment 3. The mothership sector did not operate under a cooperative agreement until 2000. This fact is mis-stated at several places in the EIS.

Response: The corrections identified in the comment letter have been made to the final EIS.

Comment 4. The EIS states that the mothership sector received a smaller allocation of pollock than it had traditionally harvested prior to the AFA and was not compensated for this loss. The EIS further states that the benefits of operating in a cooperative should offset the fish that was lost when the share percentage was reduced. This argument would be valid only if the benefits of operating in a cooperative were somehow greater to the mothership sector than to the other AFA pollock sectors. The EIS does not demonstrate that the benefits stemming from a cooperative are relatively greater for the mothership sector. Therefore, the uncompensated reduction in its AFA pollock share relative to its historical share means that the mothership sector is, even under the cooperative management of the fishery, less "better off" than are the other sectors. This fact should be acknowledged in the EIS.

Response: NMFS stands by the conclusions of the EIS. With the advent of pollock cooperatives, the mothership sector has reported a 26% increase in product recovery rates which is expected to result in comparable increases in gross revenues. This increase in gross revenues more than offsets the reduction in allocation received by the mothership sector under the AFA relative to the sector's traditional harvest percentage prior to the AFA. The analysis does not attempt to compare the relative benefits that each sector has received under the AFA to determine which sector has benefitted the most under the AFA. Indeed, such a comparison would be impossible without cost data that is unavailable to NMFS. However the analysis does conclude that all sectors of the BSAI pollock fishery have benefitted from the passage of the AFA and are better off than they would have been under the no-action alternative.

Comment 5. The EIS incorrectly states that mothership fleet cooperative vessel allocations were based on 1995-1997 pollock catch histories. The formula used by the mothership fleet cooperative was based on the best 3 years of catch history from 1995 to 1998.

Response: The EIS has been revised to reflect the correct allocation formula.

8.3.6 Response to comments from EPA Region 10.

Comment 1. One section of the EIS that should be improved is section 4.2.2, "Effects of pollock processing on substrates and bottom habitats." This EIS presents the Clean Water Act regulatory framework but does not describe the baseline information on water quality or the water quality effects of implementing action alternatives. In addition, it does not address the effects of seasonality on water quality. To address the matter, the EIS should describe how seasonality affects the water quality impacts, both offshore and inshore in bays and harbors, of dumping and discharging fish wastes. The discussion should describe the predicted effects of shifting as much as 40% of the seafood processing and attendant waste from offshore to inshore waters. The analysis should be done with the recognition that the worst time to discharge is between late July and early September when the water column is stratified by a summer thermocline. In addition, the EIS should examine how the AFA framework could benefit water quality through timing of processing and reducing processing waste.

Response: Section 4.2.2 has been revised to examine the projected quantity and seasonality of processing under the AFA alternatives relative to the no-action alternative.

Comment 2. EPA also recommends that the EIS add to the existing discussion of environmental justice effects of adopting action alternatives. The reduction of the pollock fleet to more efficient vessels would likely reduce the level of pollution from the fishery, but might negatively affect minority and low income people. For example, the EIS broadly discusses project impacts on employment in coastal areas but does not examine the impacts to the four fishing communities Unalaska/Dutch Harbor, King Cove, Sand Point, and Akutan that would be most affected by implementation of the AFA. Moreover, the EIS is almost completely silent on the effect of the project implementation on members of federally recognized tribes.

Response: Section 4.7 "Environmental Justice Considerations" has been revised to provide greater discussion on impacts to the four fishing communities most affects and on federally recognized tribes.

Appendix A: Text of the American Fisheries Act (AFA)

American Fisheries Act

Div. C, Title II, Pub. L. No. 105-277, 112 Stat. 2681 (1998)

TITLE II—FISHERIES

Subtitle I—Fishery Endorsements

SEC. 201. SHORT TITLE.

This title may be cited as the "American Fisheries Act".

SEC. 202. STANDARD FOR FISHERY ENDORSEMENTS.

(a) STANDARD.—Section 12102(c) of title 46, United States Code, is amended to read as follows—

(c)(1) A vessel owned by a corporation, partnership, association, trust, joint venture, limited liability company, limited liability partnership, or any other entity is not eligible for a fishery endorsement under section 12108 of this title unless at least 75 per centum of the interest in such entity, at each tier of ownership of such entity and in the aggregate, is owned and controlled by citizens of the United States.

(2) The Secretary shall apply section 2(c) of the Shipping Act, 1916 (46 App. U.S.C. 802(c)) in determining under this subsection whether at least 75 per centum of the interest in a corporation, partnership, association, trust, joint venture, limited liability company, limited liability partnership, or any other entity is owned and controlled by citizens of the United States. For the purposes of this subsection and of applying the restrictions on controlling interest in section 2(c) of such Act, the terms 'control' or 'controlled'—

(A) shall include—

(i) the right to direct the business of the entity which owns the vessel;

(ii) the right to limit the actions of or replace the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity which owns the vessel; or

(iii) the right to direct the transfer, operation or manning of a vessel with a fishery endorsement; and

(B) shall not include the right to simply participate in the activities under subparagraph (A), or the use by a mortgagee under paragraph (4) of loan covenants approved by the Secretary.

(3) A fishery endorsement for a vessel that is chartered or leased to an individual who is not a citizen of the United States or to an entity that is not eligible to own a vessel with a fishery endorsement and used as a fishing vessel shall be invalid immediately upon such use.

(4)(A) An individual or entity that is otherwise eligible to own a vessel with a fishery endorsement shall be ineligible by reason of an instrument or evidence of indebtedness, secured by a mortgage of the vessel to a trustee eligible to own a vessel with a fishery endorsement that is issued, assigned, transferred or held in trust for a person not eligible to own a vessel with a fishery endorsement, unless the Secretary determines that the issuance, assignment, transfer, or trust arrangement does not result in an impermissible transfer of control of the vessel and that the trustee—

(i) is organized as a corporation, and is doing business, under the laws of the United States or of a State;

(ii) is authorized under those laws to exercise corporate trust powers;

(iii) is subject to supervision or examination by an official of the United States Government or a State;

(iv) has a combined capital and surplus (as stated in its most recent published report of condition) of at least $3,000,000; and

(v) meets any other requirements prescribed by the Secretary.

(B) A vessel with a fishery endorsement may be operated by a trusuee only with the approval of the Secretary.

(C) A right under a mortgage of a vessel with a fishery endorsement may be issued, assigned, or transferred to a person not eligible to be a mortgagee of that vessel under section 31322(a)(4) of this title only with the approval of the Secretary.

(D) The issuance, assignment, or transfer of an instrument or evidence of indebtedness contrary to this paragraph is voidable by the Secretary.

(5) The requirements of this subsection shall not apply to a vessel when it is engaged in fisheries in the exclusive economic zone under the authority of the Western Pacific Fishery Management Council established under section 302(a)(1)(H) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1852(a)(1)(H)) or to a purse seine vessel when it is engaged in tuna fishing in the Pacific Ocean outside the exclusive economic zone of the United States or pursuant to the South Pacific Regional Fisheries Treaty, provided that the owner of the vessel continues to comply with the eligibility requirements for a fishery endorsement under the federal law that was in effect on October 1, 1998. A

fishery endorsement issued by the Secretary pursuant to this paragraph shall be valid for engaging only in fisheries in the exclusive economic zone under the authority of such Council, in such tuna fishing in the Pacific Ocean, or pursuant to such Treaty.

(6) A vessel greater than 165 feet in registered length, of more than 750 gross registered tons, or that has an engine or engines capable of producing a total of more than 3,000 shaft horsepower is not eligible for a fishery endorsement under section 12108 of this title unless—

(A)(i) a certificate of documentation was issued for the vessel and endorsed with a fishery endorsement that was effective on September 25, 1997;

(ii) the vessel is not placed under foreign registry after the date of the enactment of the American Fisheries Act; and

(iii) in the event of the invalidation of the fishery endorsement after the date of the enactment of the American Fisheries Act, application is made for a new fishery endorsement within fifteen (15) business days of such invalidation; or

(B) the owner of such vessel demonstrates to the Secretary that the regional fishery management council of jurisdiction established under section 302(a)(1) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1852(a)(1)) has recommended after the date of the enactment of the American Fisheries Act, and the Secretary of Commerce has approved, conservation and management measures in accordance with such Act to allow such vessel to be used in fisheries under such council's authority..

(b) PREFERRED MORTGAGE.—Section 31322(a) of title 46, United States Code is amended—

(1) by striking "and" at the end of paragraph (2);

(2) by striking the period at the end of paragraph

(3)(B) and inserting in lieu thereof a semicolon and "and"; and

(3) by inserting at the end the following new paragraph:

(4) with respect to a vessel with a fishery endorsement that is 100 feet or greater in registered length, has as the mortgagee—

(A) a person eligible to own a vessel with a fishery endorsement under section 12102(c) of this title;

(B) a state or federally chartered financial institution that satisfies the controlling interest criteria of section 2(b) of the Shipping Act, 1916 (46 U.S.C. 802(b)); or

(C) a person that complies with the provisions of section 12102(c)(4) of this title..

SEC. 203. ENFORCEMENT OF STANDARD.

(a) EFFECTIVE DATE.—The amendments made by section 202 shall take effect on October 1, 2001.

(b) REGULATIONS.—Final regulations to implement this subtitle shall be published in the Federal Register by April 1, 2000. Letter rulings and other interim interpretations about the effect of this subtitle and amendments made by this subtitle on specific vessels may not be issued prior to the publication of such final regulations. The regulations to implement this subtitle shall prohibit impermissible transfers of ownership or control, specify any transactions which require prior approval of an implementing agency, identify transactions which do not require prior agency approval, and to the extent practicable, minimize disruptions to the commercial fishing industry, to the traditional financing arrangements of such industry, and to the opportunity to form fishery cooperatives.

(c) VESSELS MEASURING 100 FEET AND GREATER.— (1) The Administrator of the Maritime Administration shall administer section 12102(c) of title 46, United States Code, as amended by this subtitle, with respect to vessels 100 feet or greater in registered length. The owner of each such vessel shall file a statement of citizenship setting forth all relevant facts regarding vessel ownership and control with the Administrator of the Maritime Administration on an annual basis to demonstrate compliance with such section. Regulations to implement this subsection shall conform to the extent practicable with the regulations establishing the form of citizenship affidavit set forth in part 355 of title 46, Code of Federal Regulations, as in effect on September 25, 1997, except that the form of the statement under this paragraph shall be written in a manner to allow the owner of each such vessel to satisfy any annual renewal requirements for a certificate of documentation for such vessel and to comply with this subsection and section 12102(c) of title 46, United States Code, as amended by this Act, and shall not be required to be notarized.

(2) After October 1, 2001, transfers of ownership and control of vessels subject to section 12102(c) of title 46, United States Code, as amended by this Act, which are 100 feet or greater in registered length, shall be rigorously scrutinized for violations of such section, with particular attention given to leases, charters, mortgages, financing, and similar arrangements, to the control of persons not eligible to own a vessel with a fishery endorsement under section 12102(c) of title 46, United States Code, as amended by this Act, over the management, sales, financing, or other operations of an entity, and to contracts involving the purchase over extended periods of time of all, or substantially all, of the living marine resources harvested by a fishing vessel.

(d) VESSELS MEASURING LESS THAN 100 FEET.— The Secretary of Transportation shall establish such requirements as are reasonable and necessary to demonstrate compliance with section

12102(c) of title 46, United States Code, as amended by this Act, with respect to vessels measuring less than 100 feet in registered length, and shall seek to minimize the administrative burden on individuals who own and operate such vessels.

(e) ENDORSEMENTS REVOKED.—The Secretary of Transportation shall revoke the fishery endorsement of any vessel subject to section 12102(c) of title 46, United States Code, as amended by this Act, whose owner does not comply with such section.

(f) PENALTY.—Section 12122 of title 46, United States Code, is amended by inserting at the end the following new subsection:

(c) In addition to penalties under subsections (a) and (b), the owner of a documented vessel for which a fishery endorsement has been issued is liable to the United States Government for a civil penalty of up to $100,000 for each day in which such vessel has engaged in fishing (as such term is defined in section 3 of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1802)) within the exclusive economic zone of the United States, if the owner or the representative or agent of the owner knowingly falsified or concealed a material fact, or knowingly made a false statement or representation with respect to the eligibility of the vessel under section 12102(c) of this title in applying for or applying to renew such fishery endorsement..

(g) CERTAIN VESSELS.—The vessels EXCELLENCE (United States official number 967502), GOLDEN ALASKA (United States official number 651041), OCEAN PHOENIX (United States official number 296779), NORTHERN TRAVELER (United States official number 635986), and NORTHERN VOYAGER (United States official number 637398) (or a replacement vessel for the NORTHERN VOYAGER that complies with paragraphs (2), (5), and (6) of section 208(g) of this Act) shall be exempt from section 12102(c), as amended by this Act, until such time after October 1, 2001 as more than 50 percent of the interest owned and controlled in the vessel changes, provided that the vessel maintains eligibility for a fishery endorsement under the federal law that was in effect the day before the date of the enactment of this Act, and unless, in the case of the NORTHERN TRAVELER or the NORTHERN VOYAGER (or such replacement), the vessel is used in any fishery under the authority of a regional fishery management council other than the New England Fishery Management Council or Mid-Atlantic Fishery Management Council established, respectively, under sub-paragraphs (A) and (B) of section 302(a)(1) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1852(a)(1)(A) and (B)), or in the case of the EXCELLENCE, GOLDEN ALASKA, or OCEAN PHOENIX, the vessel is used to harvest any fish.

SEC. 204. REPEAL OF OWNERSHIP SAVINGS CLAUSE.

(a) REPEAL.—Section 7(b) of the Commercial Fishing Industry Vessel Anti-Reflagging Act of 1987 (Public Law 100–239; 46 U.S.C. 12102 note) is hereby repealed.

(b) EFFECTIVE DATE.—Subsection (a) shall take effect on October 1, 2001.

Subtitle II—Bering Sea Pollock Fishery

SEC. 205. DEFINITIONS.

As used in this subtitle—

(1) the term "Bering Sea and Aleutian Islands Management Area" has the same meaning as the meaning given for such term in part 679.2 of title 50, Code of Federal Regulations, as in effect on October 1, 1998;

(2) the term "catcher/processor" means a vessel that is used for harvesting fish and processing that fish;

(3) the term "catcher vessel" means a vessel that is used for harvesting fish and that does not process pollock onboard;

(4) the term "directed pollock fishery" means the fishery for the directed fishing allowances allocated under paragraphs (1), (2), and (3) of section 206(b);

(5) the term "harvest" means to commercially engage in the catching, taking, or harvesting of fish or any activity that can reasonably be expected to result in the catching, taking, or harvesting of fish;

(6) the term "inshore component" means the following categories that process groundfish harvested in the Bering Sea and Aleutian Islands Management Area:

(A) shoreside processors, including those eligible under section 208(f); and

(B) vessels less than 125 feet in length overall that process less than 126 metric tons per week in round-weight equivalents of an aggregate amount of pollock and Pacific cod;

(7) the term "Magnuson-Stevens Act" means the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.);

(8) the term "mothership" means a vessel that receives and processes fish from other vessels in the exclusive economic zone of the United States and is not used for, or equipped to be used for, harvesting fish;

(9) the term "North Pacific Council" means the North Pacific Fishery Management Council established under section 302(a)(1)(G) of the Magnuson-Stevens Act (16 U.S.C. 1852(a)(1)(G));

(10) the term "offshore component" means all vessels not included in the definition of "inshore component" that process groundfish harvested in the Bering Sea and Aleutian Islands Management Area;

(11) the term "Secretary" means the Secretary of Commerce; and

(12) the term "shoreside processor" means any person or vessel that receives unprocessed fish, except catcher/processors, motherships, buying stations, restaurants, or persons receiving fish for personal consumption or bait.

SEC. 206. ALLOCATIONS.

(a) POLLOCK COMMUNITY DEVELOPMENT QUOTA.— Effective January 1, 1999, 10 percent of the total allowable catch of pollock in the Bering Sea and Aleutian Islands Management Area shall be allocated as a directed fishing allowance to the western Alaska community development quota program established under section 305(i) of the Magnuson-Stevens Act (16 U.S.C. 1855(i)).

(b) INSHORE/OFFSHORE.—Effective January 1, 1999, the remainder of the pollock total allowable catch in the Bering Sea and Aleutian Islands Management Area, after the subtraction of the allocation under subsection (a) and the subtraction of allowances for the incidental catch of pollock by vessels harvesting other groundfish species (including under the western Alaska community development quota program) shall be allocated as directed fishing allowances as follows—

(1) 50 percent to catcher vessels harvesting pollock for processing by the inshore component;

(2) 40 percent to catcher/processors and catcher vessels harvesting pollock for processing by catcher/ processors in the offshore component; and

(3) 10 percent to catcher vessels harvesting pollock for processing by motherships in the offshore component.

SEC. 207. BUYOUT.

(a) FEDERAL LOAN.—Under the authority of sections 1111 and 1112 of title XI of the Merchant Marine Act, 1936 (46 U.S.C. App. 1279f and 1279g) and notwithstanding the requirements of section 312 of the Magnuson-Stevens Act (16 U.S.C. 1861a), the Secretary shall, subject to the availability of appropriations for the cost of the direct loan, provide up to $75,000,000 through a direct loan obligation for the payments required under subsection (d).

(b) INSHORE FEE SYSTEM.—Notwithstanding the requirements of section 304(d) or 312 of the Magnuson-Stevens Act (16 U.S.C. 1854(d) and 1861a), the Secretary shall establish a fee for the repayment of such loan obligation which—

(1) shall be six-tenths (0.6) of one cent for each pound round-weight of all pollock harvested from the directed fishing allowance under section 206(b)(1); and

(2) shall begin with such pollock harvested on or after January 1, 2000, and continue without interruption until such loan obligation is fully repaid; and

(3) shall be collected in accordance with section 312(d)(2)(C) of the Magnuson-Stevens Act (16 U.S.C. 1861a(d)(2)(C)) and in accordance with such other conditions as the Secretary establishes.

(c) FEDERAL APPROPRIATION.—Under the authority of section 312(c)(1)(B) of the Magnuson-Stevens Act (16 U.S.C. 1861a(c)(1)(B)), there are authorized to be appropriated $20,000,000 for the payments required under sub-section (d).

(d) PAYMENTS.—Subject to the availability of appropriations for the cost of the direct loan under subsection (a) and funds under subsection (c), the Secretary shall pay by not later than December 31, 1998—

(1) up to $90,000,000 to the owner or owners of the catcher/processors listed in paragraphs (1) through (9) of section 209, in such manner as the owner or owners, with the concurrence of the Secretary, agree, except that—

(A) the portion of such payment with respect to the catcher/processor listed in paragraph (1) of section 209 shall be made only after the owner submits a written certification acceptable to the Secretary that neither the owner nor a purchaser from the owner intends to use such catcher/processor outsiee of the exclusive economic zone of the United States to harvest any stock of fish (as such term is defined in section 3 of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1802)) that occurs within the exclusive economic zone of the United States; and

(B) the portion of such payment with respect to the catcher/processors listed in paragraphs (2) through (9) of section 209 shall be made only after the owner or owners of such catcher/processors submit a written certification acceptable to the Secretary that such catcher/ processors will be scrapped by December 31, 2000 and will not, before that date, be used to harvest or process any fish; and

(2)(A) if a contract has been filed under section 210(a) by the catcher/processors listed in section 208(e), $5,000,000 to the owner or owners of the catcher/processors listed in paragraphs (10) through (14) of such section in such manner as the owner or owners, with the concurrence of the Secretary, agree; or

(B) if such a contract has not been filed by such date, $5,000,000 to the owners of the catcher vessels eligible under section 208(b) and the catcher/processors eligible under paragraphs (1) through (20) of section 208(e), divided based on the amount of the harvest of pollock in the directed pollock fishery by each such vessel in 1997 in such manner as the Secretary deems appropriate, except that any such payments shall be reducee by any obligation to the federal government that has not been satisfied by such owner or owners of any such vessels.

(e) PENALTY.—If the catcher/processor under paragraph (1) of section 209 is used outside of the exclusive economic zone of the United States to harvest any stock of fish that occurs within the exclusive economic zone of the United States while the owner who received the payment under subsection (d)(1)(A) has an ownership interest in such vessel, or if the catcher/processors listed in paragraphs (2) through (9) of section 209 are determined by the Secretary not to have been scrapped by December 31, 2000 or to have been used in a manner inconsistent with subsection (d)(1)(B), the Secretary may suspend any or all of the federal permits which allow any vessels owned in whole or in part by the owner or owners who received payments under subsection (d)(1) to harvest or process fish within the exclusive economic zone of the United States until such time as the obligations of such owner or owners under subsection (d)(1) have been fulfilled to the satisfaction of the Secretary.

(f) PROGRAM DEFINED; MATURITY.—For the purposes of section 1111 of the Merchant Marine Act, 1936 (46 U.S.C. App. 1279f), the fishing capacity reduction program in this subtitle shall be within the meaning of the term "program" as defined and used in such section. Notwithstanding section 1111(b)(4) of such Act (46 U.S.C. App. 1279f(b)(4)), the debt obligation under subsection (a) of this section may have a maturity not to exceed 30 years.

(g) FISHERY CAPACITY REDUCTION REGULATIONS.— The Secretary of Commerce shall by not later than October 15, 1998 publish proposed regulations to implement sub-sections (b), (c), (d), and (e) of section 312 of the Magnuson-Stevens Act (16 U.S.C. 1861a) and sections 1111 and 1112 of title XI of the Merchant Marine Act, 1936 (46 U.S.C. App. 1279f and 1279g).

SEC. 208. ELIGIBLE VESSELS AND PROCESSORS.

(a) CATCHER VESSELS ONSHORE.—Effective January 1, 2000, only catcher vessels which are—

(1) determined by the Secretary—

(A) to have delivered at least 250 metric tons of pollock; or

(B) to be less than 60 feet in length overall and to have delivered at least 40 metric tons of pollock, for processing by the inshore component in the directed pollock fishery in any one of the years 1996 or 1997, or between January 1, 1998 and September 1, 1998;

(2) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary; and

(3) not listed in subsection (b), shall be eligible to harvest the directed fishing allowance under section 206(b)(1) pursuant to a federal fishing permit.

(b) CATCHER VESSELS TO CATCHER/PROCESSORS.— Effective January 1, 1999, only the following catcher vessels shall be eligible to harvest the directed fishing allowance under section 206(b)(2) pursuant to a federal fishing permit:

(1) AMERICAN CHALLENGER (United States official number 615085);

(2) FORUM STAR (United States official number 925863);

(3) MUIR MILACH (United States official number 611524);

(4) NEAHKAHNIE (United States official number 599534);

(5) OCEAN HARVESTER (United States official number 549892);

(6) SEA STORM (United States official number 628959);

(7) TRACY ANNE (United States official number 904859); and

(8) any catcher vessel—

(A) determined by the Secretary to have delivered at least 250 metric tons and at least 75 percent of the pollock it harvested in the directed pollock fishery in 1997 to catcher/processors for processing by the offshore component; and

(B) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary.

(c) CATCHER VESSELS TO MOTHERSHIPS.—Effective January 1, 2000, only the following catcher vessels shall be eligible to harvest the directed fishing allowance under section 206(b)(3) pursuant to a federal fishing permit:

(1) ALEUTIAN CHALLENGER (United States official number 603820);

(2) ALYESKA (United States official number 560237);

(3) AMBER DAWN (United States official number 529425);

(4) AMERICAN BEAUTY (United States official number 613847);

(5) CALIFORNIA HORIZON (United States official number 590758);

(6) MAR-GUN (United States official number 525608);

(7) MARGARET LYN (United States official number 615563);

(8) MARK I (United States official number 509552);

(9) MISTY DAWN (United States official number 926647);

(10) NORDIC FURY (United States official number 542651);

(11) OCEAN LEADER (United States official number 561518);

(12) OCEANIC (United States official number 602279);

(13) PACIFIC ALLIANCE (United States official number 612084);

(14) PACIFIC CHALLENGER (United States official number 518937);

(15) PACIFIC FURY (United States official number 561934);

(16) PAPADO II (United States official number 536161);

(17) TRAVELER (United States official number 929356);

(18) VESTERAALEN (United States official number 611642);

(19) WESTERN DAWN (United States official number 524423); and

(20) any vessel—

(A) determined by the Secretary to have delivered at least 250 metric tons of pollock for processing by motherships in the offshore component of the directed pollock fishery in any one of the years 1996 or 1997, or between January 1, 1998 and September 1, 1998;

(B) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary; and

(C) not listed in subsection (b).

(d) MOTHERSHIPS.—Effective January 1, 2000, only the following motherships shall be eligible to process the directed fishing allowance under section 206(b)(3) pursuant to a federal fishing permit:

(1) EXCELLENCE (United States official number 967502);

(2) GOLDEN ALASKA (United States official number 651041); and

(3) OCEAN PHOENIX (United States official number 296779).

(e) CATCHER/PROCESSORS.—Effective January 1, 1999, only the following catcher/processors shall be eligible to harvest the directed fishing allowance under section 206(b)(2) pursuant to a federal fishing permit:

(1) AMERICAN DYNASTY (United States official number 951307);

(2) KATIE ANN (United States official number 518441);

(3) AMERICAN TRIUMPH (United States official number 646737);

(4) NORTHERN EAGLE (United States official number 506694);

(5) NORTHERN HAWK (United States official number 643771);

(6) NORTHERN JAEGER (United States official number 521069);

(7) OCEAN ROVER (United States official number 552100);

(8) ALASKA OCEAN (United States official number 637856);

(9) ENDURANCE (United States official number 592206);

(10) AMERICAN ENTERPRISE (United States official number 594803);

(11) ISLAND ENTERPRISE (United States official number 610290);

(12) KODIAK ENTERPRISE (United States official number 579450);

(13) SEATTLE ENTERPRISE (United States official number 904767);

(14) US ENTERPRISE (United States official number 921112);

(15) ARCTIC STORM (United States official number 903511);

(16) ARCTIC FJORD (United States official number 940866);

(17) NORTHERN GLACIER (United States official number 663457);

(18) PACIFIC GLACIER (United States official number 933627);

(19) HIGHLAND LIGHT (United States official number 577044);

(20) STARBOUND (United States official number 944658); and

(21) any catcher/processor not listed in this sub-section and determined by the Secretary to have harvested more than 2,000 metric tons of the pollock in the 1997 directed pollock fishery and determined to be eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary, except that catcher/processors eligible under this paragraph shall be prohibited from harvesting in the aggregate a total of more than one-half (0.5) of a percent of the pollock apportioned for the directed pollock fishery under section 206(b)(2).

Notwithstanding section 213(a), failure to satisfy the requirements of section 4(a) of the Commercial Fishing Industry Vessel Anti-Reflagging Act of 1987 (Public Law 100–239; 46 U.S.C. 12108 note) shall not make a catcher/ processor listed under this subsection ineligible for a fishery endorsement.

(f) SHORESIDE PROCESSORS.—(1) Effective January 1, 2000 and except as provided in paragraph (2), the catcher vessels eligible under subsection (a) may deliver pollock harvested from the directed fishing allowance under section 206(b)(1) only to—

(A) shoreside processors (including vessels in a single geographic location in Alaska State waters) determined by the Secretary to have processed more than 2,000 metric tons round-weight of pollock in the inshore component of the directed pollock fishery during each of 1996 and 1997; and

(B) shoreside processors determined by the Secretary to have processed pollock in the inshore component of the directed pollock fishery in 1996 or 1997, but to have processed less than 2,000 metric tons round-weight of such pollock in each year, except that effective January 1, 2000, each such shoreside processor may not process more than 2,000 metric tons round-weight from such directed fishing allowance in any year.

(2) Upon recommendation by the North Pacific Council, the Secretary may approve measures to allow catcher vessels eligible under subsection (a) to deliver pollock harvested from the directed fishing allowance under section 206(b)(1) to shoreside processors not eligible under paragraph (1) if the total allowable catch for pollock in the Bering Sea and Aleutian Islands Management Area increases by more than 10 percent above the total allowable catch in such fishery in 1997, or in the event of the actual total loss or constructive total loss of a shoreside processor eligible under paragraph (1)(A).

(g) REPLACEMENT VESSELS.—In the event of the actual total loss or constructive total loss of a vessel eligible under subsections (a), (b), (c), (d), or (e), the owner of such vessel may replace such vessel with a vessel which shall be eligible in the same manner under that subsection as the eligible vessel, provided that—

(1) such loss was caused by an act of God, an act of war, a collision, an act or omission of a party other than the owner or agent of the vessel, or any other event not caused by the willful misconduct of the owner or agent;

(2) the replacement vessel was built in the United States and if ever rebuilt, was rebuilt in the United States;

(3) the fishery endorsement for the replacement vessel is issued within 36 months of the end of the last year in which the eligible vessel harvested or processed pollock in the directed pollock fishery;

(4) if the eligible vessel is greater than 165 feet in registered length, of more than 750 gross registered tons, or has engines capable of producing more than 3,000 shaft horsepower, the replacement vessel is of the same or lesser registered length, gross registered tons, and shaft horsepower;

(5) if the eligible vessel is less than 165 feet in registered length, of fewer than 750 gross registered tons, and has engines incapable of producing less than 3,000 shaft horsepower, the replacement vessel is less than each of such thresholds and does not exceed by more than 10 percent the registered length, gross registered tons or shaft horsepower of the eligible vessel; and

(6) the replacement vessel otherwise qualifies under federal law for a fishery endorsement, including under section 12102(c) of title 46, United States Code, as amended by this Act.

(h) ELIGIBILITY DURING IMPLEMENTATION.—In the event the Secretary is unable to make a final determination about the eligibility of a vessel under subsection (b)(8) or subsection (e)(21) before January 1, 1999, or a vessel or shoreside processor under subsection (a), subsection (c)(21), or subsection (f) before January 1, 2000, such vessel or shoreside processor, upon the filing of an application for eligibility, shall be eligible to participate in the directed pollock fishery pending final determination by the Secretary with respect to such vessel or shoreside processor.

(i) ELIGIBILITY NOT A RIGHT.—Eligibility under this section shall not be construed—

(1) to confer any right of compensation, monetary or otherwise, to the owner of any catcher vessel, catcher/processor, mothership, or shoreside processor if such eligibility is revoked or limited in any way, including through the revocation or limitation of a fishery endorsement or any federal permit or license;

(2) to create any right, title, or interest in or to any fish in any fishery; or

(3) to waive any provision of law otherwise applicable to such catcher vessel, catcher/processor, mothership, or shoreside processor.

SEC. 209. LIST OF INELIGIBLE VESSELS.

Effective December 31, 1998, the following vessels shall be permanently ineligible for fishery endorsements, and any claims (including relating to catch history) associated with such vessels that could qualify any owners of such vessels for any present or future limited access system permit in any fishery within the exclusive economic zone of the United States (including a vessel moratorium permit or license limitation program permit in fisheries under the authority of the North Pacific Council) are hereby extinguished:

(1) AMERICAN EMPRESS (United States official number 942347);

(2) PACIFIC SCOUT (United States official number 934772);

(3) PACIFIC EXPLORER (United States official number 942592);

(4) PACIFIC NAVIGATOR (Uoited States official number 592204);

(5) VICTORIA ANN (United States official number 592207);

(6) ELIZABETH ANN (United States official number 534721);

(7) CHRISTINA ANN (United States official number 653045);

(8) REBECCA ANN (United States official number 592205); and

(9) BROWNS POINT (United States official number 587440).

SEC. 210. FISHERY COOPERATIVE LIMITATIONS.

(a) PUBLIC NOTICE.—(1) Any contract implementing a fishery cooperative under section 1 of the Act of June 25, 1934 (15 U.S.C. 521) in the directed pollock fishery and any material modifications to any such contract shall be filed not less than 30 days prior to the start of fishing under the contract with the North Pacific Council and with the Secretary, together with a copy of a letter from a party to the contract requesting a business review letter on the fishery cooperative from the Department of Justice and any response to such request. Notwithstanding section 402 of the Magnuson-Stevens Act (16 U.S.C. 1881a) or any other provision of law, but taking into account the interest of parties to any such contract in protecting the confidentiality of proprietary information, the North Pacific Council and Secretary shall—

(A) make available to the public such information about the contract, contract modifications, or fishery cooperative the North Pacific Council and Secretary deem appropriate, which at a minimum shall include a list of the parties to the contract, a list of the vessels involved, and the amount of pollock and other fish to be harvested by each party to such contract; and

(B) make available to the public in such manner as the North Pacific Council and Secretary deem appropriate information about the harvest by vessels under a fishery cooperative of all species (including bycatch) in the directed pollock fishery on a vessel-by-vessel basis.

(b) CATCHER VESSELS ONSHORE.—

(1) CATCHER VESSEL COOPERATIVES.—Effective January 1, 2000, upon the filing of a contract implementing a fishery cooperative under subsection (a) which—

(A) is signed by the owners of 80 percent or more of the qualified catcher vessels that delivered pollock for processing by a shoreside processor in the directed pollock fishery in the year prior to the year in which the fishery cooperative will be in effect; and

(B) specifies, except as provided in paragraph (6), that such catcher vessels will deliver pollock in the directed pollock fishery only to such shoreside processor during the year in which the fishery cooperative will be in effect and that such shoreside processor has agreed to process such pollock, the Secretary shall allow only such catcher vessels (and catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) to harvest the aggregate percentage of the directed fishing allowance under section 206(b)(1) in the year in which the fishery cooperative will be in effect that is equivalent to the aggregate total amount of pollock harvested by such catcher vessels (and by such catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) in the directed pollock fishery for processing by the inshore component during 1995, 1996, and

1997 relative to the aggregate total amount of pollock harvested in the directed pollock fishery for processing by the inshore component during such years and shall prevent such catcher vessels (and catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) from harvesting in aggregate in excess of such percentage of such directed fishing allowance.

(2) VOLUNTARY PARTICIPATION.—Any contract implementing a fishery cooperative under paragraph (1) must allow the owners of other qualified catcher vessels to enter into such contract after it is filed and before the calender year in which fishing will begin under the same terms and conditions as the owners of the qualified catcher vessels who entered into such contract upon filing.

(3) QUALIFIED CATCHER VESSEL.—For the purposes of this subsection, a catcher vessel shall be considered a "qualified catcher vessel" if, during the year prior to the year in which the fishery cooperative will be in effect, it delivered more pollock to the shoreside processor to which it will deliver pollock under the fishery cooperative in paragraph (1) than to any other shoreside processor.

(4) CONSIDERATION OF CERTAIN VESSELS.—Any contract implementing a fishery cooperative under paragraph (1) which has been entered into by the owner of a qualified catcher vessel eligible under section 208(a) that harvested pollock for processing by catcher/processors or motherships in the directed pollock fishery during 1995, 1996, and 1997 shall, to the extent practicable, provide fair and equitable terms and conditions for the owner of such qualified catcher vessel.

(5) OPEN ACCESS.—A catcher vessel eligible under section 208(a) the catch history of which has not been attributed to a fishery cooperative under paragraph (1) may be used to deliver pollock harvested by such vessel from the directed fishing allowance under section 206(b)(1) (other than pollock reserved under paragraph (1) for a fishery cooperative) to any of the shoreside processors eligible under section 208(f). A catcher vessel eligible under section 208(a) the catch history of which has been attributed to a fishery cooperative under paragraph (1) during any calendar year may not harvest any pollock apportioned under section 206(b)(1) in such calendar year other than the pollock reserved under paragraph (1) for such fishery cooperative.

(6) TRANSFER OF COOPERATIVE HARVEST.—A contract implementing a fishery cooperative under paragraph (1) may, notwithstanding the other provisions of this subsection, provide for up to 10 percent of the pollock harvested under such cooperative to be processed by a

shoreside processor eligible under section 208(f) other than the shoreside processor to which pollock will be delivered under paragraph (1).

(c) CATCHER VESSELS TO CATCHER/PROCESSORS.— Effective January 1, 1999, not less than 8.5 percent of the directed fishing allowance under section 206(b)(2) shall be available for harvest only by the catcher vessels eligible under section 208(b). The owners of such catcher vessels may participate in a fishery cooperative with the owners of the catcher/processors eligible under paragraphs (1) through (20) of the section 208(e). The owners of such catcher vessels may participate in a fishery cooperative that will be in effect during 1999 only if the contract implementing such cooperative establishes penalties to prevent such vessels from exceeding in 1999 the traditional levels harvested by such vessels in all other fisheries in the exclusive economic zone of the United States.

(d) CATCHER VESSELS TO MOTHERSHIPS.—

(1) PROCESSING.—Effective January 1, 2000, the authority in section 1 of the Act of June 25, 1934 (48 Stat. 1213 and 1214; 15 U.S.C. 521 et seq.) shall extend to processing by motherships eligible under section 208(d) solely for the purposes of forming or participating in a fishery cooperative in the directed pollock fishery upon the filing of a contract to implement a fishery cooperative under subsection (a) which has been entered into by the owners of 80 percent or more of the catcher vessels eligible under section 208(c) for the duration of such contract, provided that such owners agree to the terms of the fishery cooperative involving processing by the motherships.

(2) VOLUNTARY PARTICIPATION.—Any contract implementing a fishery cooperative described in paragraph (1) must allow the owners of any other catcher vessels eligible under section 208(c) to enter such contract after it is filed and before the calendar year in which fishing will begin under the same terms and conditions as the owners of the catcher vessels who entered into such contract upon filing.

(e) EXCESSIVE SHARES.—

(1) HARVESTING.—No particular individual, corporation, or other entity may harvest, through a fishery cooperative or otherwise, a total of more than 17.5 percent of the pollock available to be harvested in the directed pollock fishery.

(2) PROCESSING.—Under the authority of section 301(a)(4) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(4)), the North Pacific Council is directed to recommend for approval by the Secretary conservation and management measures to prevent any particular individual or entity from processing an excessive share of the pollock available to be harvested in the directed pollock fishery. In the event the North Pacific Council recommends and the Secretary approves

an excessive processing share that is lower than 17.5 percent, any individual or entity that previously processed a percentage greater than such share shall be allowed to continue to process such percentage, except that their percentage may not exceed 17.5 percent (excluding pollock processed by catcher/processors that was harvested in the directed pollock fishery by catcher vessels eligible under 208(b)) and shall be reduced if their percentage decreases, until their percentage is below such share. In recommending the excessive processing share, the North Pacific Council shall consider the need of catcher vessels in the directed pollock fishery to have competitive buyers for the pollock harvested by such vessels.

(3) REVIEW BY MARITIME ADMINISTRATION.—At the request of the North Pacific Council or the Secretary, any individual or entity believed by such Council or the Secretary to have exceeded the percentage in either paragraph (1) or (2) shall submit such information to the Administrator of the Maritime Administration as the Administrator deems appropriate to allow the Administrator to determine whether such individual or entity has exceeded either such percentage. The Administrator shall make a finding as soon as practicable upon such request and shall submit such finding to the North Pacific Council and the Secretary. For the purposes of this subsection, any entity in which 10 percent or more of the interest is owned or controlled by another individual or entity shall be considered to be the same entity as the other individual or entity.

(f) LANDING TAX JURISDICTION.—Any contract filed under subsection (a) shall include a contract clause under which the parties to the contract agree to make payments to the State of Alaska for any pollock harvested in the directed pollock fishery which is not landed in the State of Alaska, in amounts which would otherwise accrue had the pollock been landed in the State of Alaska subject to any landing taxes established under Alaska law. Failure to include such a contract clause or for such amounts to be paid shall result in a revocation of the authority to form fishery cooperatives under section 1 of the Act of June 25, 1934 (15 U.S.C. 521 et seq.).

(g) PENALTIES.—The violation of any of the requirements of this section or section 211 shall be considered the commission of an act prohibited by section 307 of the Magnuson-Stevens Act (16 U.S.C. 1857). In addition to the civil penalties and permit sanctions applicable to prohibited acts under section 308 of such Act (16 U.S.C. 1858), any person who is found by the Secretary, after notice and an opportunity for a hearing in accordance with section 554 of title 5, United States Code, to have violated a requirement of this section shall be subject to the forfeiture to the Secretary of Commerce of any fish harvested or processed during the commission of such act.

SEC. 211. PROTECTIONS FOR OTHER FISHERIES; CONSERVATION MEASURES.

(a) GENERAL.—The North Pacific Council shall recommend for approval by the Secretary such conservation and management measures as it determines necessary to protect other fisheries under its jurisdiction and the participants in those fisheries, including processors, from adverse impacts caused by this Act or fishery cooperatives in the directed pollock fishery.

(b) CATCHER/PROCESSOR RESTRICTIONS.—

(1) GENERAL.—The restrictions in this sub-section shall take effect on January 1, 1999 and shall remain in effect thereafter except that they may be superceded (with the exception of paragraph (4)) by conservation and management measures recommended after the date of the enactment of this Act by the North Pacific Council and approved by the Secretary in accordance with the Magnuson-Stevens Act.

(2) BERING SEA FISHING.—The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from, in the aggregate—

(A) exceeding the percentage of the harvest available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total harvest by such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997;

(B) exceeding the percentage of the prohibited species available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total of the prohibited species harvested by such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount of prohibited species available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997; and

(C) fishing for Atka mackerel in the eastern area of the Bering Sea and Aleutian Islands and from exceeding the following percentages of the directed harvest available in the Bering Sea and Aleutian Islands Atka mackerel fishery—

(i) 11.5 percent in the central area; and

(ii) 20 percent in the western area.

(3) BERING SEA PROCESSING.—The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from—

(A) processing any of the directed fishing allowances under paragraphs (1) or (3) of section 206(b); and

(B) processing any species of crab harvested in the Bering Sea and Aleutian Islands Management Area.

(4) GULF OF ALASKA.—The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from—

(A) harvesting any fish in the Gulf of Alaska;

(B) processing any groundfish harvested from the portion of the exclusive economic zone off Alaska known as area 630 under the fishery management plan for Gulf of Alaska groundfish; or

(C) processing any pollock in the Gulf of Alaska (other than as bycatch in non-pollock groundfish fisheries) or processing, in the aggregate, a total of more than 10 percent of the cod harvested from areas 610, 620, and 640 of the Gulf of Alaska under the fishery management plan for Gulf of Alaska groundfish.

(5) FISHERIES OTHER THAN NORTH PACIFIC.— The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) and motherships eligible under section 208(d) are hereby prohibited from harvesting fish in any fishery under the authority of any regional fishery management council established under section 302(a) of the Magnuson-Stevens Act (16 U.S.C. 1852(a)) other than the North Pacific Council, except for the Pacific whiting fishery, and from processing fish in any fishery under the authority of any such regional fishery management council other than the North Pacific Council, except in the Pacific whiting fishery, unless the catcher/processor or mothership is authorized to harvest or process fish under a fishery management plan recommended by the regional fishery management council of jurisdiction and approved by the Secretary.

(6) OBSERVERS AND SCALES.—The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) shall—

(A) have two observers onboard at all times while groundfish is being harvested, processed, or received from another vessel in any fishery under the authority of the North Pacific Council; and

(B) weigh its catch on a scale onboard approved by the National Marine Fisheries Service while harvesting groundfish in fisheries under the authority of the North Pacific Council. This paragraph shall take effect on January 1, 1999 for catcher/processors eligible under paragraphs (1) through (20) of section 208(e) that will harvest pollock allocated under section 206(a) in 1999, and shall take effect on January 1, 2000 for all other catcher/ processors eligible under such paragraphs of section 208(e).

(c) CATCHER VESSEL AND SHORESIDE PROCESSOR RESTRICTIONS.—

(1) REQUIRED COUNCIL RECOMMENDATIONS.— By not later than July 1, 1999, the North Pacific Council shall recommend for approval by the Secretary conservation and management measures to—

(A) prevent the catcher vessels eligible under subsections (a), (b), and (c) of section 208 from exceeding in the aggregate the traditional harvest levels of such vessels in other fisheries under the authority of the North Pacific Council as a result of fishery cooperatives in the directed pollock fishery; and

(B) protect processors not eligible to participate in the directed pollock fishery from adverse effects as a result of this Act or fishery cooperatives in the directed pollock fishery. If the North Pacific Council does not recommend such conservation and management measures by such date, or if the Secretary determines that such conservation and management measures recommended by the North Pacific Council are not adequate to fulfill the purposes of this paragraph, the Secretary may by regulation restrict or change the authority in section 210(b) to the extent the Secretary deems appropriate, including by preventing fishery cooperatives from being formed pursuant to such section and by providing greater flexibility with respect to the shoreside processor or shoreside processors to which catcher vessels in a fishery cooperative under section 210(b) may deliver pollock.

(2) BERING SEA CRAB AND GROUNDFISH.—

(A) Effective January 1, 2000, the owners of the motherships eligible under section 208(d) and the shoreside processors eligible under section 208(f) that receive pollock from the directed pollock fishery under a fishery cooperative are hereby prohibited from processing, in the aggregate for each calendar year, more than the percentage of the total catch of each species of crab in directed fisheries under the jurisdiction of the North Pacific Council than facilities operated by such owners processed of each such species in the aggregate, on average, in 1995, 1996, 1997. For the purposes of this subparagraph, the term "facilities" means any processing plant, catcher/ processor, mothership, floating processor, or any other operation that processes fish. Any entity in which 10 percent or more of the interest is owned or controlled by another individual or entity shall be considered to be the same entity as the other individual or entity for the purposes of this subparagraph.

(B) Under the authority of section 301(a)(4) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(4)), the North Pacific Council is directed to recommend for approval by the Secretary conservation and management measures to prevent any particular individual or entity from harvesting or processing an excessive share of crab or of groundfish in fisheries in the Bering Sea and Aleutian Islands Management Area.

(C) The catcher vessels eligible under section 208(b) are hereby prohibited from participating in a directed fishery for any species of crab in the Bering Sea and Aleutian Islands Management Area unless the catcher vessel harvested crab in the directed fishery for that species of crab in such Area during 1997 and is eligible to harvest such crab in such directed fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary. The North Pacific Council is directed to recommend measures for approval by the Secretary to eliminate latent licenses under such program, and nothing in this subparagraph shall preclude the Council from recommending measures more restrictive than under this paragraph.

(3) FISHERIES OTHER THAN NORTH PACIFIC.—

(A) By not later than July 1, 2000, the Pacific Fishery Management Council established under section 302(a)(1)(F) of the Magnuson-Stevens Act (16 U.S.C. 1852(a)(1)(F)) shall recommend for approval by the Secretary conservation and management measures to protect fisheries under its jurisdiction and the participants in those fisheries from adverse impacts caused by this Act or by any fishery cooperatives in the directed pollock fishery.

(B) If the Pacific Council does not recommend such conservation and management measures by such date, or if the Secretary determines that such conservation and management measures recommended by the Pacific Council are not adequate to fulfill the purposes of this paragraph, the Secretary may by regulation implement adequate measures including, but not limited to, restrictions on vessels which harvest pollock under a fishery cooperative which will prevent such vessels from harvesting Pacific groundfish, and restrictions on the number of processors eligible to process Pacific groundfish.

(d) BYCATCH INFORMATION.—Notwithstanding section 402 of the Magnuson-Stevens Act (16 U.S.C. 1881a), the North Pacific Council may recommend and the Secretary may approve, under such terms and conditions as the North Pacific Council and Secretary deem appropriate, the public disclosure of any information from the groundfish fisheries under the authority of such Council that would be beneficial in the implementation of section 301(a)(9) or section 303(a)(11) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(9) and 1853(a)(11)).

(e) COMMUNITY DEVELOPMENT LOAN PROGRAM.— Under the authority of title XI of the Merchant Marine Act, 1936 (46 U.S.C. App. 1271 et seq.), and subject to the availability of appropriations, the Secretary is authorized to provide direct loan obligations to communities eligible to participate in the western Alaska community development quota program established under 304(i) of the Magnuson-Stevens Act (16 U.S.C. 1855(i)) for the purposes of purchasing all or part of an ownership interest in vessels and shoreside processors eligible under subsections (a), (b), (c), (d), (e), or (f) of section 208. Notwithstanding the eligibility criteria in section 208(a) and section 208(c), the LISA MARIE (United States official number 1038717) shall be eligible under such sections in the same manner as other vessels eligible under such sections. SEC. 212. RESTRICTION ON FEDERAL LOANS. Section 302(b) of the Fisheries Financing Act (46 U.S.C. 1274 note) is amended—

(1) by inserting “(1)” before “Until October 1, 2001”; and

(2) by inserting at the end the following new paragraph:

(2) No loans may be provided or guaranteed by the Federal Government for the construction or rebuilding of a vessel intended for use as a fishing vessel (as defined in section 2101 of title 46, United States Code), if such vessel will be greater than 165 feet in registered length, of more than 750 gross registered tons, or have an engine or engines capable of producing a total of more than 3,000 shaft horsepower, after such construction or rebuilding is completed. This prohibition shall not apply to vessels to be used in the menhaden fishery or in tuna purse seine fisheries outside the exclusive economic zone of the United States or the area of the South Pacific Regional Fisheries Treaty..

SEC. 213. DURATION.

(a) GENERAL.—Except as otherwise provided in this title, the provisions of this title shall take effect upon the date of the enactment of this Act. Sections 206, 208, and 210 shall remain in effect until December 31, 2004, and shall be repealed on such date, except that the North Pacific Council may recommend and the Secretary may approve conservation and management measures as part of a fishery management plan under the Magnuson-Stevens Act to give effect to the measures in such sections thereafter.

(b) EXISTING AUTHORITY.—Except for the measures required by this subtitle, nothing in this subtitle shall be construed to limit the authority of the North Pacific Council or the Secretary under the Magnuson-Stevens Act.

(c) CHANGES TO FISHERY COOPERATIVE LIMITATIONS AND POLLOCK CDQ ALLOCATION.—The North Pacific Council may recommend and the Secretary may approve conservation and management measures in accordance with the Magnuson-Stevens Act—

(1) that supersede the provisions of this title, except for sections 206 and 208, for conservation purposes or to mitigate adverse effects in fisheries or on owners of fewer than three vessels in the directed pollock fishery caused by this title or fishery cooperatives in the directed pollock fishery, provided such measures take into account all factors affecting the fisheries and are imposed fairly and equitably to the extent practicable among and within the sectors in the directed pollock fishery;

(2) that supersede the allocation in section 206(a) for any of the years 2002, 2003, and 2004, upon the finding by such Council that the western Alaska community development quota program for pollock has been adversely affected by the amendments in this title; or

(3) that supersede the criteria required in paragraph (1) of section 210(b) to be used by the Secretary to set the percentage allowed to be harvested by catcher vessels pursuant to a fishery cooperative under such paragraph.

(d) REPORT TO CONGRESS.—Not later than October 1, 2000, the North Pacific Council shall submit a report to the Secretary and to Congress on the implementation and effects of this Act, including the effects on fishery conservation and management, on bycatch levels, on fishing communities, on business and employment practices of participants in any fishery cooperatives, on the western Alaska community development quota program, on any fisheries outside of the authority of the North Pacific Council, and such other matters as the North Pacific Council deems appropriate.

(e) REPORT ON FILLET PRODUCTION.—Not later than June 1, 2000, the General Accounting Office shall submit a report to the North Pacific Council, the Secretary, and the Congress on the whether this Act has negatively affected the market for fillets and fillet blocks, including through the reduction in the supply of such fillets and fillet blocks. If the report determines that such market has been negatively affected, the North Pacific Council shall recommend measures for the Secretary's approval to mitigate any negative effects.

(f) SEVERABILITY.—If any provision of this title, an amendment made by this title, or the application of such provision or amendment to any person or circumstance is held to be unconstitutional, the remainder of this title, the amendments made by this title, and the application of the provisions of such to any person or circumstance shall not be affected thereby.

(g) INTERNATIONAL AGREEMENTS.—In the event that any provision of section 12102(c) or section 31322(a) of title 46, United States Code, as amended by this Act, is determined to be inconsistent with an existing international agreement relating to foreign investment to which the United States is a party with respect to the owner or mortgagee on October 1, 2001 of a vessel with a fishery endorsement, such provision shall not apply to that owner or mortgagee with respect to such vessel to the extent of any such inconsistency. The provisions of section 12102(c) and section 31322(a) of title 46, United States Code, as amended by this Act, shall apply to all subsequent owners and mortgagees of such vessel, and shall apply, notwithstanding the preceding sentence, to the owner on October 1, 2001 of such vessel if any ownership interest in that owner is transferred to or otherwise acquired by a foreign individual or entity after such date.

Appendix B: Text of Amendments 61/61/13/8

Amendment 61
to the
Fishery Management Plan
for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area

Section 13.4.11 of *the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area* is revised to read as follows:

13.4.11 American Fisheries Act (AFA) management measures (effective through December 31, 2004).

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) which superseded the previous inshore/offshore management regime for BSAI pollock that was adopted under Amendment 18 and extended under Amendments 23 and 51. With respect to the fisheries off Alaska, the AFA requires a suite of new management measures that fall into four general categories: (1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the BSAI pollock fishery, (3) regulations to protect other fisheries from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the BSAI pollock fishery.

The AFA is a complex piece of legislation with numerous provisions that affect the management of the groundfish and crab fisheries off Alaska. The AFA is divided into two subtitles. *Subtitle I–Fisheries Endorsements* includes new nationwide U.S. ownership and vessel length restrictions for U.S. vessels with fisheries endorsements. These new requirements are currently being implemented by the Maritime Administration and the U.S. Coast Guard under the Department of Transportation. *Subtitle II–Bering Sea Pollock Fishery* contains measures related to the management of BSAI pollock fishery.

Key provisions of the AFA include:

- A requirement that owners of all U.S. flag fishing vessels comply with a 75 percent U.S. controlling interest standard.

- A prohibition on the entry of any new fishing vessels into U.S. waters that exceed 165 ft registered length, 750 gross registered tons, or 3,000 shaft horsepower.

- The buyout of nine pollock catcher/processors and the subsequent scrapping of eight of these vessels through a combination of $20 million in federal appropriations and $75 million in direct loan obligations.

- A new allocation scheme for BSAI pollock that allocates 10 percent of the BSAI pollock total allowable catch (TAC) to the CDQ Program, and after allowance for incidental catch of pollock in other fisheries, allocates the remaining TAC as follows: 50 percent to vessels harvesting pollock for processing by inshore processors, 40 percent to vessels harvesting pollock for processing by catcher/processors, and 10 percent to vessels harvesting pollock for processing by motherships.

- A fee of six-tenths (0.6) of one cent for each pound round weight of pollock harvested by catcher vessels delivering to inshore processors for the purpose of repaying the $75 million direct loan obligation.

- A prohibition on entry of new vessels and processors into the BSAI pollock fishery. The AFA lists by name vessels and processors and/or provides qualifying criteria for those vessels and processors eligible to participate in the non-CDQ portion of the BSAI pollock fishery.

- An increase in observer coverage and scale requirements for AFA catcher/processors.

- New standards and limitations for the creation of fishery cooperatives in the catcher/processor, mothership, and inshore industry sectors;

- A quasi-IFQ program under which NMFS grant individual allocations of the inshore BSAI pollock TAC to inshore catcher vessel cooperatives that form around a specific inshore processor and agree to deliver at least 90 percent of their pollock catch to that processor.

- The establishment of harvesting and processing restrictions (commonly known as "sideboards") on fishermen and processors who have received exclusive harvesting or processing privileges under the AFA to protect the interests of fishermen and processors who have not directly benefitted from the AFA; and

- A 17.5 percent excessive share harvesting cap for BSAI pollock and a requirement that the Council to develop excessive share caps for BSAI pollock processing and for the harvesting and processing of other groundfish.

13.4.11.1 Management measures to implement the AFA

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

13.4.11.2 Management measure to supersede the AFA

Subsection 213 of the AFA provides the Council with the following authority to recommend management measures to supersede certain provisions of the AFA:

> *(c) CHANGES TO FISHERY COOPERATIVE LIMITATIONS AND POLLOCK CDQ ALLOCATION.—The North Pacific Council may recommend and the Secretary may approve conservation and management measures in accordance with the Magnuson-Stevens Act—*

(1) that supersede the provisions of this title, except for sections 206 and 208, for conservation purposes or to mitigate adverse effects in fisheries or on owners of fewer than three vessels in the directed pollock fishery caused by this title or fishery cooperatives in the directed pollock fishery, provided such measures take into account all factors affecting the fisheries and are imposed fairly and equitably to the extent practicable among and within the sectors in the directed pollock fishery;

(2) that supersede the allocation in section 206(a) for any of the years 2002, 2003, and 2004, upon the finding by such Council that the western Alaska community development quota program for pollock has been adversely affected by the amendments in this title; or

(3) that supersede the criteria required in paragraph (1) of section 210(b) to be used by the Secretary to set the percentage allowed to be harvested by catcher vessels pursuant to a fishery cooperative under such paragraph.

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

(1) Inshore cooperative allocation formula

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

An inshore catcher vessel cooperative that applies for and receives an AFA inshore cooperative fishing permit will receive a sub-allocation of the annual Bering Sea subarea inshore sector directed fishing allowance. If the Aleutian Islands Subarea is open to directed fishing for pollock then the cooperative also will receive a sub-allocation of the annual Aleutian Islands Subarea inshore sector directed fishing allowance. Each inshore cooperative co-op's annual allocation amount(s) will be determined using the following procedure:

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

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

(ii) Offshore compensation. If a catcher vessel made a total of 500 or more mt of landings of Bering Sea Subarea pollock or Aleutian Islands Subarea pollock to catcher/processors or offshore motherships other than the EXCELLENCE (USCG documentation number 967502); GOLDEN ALASKA (USCG documentation number 651041); or OCEAN PHOENIX (USCG documentation number 296779) over the 3-year period from 1995 through 1997, then all offshore pollock landings made by that vessel during from 1995 through 1997 will be added to the vessel's inshore catch history by year and subarea.

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

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

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

(2) Definition of qualified catcher vessel

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

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

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

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

(3) Crab processing sideboard limits

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

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

Amendment 61
to the
Fishery Management Plan
for Groundfish of the Gulf of Alaska

In the *Fishery Management Plan for Groundfish of the Gulf of Alaska*, Section 4.3.1.6 Inshore/offshore allocations of pollock and Pacific cod is revised, Section 4.3.1.6.5 Duration is removed, and Section 4.3.1.7 American Fisheries Act (AFA) sideboard measures is added to read as follows:

4.3.1.6 Inshore/offshore allocations of pollock and Pacific cod (Effective through December 31, 2004)

The total allowable catch of Gulf of Alaska pollock and Pacific cod will be allocated between the inshore and offshore components of industry in specific shares in order to lessen or resolve resource use conflicts and preemption of one segment of the groundfish industry by another, to promote stability between and within industry sectors and affected communities, and to enhance conservation and management of groundfish and other fish resources.

Amendment 61, implemented in February 2002, replaced the 3-year inshore/offshore allocation established by Amendment 51. Under Amendment 61, the inshore/offshore allocations of pollock established by Amendment 51 are extended unchanged for the duration of the AFA which expires on December 31, 2004. The Council took this action so that pollock allocation issues in both the BSAI and GOA could be readdressed concurrently upon expiration of the AFA. Under Amendment 61, 100% of the pollock TAC and 90% of the Pacific cod TAC is allocated to catcher vessels delivering to the inshore component. The remaining 10% of the Pacific cod TAC is allocated to catcher/processors and catcher vessels that deliver to the offshore component. Catcher/processors in the offshore component will be able to take pollock as bycatch.

* * * * *

4.3.1.7 American Fisheries Act (AFA) sideboard measures (Effective through December 31, 2004)

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) which mandated sweeping changes to the conservation and management program for the pollock fishery of the BSAI and to a lesser extent, affected the management programs for the other groundfish fisheries of the BSAI the groundfish fisheries of the GOA, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska. With respect to the fisheries off Alaska, the AFA requires a suite of new management measures that fall into four general categories: (1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the BSAI pollock fishery, (3) sideboard regulations to protect other fisheries from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the BSAI pollock fishery.

While the AFA primarily affects the management of the BSAI pollock fishery, the Council is also directed to develop and recommend harvesting and processing sideboard restrictions for AFA catcher vessels, AFA catcher/processors, AFA motherships, and AFA inshore processors that are fishing for or processing groundfish harvested in the GOA. Section 211 of the AFA addresses harvesting and processing sideboards for the GOA and this entire section of the AFA is incorporated into the AFA by reference. GOA harvesting and processing sideboard restrictions that are consistent with section 211 of the AFA will be implemented through regulation. Any measure recommended by the Council that supersedes section 211 of the AFA must be implemented by FMP amendment in accordance with the provisions of section 213 of the AFA and the Magnuson-Stevens Act.

Amendment 13
to the
Fishery Management Plan
for Bering Sea and Aleutian Islands King and Tanner Crab

Section 8.0 Management Measures of *The Fishery Management Plan for the Bering Sea and Aleutian Islands King and Tanner Crab* is revised to read as follows:

8.1.6 American Fisheries Act (AFA) sideboard restrictions

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) which mandated sweeping changes to the conservation and management program for the pollock fishery of the BSAI and to a lesser extent, affected the management programs for the other groundfish fisheries of the BSAI the groundfish fisheries of the GOA, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska. With respect to the fisheries off Alaska, the AFA requires a suite of new management measures that fall into four general categories: (1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the BSAI pollock fishery, (3) sideboard regulations to protect other fisheries from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the BSAI pollock fishery.

While the AFA primarily affects the management of the BSAI pollock fishery, the Council is also directed to develop and recommend harvesting and processing sideboard restrictions for AFA catcher vessels, AFA catcher/processors, AFA motherships, and AFA inshore processors that are fishing for or processing king and Tanner crab harvested in the BSAI. Section 211 of the AFA addresses crab harvesting and processing sideboards and this entire section of the AFA is incorporated into the AFA by reference. Crab harvesting and processing sideboard restrictions that are consistent with section 211 of the AFA will be implemented through regulation or provided to the Board of Fish as recommendations. Any measure recommended by the Council that supersedes section 211 of the AFA must be implemented by FMP amendment in accordance with the provisions of section 213 of the AFA and the Magnuson-Stevens Act.

Limits on participation by AFA vessels. NMFS may issue regulations, as approved by the Council, which define the participation criteria for AFA vessels that wish to participate in the king and/or Tanner crab fisheries of the BSAI.

8.2.10 Harvest limitations for AFA vessels.

The Council may provide crab harvesting sideboard recommendations to the Board of Fisheries for each king and Tanner crab species. The State of Alaska, through the Board of Fisheries, may issue regulations, as described within Category 2 and 3 of this FMP, to establish an allowable harvest percentage of the GHL by AFA eligible vessels in any BSAI crab fishery, and to govern the in-season management of any sideboard harvest levels established for AFA eligible vessels.

Amendment 8
to the
Fishery Management Plan
for the Scallop Fishery off Alaska

Section 2.4 Framework Measures of *The Fishery Management Plan for the Scallop Fishery Off Alaska* is revised to read as follows:

2.4.4 American Fisheries Act (AFA) sideboard restrictions

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) which mandated sweeping changes to the conservation and management program for the pollock fishery of the BSAI and to a lesser extent, affected the management programs for the other groundfish fisheries of the BSAI the groundfish fisheries of the GOA, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska. With respect to the fisheries off Alaska, the AFA requires a suite of new management measures that fall into four general categories: (1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the BSAI pollock fishery, (3) sideboard regulations to protect other fisheries from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the BSAI pollock fishery.

While the AFA primarily affects the management of the BSAI pollock fishery, the Council is also directed to develop and recommend harvesting and processing sideboard restrictions for AFA catcher vessels that are fishing for scallops in the EEZ off Alaska. Section 211 of the AFA addresses sideboard protections for other fisheries off Alaska and this entire section of the AFA is incorporated into the AFA by reference. Scallop harvesting sideboard restrictions that are consistent with section 211 of the AFA will be implemented through regulation or provided to the Board of Fisheries as recommendations. Any measure recommended by the Council that supersedes section 211 of the AFA must be implemented by FMP amendment in accordance with the provisions of section 213 of the AFA and the Magnuson-Stevens Act.

2.4.4.1 Limits on participation by AFA vessels. NMFS may issue regulations, as approved by the Council, which define the participation criteria for AFA vessels that wish to participate in the scallop fishery off Alaska.

2.4.4.2 Harvest limitations for AFA vessels. The Council may provide scallop harvesting sideboard recommendations to the Board of Fisheries. The State of Alaska, through the Board of Fisheries, may issue regulations to establish an allowable harvest percentage of the GHL by AFA eligible vessels in any scallop fishery, and to govern the in-season management of any sideboard harvest levels established for AFA eligible vessels.

Appendix C: Notice of Intent to publish an EIS for Amendments 61/61/13/8

geographic information on the location of vernal pools and fairy shrimp, and information generated in section 7 consultations and section 10 habitat conservation plans. Except for the discovery of a new population of vernal pool fairy shrimp in Jackson County, Oregon (Brent Helm, May Consulting Services, *in litt.* 1998), the current range and distribution of these species is as described in the final rule. Current information on the status of the vernal pool crustaceans indicates these species are not yet recovered. Significant threats still exist throughout their ranges, primarily urban development and conversion of land to intensive agricultural use. Habitat loss occurs from direct destruction and modification of vernal pools due to these and other activities, as well as modification of surrounding uplands that can alter vernal pool habitats indirectly. Population growth projections for California indicate the current trends of agricultural conversion and urbanization will continue to threaten the vernal pool crustacean species, particularly because areas containing vernal pools are primarily privately owned. The existing network of protected areas is not yet adequate to permanently protect these species from extinction. Continued implementation of the Act is necessary to achieve a conservation strategy that includes large areas of permanently protected vernal pool crustacean habitats that are not subject to the threats of urbanization and agricultural conversion.

Listing the fairy shrimp and the vernal pool tadpole shrimp as threatened and endangered provides for the development of a recovery plan, which is being developed. The recovery plan will describe site-specific actions necessary to achieve conservation and survival of the fairy shrimp and the vernal pool tadpole shrimp, and will establish a framework for agencies to coordinate activities and cooperate with each other in conservation efforts. The plan will also set recovery goals and priorities. After the plan is completed and implemented, we will continue to evaluate information on the status of and threats to these species, and undertake delisting actions as appropriate.

Thus, based on our review of information on the vernal pool crustaceans added to our files since the time of listing and the information that the petitioner asked us to review, we determine there is not substantial information to indicate that delisting of the vernal pool tadpole shrimp and vernal pool fairy shrimp may be warranted.

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Author

The primary author of this document is Kyle E. Merriam, Sacramento Fish and Wildlife Office (see **ADDRESSES** section above).

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*).

Dated: March 30, 2000.

Jamie Rappaport Clark,

Director, U.S. Fish and Wildlife Service.

[FR Doc. 00–8420 Filed 4–4–00; 8:45am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 679

[I.D. 032800B]

Fisheries of the Exclusive Economic Zone Off Alaska; Amendments 61/61/13/8 to Implement Major Provisions of the American Fisheries Act

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of intent; scoping period; request for comments.

SUMMARY: NMFS announces its intent to prepare an environmental impact statement (EIS) on proposed Amendment 61 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area, proposed Amendment 61 to the Fishery Management Plan for Groundfish of the Gulf of Alaska, proposed Amendment 13 to the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crab, and proposed Amendment 8 to the Fishery Management Plan for the Scallop Fishery off Alaska (FMPs). These fishery management plan (FMP) amendments would incorporate the provisions of the American Fisheries Act (AFA) into the FMPs and their implementing regulations. The scope of the analysis will include all proposed regulations and activities that would be implemented under the proposed FMP amendments.

DATES: Written comments will be accepted through May 8, 2000.

ADDRESSES: Written comments and requests to be included on a mailing list of persons interested in the EIS should be sent to Lori Gravel, NMFS, Alaska Region, P.O. Box 21668, Juneau, AK 99802, or delivered to the Federal Office Building, Room 457–1, 709 West 9th Street, Juneau, AK, and marked Attn: Lori Gravel.

FOR FURTHER INFORMATION CONTACT: Kent Lind, NMFS, (907) 586–7228 or kent.lind@noaa.gov.

SUPPLEMENTARY INFORMATION: NMFS manages the U.S. groundfish fisheries in the exclusive economic zone of the Bering Sea and Aleutian Islands Management Area (BSAI) and Gulf of Alaska (GOA) under the FMPs for groundfish in the respective areas. With Federal oversight, the State of Alaska (State) manages the commercial king crab and Tanner crab fisheries in the BSAI and the commercial scallop fishery off Alaska under the FMPs for those fisheries. The North Pacific Fishery Management Council (Council) prepared, and NMFS approved, the FMPs under the authority of the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 *et seq*. Regulations implementing the FMPs appear at 50 CFR part 679. General regulations governing U.S. fisheries also appear at 50 CFR part 600.

EISs were prepared and filed when the FMPs for the groundfish fisheries of the BSAI and GOA were prepared and approved by NMFS in 1978 and 1981, respectively. On October 1, 1999, NMFS announced its intent to prepare a programmatic supplemental environmental impact statement that defined the Federal action under review as, among other things, all activities authorized and managed under the FMPs and all amendments thereto, and that addresses the conduct of the BSAI and GOA groundfish fisheries as a whole. Work on this programmatic SEIS is ongoing. However, the programmatic SEIS will not examine in detail a range of alternatives specific to proposed Amendments 61/61/13/8 and implementation of the AFA.

The National Environmental Policy Act (NEPA) requires preparation of EISs for major Federal actions significantly affecting the quality of the human environment. NEPA regulations state: ''Environmental impact statements may be prepared, and are sometimes required, for broad Federal actions such as the adoption of new agency programs or regulations'' (40 CFR 1502.4). NMFS has determined that the new management programs mandated by the AFA and proposed to be implemented under Amendments 61/61/13/8 are of sufficient magnitude to warrant preparation of a separate EIS for these amendments.

The AFA, Div. C, Title II, Subtitle II, Pub. L. No. 105-277, 112 Stat. 2681 (1998), made profound changes in the management of the groundfish fisheries of the BSAI and, to a lesser extent, the groundfish fisheries of the GOA, crab fisheries of the BSAI, and scallop fishery off Alaska, and requires the adoption of new agency programs and regulations. With respect to the groundfish and crab fisheries off Alaska, the AFA—

(1) Established a new allocation scheme for BSAI pollock that allocates 10 percent of the BSAI pollock total allowable catch (TAC) to the Community Development Quota (CDQ) Program, and after allowance for incidental catch of pollock in other fisheries, allocates the remaining TAC as follows: 50 percent to vessels harvesting pollock for processing by inshore processors, 40 percent to vessels harvesting pollock for processing by catcher/processors, and 10 percent to vessels harvesting pollock for processing by motherships;

(2) Provided for the buyout of nine pollock catcher/processors and the subsequent scrapping of eight of these vessels through a combination of $20 million in Federal appropriations and $75 million in direct loan obligations;

(3) Required a fee of six-tenths (0.6) of one cent for each pound round weight of pollock harvested by catcher vessels delivering to inshore processors for the purpose of repaying the $75 million direct loan obligation;

(4) Listed by name and/or provided qualifying criteria for those vessels and processors eligible to participate in the non-CDQ portion of the BSAI pollock fishery;

(5) Increased observer coverage and scale requirements for AFA catcher/processors;

(6) Established limitations for the creation of fishery cooperatives in the catcher/processor, mothership, and inshore industry sectors of the BSAI pollock fishery;

(7) Required that NMFS grant individual allocations of the inshore BSAI pollock TAC to inshore catcher vessel cooperatives that form around a specific inshore processor and agree to deliver the bulk of their catch to that processor;

(8) Required harvesting and processing restrictions (commonly known as ''sideboards'') on fishermen and processors who have received exclusive harvesting or processing privileges under the AFA to protect the interests of fishermen and processors who have not directly benefitted from the AFA; and

(9) Established excessive share harvesting caps for BSAI pollock and directed the Council to develop excessive share caps for BSAI pollock processing and for the harvesting and processing of other groundfish.

Since the passage of the AFA in October 1998, NMFS has begun to implement specific provisions of the AFA through a variety of mechanisms. For the 2000 fishing year, NMFS implemented AFA-related permit requirements through an emergency interim rule published on January 5, 2000 (65 FR 380). AFA-related pollock allocations, monitoring requirements, and sideboard restrictions were implemented through a second emergency rule published January 28, 2000 (65 FR 4520). Required changes to the CDQ program were implemented through an emergency interim rule (64 FR 3877, January 26, 1999; extended at 64 FR 34743, June 29, 1999). Since the passage of the AFA, the Council also has taken an active role in the development of management measures to implement the various provisions of the AFA. The Council began consideration of the implications of the AFA during a special meeting in November 1998, during which it discussed AFA-related actions that were required for the 1999 fishing year. At its December 1998 meeting, the Council began an analysis of a suite of AFA-related management measures that subsequently became known as Amendments 61/61/13/8. The Council conducted an initial review of Amendments 61/61/13/8 and related AFA measures at its April 1999 meeting, and took final action on these amendments at its June 1999 meeting. At its December 1999 meeting, the Council reviewed the status of Amendments 61/61/13/8 and recommended that NMFS proceed immediately with an emergency interim rule to implement the Council's June 1999 recommendations so that AFA regulations could be in place prior to the start of the 2000 fisheries while Amendments 61/61/13/8 and the proposed rule to implement the amendments are under continued development and review by the Council and NMFS. In accordance with the Council's recommendation, NMFS has implemented the main provisions of Amendments 61/61/13/8 through the two emergency interim rules cited here to meet the statutory deadlines contained in the AFA for most management measures.

With this document, NMFS announces its intent to prepare an EIS on proposed Amendments 61/61/13/8 that defines the proposed Federal action under review as the suite of regulations and management measures that, taken as a whole, would implement the required provisions of the AFA as recommended by the Council under proposed Amendments 61/61/13/8. NMFS will present in the EIS an overview and an assessment of all impacts (including environmental, biological, economic, and socio-economic) that result from fishing and processing activities that would be conducted under proposed Amendments 61/61/13/8 and all reasonable alternatives. The Responsible Program Manager for this EIS is Steven Pennoyer, Administrator, Alaska Region, NMFS.

Alternatives

The EIS will consider a range of alternative management measures to implement the requirements of the AFA. The EIS will not consider detailed alternatives that are inconsistent with the statutory requirements of the AFA, or alternatives that would expand the provisions of the AFA into other groundfish or crab fisheries under the authority of the Council. This EIS also will not consider alternatives for the buyout and scrapping of ineligible catcher/processors or the 0.6 cent/lb fee on inshore pollock because these two provisions of the AFA have already been permanently implemented by NMFS through separate actions.

Alternatives will be grouped into three categories of management measures for the purpose of analysis: (1) Alternatives for allocating the BSAI pollock resource among industry sectors, vessels and processors, (2) alternatives for harvesting and processing sideboard limits for AFA vessels and processors in other fisheries, and (3) alternatives for monitoring and enforcement.

Alternatives for allocating the BSAI pollock resource. The AFA provides an explicit formula for allocating the BSAI pollock resource among the CDQ, inshore, mothership, and catcher/processor sectors. The AFA further defines which vessels and processors are eligible to participate in the inshore, mothership, and catcher/processor sectors and sets an overall harvesting excessive share cap of 17.5 percent of the BSAI pollock directed fishery which no individual, corporation, or other entity may exceed. The AFA also provides guidelines for the formation of fishery cooperatives and for the allocation of BSAI pollock to fishery cooperatives. The EIS will examine the environmental and economic effects of proposed Amendments 61/61/13/8 that would allocate pollock according to the formulas set out in the AFA and contrast this allocation alternative against the no-action alternative (i.e., the pre-AFA regime). The EIS also will analyze various alternative mechanisms for allocating BSAI pollock to fishery cooperatives that have been proposed by the Council including alternatives that would modify the restrictions on inshore cooperative membership and requirements that tie inshore cooperatives to specific processors. However, the EIS will not examine, in detail, different sector allocation formulas or alternative qualification criteria for vessels and processors that would be inconsistent with the AFA and that would be outside the authority of the Council to recommend or NMFS to implement.

Alternatives for harvesting and processing sideboards. Since November 1998, the Council has examined a wide range of alternative measures for harvesting and processing sideboards. At its June 1999 meeting, the Council considered various options for establishing groundfish harvesting sideboard amounts for catcher/processors and groundfish and crab sideboard amounts for catcher vessels. The Council also considered various methods by which harvesting sideboards would be managed and considered various exemptions for catcher vessels that meet certain criteria. The full range of harvesting sideboard alternatives considered by the Council will be analyzed in the EIS including the Council's preferred alternative under proposed Amendments 61/61/13/8. The EIS will also examine the crab processing sideboard alternatives developed by the Council. However, the EIS will not examine alternatives for groundfish processing sideboards and excessive processing shares. The Council is currently examining groundfish processing sideboards and excessive processing share limits as a separate action and is preparing a separate analysis to examine those issues for initial review at its June 2000 Council meeting.

Alternatives for monitoring and enforcement. A suite of new monitoring and enforcement measures are required to implement the limited access allocation program effectively for BSAI pollock and the accompanying sideboard measures proposed under Amendments 61/61/13/8. The AFA sets out new observer and scale requirements for catcher/processors but is silent with respect to monitoring and enforcement of both BSAI pollock and sideboard fisheries in the mothership and inshore sectors. The EIS will examine a range of monitoring and enforcement options including electronic recordkeeping and reporting requirements, observer coverage requirements, and scale and catch weighing requirements for all three sectors of the BSAI directed pollock fishery.

Issues

The environmental consequences section of the EIS will examine the impacts of fishing and processing under pre-AFA management regulations and under a range of representative alternative management alternatives to implement the requirements of the AFA. The environmental issues to be examined include: (1) marine habitat and water quality, (2) major fish species, (3) bycatch, (4) marine mammals, (5) seabirds, and (6) cumulative and synergistic impacts on species across the food web. In addition, the environmental consequences section will contain summary, interpretation, and predictions for economic and socioeconomic issues associated with the conduct of the BSAI pollock fishery on the following individuals and groups: (1) Those who participate in harvesting the fishery resources off Alaska, (2) those who process and market the fishery resources harvested off Alaska, (3) those who are involved in allied support industries, (4) those who consume these fishery products, (5) those who rely on these fishery resources for subsistence or recreational needs, (6) those who benefit from non-consumptive uses of these living marine resources, (7) those involved in managing and monitoring these fisheries, and (8) affected fishing communities.

NMFS requests public input on the range of environmental, economic and socioeconomic issues that should be considered in this EIS on proposed Amendments 61/61/13/8.

Public Involvement

Scoping for the EIS begins with publication of this document. The Council will receive a presentation of the EIA project and the public will have opportunity to comment on the scope of the EIS at the Council's April 2000 meeting (Anchorage, AK, Hilton Hotel, April 12–17, 2000). Additional scoping meetings are not scheduled. The proposed action has already been subject to a lengthy development process that has included early and meaningful opportunity for public participation in the development of the proposed action including eight Council meetings beginning with a special Council meeting on the AFA in November 1998, and including every Council meeting since that date. The Council also has formed special committees to examine specific aspects of the AFA in detail including the structure and management of inshore cooperatives and the issue of processor sideboards. The Council provided notice of these meetings and they were open to the public.

Dated: April 3, 2000.

Bruce C. Morehead,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

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Appendix D: Discussion paper on inshore cooperatives

Discussion Paper on

Inshore Sector Catcher Vessel Cooperatives in the
Bering Sea/Aleutian Islands Pollock Fisheries

Prepared for the

North Pacific Fishery Management Council

February 7, 2000

by

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Department of Economics
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Executive Summary

In October 1999 we presented to the Council an analysis of three issues: whether implementation of inshore American Fishery Act (AFA) cooperatives will have beneficial or adverse effects on inshore independent vessel owners, which features of the AFA rules or characteristics of the inshore sector increase the probability of adverse results, and the effects of three alternative proposals on the participants in the inshore sector.

In November 1999 we were requested to prepare an expanded analysis addressing four questions: the qualitative effects of the AFA with the existing rules on net benefits in each sector of the fishery, whether implementation of AFA cooperatives will have beneficial or adverse effects on inshore independent vessel owners, the effects of an expanded set of alternative proposals, and the long-term economic viability of inshore sector independent vessel owners. We were requested to also address nine other related issues, and to focus principally on the effects within the inshore sector.

We begin our analysis with the expected qualitative effects of the AFA on the aggregate net benefits of each sector. Two aspects of the AFA are considered: the reallocation of total allowable catch (TAC) among the sectors, and the rationalization made possible by the formation of cooperatives.

The catcher/processor sector's share of the total BSAI TAC was decreased by approximately one third, and this decrease in allocation was only partially compensated by a buyback of some of the sector's catching and processing capacity. However, the sector has received large benefits from the rationalization made possible by the AFA, and there appears to be a consensus that the overall net benefits of the AFA to this sector were positive.

The mothership sector's share of TAC was decreased by approximately one-sixth, and this sector did not receive any direct compensation for the decrease in its allocation. The mothership sector is expected to benefit from rationalization, but not by as much as the catcher/processor sector. Therefore it is not clear whether the AFA will result in positive net benefits to this sector.

The inshore sector's share of TAC increased by approximately one-third, and the benefits from this increase in allocation were only partially offset by the requirement that it repay a loan for part of the compensation paid to the catcher/processor sector. Therefore the inshore sector received a net benefit from the reallocation aspect of the AFA. In addition, the sector will receive benefits from rationalization, either under the existing AFA rules or alternative rules.

We conclude that the balance of net benefits among the sectors is in favor first of the inshore sector, then the catcher/processor sector, and last the mothership sector. One of the issues we were asked to address is whether the balance of net benefits among sectors would be eliminated if one sector were unable to receive the benefits of rationalization. Because all sectors have now formed cooperatives, they will all be able to receive benefits from rationalization, making this issue moot.

Our primary focus is on the distribution of net benefits within the inshore sector. The processing sector is highly concentrated and the harvesting sector can legally negotiate under the umbrella of a bargaining association. The participants are keenly aware of their strategic interdependence, and that necessitates the use of tools from game theory. Our analysis is based on the implications of bargaining theory, which deals with the division of rent between game players. We define three types of players: independent catcher vessels (ICVs), processor-controlled catcher vessels (PCVs), and processors.

We employ the tools of both cooperative and non-cooperative bargaining theory. We conclude from our analysis of the circumstances in the inshore fishery that the most plausible model is one based on moderate, but not cutthroat, competition. In reaching this conclusion we specifically address the issues of excess capacity, asymmetric information, and the results of price negotiations in the catcher/processor sector. We also discuss several alternative models that have been suggested for the analysis of the inshore fishery, including monopsony and bilateral monopoly, and explain why they are inadequate. Although we do not believe that either cutthroat competition or the alternative models are appropriate characterizations of the fishery, we analyze the results obtained under the extreme alternatives of cutthroat competition and bilateral monopoly in order to examine the implications of varying the degree of competition.

We have been instructed to use different benchmarks for each of the first three questions we have been asked to address. Analysis of the qualitative effects of the AFA on the net benefits of the three sectors compares the situation in the period immediately prior to the passage of the AFA, the "pre-AFA" benchmark, with the anticipated situation after cooperatives are implemented under the existing AFA rules. In considering whether implementation of inshore AFA cooperatives will have beneficial or adverse effects on inshore independent vessel owners, we use the "AFA without cooperatives" benchmark as in our earlier discussion paper. The qualitative effects of alternative rules are analyzed relative to the benchmark of the cooperatives implemented under the existing AFA rules, the “AFA cooperatives” benchmark.

The first question was addressed above with respect to the aggregate net benefits to each sector. Analysis of the disaggregated net benefits to ICVs and processors in the inshore sector involves two steps. The first is the net benefits from going from the first, pre-AFA, benchmark to the second, AFA without cooperatives, benchmark. The difference between these two benchmarks is equal to the net benefits that ICVs and processors received from the reallocation aspect of the AFA. The second step evaluates the effects on the net benefits of ICVs and processors of the rationalization and distributional effects of implementing cooperatives under the existing AFA rules by comparing the situation under the AFA without cooperatives benchmark with the situation after the cooperatives are implemented.

As already noted, the inshore sector as a whole received a substantial positive net benefit from the reallocation aspect of the AFA. It is unlikely that the increase in allowable catch would alter the participants' relative bargaining strengths significantly, and therefore both ICVs and processors would be expected to do at least as well under the AFA without cooperatives benchmark as it had done in the pre-AFA fishery. However, determining what the relative bargaining strengths actually were, and therefore what the distribution of rents would be under the AFA without cooperatives benchmark, is difficult.

Processors have a number of important bargaining advantages. Their ownership of catching vessels reduces their reliance on supply from ICVs, while also providing them an informational advantage given that ICVs do not own inshore processing plants. Because the processing sector is highly concentrated, entry is prohibited, and the situation in the fishery is a repeated game, processors are expected to realize that aggressive tactics yielding short-term gains are unlikely to be profitable in the long-run, and capacity constraints under the benchmark would help them refrain from engaging in such tactics. Although the ICVs do have the advantage of being able to legally bargain as a group, we conclude that on balance the processors have substantially more bargaining power than ICVs. Therefore, we expect outcomes under the AFA without cooperatives benchmark to favor processors over ICVs.

Unlike the AFA without cooperatives benchmark, the actual AFA includes provisions for the formation of harvesting cooperatives. To the extent that the cooperatives are implemented, the race for fish will abate. The resulting rationalization will increase both the total rents in the fishery and the effective amount of capacity in harvesting and processing. The expected large increase in the effective amount of processing capacity will provide more opportunities for processors to engage in aggressive competition, but the long-term incentives for refraining from doing so will remain. The existence of PCVs will continue to provide the same bargaining advantages as under the benchmark, and in addition will now provide the processor influence over its cooperative's decisions.

If an ICV does not join a cooperative, or chooses to change the processor it is assigned by the AFA rules, it has to compete for the fish not allocated to cooperatives. The term "open access fishery" will be used to refer to this part of the inshore pollock fishery, with the understanding that access of catcher vessels and processors will be limited by the AFA. The "outside option" for an ICV is the return it can obtain in this open access fishery and then possibly joining another cooperative.

If the open access under the AFA were the same as open access under the benchmark, then ICVs could not be adversely affected by the AFA provisions for cooperatives. However, open access would be the same in the two cases only if no cooperatives were in fact formed under the AFA, which would not be an equilibrium outcome. Under most plausible scenarios for open access under the AFA, ICVs would do worse in open access under the AFA than in the benchmark case. Therefore, we conclude that there is a significant probability that ICVs will be adversely affected by the AFA's provisions for cooperatives.

Taking into account the positive net benefits most likely received by ICVs from the reallocation aspect of the AFA, that is, in going from the pre-AFA benchmark to the AFA without cooperatives benchmark, decreases the likelihood that the ICVs would be adversely affected by the implementation of the AFA cooperatives, relative to the situation pre-AFA. However, the possibility that they would be cannot be dismissed. We also note that, whatever the results for the ICVs collectively, the results for individual ICVs will vary, with some likely to benefit even if the results at the aggregate level are adverse, and vice versa. In particular we expect that, other things equal, an ICV will do better the less influential that PCVs are in its cooperative. Lastly, it should be noted that because the AFA without cooperatives benchmark is not the ICV's outside option under the AFA, the decision to join a cooperative does not imply that an ICV is better off under the AFA than under this benchmark.

Economic characteristics of the inshore sector that substantially increase the probability of adverse effects are the degree of concentration in the processing sector, the number and importance of PCVs, the existence of catcher vessels whose share of catch history is substantially less than their relative catching power, and the difficulty of specifying long-term price contracts. The most important features of the AFA cooperative rules are that a catcher vessel can only join the cooperative for which it qualifies based on the prior year's fish deliveries, implying that it must go through open access to change processors, and the restriction that a cooperative can sell no more than 10% of its catch to a processor other than the one for which it is qualified.

In analyzing the qualitative effects of each of the alternatives to the AFA, we have been instructed to use a third benchmark, namely the expected outcomes under implementation of the existing AFA rules for cooperatives. One of the alternatives that we evaluated, the Dooley-Hall proposal, would remove the qualification requirements, so that a cooperative could deliver to any processor, and any eligible catcher vessel could join any cooperative. Except for the requirement of belonging to a cooperative with at least five members, the Dooley-Hall proposal is equivalent to an individual fishing quota (IFQ) program.

There is little doubt that ICVs would be better off, and processors worse off, under the Dooley-Hall proposal than under the AFA cooperatives. The most critical factor determining the outcomes for both ICVs and processors under the Dooley-Hall proposal would be how aggressively processors would compete. The presence of a large amount of excess capacity would provide opportunities for short-term gains from aggressive competition, but the factors that can be expected to cause processors to refrain from aggressive competition would remain.

More importantly, even if processors engaged in cutthroat competition, they would not be much worse off under the Dooley-Hall proposal than under the AFA, because cutthroat competition would also result in an adverse outcome for them under the AFA. Similarly, under the opposite extreme assumption that the processors are able to act as a monopsony, the outcome under the Dooley-Hall proposal would be adverse for ICVs, but not as adverse as under the AFA. Accordingly, whatever the degree of competition, ICVs would be expected to be somewhat better off, and processors somewhat worse off, under the Dooley-Hall proposal than under the AFA.

Another alternative that we evaluated would raise the limit on the amount of its deliveries that a cooperative could sell to a processor other than the one for which it was qualified. Raising this limit would facilitate rationalization under the AFA. Whether or not it would reduce the probability of adverse effects on ICVs would depend in part on whether they could exercise the transfer option without hindrance from processors. Determining the magnitude of the benefits to ICVs of increases in the transfer limit would require more information than is currently available on the value of incremental supplies.

The remaining alternatives are intended to eliminate or reduce the cost of open access to ICVs. One of these alternatives, which was also analyzed in our earlier discussion paper, would eliminate the qualification requirement for cooperative membership, so that a catcher vessel could change processors without having to go through open access. There are several ambiguities concerning the interpretation of this proposal. The most important is whether it would apply only when a new cooperative agreement was signed, or every year. Under the former interpretation the proposed change would have no effect.

If this alternative would apply in every year, it would enhance the bargaining power of ICVs by greatly improving their outside option. This alternative would not be equivalent to the Dooley-Hall proposal because of two important differences. First, the organization of the cooperatives would be less favorable to ICVs, and more favorable to processors, under this alternative than under the Dooley-Hall proposal. Second, and cutting the other way, ICVs would retain the potentially important bargaining advantage conferred by the 80% rule, which we understand would apply in every year of the cooperative's existence. This advantage would not exist under the Dooley-Hall proposal. Under the conditions of moderate competition, which we consider to be the most likely to prevail, the proposal to eliminate the qualification requirement for cooperative membership can be expected on balance to be more favorable to ICVs than the AFA rules, but less favorable than the Dooley-Hall proposal.

At the October 1999 Council meeting, the AP recommended a modified version of the proposal to eliminate the open access requirement. The most important new provision in the modified proposal is that the 80% rule would apply only in the first calendar year in which the cooperative received its allocation pursuant to the AFA. Because the cooperatives have now been formed, and the duration of the cooperatives has been defined as the effective life of the AFA, the AP proposal would effectively result in the elimination of the 80% rule. The importance of the 80% rule depends on the degree of competition. Under the conditions of moderate competition, the AP proposal would be clearly less favorable to ICVs then simply eliminating the qualification requirement, but would be likely to be more favorable for ICVs than the AFA rules for cooperatives.

At the October 1999 meeting, the Council added three new options that could be used singly or in combination to modify other alternatives. The first option would allow a catcher vessel to change cooperatives without having to go through open access. Two sub-options would be to allow such a change once every calendar year, or once every other calendar year. We interpret the first sub-option as being identical to the original proposal to eliminate the qualification requirement for cooperative membership.

The second sub-option would make it more costly for an ICV to switch two years in succession. Indeed, an ICV that had just joined a cooperative could find itself in a difficult bargaining position at the beginning of its second year when negotiating its ex-vessel price. The ICV could protect itself by requiring a two-year price contract, but it is our understanding that multi-year price contracts are often considered unfeasible. Therefore we conclude that the two-year option is worse for ICVs than the one-year option, but more favorable to ICVs than the AFA rules.

Another option suggested by the Council would prohibit a processor-owned catcher vessel from entering the open access portion of the inshore fishery unless the processor for which it was qualified, which would usually be the one that owned it, did not have a cooperative. The most likely case in which the rule would be binding is that of a processor that had one or more under-vested PCVs but that would also gain significantly from having a cooperative. If enough of the qualified CVs were in favor of the cooperative to satisfy the 80% rule without some of the under-vested PCVs, the processor could prefer to have them in open access to harvest more than their allocation under the cooperative.

Prohibiting such vessels from entering open access would reduce the potential costs of open access to ICVs, and therefore improve their outside option. There are two ways in which this could benefit ICVs. First, to the extent that the proposed rule reduced the actual cost of open access, it would improve the outside option for ICVs in general. Second, the proposed rule could affect the bargaining power of the specific ICVs qualified for a processor for which the rule was binding, because it would eliminate the ability of the processor to obtain a bargaining advantage over ICVs by threatening to send its under-vested PCVs into open access if an ICV did not join its cooperative.

The third option would prohibit a mothership catcher vessel (MSCV) from entering the open access portion of the inshore fishery unless the processor for which it was qualified did not have a cooperative. Because all the inshore processors for which MSCVs are qualified did form cooperatives, the proposed rule would exclude all MSCVs from the inshore open access fishery. This would reduce the cost of open access to inshore ICVs and therefore enhance their bargaining power. However, this benefit for inshore ICVs would be attained only at significant cost to the mothership sector, which is already receiving the least net benefits from the AFA.

I. Introduction

In October 1999 we presented to the Council a discussion paper that addressed the following objectives concerning the inshore sector catcher vessel cooperatives in the Bering Sea/Aleutian Islands (BSAI) pollock fisheries:

1. Provide information that will help determine if the implementation of inshore sector cooperatives for the BSAI pollock fishery, as provided for in the American Fisheries Act (AFA), is expected in aggregate to have beneficial or adverse effects on the independent vessel owners who, under the AFA, are eligible to participate in the BSAI pollock fishery. An independent vessel owner is an entity that owns fewer than three vessels in the BSAI pollock fishery.

2. Determine which, if any, of either the features of the AFA inshore cooperative rules or the characteristics of the inshore sector of the BSAI pollock fishery substantially increase the probability of adverse effects.

3. Determine the effects of three specific alternatives to mitigate any such adverse effects. In particular, determine the expected effects on the independent vessel owners, other vessel owners and pollock processors who are eligible to participate in the inshore sector of the BSAI pollock fishery.

The three alternatives to the current AFA rules for inshore sector cooperatives for the BSAI pollock fishery that we were requested to analyze were:

1. Implement the Dooley-Hall Independent Catcher Vessel Owner proposal.

2. Replace the 10% limit on sales to another eligible inshore processor with a higher limit.

3. Eliminate the requirement that an eligible catcher vessel can only belong to a cooperative that will principally deliver its pollock apportionment to the inshore processor that received more of the pollock delivered by that catcher vessel than any other inshore processor in the previous year. This could be done by allowing any eligible catcher vessel to join a cooperative that was established to receive a catch allocation that can be used to deliver BSAI pollock to a specific inshore processor.

The current AFA rules for inshore cooperatives are described in Table 1 and the rules for each of the alternatives listed above are described in Table 2.

In November 1999 we were requested to prepare an expanded analysis and discussion paper. The current discussion paper updates our September report and presents new analysis. The primary objective of this discussion paper is to provide information relative to the following questions.

1. What are the expected qualitative effects of the AFA with the existing set of inshore cooperative rules on the net benefits of the inshore sector independent catcher vessel owners, inshore sector processors, factory trawler sector, and mothership sector?

2. Is the implementation of inshore sector cooperatives for the BSAI pollock fishery, as provided for in the AFA, expected in aggregate to have beneficial or adverse effects on the independent vessel owners who, under the AFA, are eligible to participate in the BSAI pollock fishery, where an independent vessel owner is an entity that owns fewer than three vessels in the BSAI pollock fishery?

3. What are the expected qualitative effects of each of the alternatives to the existing set of inshore cooperative rules?

4. How will the alternatives affect the long-term economic viability of independent catcher vessels in the inshore sector of the BSAI pollock fishery?

In addition to the initial three alternatives to the current AFA rules for inshore sector cooperatives considered in the earlier discussion paper, the expanded set of alternatives for this discussion paper includes an alternative recommended by the AP in October and other alternatives added by the Council in October. The additional alternatives are described in Table 3.

In providing information relative to those questions, we were asked to address the following related issues:

i. the features of the alternatives and the characteristics of the inshore sector of the BSAI pollock fishery which are particularly important in assessing the answers to the four preceding questions;

ii the effects on the benefits of rationalization for the harvesting and processing participants in the inshore sector if the Department of Justice rules that processor owned vessels cannot be members of cooperatives;

iii the results of the price negotiations in the factory trawler sector and their implications for price negotiations in the inshore sector;

iv the level of price competition among the major inshore processors;

v the degree of competitive behavior among inshore processors reflected by excess capacity;

vi the probability that such cooperatives will be formed;

vii the level of asymmetry in the information used in bargaining by inshore sector processors and independent catcher vessel owners;

viii whether the AFA's balance of benefits among and within the sectors in the Bering Sea pollock fishery (factory trawler, mothership, and inshore) will be eliminated if one sector is unable to receive benefits of rationalization in the fishery; and

ix the differences in cooperative structures among the three sectors.

Our contract instructed us to focus principally on the effects within the inshore sector of the BSAI pollock fishery, but to address inter-sector effects to the extent feasible given the resources available for the discussion paper and the effort required to address the intra-sector effects. Also, we were subsequently informed that a ruling had been made by the Department of Justice that processor owned vessels can be members of cooperatives, and therefore that the issue raised in item ii no longer needed to be addressed.

Our analysis will use the tools of game theory, and more specifically of bargaining theory. Game theory is a powerful tool for the analysis of situations involving strategic interactions. However, it is important also to note its limitations. In particular, game theory can offer definitive predictions only if the "extensive form" of the game is well-defined (see, e.g., Fudenberg and Tirole 1991). The extensive form spells out all the rules of the game, all the possible moves by all the players, the information structure, and the timing and payoffs of each player for any possible scenario. While small changes in the rules of the game can lead to dramatic changes in the equilibrium outcome, game theory remains the only widely accepted tool to analyze situations involving strategic interactions.

We will provide a framework to analyze the AFA and the specific questions we have been requested to address. The results will hopefully enhance the understanding of fundamental inter-relationships, indicate useful policy implications, and identify the critical assumptions underlying them. It must be kept in mind, however, that while our analysis should shed light on what *may* happen under various circumstances, it will not be able to offer definitive predictions about what *will* happen.

We will make extensive use of bargaining theory, which deals with the division of rent between game players. This is, in general, a complex issue, but there are some simple and key predictions that can be fruitfully applied. We will employ the tools of both cooperative and non-cooperative bargaining theory, as we did in our earlier report. The cooperative bargaining theory developed by Nash (1953) predicts that if all players are fully informed, they will negotiate an allocation that does not involve the waste of economic resources and that is biased towards the party with the better or stronger "outside option." The outside option, or "threat point," is defined as the outcome that a participant can obtain if negotiation breaks down. This theory does not spell out the exact game played by players that leads to the predicted outcome. There is also a non-cooperative theory of bargaining (e.g., Osborne and Rubinstein 1990) that pays detailed attention to the exact game form and tries to predict choices by players. This theory also predicts that economic resources will not be wasted and the outcome will be biased towards the player with the better outside option.

However, if there is asymmetric information between players, so that not all players have the same information available to them, then both cooperative and non-cooperative bargaining theories predict some waste of economic resources. For example, if everyone knows the size of the rent to be divided, as well as each other's outside options, then no one can gain by prolonging negotiations. On the other hand, if outside options are only known privately by each party, a party may reject offers repeatedly in order to signal that it has a strong outside option and this is wasteful because delay is costly.

Delay is just one example of how bargaining can involve wasting economic resources; the key point is that resources have to be used to signal, which is a cost incurred due to asymmetric information. Since parties with private information have incentives to mislead those who do not have this information, only actions that are costly can credibly convey information. Everyone will want to claim the strongest outside option, so less informed parties will start with a low offer to force better informed parties to reveal their outside option by rejecting offers. The stronger the outside option, the more they are able and willing to wait. Private information will also bias the final outcome towards the better-informed players.

Understanding participants' outside options is a fundamental aspect of analyzing bargaining outcomes under conditions of either full or asymmetric information. The concept of a participant's outside option can be illustrated by considering the situation of an independent catcher vessel considering whether or not to join an inshore cooperative under the current AFA rules. The alternative is to fish in open access for at least one year. The payoff from open access will depend upon who else is in open access. If only a single independent catcher vessel decided to go into open access, its AFA allocation based on its catch history would effectively give it a quota for that year. On the other hand, if many vessels entered open access, each would be fishing under conditions of a race.

Thus the payoff for an individual vessel depends critically on the particular configuration of vessels in open access in a given year, and therefore its outside option depends upon what is happening in the entire industry. This makes our overall task difficult. The outcome of bargaining mainly depends upon the value of one's outside option, and this is difficult to determine in this case. We will devote a considerable amount of the analysis to trying to determine plausible scenarios under open access and evaluate their effects on independent catcher vessels. This analysis will also shed light on the outside options for the processors.

A primary objective of our analysis is to examine if the implementation of inshore sector cooperatives for the BSAI pollock fishery under the AFA rules is expected in aggregate to have beneficial or adverse effects on independent vessel owners. Because the choice of specific economic institutions can influence not only the distribution of the rent but also the total amount of rent that is created, the AFA, and the final choice of rules governing the cooperatives, will influence the efficiency of the BSAI fishery as well as the distribution of its rents.

It should also be noted that one has to be careful in using current occurrences as indicators of what may happen in the future. The rules of the game are still in a state of flux: the AFA sunsets in a few years and the Council has yet to take final action on alternatives that have significant impacts. Therefore, participants will tread carefully lest current actions come back to haunt them as punitive rule changes in the future. In other words, participants expect that their choices will affect the rules that may govern them in the future. So their current actions must not be interpreted as only reflecting impacts of current rules, they may be strategically chosen to influence the choice of the rules themselves.

We begin our analysis in the following section with an examination of the expected qualitative effects of the AFA on the net benefits of the catcher/processor sector, the mothership sector, and the inshore sector. The emphasis in this section is on the aggregate net benefits to each sector, rather than the division of net benefits within individual sectors.

Section III addresses the major modeling choices underlying our analysis of the inshore sector, and in section IV we discuss the benchmarks that we have been instructed to use. Our analysis of the qualitative effects of the implementation of inshore sector cooperatives as provided for in the AFA is contained in section V. The analysis of the qualitative effects of each of the alternatives to the existing set of inshore cooperative rules appears in section VI.

Professor Steven T. Buccola of Oregon State University served as a consultant to the earlier discussion paper concerning the lessons to be learned from the experience of agricultural cooperatives. In addition to being a valuable resource for us, he was the author of a report on agricultural marketing and bargaining cooperatives that was appended to the discussion paper. His report remains relevant for the issues considered in the present paper and is contained in Appendix A.

One issue discussed in our research is the extent of processor ownership interests in catcher vessels in the inshore sector. The National Marine Fisheries Service (NMFS) has provided us an analysis of ownership links for catcher vessels, which is contained in Appendix B.

We have benefitted greatly from discussions with participants in all three sectors of the BSAI pollock fishery as well as with other interested parties. Appendix C lists the individuals with whom we have discussed our research, usually at length, and sometimes on more than one occasion. We are very grateful for their help, while retaining full responsibility for the analysis and conclusions contained in this paper.

II. Effects of the AFA on the Three Sectors of the BSAI Pollock Fishery

The BSAI pollock fishery is divided into three sectors, the inshore sector, the catcher processor (C/P) sector, and the mothership (MS) sector. The principal focus of this discussion paper is on the inshore sector, and in particular the cooperative structure in that sector. However, we have also been requested to evaluate the expected qualitative effects of the AFA on each sector as a whole, possible effects on the AFA's balance of net benefits if one sector is unable to rationalize, the differences in cooperative structures among the three sectors, and the implications of the results of the price negotiations in the C/P sector for the inshore sector. In this section we briefly describe each sector and qualitatively evaluate the net benefits of the AFA to each.

There are two distinct aspects of the AFA to be considered. The first is the reallocation of the total allowable catch (TAC) among the sectors, and the second is the potential rationalization made possible by allowing each sector to form cooperatives in order to stop the race for fish. The sectors differ with respect both to the effects of the reallocation of TAC and with respect to the rules under which cooperatives can be formed. Because the C/P sector is the only one to have obtained substantial experience with the operation of cooperatives, we begin with it.

A. The Catcher/Processor Sector

During the six years prior to the implementation of the AFA, 65% of the BSAI directed pollock fishery was allocated to the offshore sector, which included both the C/P and MS sectors. The shares of these two sectors varied somewhat over time, with the C/P sector harvesting approximately 54% of the total directed fishing allowance in 1998. The AFA established separate allocations of the directed fishery allowance for the C/P and MS sectors, with the C/P sector receiving 40%. The AFA also increased the Community Development Quota from 7.5% of TAC to 10%, and established a bycatch set aside of approximately 4.5%. As a result the share of the C/P sector in the total TAC decreased from 50% in 1998 (54%´.925) to 34% (40%´.855) in 1999. Holding total TAC constant, this represents a 32% decrease in the amount of pollock available to be harvested and processed by the C/P sector.

The decrease in allocation was partially compensated for by a buyback of some of the C/P sector's capacity and catch history. Total compensation was $95 million. Because the compensated reduction in TAC was only about two-thirds as large as the total reduction in the sector's allocation, the reallocation aspect of the AFA, including the buyback, is generally concluded to have had a negative effect on the C/P sector.

However, there seems to be a consensus that the benefits to the sector from the rationalization made possible by the AFA's allowing the sector to form cooperatives more than outweigh the effects of the reallocation of TAC. Two cooperatives were implemented in the C/P sector in 1999. Catcher/processor owners formed the Pollock Conservation Cooperative (PCC) and catcher vessel (CV) owners formed the High Seas Catchers' Cooperative (HSCC). The members of each cooperative, and their allocations of catch, are detailed in their preliminary report to the Council (Pollock Conservative Cooperative and High Seas Catchers' Cooperative, 1999). The primary purpose of the cooperatives is to assign the initial distribution of catch allocation among its members. The cooperatives entered an inter-cooperative agreement covering harvest management, but are not involved in price negotiations or marketing of products.

The AFA required that no less than 8.5% of the C/P sector's directed fishing allowance be made available for harvest by the catcher vessels, and this is the amount that was assigned to them. Therefore the HSCC has available to it 3.4% of the directed fishing allowance (8.5%´.40) and 2.9% of total TAC (3.4%´.855). At the time the HSCC was formed, two of the CVs in it were owned by companies owning C/Ps. These two CVs together accounted for approximately one-third of the cooperative's total harvest allocation. Therefore the independent CVs in HSCC had available to them 5.7% of the C/P sector's directed fishing allowance, which translates to 2.3% of the directed fishing allowance and 1.9% of total TAC. We have been informed that two more of the independent CVs, which together account for one-third of the HSCC allowable catch, are in the process of being sold to companies owning C/Ps. If these sales go through, the remaining independent CVs will account for 2.8% of the C/P sector's directed fishing allowance, which translates to 1.1% of the directed fishing allowance and 1.0% of total TAC.

The PCC has nine members, which together own twenty C/Ps. We have been informed that a member owning one C/P has sold its vessel, and that the vessel's allocation, which accounts for about 4% of the PCC's total allocation, has been divided among other members. Based on the allocation of catch histories at the time the PCC was formed, the largest company accounted for about 44% of the PCC's total allocation and the largest three companies together accounted for about 68%.

Formation of the cooperatives made it possible for the C/P sector to rationalize in many highly valuable ways. Costs were reduced by the ability to transfer harvest allocations. Even though it was only the first year of operation of the cooperatives, about 11% of the total allocation was transferred among members of the two cooperatives, and there appear to have been additional transfers within companies. In the PCC, four C/Ps did not fish at all, and an additional two did not fish in the B season (Pollock Conservative Cooperative and High Seas Catchers' Cooperative, 1999). As a proportion of initial allocations, the largest transfers were from vessels in the HSCC to vessels in the PCC. Almost three-quarters of the total allocation of the HSCC were transferred to members of the PCC, and two of the seven CVs in the HSCC did not fish at all. In addition to reducing harvesting costs, transfers from the HSCC to the PCC are reported to have also reduced scheduling complications and to have significantly increased the quality of the harvest, to the extent that C/Ps were willing to pay at least as much for renting a CV's allocation as for harvested fish.

Cost savings and quality increases were also realized as a result of the slow down in harvesting and processing made possible by the formation of the cooperatives (At-sea Processors Association 1999). The C/Ps made fewer tows per day and harvested fewer fish per tow than they had under the race for fish. The smaller tow sizes reduced bruising and other damage to harvested fish and are thought to have contributed to an improvement in roe quality. Slower processing resulted in an increase of approximately 20% in fish products per pound of pollock catch and allowed a significant shift in product mix to more highly valued products, including deep-skin fillets. The slowdown in harvesting also contributed to the change in product mix, with vessel captains being able to locate schools of larger fish and use nets with larger mesh sizes. We have also been informed that the end of the race for fish facilitated new harvesting techniques for roe.

B. The Mothership Sector

The MS sector consists of three motherships and twenty catcher vessels, one of which is sunk. Fifteen of the CVs, including the sunken one, are qualified for fishing in the inshore sector of the BSAI pollock fishery.

Immediately prior to the implementation of the AFA the MS sector harvested about 11% of the directed pollock fishery, while under the AFA its allocation was set at 10%. Taking into account the increase in the Community Development Quota and the establishment of the bycatch set aside, the share of the MS sector in the total TAC decreased from about 10.2% in 1998 (11%´.925) to 8.6% in 1999 (10%´.855). Holding total TAC constant, this represents a 16% decrease in the amount of pollock available to be harvested and processed by the MS sector.

If there were no benefits from rationalization as a result of the AFA, the 16% would be a reasonable estimate of the net loss to this sector. Unlike the C/P sector, the MS sector did not receive any compensation for its reduction in allowable harvest in the form of a buyback of capacity. In terms of percentage points of the total TAC, the reduction in the MS sector's allocation was about one-tenth as large as the C/P sector's, implying that a proportional compensation would have been $9.5 million.

Although it lost fish and did not gain cash, the MS sector as a whole might still come out ahead as a result of rationalization. The AFA provides minimal rules for implementing a cooperative in this sector, saying that an allocative cooperative can be established by the catcher vessels provided that 80% agree. We understand that it would also be possible for the motherships to join the cooperative, although there are currently no plans for this to happen. A cooperative has now been formed and we are informed that all eligible CVs have joined it.

We were informed that the expected benefits to the MS sector from increased recovery rates and better product mix were not as large as those experienced by the C/P sector. However, benefits could be realized from a reduction in capacity. It was indicated that at least one-fourth of both processing and harvesting capacity could be removed from the sector. The savings from rationalization would depend in part on the alternatives available to the vessels that were removed. Historically, they have participated in other fisheries. The motherships have been active in the hake fishery, and the C/Vs are said to have gotten a substantial fraction of their total revenue from non-pollock sources. But as a result of the AFA sideboards, they would be largely prevented from switching the excess capacity to other sectors. For the CVs that are also qualified in the inshore sector, an alternative would be to fish in the inshore open access fishery. However, this possibility would be largely eliminated by one of the alternatives for the inshore sector that the Council is currently considering.

C. The Inshore Sector

The inshore sector is the primary focus of our discussion paper. In subsequent sections we will discuss in detail the AFA and alternative rules for cooperatives and their effect on the distribution of net benefits within the sector. Here we provide a brief description of the major types of participants in the inshore sector and consider the potential net benefits of the AFA to the sector as a whole.

In the inshore BSAI pollock fishery the major types of participants are the owners of independent catcher vessels (ICVs), processor-controlled catcher vessels (PCVs), and pollock processors. Owners of ICVs are defined in the AFA as entities that own fewer than three vessels in the BSAI pollock fishery. However, for most analytical purposes it is more important to specify whether a vessel-owning entity is or is not an inshore processor, rather than whether it owns more than two vessels. Therefore, unless specified otherwise, we will use the more inclusive definition that an ICV is any vessel owned by an entity other than an inshore processor.

Processor-controlled catcher vessels are defined as vessels that are controlled by an inshore processor. The National Marine Fisheries Service (NMFS) has identified for us those vessels that are wholly or partially owned by processors. We recognize that ownership and control are two different things, but for purposes of data analysis we will necessarily have to use the NMFS list based on ownership as a proxy for the list of PCVs. This will probably result in overestimates of the numbers and aggregate catch shares of PCVs.

Consistent with the definition in the AFA, processors are defined in terms of facilities, rather than the entities owning them. The AFA eligible inshore processors, listed in descending order of BSAI pollock deliveries to them in 1998, are Akutan, UniSea, Westward, Alyeska, Arctic Enterprise, Northern Victor, Sand Point, and Peter Pan. In addition, reference will sometimes be made to the entities owning the processing facilities. The three largest ownership entities are Trident Seafoods, which owns the Akutan, Arctic Enterprise, and Sand Point facilities, Maruha, which owns Westward and a majority interest in Alyeska, and Nippon Suisan, which owns UniSea.

Prior to the implementation of the AFA, 35% of the BSAI directed pollock fishery was allocated to the inshore sector. The AFA increased the inshore sector's share of the directed pollock fishery to 50%. The increase in the share of the directed pollock fishery was partially offset by the increase in the Community Development Quota and the establishment of the bycatch set aside. Taking these into account, the share of the inshore sector in the total TAC increased from 32.4% pre-AFA (35%´.925) to 42.8% post-AFA (50%´.855). Holding total TAC constant, this represents a 32% increase in the amount of pollock available to be harvested and processed by the inshore sector.

The NMFS has informed us that the TAC in 2000 is expected to be approximately 1.1 million metric tons. Therefore, the increase in the inshore sector's allowable catch as a result of the AFA in that year will be approximately 110,000 metric tons per year. The benefits from the increase in allowable catch is partially offset by the requirement to repay a loan of $75 million through a tax of 0.6 cents per pound of fish harvested. This can be thought of as the cost at which the inshore sector acquired pollock quota from the offshore sector.

With a TAC of 1.1 million metric tons, the inshore sector's allowable catch would be about 470,000 thousand tons. The tax per metric ton is $13.23, so the total annual amount paid would be $6.2 million. Dividing this by 110,000 metric tons yields an effective annual cost per ton of $56 per ton. We have been informed that the rental price for catcher vessel allocations in the C/P sector in 1999 was $300 per metric ton, which is more than five times the implicit price of $56 the inshore sector is paying. Therefore, even if the value of quota in the inshore sector were considerably less than in the C/P sector, the benefit to the inshore sector of the increase in total allowable catch would be substantially greater than the cost imposed in the form of the tax.

Accordingly, we conclude that the inshore sector received a substantial net benefit from the reallocation aspect of the AFA, whereas the other sectors lost with respect to reallocation. If, in addition, the inshore sector is able to realize the potential rationalization benefits from the formation of cooperatives, either under the AFA rules or one of the alternatives, then it will almost certainly be the sector to gain most from the AFA.

D. The Balance of Benefits Among Sectors

The above analysis leads us to conclude that the balance of net benefits among the sectors is in favor first of the inshore sector, then the catcher/processor sector, and last the mothership sector. One of the issues we have been asked to consider is whether the AFA's balance of benefits among and within the sectors in the Bering Sea pollock fishery will be eliminated if one sector is unable to receive benefits of rationalization in the fishery. In this section we consider only the balance of benefits among sectors, the balance of benefits within the inshore sector will be considered at length later in the paper. We did not examine the balance of benefits within the catcher/processor or mothership sectors.

A sector would be unable to receive benefits of rationalization only if it were unable to form cooperatives. Because cooperatives have now been formed in all three sectors, all sectors should receive benefits of rationalization.

Even if the inshore sector had been unable to form cooperatives, it is unlikely that the competitive balance among sectors would have been affected. First, there is no longer any competition between sectors with respect to the total harvest. Instead, each sector is assured of having its AFA specified allocation of fish available to it. Second, each sector seems to be able to find a ready market for its output, even with the higher costs of operation associated with the race for fish. Put differently, the binding constraint on the sales of each sector is the harvest available to it. A sector that rationalizes will be able to realize higher profits than one that does not, but its lower costs will not give it a marketing advantage.

In discussing this issue with industry participants, we have encountered only two arguments as to why the realization of benefits from rationalization might matter with respect to competitiveness. One, which is not directly relevant to the issues that we are considering, is the argument that participants in a sector that realizes large gains from rationalization could use the benefits to finance entry into other fisheries. The second argument, whose merits we are not qualified to evaluate, is that the benefits of rationalization could be used to gain political influence with respect to issues affecting a sector's own fishery.

III. Modeling Issues

Our focus is the inshore sector. In order to analyze this sector and the implications of specific aspects of the AFA for its participants, we need to make some basic modeling choices. In this section we discuss the choices that we have made, explain why we believe they are appropriate, and indicate the manner in which they influence the outcome of our analysis.

The processing sector is concentrated, with the facilities currently belonging to the largest three firms processing 80% of the pollock delivered in the inshore sector in 1998. In addition, two of these firms, Maruha and Nippon Suisan, are Japanese firms with dominant positions in the Japanese surimi products market (NMFS 1999), and Maruha owns a majority interest in Alyeska, which is the fourth largest firm in the inshore sector. In the harvesting sector, the vessels delivering to the Westward, Alyeska, and UniSea facilities have traditionally negotiated under the umbrella of the Bering Sea Marketing Association (BSMA), rather than as individuals. Therefore, we conclude that the perfectly competitive model, in which each participant takes price as given by the market and does not pay attention to what others in the industry are doing, does not apply to this fishery. Rather, the participants are keenly aware of their mutual interdependence and therefore the relevant tools to use are taken from game theory. In particular, we will rely on insights developed by bargaining theory, as we discussed in the introduction.

Pollock processing is a complex and expensive business, much more so than in some other major fisheries, such as halibut. The large investments require capable management with long planning horizons. The AFA has effectively blocked entry into this sector, and through its various regulations has effectively sealed off the sector from outside competitive pressures. Given the restrictions, there is a significant amount of rent to be divided among the participants if rationalization takes place. These are the key indicators for the applicability of a model of a "repeated game". In this sort of a model, essentially the same interaction occurs repeatedly and the participants do not change over time.

One of the fundamental contributions of non-cooperative game theory is to illustrate the tension between relatively smaller personal gain versus greater common gain using well-known models like the prisoners' dilemma. It shows that if a game is played only once, the equilibrium outcome could well be the self-seeking one instead of the one that provides for a higher joint benefit to everyone. The "tragedy of the commons" and the "race to fish" are other common examples. If everyone slowed down, everyone would be better off, but if the others slow down, an individual can gain a lot by increasing the rate of fishing. Since everyone realizes the incentives, the resulting equilibrium is self-seeking behavior at the expense of common and greater gain.

If the interactions are repeated, then there is scope for future rewards and penalties. Because of this, strategic players may be influenced to take into account the effect of their actions on others. For example, suppose there were only two fishermen in a closed fishery with a TAC. They would soon realize that if both slowed down, they would both make more profit. If one of them sped up, so would the other, and anticipating this, neither of them should speed up. From outside, it would look as if they were cooperating, but they would in fact be playing non-myopic strategies in a non-cooperative game. The key assumptions required to sustain such an equilibrium are: (i) players are rational; (ii) they value the future so that penalties and rewards are important; (iii) they can observe each others actions relatively quickly so that it is known that there can be swift reactions to each one's choices.

It is very difficult to sustain this mutually beneficial equilibrium if there are many players, or if entry is not blocked. With many players, it is difficult to observe each other's actions or to punish and reward individuals for not "playing fair" since these typically require coordinated actions. If coordination for common gain is a problem, coordination for penalizing someone will also be difficult. Also, slowing down of the race to increase the gains to everyone will typically create rent, which will attract entry. So, unless entry is blocked, there is little incentive to create rent by slowing down, because some new entrant will take it away from those who created it. However, blocking entry, as is done in the AFA, makes it much easier to achieve a mutually beneficial outcome.

If players know each other's costs and benefits, and they are of relatively similar strength, it will make it easier to achieve a mutually beneficial equilibrium. If they are not of equal strength, the alternative to a mutually beneficial equilibrium is not necessarily fierce competition. For example, suppose one fisherman is so much more efficient than the other that it can catch almost the entire TAC in a race. It knows it can wipe out the other, and therefore we should not expect an equilibrium in which both fishermen slow down. The most likely case is that the efficient fisherman buys out the inefficient one since it avoids the race for both. Again, such buyouts are easier to implement if there are relatively few players with very dissimilar strengths. This is also the result of a "War of Attrition game" (Fudenberg and Tirole 1991), which simply concludes, "why fight a war if you know you are going to lose?" McGee (1958) examined the Standard Oil case and made a forceful argument along the same lines, saying that Rockefeller bought out rivals at attractive rates and thereby avoided a price war.

From the above, we can conclude that the large number of ICVs in the inshore sector would make it difficult for them to individually achieve a mutually beneficial equilibrium in a non-cooperative game. However, by law they can form marketing associations, which can help them coordinate their actions for their mutual benefit.

The situation is different for processors. On the one hand, there are relatively few of them, and entry is blocked, making it easier to attain a mutually beneficial equilibrium without explicitly cooperating. On the other hand, they cannot act jointly without violating antitrust laws. For the rest of the report, we will take as our base case the existence of "moderate but not cutthroat competition" among processors. Achieving higher levels of coordination without violating antitrust laws is difficult, but cutthroat competition is not an optimal strategy given the conditions of the industry if players are rational and non-myopic. Note that "moderate competition" is a *conclusion* of our analysis above, not simply a prior assumption. Although we believe this is the most likely behavior, we will also analyze implications for more extreme levels of processor competition, or lack thereof, and derive the implications for the effects of alternative policies.

A. Alternative Modeling Choices

In reaching our conclusion concerning the appropriate modeling choices to use in analyzing the BSAI inshore pollock fishery, we have evaluated the appropriateness of several alternative models that have been used, or proposed, for analyzing the BSAI inshore pollock fishery: a single monopsony for the sector as a whole, a single bilateral monopoly for the sector as a whole, and separate bilateral monopolies for each of the processors. We will summarize our reasons for rejecting each of these alternatives for use in the base-case analysis.

Monopsony

Wilen (1998) argues that the inshore sector is best characterized as a single monopsony. One important component of his argument is the dominant position of Maruha and Nippon Suisan in the main market for surimi products. He also reports data showing a decreasing share of ex-vessel prices in the price of final product as empirical evidence supporting his conclusion that the processors are a monopsony. We consider his analysis as supporting the conclusion that processors have significant market power, but believe that his conclusion of monopsony is too extreme.

The most important reason for rejecting the conclusion of monopsony is that for the processors to behave as a monopsony they would have to overcome the economic and legal difficulties discussed immediately above, which we do not believe would be feasible. Also, there is evidence that the processors have not always acted in a united way, as they would have if they were a monopsony. For example, when the Bering Sea Marketing Association (BSMA) went on strike against the Dutch Harbor processors in the 1999 A-season, Trident convinced its fleet to continue to fish, making prolongation of the strike too costly to both the members of the BSMA and their processors. The existence of the BSMA also argues against the conclusion that the inshore sector is a monopsony, because this would require that the suppliers in the market act as passive price takers, whereas the CVs in the BSMA have been engaged in collective bargaining.

Bilateral Monopoly

The existence of the BSMA is considered especially important by Matulich and Sever (1999), who argue that it implies that the inshore sector is a single bilateral monopoly. They claim that the dissemination of price information to each processor by the marketing association during the course of negotiations will allow the processors to unify even though they are not sharing information among themselves. In other words, the ICVs' representative unwittingly makes it possible for the processors to unite against its clients.

One factual problem with their analysis is that the BSMA does not represent all of the CVs and the largest processor is not a party to the negotiations. More importantly, the theoretical analysis leaves two critical questions unanswered. First, why would such information on prices be sufficient to allow the processors to overcome the other economic and legal difficulties hindering their behavior as a single agent? Second, why would the marketing association not take advantage of the processors' lack of communication and play one against the other by misrepresenting received price offers? It is well accepted in game theory that it is typically the informed party that gains at the expense of uninformed parties, and we fail to see why the marketing association would not use this advantage. Finally, in their model the authors assume there are no PCVs, and this makes their study of limited use for the task at hand.

It should also be noted that the assumption of a single bilateral monopoly would not, by itself, be sufficient to derive any conclusion concerning equilibrium outcomes in the inshore sector under either the AFA cooperative rules or the alternative rules. Instead, a bilateral monopoly model needs a solution concept to identify an equilibrium. The Nash bargaining solution is such a solution concept and it simply says that, if there are two parties negotiating over a given pie under conditions of symmetric information, the pie will be equally divided if the outside options are symmetric, and will be asymmetrically divided if the outside options are asymmetric. However, the Nash bargaining solution does not say anything about the outside options and how to calculate them. It would remain necessary to engage in the types of analyses in this report to work through possible outside options under alternative sets of rules. This will be illustrated in later sections when we consider the effects of using alternative extreme, and unrealistic, assumptions, for comparison with the outcomes in our base case of moderate competition.

Multiple Bilateral Monopolies

We have been informed that some interested parties have recently suggested that the appropriate model for the inshore sector is one with multiple bilateral monopolies, one for each potential cooperative under the

AFA rules. At first glance, this model may appear to have some relevance because it might seem that within each cooperative the CVs are united and negotiate with their processor on a one-to-one basis regarding how to share the rent. However, modeling AFA cooperatives in the inshore sector as a set of bilateral monopolies would not capture some essential features of the fishery.

First, it appears that only one of the cooperative's membership would be entirely composed of ICVs. In other cases, PCVs would be involved in, and in some cases perhaps dominate, cooperative decision making. The PCVs would have, at best, a conflict of interest concerning the well-being of the cooperative versus the well-being of the processor. Therefore the cooperatives would not be united as one entity pursuing the well-being only of its own members.

Second, in a bilateral monopoly there can be no outside competitive pressure on the two negotiating parties. However, under the AFA a processor may be able to bid away an ICV from another cooperative. Therefore, assuming that each cooperative is a bilateral monopoly unto itself, is equivalent to assuming either that the processors will not try to attract an ICV from another cooperative, or that open access is prohibitively costly and no ICV sees that as a feasible option.

Lastly, as noted above, the assumption of a bilateral monopoly would not, by itself, be sufficient to derive any conclusions concerning equilibrium outcomes in the inshore sector under either the AFA cooperative rules or the alternative rules. This is as true of a model with multiple bilateral monopolies as one with a single bilateral monopoly.

Later in this report we will consider the effects of the degree of competition on the equilibrium outcomes under AFA cooperatives by considering the cases of both extreme competition and extreme lack of competition. The second point above suggests that the bilateral monopoly framework should only be considered for the entire industry and not for a particular cooperative. If the processors were able to unite as one, there would be no attempt at bidding away ICVs. In addition, with catch history more valuable inside cooperatives than in open access, processors would induce ICVs to be in cooperatives by refusing to process any fish ICVs caught in open access. This is equivalent to open access being prohibitively costly and not an option for ICVs. If ICVs were to also unite in an effective association, then, except for the important exception of the PCVs, the model would be one of bilateral monopoly for the entire industry.

B. Other Issues

We have been asked to specifically address three modeling issues that received considerable attention at the October Council meeting. The issues are: the extent of excess capacity and its implications for competition among processors, the level of asymmetry in the information used in bargaining by inshore sector processors and ICVs, and the results of the price negotiations in the catcher/processor sector and their implications for price negotiations in the inshore sector.

Excess Capacity

The implementation of cooperatives under either the AFA or alternative rules has the potential to reduce or eliminate the race for fish, which would result in the creation of additional effective capacity in both harvesting and processing. The extent of the resulting excess capacity has been a controversial issue. As reported in our earlier discussion paper, our discussions with fishery participants yielded widely varying responses concerning the extent of excess capacity, with representatives of processors predicting much more excess capacity than representatives of ICVs. Not having sufficient technical knowledge of the industry to form an independent opinion, we requested the NMFS to provide an estimate.

The response was that we should assume that there would be sufficient excess capacity for the inshore TAC to be used fully even if three or four of the smaller processing facilities did not process BSAI pollock. Based on 1998 data on pollock deliveries, the three smallest processing facilities together processed about 10% of the total deliveries, while the four smallest together processed about 20%. Therefore we used the assumption that excess capacity would be in the range of 10-20%.

It was strongly suggested during the course of our presentations at the October Council meeting that this was not considered to be a realistic estimate of the extent of the excess capacity. We have asked the NMFS to reconsider the estimates of excess capacity and they have provided us with the data in Table 4. The capacity utilization rate in 1999 is derived by dividing the total possible days of fishing, 172, by the days actually fished, 82. The results indicate that the fraction of total capacity that is in excess is 52%, or equivalently, that total capacity is 110% larger than required capacity.

In estimating the degree of excess capacity in the year 2000, several changes from 1999 have to be taken into account: the number of possible fishing days will be greater, the total allowable catch for the inshore sector will be greater, and the elimination of the race for fish is expected to result in a slowdown in the daily processing rate.

The starting point for the year 2000 estimates is the average daily processing rate in 1999, which is assumed to provide a reasonable estimate of feasible average processing capacity. Dividing this figure, 5,173 metric tons, into the total allowable harvest, 470,250 metric tons, indicates that with no slow down in the average rate of processing the total allowable harvest could be processed in 91 days. Dividing by the total possible days of fishing, 233, to obtain the capacity utilization rate indicates that the fraction of total capacity that is in excess is 61%, or equivalently, that total capacity is 156% larger than required capacity. The NMFS has informed us that a slowdown of at least 10% is most likely. With a slowdown of 10%, the estimated fraction of total capacity that is in excess is 57%, implying that total capacity is 131% larger than required capacity. Estimates based on alternative rates of slowdown are also shown in Table 4.

Given these large estimates of the degree of excess capacity in the processing sector, two questions to be addressed are whether the degree of excess capacity is evidence of competition between processors, and whether a large amount of excess capacity implies a high level of price competition among the major processors.

To address the first question we can consider the following counterfactual situation. *If* the processing sector were a monopsony, *and if* new entry to the processing sector was not possible, then it would be expected that there would be no excess capacity. The present estimates of the degree of excess capacity clearly indicate that at least one of these conditions was not satisfied. We know that the second condition was not satisfied prior to the implementation of the AFA, and we do not believe that the first condition was either. What cannot be determined is the extent to which the existing excess capacity reflected fierce competitive behavior among processors before the AFA.

In part this is a moot point, because the passage of the AFA has itself changed the competitive conditions in the industry by blocking entry, potentially ending the race for fish, and creating the framework for processor-specific cooperatives. However, it is useful to consider one indirect measure of past competition in capacity that was suggested during public testimony at the October Council meeting, namely the rate at which capacity was expanded over the recent past.

We have examined data on the largest weekly landings by facility for the period 1993 to 1999 to derive estimates of the growth of capacity over time. For the four largest processing facilities, UniSea, Akutan, Westward, and Alyeska, total combined capacity increased over this period by 13.6%, implying an average annual growth rate of 2.1% per year. Using the three largest landings in each year as an alternative estimate of capacity provides a somewhat larger estimate of the rate of capacity growth, 2.6% per year. These are imperfect measures of capacity, and the results vary across facilities, with the fastest growing facility having an average annual growth rate of 4.7%. Nevertheless, the results for the combined capacity for these four facilities are not considered to lend strong support to the proposition that there has been a general competitive race to expand capacity.

The second question to be addressed is the relationship between the amount of excess capacity and the level of competition. It has been argued that if, as seems to be the case, large amounts of excess capacity result from ending the race for fish, this will drive the processors to engage in fierce price competition. We do not believe that even the large amount of excess capacity indicated by the NMFS' new estimates would make the processors blind to the benefits of moderate competition. These investments in capacity are sunk costs and cutthroat competition will not make them profitable. It is well accepted in the industrial organization literature that when relatively few firms compete against each other repeatedly, they will find non-myopic behavior attractive even with large amounts of excess capacity (see, for example, Tirole 1988). It should also be noted that the extent of competition may be constrained by excessive share caps for harvesting and processing.

Asymmetric Information

As discussed in the introduction, the presence of asymmetric information is also an important determinant of the outcomes of bargaining. The omnipresence of confidentiality requirements likely indicates that private information is pervasive in this fishery. But this by itself does not say which side has the superior information.

One factor that is expected to contribute to superior information on the part of processors is that it is more common for processors to own catching vessels than for ICVs to own processing capacity, and therefore processors can be expected to know more about the costs and other conditions of harvesting than ICVs know about the costs and other conditions of processing. We understand that although none of the ICVs have ownership interests in onshore processing facilities, some do have ownership interests in offshore facilities. However, onshore and offshore processing are very different operations. The offshore processing facilities are said to be relatively simple, well-focused, product lines, whereas the onshore plants typically handle a diverse set of inputs and outputs. Allocating cost among alternative uses is a notoriously difficult task. Also, it is not clear that the information gained from ownership interests in offshore facilities is widely shared among the ICVs. In addition, several onshore processors sell most of their output to downstream-integrated parent companies, which complicates revenue calculations.

Some participants have expressed the opinion that ICVs can gain adequate information on a processor's costs and revenues by hiring consultants knowledgeable about the industry to study these issues, and we understand that some studies of this type have taken place. That such studies can mitigate, but not eliminate, the effects of asymmetric information is suggested by Professor Buccola's review of the experiences of agricultural cooperatives, which appears in Appendix A. It should also be noted that the very fact that ICVs feel such studies are necessary is evidence of the presence of asymmetric information.

The C/P Sector Pricing Experience

The prices paid to independent CVs in the C/P sector increased dramatically in 1999. The reports we have heard indicate that the average price paid by C/Ps to ICVs was approximately $300 per metric ton, as compared to approximately $132 in 1998. Furthermore, the increase in the net revenue to ICVs was even more dramatic, because the ICVs received the $300 price whether they actually harvested the fish or merely transferred catch allocation. The ICVs as a group in fact harvested less than 30% of their catch allocation, transferring the rest for harvest by the C/Ps. Thus the conclusion that ICVs in the C/P sector received large gains from the AFA seems clear-cut.

We have been requested to consider the implications of this experience for the inshore sector. In particular, it has been suggested that this experience indicates that the ICVs were able to capture the full marginal value of their fish, that this implies fierce, rather than moderate, competition in the C/P sector, and that a similar experience can be expected in the inshore sector if the Dooley-Hall proposal were implemented. We will consider each issue in turn.

As discussed in section II.A, the formation of cooperatives and the resulting cessation of the race for fish allowed the C/P sector to obtain large benefits from rationalization. In addition, market conditions for the C/Ps' products improved. Therefore the total rent from fish in this sector increased substantially. Furthermore, we were informed that the value of catch allocation transfers by ICVs increased by more than the value of ICV harvested fish, because the C/Ps realized higher quality and reduced scheduling complications by harvesting the fish themselves. Therefore the increase in the ICVs price, while large, may have represented only a fraction of the total increase in the marginal value of the fish.

In this regard it is worth noting a simple arithmetic fact, a given percentage change in the value of product will translate into a more than proportional increase in rents. To take a purely hypothetical illustration, if the share of total rent in the price of final product was originally 25%, and the price of the final product increased by 50%, if costs remained unchanged the total rent would triple. And if two parties originally shared the total rent equally, in the new situation one party would have to have its rent more than quintuple before the other party would be made worse off.

Whatever share of the increase in rent the ICVs received, they did obtain a large increase in the price of their fish, which would not have been the case if there had not been some degree of competition among the C/Ps. On the other hand, the ICVs experience does not demonstrate the existence of cutthroat competition on the part of the C/Ps. As noted in section II.A, the ICVs share of the harvest allocation was equal to only 5.7% of the C/P sector's directed fishing allowance. Therefore it represented incremental supply, implying both that higher prices could be paid for it than could be paid on average, and that the C/Ps could compete for it without signaling that they intended to compete fiercely more generally. It is interesting to note that the total ICV allocation was equal to only 1.9% of the total TAC, or less than one-fifth as much as the CDQ allocation, and that the price for CDQ harvest allocation in 1998, before the full benefits from rationalization were realized, were comparable to the price received by ICVs in 1999, despite the benefits to the C/P sector of rationalization and improved market conditions.

Given that there is little or no quantitative evidence that ICVs received the full marginal value for their fish, and that even if they had, it would not have demonstrated the presence of cutthroat competition in the C/P sector, we do not believe that there are any direct implications of this experience for the outcomes that could be expected in the inshore sector if the Dooley-Hall proposal were implemented.

IV. Benchmarks

We have been instructed to use different benchmarks for each of the first three questions we have been asked to address. For ease of reference, the first three questions are reproduced here:

1. at are the expected qualitative effects of the AFA with the existing set of inshore cooperative rules on the net benefits of the inshore sector independent catcher vessel owners, inshore sector processors, factory trawler sector, and mothership sector?

2. the implementation of inshore sector cooperatives for the BSAI pollock fishery, as provided for in the AFA, expected in aggregate to have beneficial or adverse effects on the independent vessel owners who, under the AFA, are eligible to participate in the BSAI pollock fishery, where an independent vessel owner is an entity that owns fewer than three vessels in the BSAI pollock fishery?

3. at are the expected qualitative effects of each of the alternatives to the existing set of inshore cooperative rules?

Our contract contained the following instructions concerning the specification of each of the benchmarks:

> "There is a different benchmark for each of the first three questions. This is done to address each of the following: 1) the effects of the implementation of the AFA including the formation of inshore cooperatives under the regulations that are being prepared for 2000 (i.e., the pre and post-AFA comparison); 2) the effects of the formation of inshore cooperatives under the regulations that are being prepared for 2000 (i.e., the with and without inshore cooperatives comparison); and 3) the differences of the effects of the alternatives that are being considered for inshore cooperatives."

We understand the "pre and post-AFA comparison" to refer to the comparison of the situation in the period immediately prior to passage of the AFA, the "pre-AFA" benchmark, with the anticipated situation after cooperatives are allowed to be implemented in all three sectors under the existing AFA rules, the "AFA with cooperatives" benchmark. The "with and without inshore cooperatives comparison" we interpret as referring to a comparison of the "AFA cooperatives" benchmark and the "AFA without cooperatives" benchmark that was used in our earlier discussion paper. Lastly, we understand that the effects of the alternatives are to be evaluated relative to the "AFA cooperatives" benchmark.

The first question has already been addressed in section II with respect to the total inshore sector as well as the catcher/processor and mothership sectors. In that section, we concluded that the inshore sector received a substantial benefit from the reallocation of allowable harvest under the AFA. In order to complete the analysis of the expected qualitative effects on the net benefits of the inshore sector processors and ICV owners, we analyze the effects of the cooperatives on the two groups using our original benchmark, then "add" on the benefits from reallocation of available harvest considered in section II.

It should be noted that the "AFA without cooperatives" benchmark used in question 2 does not correspond to the actual situation in 1999. This benchmark and the 1999 situation are similar in that they involve the same allocation of available harvest, and no cooperatives, but they differ in that the benchmark assumes no possibility of forming cooperatives, whereas behavior in 1999 was affected by the anticipation of being able to form cooperatives in the following year. For example, given the AFA rules for cooperatives, deliveries in 1999 affected possible cooperative membership in 2000, and this can be expected to have resulted in a different distribution of deliveries than would have occurred under the, hypothetical, AFA without cooperatives benchmark.

This benchmark also does not correspond to the outside option available to ICVs if cooperatives are implemented under the AFA rules. As discussed in the following section, the outside option with AFA cooperatives is to fish in open access. The open access with AFA cooperatives will be equivalent to the open access in the AFA without cooperatives benchmark case only if not a single AFA cooperative could be formed.

V. AFA Cooperatives

The AFA allows for the formation of inshore catcher vessel cooperatives according to the rules summarized in Table 1. The membership in the cooperative for each processor is limited to the vessels that are qualified for that processor, where qualification is determined on the basis of the processor to which the vessel delivered the largest share of its total catch in the prior year. Vessels that obtain permits to participate in the inshore sector and do not belong to a cooperative can fish under open access conditions for the share of the total inshore allocation not apportioned to the cooperatives.

A vessel fishing in the open access inshore fishery will qualify for membership the following year in the cooperative, if any, associated with the processor to which it delivers the largest share of its fish. Under the AFA rules, it will not be possible for a vessel to leave one cooperative to join another without first spending a year in open access to qualify for the new processor. It is also necessary that the processor for whose cooperative the vessel wishes to qualify is willing to process it's fish during the open access year. We assume under our base case of moderate competition that this will be the case.

Thus open access is the outside option, or threat point, for an ICV qualified for a particular cooperative. Accordingly, it is a potentially crucial element of its bargaining power. Therefore, before examining other aspects of the AFA cooperative rules, we will first investigate the possible outcomes under open access. We will do this by considering several alternative open access scenarios, including some that are unlikely to be equilibrium outcomes.

A. Open Access

Two issues relevant to each scenario, although not equally important in all, are the aggregate amount of fish available to catcher vessels (CVs) in open access relative to their aggregate catch histories, and the catch history of individual CVs relative to their catching power.

The aggregate amount of fish available under open access conditions will equal the share of the total inshore allocation not apportioned to the cooperatives. Therefore it will include the share of the allowable catch assigned to each CV in open access on the basis of its catch history and will also include the shares of catch histories of non-eligible CVs, CVs that are eligible but do not participate, and CVs that could be eligible but do not apply. The NMFS has informed us that the current estimate of this additional allowable catch in open access is almost 20,000 metric tons, a substantial increase from the estimate of up to 4,000 metric tons that we were given when we wrote our previous discussion paper.

The AFA's estimated catch history shares for individual CVs are based on their best two years' history during the three years 1995 to 1997. In some cases, CVs' catch histories are not commensurate with their catching power. For example, a large CV (Alaskan Command, ADFG# 57321) began operating in the BSAI inshore sector only in mid-1997 and therefore its catch history calculation is based on one partial year's catch. The following year its share of the total catch was more than six times as large as its catch history share. Therefore this vessel is under vested, in the sense that its relative allocation of catch under the AFA is substantially less than its relative catching power. For an under-vested CV, the quantity of fish that could be caught in open access would exceed the quantity that it would bring into a cooperative's allocation.

The first scenario we consider is the extreme case in which every eligible CV would be in open access. The situation would be similar to the 1999 conditions. All CVs would be free to choose their processors, subject to the processors' willingness to accept their deliveries and subject to existing delivery contracts. Strategic movement between processors might take place, to the extent that they had not already occurred previously. Most CVs would be expected to harvest an amount of fish similar to their catch history. The additional amounts of allowable catch available in open access would have a small positive effect at the aggregate level. The adverse effects on fully-vested CVs of having under-vested CVs harvest more than their catch histories would be more substantial in aggregate, but the effect on any one CV would not be large with all CVs in open access. The ex-vessel price would most likely be determined by a process similar to that in 1999.

In short, except for the possibility of strategic movements between processors because of the prospect that cooperatives might be formed in the subsequent year, the situation would be very similar to the benchmark case of the AFA without cooperatives. ICVs would essentially be no better or worse off in aggregate than in the benchmark. The inshore sector as a whole would benefit from the larger allocation of TAC than in the pre-AFA fishery, but would fail to realize the potential benefits from rationalization under the AFA.

Consider now the opposite extreme, with every eligible CV in a cooperative. In this case, if one, and only one, fully-vested CV went into open access it would do very well. It would bring its own catch history with it, and in addition have access to the additional amounts that were not apportioned to the cooperatives. Because it would be the only CV there would be no race. It would be as if this one CV had been granted an individual vessel quota (IVQ) for the year in an amount some 20,000 metric tons greater than its catch history. Furthermore, because it would be the only inshore source of incremental fish to the processors, it could probably negotiate a higher price for its fish than it would receive as a member of a cooperative. Not only would there be no cost to having to go through open access to change cooperatives, open access would be so desirable there would be no incentive to join a cooperative.

Of course, the very fact that this situation would be so attractive implies that it would not be an equilibrium solution, because other CVs would enter open access. Therefore we next consider intermediate scenarios in which some CVs are in cooperatives while others are in open access.

If all CVs in open access were fully vested, they would generally be able to harvest amounts of fish in proportion to their catch histories because they would be in a race only against others whose catch histories were commensurate with their catching power. They would also share the 20,000 metric ton "bonus," whose impact on an individual CV would depend on the number of CVs in open access. However, they would not benefit from the rationalization gains that would be made possible by avoiding the need to race. Their relative position with respect to ex-vessel price is unclear. Their ability to supply fish when most valued by the processors would be constrained by the need to race, but they might benefit from being the incremental suppliers.

However, an open access fishery comprising only fully-vested CVs is unlikely to be an equilibrium solution, because under-vested CVs would find entry to be attractive in order to exploit the catch history of the fully-vested CVs plus the open access bonus. The magnitude of the adverse effects on individual fully-vested CVs would increase with the ratio of under-vested CVs to fully-vested CVs in open access. If this ratio were high, the cost to a fully-vested CV of switching processors by going through open access could be very high. The bonus can moderate the adverse effects to the extent that the number of CVs in open access is relatively small.

Now, suppose that the inshore CVs in open access were all qualified for the same processor. This would be the case if all other inshore CVs joined the cooperatives for which they were qualified, but the cooperative for the one processor in question failed to form because of a breakdown of negotiations. If one or more of the CVs that were qualified for that processor were substantially under vested, the other CVs qualified for that processor could find the open access situation to be sufficiently costly that they would be willing to make large concessions so that the cooperative could form and they could avoid being forced into open access. Similarly, a processor could threaten to send its under-vested PCVs, if any, into open access to raise the cost of open access to ICVs contemplating a switch to another cooperative.

We know of one study that estimated the cost of open access for two particular ICVs whose owner feared that he might find himself in a situation similar to this scenario. The results indicated that the cost would in fact be prohibitive, with the ICVs' harvest being reduced by more than 40%. We do not rely on these specific results in our analysis, because some of the assumptions used in the study do not seem to be borne out by current facts. However, the study does illustrate the possibility of obtaining quantitative estimates of the costs of open access under specified scenarios, and further research of this type would be worthwhile.

A difficult question to answer is which equilibrium is most likely. There are two principal candidates. Either a large number of CVs is in open access so that under-vested CVs cannot hurt the fully-vested CVs too much, or primarily only under-vested CVs are in open access. The first case seems unlikely. Indeed, if the cooperatives are designed effectively, fully-vested CVs should find it preferable to join them. The second case is more likely, but it is still difficult to determine how many under-vested CVs would be in open access. In theory, their number should be such that the last CV to join should be indifferent between joining a cooperative or staying in open access. The bigger the bonus, the larger the expected number of CVs in open access. This indifference condition implies that, for a given price, a fully-vested CV would be worse off in open access than it would be if it could catch its allocation inside a cooperative.

We concluded in our earlier report that the most likely open access would consist of under-vested CVs, and the structure of open access for the year 2000 appears to be consistent with our prediction. In such an equilibrium, a fully-vested CV spending a year in open access in order to change processors could incur a severe penalty in terms of not being able to catch an amount of fish similar to its catch history.

While investigation of these various open access scenarios has been necessarily conjectural, it does indicate that an ICV could get seriously hurt in an open access year. This is a crucial consideration in evaluating the bargaining power of an ICV inside an AFA cooperative, because the open access year represents its threat point. In other words, if an ICV can get hurt in open access, it can also get hurt in a cooperative.

B. Negotiations

Implementation of cooperatives under the AFA requires, for each processing facility, negotiation among the qualified CVs over the formation of a cooperative, an agreement with the processor to process the cooperative's pollock, and a mechanism for negotiating ex-vessel prices.

Formation of a cooperative requires the approval of 80% of the qualified CVs ("the 80% rule"). The potential members of a cooperative have to agree on both the governance structure of the cooperative, as contained in its bylaws, and its operational procedures, as contained in a membership agreement. We will not discuss governance issues, other than to note that the choice of rules concerning voting is an important issue. Professor Buccola's report, Appendix A, discusses the choice of voting rules in agricultural cooperatives.

Issues concerning the membership agreement include the initial distribution of the cooperative's pollock harvest allocation among individual members, rules for subsequent transfers of pollock harvest allocation among members, allocations and rules concerning other species, monitoring and enforcement procedures, and, most importantly, the duration of the cooperative and rules governing the withdrawal of individual members.

Review of the membership agreements indicates that the initial distribution of each cooperative's annual pollock allocation among individual members was proportional to their annual catch histories, as had been expected. The intra-year distribution of allocations is based on the same percentages for all of a cooperative's members, and therefore involves a reallocation of the value of catch history among members to the extent that they had harvested differing proportions of their catch histories in different seasons.

The membership agreements provide for the transfer of harvest allocations within each cooperative. The resulting rationalization in the harvesting sector, with harvest allocations moving from less efficient to more efficient vessels, should be a major economic benefit of the cooperative structure. Further rationalization benefits could be obtained if harvest allocations could be transferred between vessels in different cooperatives. However, under the AFA rules this is difficult because the vessel whose allocation was to be transferred would first have to go through open access in order to qualify for the new cooperative.

The duration of each membership agreement is for an indefinite period, remaining valid until terminated by its members or by an event such as the termination of specific portions of the AFA. This is consistent with the advantages to both processors and CVs from having the planned duration of a cooperative extend over more than one year. However, multiple-year cooperative agreements also involve difficulties in the case of the AFA. A crucial feature of AFA cooperatives is that each cooperative is tightly linked to a single processor. Although the processor is not formally a member of the cooperative, it must agree to process the cooperative's pollock in order for the cooperative to be formed, and therefore the terms and conditions of the agreement, such as its duration, have to be acceptable to the processor. Also, the agreement to process is closely related to the membership agreement and contains clauses concerning issues such as quality and adherence to harvesting schedules.

This close dependence of the cooperative and the processor makes it difficult to sustain a multiple-year cooperative agreement. From the point of view of an ICV, a multiple-year cooperative agreement would be problematic without a corresponding multiple-year price agreement. Joining an AFA cooperative would commit its fish to a single processor (we ignore for the moment the 10% rule), and without a corresponding agreement on the price to be received, it could be placing itself in a difficult bargaining position by signing the cooperative contract. Similarly, a processor would be reluctant to commit to a long-term purchasing agreement without a corresponding agreement on price, because doing so might make it vulnerable to supply disruptions. Other things equal, a processor's vulnerability to supply disruptions would be greater the smaller the role of PCVs in its cooperative.

Unfortunately, the large variability in production and demand conditions appears to make long-term fixed-price agreements impracticable, and our interviews with participants in the fishery indicate that this is the general consensus among them as well. Several participants have expressed the view that some form of profit or revenue sharing mechanism might make longer-term price agreements possible, but others have expressed serious reservations as to their practicability. As discussed in Appendix A, most agricultural bargaining associations negotiate prices for a single harvest season, including many that had previously experimented with price formulas but found them to be impracticable. As in the case of agricultural cooperatives, the two main reasons that profit or revenue sharing formulas are likely to be impracticable in AFA cooperatives are the asymmetric information between the processors and the ICVs regarding the processors' costs, and the possible use of "creative accounting" by the processors. This second problem can be particularly serious when a processor is vertically integrated with the downstream market, as some pollock processors are.

One approach to mitigating the problems from having cooperative agreements that are longer term than price agreements is to allow for members to withdraw from the cooperative agreement, and the cooperative agreements do allow withdrawal on an annual basis. If a cooperative member could withdraw annually without any penalty, the multiple-year cooperative contract would not be much more than an annual contract. But, under the AFA, withdrawal to transfer to a different cooperative involves the cost of going through open access.

If withdrawing from a cooperative were not a practical option for ICVs that were unhappy about the results of a price negotiation, the possible actions available to them may not be effective in improving their position. One possibility would be to go on strike. However, if the processor obtains a large share of its deliveries from its own PCVs, it could let them continue fishing and simply reschedule deliveries from the striking ICVs until later in the season, so that the striking vessels would incur costs beginning immediately but the processor would not.

Another possibility for the owner of an ICV who found himself involved in a long-term supply commitment with unfavorable ex-vessel prices would be to sell the vessel and its associated harvest allocation. But, unless the vessel went through an open access year, it would have to remain with the cooperative for which it was already qualified. Since the annual value of a unit of harvest allocation to an ICV in a cooperative is the ex-vessel price net of catching cost, an unfavorable ex-vessel price would imply an unfavorable price for the vessel's harvest allocation. Therefore only a processor might find it profitable to buy such a vessel. An additional benefit to a processor of buying a vessel is that doing so would increase the potential influence of PCVs relative to ICVs in the cooperative.

C. Processor-controlled Catcher Vessels

Two measures of PCV participation in a cooperative are potentially relevant: the percentage of the cooperative's total number of vessels that are PCVs, and the percentage of the cooperative's total deliveries that are accounted for by PCVs. The first measure is relevant to any issue involving voting for which the voting rule assigns one vote to each vessel, as is implicitly the case in the 80% rule, and would also be the case for electoral decisions in a cooperative choosing a one-vessel, one-vote rule. The second measure is relevant to issues such as the effectiveness of strikes, because it indicates the extent to which a processor would have to rely on ICVs for its supplies of fish, and would also be relevant for electoral decisions in a cooperative that based its allocation of votes on relative harvest allocations.

Because the participation of PCVs in cooperatives is important in these and other contexts, we have used data on interim permits to determine the membership of each cooperative. We then assigned the NMFS allocation share for each CV to its cooperative to determine the share of the total inshore allocation that each cooperative would receive. The allocation shares for qualified CVs that did not join an inshore cooperative were assigned to the open access pool. The allocation shares of CVs that had catch histories but were not eligible for permits, or were eligible but did not apply, were also assigned to the open access pool.

The results are shown in the first two columns of Table 5. Seven inshore cooperatives have been formed and together they account for 93.9% of the total inshore allocation, with the remaining 6.1% being available to the open access fishery. Of the amount in the open access fishery, 1.9 percentage points are accounted for by CVs that were qualified for an inshore cooperative but did not join, and 4.2 percentage points are accounted for by the catch histories that were not assigned to vessels with interim permits.

The four largest cooperatives account for 80.9% of the total inshore allocation. Results are also shown for each processing company. Trident has the largest share, 33.8%. Nippon Suisan, the owner of UniSea, is the second largest company, with a share of 24.1%, if Westward and Alyeska are treated as separate companies. Alternatively, if the results for Westward and Alyeska are combined to reflect Maruha's ownership interests, Maruha would be the second largest company, with 28.5% of the total inshore allocation.

We based the identification of PCVs on the ownership links identified by the NMFS and shown in Appendix B. As noted in section II.C, we recognize that some vessels identified as involving processor ownership may not be controlled by processors. Although it is also possible that some CVs that are not identified as processor-owned are in fact processor-controlled, we believe that the net effect of using processor ownership as a proxy for processor control is to over-estimate the numbers and aggregate catch shares of PCVs. Also, given the use of proxy data, comparisons across processors may not accurately reflect the relative importance of PCVs to them.

Keeping these caveats in mind, the final two columns of the table show, respectively, PCVs as a percent of each cooperative's total catcher vessels, and their share of each cooperative's total allocation. The data on the share of PCVs in each cooperative's total allocation, which are reported in terms of ranges for confidentiality reasons, indicate that PCVs account for a large share of the inshore allocation for five of the cooperatives. The results with respect to companies are similar.

The share of PCVs in the total inshore fleet is of interest because it indicates the extent to which processors would be the direct beneficiaries of rationalization in harvesting. Also, because processors would reallocate harvest allocations among their CVs under conditions of full information, the results would be expected to be fully efficient, whereas ICVs would reallocate harvest allocations under conditions of asymmetric information and therefore full efficiency would not be reached (Myerson and Satterthwaite 1983). The share of PCVs in the total assigned allocations is of interest in evaluating the aggregate welfare effects of policies affecting the distribution of net benefits between processors and catcher vessels. Other things equal, the greater the share of PCVs in total deliveries, the smaller the effect on processors' total profits of a redistribution of benefits in favor of catcher vessels. As shown in Table 5, PCVs that are members of cooperatives account for 42.2% of the total inshore fleet and 55.1% of the total inshore allocation. In addition, two PCVs are operating in the open access fishery.

D. The 80% Rule

The AFA requires that a contract implementing an inshore cooperative must be signed by the owners of 80% or more of the vessels qualified for that processor. This is equivalent to requiring a vote on whether a cooperative should be implemented, with at least 80% of the votes in favor being required for passage. The implications of this rule can be analyzed using the theory of the optimal majority (Buchanan and Tullock 1962).

Increasing the percentage of votes required for approval of an issue has both benefits and costs to those potentially affected by the outcome. The main benefit is that as the percentage is increased, the probability of any one type of participant being affected by an adverse outcome is reduced. In the extreme, requiring 100% approval, i.e., a unanimity voting rule, would eliminate the possibility of any voter being adversely affected, because anyone who would be hurt by passage could block it with a negative vote. In effect, a unanimity rule gives each individual voter veto power over the issue in question. As the required approval percentage decreases below 100%, the percentage of individuals who would have to vote negatively to block passage increases. This increases the probability of some participants being hurt by adverse outcomes, as well as the number of individuals who might be on the losing side.

The cost of increasing the percentage of votes required for approval of an issue is that it increases the costs of reaching agreement. Under a unanimity rule, negotiations would have to occur until every individual voter agreed to a proposal. This would not only be time consuming, but would also involve strategic behavior by individuals as they sought to take advantage of the leverage that their veto power gave them. In fact, the difficulty of reaching agreement might be so great that no proposals could pass. As the required approval percentage decreases, the costs of reaching agreement decrease, and the probability of passing proposals increases.

Because participants will differ with respect to their potential gains or losses from various types of issues, they will also differ with respect to the optimal choice of voting rule. In considering the AFA provisions for cooperatives, it is not possible to determine in general how changing the 80% required approval to a higher or lower percentage would affect the participants. However, the following observations should be noted.

First, there is a clear and important difference in one aspect of the benefits and costs to processors and ICVs. As the required approval percentage increases, the costs of reaching agreement increase for both processors and ICVs. However, the benefits in terms of reducing the probability of adverse decisions increase only for ICVs, because the processor already has veto power by the requirement that it agrees to process the cooperative's fish.

On the other hand, differences between processors and ICVs in the rate at which costs increase with the required approval percentage could more than offset the difference in benefits. For example, if the number of catcher vessels qualified for a processor were relatively small, and included one or more substantially under-vested PCVs, the costs to the processor of not being able to reach agreement could be much less than the cost to the qualified ICVs. The reason for this is that if agreement were not reached, all the CVs qualified for this processor would have to go into open access. As discussed in section V.A, this open access scenario could be costly for the ICVs that would have to compete against the under-vested PCVs.

It should be noted that the 80% rule allocates one vote to each CV. If a different allocation of votes had been used, the relative influence of different types of participants would have been affected. For example, one alternative would have been to base the allocation of votes on the quantity of catch history that a CV would bring into a cooperative. The data in Table 5 indicate that processors' vessels generally account for a larger percentage of catch history than of the number of vessels, implying that basing the allocation of votes on catch history would have increased the fraction of votes held by PCVs. Another effect of allocating votes on the basis of catch history would have been to reduce the fraction of votes held by small CVs.

E. The 10% rule

The AFA permits, but does not require, that a contract implementing a cooperative provide for up to 10% of the cooperative's total pollock harvest to be processed by a different processor than the one for which it is qualified. The possibility of increasing the permitted transfer to more than 10% is one of the alternatives to the AFA rules that we consider later in this report. In this section, we consider some issues related to the rule as currently written.

If a cooperative contract includes a 10% transfer provision, and decisions on such transfers are entirely up to the cooperatives, without being subject to hindrance by their primary processors, then this rule will increase cooperative's bargaining power relative to a situation in which they had to deliver all of their harvest to the processor for which they were qualified. In addition, any such transfers that took place should increase the degree of rationalization in processing under the AFA, because the willingness to pay for fish would reflect the economic value of the fish to the bidder.

However, the ability of a cooperative to make transfers that are against the interests of its primary processor cannot be taken for granted. For example, if the transfer could be made subject only to the approval of the processor's official in charge of scheduling deliveries, then the processor might be able to reduce or eliminate the advantage to the cooperative from making the transfer. Similarly, PCVs will presumably be allowed to vote on issues such as whether or not to transfer harvest (though not on the price at which it would be transferred) and could cast their votes in favor of the processor's interests, rather than those of the cooperative.

The 10% rule could be of direct benefit to processing companies that own more than one processing facility, because it could make it possible to fine tune the allocation of deliveries between its own plants to reflect their relative efficiencies. This would again facilitate rationalization of processing under the AFA, but potentially not as much as transfers between processing firms. However, if cooperatives were effectively limited to transfers within processing companies, the cooperatives would receive relatively little benefit from the 10% rule.

While the AFA places specific limitations on the amount of transfers that could be initiated by a cooperative, it does not appear to place any limitations on the amount of a cooperative's harvest that could be transferred by a processor. In discussions with participants, we have heard the view expressed that such transfers would be essentially unlimited. If this is correct, a processor could have its cooperative deliver part or all of its harvest to one or more other processors, while retaining the benefit of any difference between the price it had to pay its cooperative and the amount that other processors would be willing to pay. Such transfers of harvest might result in substantially more rationalization of processing capacity than could otherwise be attained under the AFA, but the increased transparency of the resulting transfers of rents could also be a source of friction between processors and cooperatives.

F. Time Frame

Rationalization in both the harvesting and processing sectors would benefit from a long time frame for planning decisions. The AFA is scheduled to expire at the end of 2004. As players anticipate an end, a change, or a straight renewal of the AFA at the end of this period, their behavior will be affected. In other words, players will not behave as if the AFA had no end in sight. For instance, a player might not exploit all its market or bargaining power for fear of changes after 2004. This means that few long-term lessons can be learned from the experience of the first years of the AFA.

Also, less rationalization might take place if CVs and processors anticipate that the scheduled end of the AFA will imply a return to the race for fish. In this case, participants would want to retain more capacity than would otherwise be optimal.

Catcher vessels and processors might also decide to retain excess capacity for another reason. When bargaining for the cooperative and the price contracts, catcher vessels and processors know that in case an agreement is not reached by the deadline, they will be thrown back into a race for fish in the open access part of the fishery. In that case, keeping excess capacity will make open access more attractive and therefore improve the bargaining power in the cooperative and price negotiations.

G. Degree of Competition

In this section we analyze two extreme assumptions about the level of competition in the processing sector: monopsony and cutthroat competition. As we explained in section III, these assumptions are not realistic, but they can be useful in understanding how the level of competition shapes the equilibrium outcome.

Monopsony

Monopsony implies that the processors fully account for their mutual interdependence and behave as if they were one entity. For ease of exposition, we will also assume that the ICVs are united (for instance under the umbrella of a marketing association), recognizing that this assumption overstates the ICVs' actual bargaining power. With ICVs, as well as processors, united, the analysis becomes one of bilateral monopoly for the entire industry. The situation is equivalent to there being only one processing firm, which also owns PCVs, and one entity that owns all the ICVs.

The first step in the analysis is to understand the outside options (threat points) of the two players. Since there would be effectively only one processor, the ICV owner could not switch to another processor to process its fish. Therefore its only threat would be to refuse to fish. The threat of the processor would be to refuse to process the fish of the ICV owner. Obviously if the threats were carried out, no cooperative would be formed. The processor would do very well in this situation, because it could deter ICVs from fishing by refusing to process fish from them, thereby allowing only its own PCVs to harvest the TAC. There would be no need to race with ICVs and the processor would have a de facto quota for all the fish its PCVs could harvest. The ICV owner would have no bargaining power at all, unless the PCVs could not harvest the entire TAC at an efficient rate given season restrictions.

Because the outside option would be so unfavorable for the ICV owner, the processor would obtain almost all of the rent under AFA cooperatives. But, under bilateral monopoly the same outcomes would be obtained under the benchmark of the AFA without cooperatives. That is, in this extreme, and unrealistic, case, the implementation of inshore sector cooperatives under the AFA would not affect either the extent of rationalization of the fishery or the distribution of the rents, and therefore would have neither beneficial nor adverse effects upon the ICV owner.

Note that the existence of PCVs plays a critical role in this analysis. If there were no PCVs, the processor also would earn zero rent in the outside option because no fishing would take place. Then the Nash bargaining solution would imply a more symmetric distribution of rent between the processor and the ICV owner.

Cutthroat Competition

Cutthroat competition occurs if the processors are myopic and non-strategic, i.e., they ignore the effects of their actions on each other. In that case, they would attempt to obtain any apparent short-term advantages without regard to the possibility of retaliation from other processors in the future.

This type of competitive behavior by the processors would dramatically increase the bargaining power of the ICVs. Under cutthroat competition, the processors would bid up the price of the ICVs' fish to the point that would exhaust all their rents from the ICVs' fish, and would just mange to cover their short run average variable costs in processing ICVs' fish. Processors' fixed costs would have to be covered by the rent from their PCVs' fish. The less the harvesting capacity of a processor's PCVs, the more severely it would be affected, and processors with few or no PCVs could be bankrupted. Moreover, the 80% rule might make it possible for ICVs to capture some of the rents of their processor's PCVs, by threatening to block formation of the cooperative and thereby prevent the processor from protecting its PCVs' catch histories.

However, ICVs would have to spend a year in open access in order to switch processors under the AFA, and open access can be costly. The existence of such switching costs would allow processors to retain some rent, and the bigger the switching costs, the bigger the rent the processors could secure (see, for example, Tirole 1988).

Total rents would be greater under the AFA with cooperatives than under the benchmark of the AFA without cooperatives, and, under cutthroat competition, ICVs would have most of the bargaining power. Therefore, the implementation of AFA cooperatives would in aggregate have beneficial effects on ICV owners under conditions of cutthroat competition

H. Conclusions Concerning AFA Cooperatives

Neither of the extreme competitive situations considered in the previous section is a plausible characterization of the situation in the inshore fishery. Instead the most likely situation is one of moderate competition. If the open access under the AFA were the same as open access under the benchmark of the AFA without cooperatives, then ICVs could not be adversely affected by the AFA provisions for cooperatives. However, open access would be the same in the two cases only if no cooperatives were in fact formed under the AFA, which would not be an equilibrium outcome. Under most plausible scenarios for open access under the AFA, ICVs would do worse in open access under the AFA than in the benchmark case. Therefore, we conclude that there is a significant probability that ICVs will be adversely affected by the AFA's provisions for cooperatives.

Taking into account the positive net benefits most likely received by ICVs from the reallocation aspect of the AFA, that is, in going from the pre-AFA benchmark to the AFA without cooperatives benchmark, decreases the likelihood that the ICVs would be adversely affected by the implementation of the AFA cooperatives, relative to the situation pre-AFA. However, the possibility that they would be cannot be dismissed. We also note that, whatever the results for the ICVs collectively, the results for individual ICVs will vary, with some likely to benefit even if the results at the aggregate level are adverse, and vice versa. In particular we expect that, other things equal, an ICV will do better the less influential that PCVs are in its cooperative.

As noted in section V.B, one option for the owner of an ICV who found himself involved in a cooperative with unfavorable ex-vessel prices would be to sell the vessel and its associated harvest allocation. But, unless the vessel went through an open access year, it would have to remain within the cooperative for which it was already qualified. Since the annual value of a unit of harvest allocation to an ICV in a cooperative is the ex-vessel price net of catching cost, an unfavorable ex-vessel price would imply an unfavorable price for the vessel's harvest allocation. Therefore only a processor might find it profitable to buy such a vessel. An additional benefit to a processor of buying a vessel is that doing so would increase the potential influence of PCVs relative to ICVs in the cooperative. Therefore, unfavorable outcomes with respect to ex-vessel prices would be likely to lead to increased processor ownership of catching vessels, and might eliminate the economic viability of a significant role for ICVs in the inshore sector.

VI. Alternatives to AFA Cooperatives

A. The Dooley-Hall Proposal

The Dooley-Hall proposal would modify or eliminate several of the AFA rules for inshore cooperatives. A list of the proposed changes is shown in Table 2. The most important proposed change is to eliminate the "qualification" requirements. A cooperative could deliver to any processor, and any eligible catcher vessel could join any cooperative. Elimination of the qualification requirements makes the 80% rule inoperable, and it is replaced by a rule requiring that the cooperative contract be signed by the owners of five or more catcher vessels.

Except for the requirement that CVs have to belong to a cooperative in order to obtain the advantages of pollock harvest allocations, the Dooley-Hall proposal would be equivalent to an individual fishing quota (IFQ) program. The cooperative requirement has some important practical implications for the management of the fishery, for example, with respect to monitoring and enforcement issues. However, for the purpose of evaluating the principal effects of the Dooley-Hall alternative on the different types of participants in the fishery, we can treat the proposal as if it were an IFQ program.

Therefore the evaluation of the Dooley-Hall proposal can be based on the considerable amount of theoretical and empirical information available on fishery management programs involving IFQs (see, e.g., National Research Council 1999). One basic finding is that IFQ programs score highly on efficiency grounds, allowing the creation of rents and facilitating rationalization in both the harvesting and processing sectors. However, rationalization generally involves losers as well as winners, and IFQ programs have been controversial with respect to their distributional effects.

We have been repeatedly informed by participants that the AFA rules for cooperatives were designed to avoid adverse effects of rationalization on processors. In addition, there is an apparent consensus that processors would be worse off, and ICVs better off, under the Dooley-Hall proposal than under the AFA cooperatives. However, there is sharp disagreement concerning the magnitude of the distributional effects. We have had representatives of processors tell us that both sides would gain under the AFA rules, whereas the processors would lose disastrously under the Dooley-Hall proposal, while representatives of ICVs have said that both sides would gain under the Dooley-Hall proposal, whereas ICVs would lose disastrously under the AFA rules.

We have heard coherent arguments in favor of both of these extreme positions. Our goal in this section is to analyze the economic determinants of different possible outcomes, and to evaluate the extent to which they are likely to be present in the inshore pollock fishery. In carrying out the analysis, we will assume for simplicity in the base case that the same total amount of wealth would be available for division under the AFA and Dooley-Hall rules. Thus we will ignore for the moment the probability that the efficiency gains under the Dooley-Hall proposal would be greater than under the AFA rules.

The degree of competitive behavior among processors would be a critical factor in determining outcomes under the Dooley-Hall proposal. The basic change that the AFA made in the economic circumstances of the fishery is that catcher vessels will have a claim on the available harvest allocation based on their catch history. Historically, the lack of such a claim has been the primary incentive for the race to fish, and therefore the AFA is expected to decrease the daily rate of harvest and thereby extend harvesting periods. This in turn will create extra capacity in both the harvesting and processing sectors, which may affect the degree of competitive behavior among processors.

As discussed in Section III.B, the extent of excess capacity is expected to be large. However, the processing sector is very concentrated, entry is legally blocked by the AFA, and the situation in the inshore fishery is a classic example of a repeated game. Processors should anticipate that aggressive tactics that give them short-term gains might not be profitable in the long run as each can engage in such tactics. We do not believe that even the large amount of excess capacity that is now anticipated would make the processors blind to the benefits of moderate competition. Their investments in capacity are sunk costs and cutthroat competition will not make them profitable. Therefore, we would not expect the situation to deteriorate, from the processors' point of view, into one of cutthroat competition. Nevertheless, such an outcome is not a logical impossibility, and therefore the outcomes under cutthroat competition should be examined.

This case has previously been considered by Matulich, Mittelhammer, and Reberte (1996) in the context of a race for fish that is ended by the introduction of IFQs. Their paper concludes that if processing capital is non-malleable, the ex-vessel price of fish will increase to the point where it is equal to the difference between final product price and short-run average variable processing cost. Processors will leave the industry until excess capacity no longer exists. During the transitional period, catcher vessels not only gain all the rents from the fish, but also the quasi-rents from the processors' capital. Once a new equilibrium is established, the remaining processors earn a normal rate of return on capital.

However, this theoretical analysis cannot be applied straightforwardly to the BSAI pollock fishery. Even under the unlikely assumption that processors in such a highly concentrated fishery would not be able to do better than the perfectly competitive market outcomes, the results of this paper would exaggerate the negative effects on pollock processors of an IFQ, or Dooley-Hall, program. First, the model assumes that processors receive no IFQs. However, in the pollock fishery, processors own catcher vessels, which are being given harvest allocations on the same terms as the ICVs. To the extent that processors would be paying the higher prices for fish to their own vessels, except for higher crewshare payments the result would be merely an internal transfer, not an economic loss. Second, the model assumes that there is only one basic type of processing capital, so that excess aggregate capacity implies that all capital is in excess supply. However, pollock processors produce two main types of primary product, surimi and fillets. Under current market conditions, fillet capital would not be in excess supply even with a large amount of total excess capacity. Therefore, fillet capital would continue to earn quasi-rents. The model's assumptions that processors could not earn informational rents, and that pollock processing capital has no alternative uses, are also too pessimistic.

Nevertheless, it is clear that if processors were unable to restrain themselves from cutthroat competition, the Dooley-Hall proposal could result in adverse results for them. On the other hand, the analysis in section V.G concluded that if processors were unable to restrain themselves from cutthroat competition, the AFA cooperatives could also result in adverse results for them. In both cases, the basic problem for the processors would be their inability to restrain themselves from acting against their own interests, not the rules under which cooperatives were formed. However, the rules would make some difference. In particular, under Dooley-Hall ICVs would benefit from not having to bear switching costs by going through open access but would lose the bargaining power provided by the 80% rule. On balance, we believe that under conditions of cutthroat competition, processors would be somewhat worse off, and ICVs somewhat better off, under the Dooley-Hall proposal than under the AFA rules.

The results under the Dooley-Hall proposal can also be compared with those under the AFA rules with the alternative extreme assumption of monopsony. If we assume that the ICVs are also united, as could occur under the Dooley-Hall proposal by the formation of a single cooperative containing all ICVs, the monopsony case becomes equivalent to that of a bilateral monopoly. The equilibrium concept we use is the Nash bargaining solution. Assuming for the moment the absence of asymmetric information, the two parties would equally share the surplus above their threat points.

The ICVs' cooperative would give them an exclusive right to their fish. If they could not negotiate an agreement with the processors, they would not fish. Similarly, the most severe threat of the processors would be to not process the fish. In both of these cases, the processors and the ICVs would receive nothing from the ICVs' share of the allowable harvest. According to the Nash bargaining solution, they would split the benefits from the ICVs' fish equally. The processors would also obtain the rent from their PCVs. Suppose that the processors control 50% of the fishery through their PCVs. We conclude that they would get roughly ¾ of the benefits from the fishery (½ from their PCVs and ¼ from the ICVs). Thus a bilateral monopoly under Dooley-Hall would result in the processors getting the major share of the rents from the fishery, and allowing for asymmetric information would increase the estimated benefit to processors. Nevertheless, ICVs would be better off than under the AFA, because with bilateral monopoly under the AFA the processors would be expected to receive an even larger share of the rent. The more favorable result for ICVs under Dooley-Hall is attributable to their obtaining an exclusive right to their fish.

The comparison of the Dooley-Hall proposal with the AFA cooperatives under the extreme assumptions of cutthroat competition and monopsony shows that in both cases ICVs would be somewhat better off, and processors would be somewhat worse off, under the Dooley-Hall proposal than under the AFA rules. The analysis of the outcomes under our base case of moderate competition is necessarily more speculative, because it cannot rely on the results of the standard simple models of cutthroat competition and monopsony. However, the same key trade-offs are at work. ICVs benefit under the Dooley-Hall proposal from the elimination of the costs of open access and from the ability to form cooperatives independent of the processors, but lose the bargaining leverage provided by the 80% rule. Consistent with the results under the extreme assumptions of both cutthroat competition and monopsony, it is most reasonable to conclude that under our base case of moderate competition, ICVs would be somewhat better off, and processors somewhat worse off, under the Dooley-Hall proposal than under the AFA rules.

B. Increase in the Transfer Limit

Under the AFA rules, a cooperative contract may provide for up to 10% of the cooperative's pollock harvest to be processed by a different processor than the one for which it is qualified. One of the proposed alternatives that we have been asked to evaluate would increase the 10% to a larger, unspecified, figure, while retaining the remainder of the AFA rules unchanged.

As discussed in section V.E, the ability of a cooperative to benefit from a transfer rule depends on the extent that it could implement transfers if they were against the interests of its principal processor. If a processor can impede transfers through its role in the scheduling of deliveries, or through its influence over PCVs, the existing transfer rule would not be very effective in increasing a cooperative's bargaining power. Accordingly, increasing the limit on the percentage that could be transferred would not be a significant improvement in the AFA rules from an ICV's perspective, although it might facilitate rationalization in processing. However, if a cooperative is able to exercise the transfer option without hindrance from its processor, then increasing the limit could be of significant benefit to it.

Under the AFA rules, each processor is guaranteed at least 90% of its cooperative's deliveries. Therefore, the potential adverse consequences to them of aggressive competition over the transferable amounts would be much less than if their total supplies were potentially at stake. In addition, the amount subject to transfer is equivalent to an incremental supply of fish, the value of which to a processor is equal to the value of processed fish minus the short-run variable cost of production. Therefore, processors would be expected to be willing to pay more for incremental supplies than for their base supplies, and this expectation is consistent with experience in the market for CDQs.

The data available to us are not adequate to estimate the value of incremental fish to inshore processors under the AFA, and therefore we will use a hypothetical example to illustrate the analysis. Suppose that the ex-vessel price under the AFA rules would be P dollars if there were no provision for a cooperative to transfer part of its harvest, and that the value to a processor of incremental supply were constant over the relevant range at 2.5P dollars. Then the provision allowing a cooperative to transfer 10% of its deliveries could increase its average ex-vessel price by up to 15% (.9´P + .1´2.5P) over what they would be without such a provision.

Similarly, under these illustrative conditions, each percentage point by which the transfer limit was raised could result in an increase in average revenue of up to 1.5%. However, the actual benefit would be less than this if the processors did not compete away the full net benefit to them of incremental supplies, and as the percentage allowed to be transferred increased, the characterization of these amounts as incremental supplies would become less appropriate. Also, we emphasize that the numbers used in this example are purely hypothetical.

C. Eliminate the Qualification Requirement for Cooperative Membership

Under the AFA rules, a cooperative contract must allow owners of other qualified catcher vessels to enter the cooperative, after the contract is filed but before fishing for the year begins, under the same terms and conditions as the qualified vessel owners who entered the contract when it was filed. One of the proposed alternatives that we were asked to evaluate in our earlier paper was the elimination of the qualification requirement for vessels entering a contract after it is filed, while keeping the remainder of the AFA rules unchanged.

The intention of this proposed change in the AFA rules was to allow CVs to change processors without going through an open access year. Because the open access requirement is potentially very costly to a catcher vessel, eliminating it would help ICVs by increasing their bargaining power. However, there is considerable ambiguity about the interpretation of the proposed rule change, and about its compatibility with other aspects of the AFA rules.

The original rule made it mandatory for cooperatives to allow qualified CVs to enter under the same terms and conditions as the original members. The same wording is carried over into the proposed new rule, but now the class of CVs that would have to be allowed to enter is broadened to include all eligible CVs, not just qualified CVs. Therefore, it would be possible that a cooperative could suddenly be faced with a large influx of new members. This could create serious difficulties for both the cooperative and its processor. For example, the optimal set of terms and conditions for a cooperative may be affected by the composition of the membership, and logistical problems could be created for processors from large changes in cooperative membership. Therefore, some industry participants have suggested that the rule should be made permissive, rather than mandatory. That is, an eligible CV would not have to be qualified for a processor in order to join its cooperative, but would require the permission of the cooperative's current members. One possible middle course would be to make the rule mandatory with respect to qualified CVs, as currently drafted, but permissive for eligible but not qualified CVs.

Because the other AFA rules would be retained unchanged, the implementation of a contract would still require that it be signed by the owners of 80% of the catcher vessels that qualified for a processor by delivering the largest share of their catch to it. However, under the proposed new rule, between the date the contract was filed and the end of the year, non-signers could join either the cooperative for which they were qualified, or any other cooperative. This could make it more difficult to implement cooperatives, because ICVs would have an incentive to not commit themselves to a cooperative by the filing date, in order to keep open the possibility of finding a more attractive cooperative to join. Therefore, if the proposed rule were adopted, consideration might be given to reducing the percentage required for approval below 80%. Note however that reducing this requirement would adversely affect the bargaining power of ICVs, because it would make it more difficult for them to block the formation of a cooperative.

The most important ambiguity concerning the interpretation of the proposed new rule is whether it would apply only when a new cooperative agreement is signed, or every year. This is a critical distinction, because the duration of the cooperative agreements is essentially defined as the effective life of the AFA. Therefore the proposed rule change would be moot if it applied only when a new agreement was signed.

In evaluating the effects of this alternative, we will assume that it would apply in every year, and also that cooperative agreements will have annual withdrawal clauses. Therefore if this alternative were adopted, an ICV could change processors in any year without going through open access. As discussed in Section V.A, the potential cost of having to go through open access is a crucial consideration in determining the bargaining power of an ICV within an AFA cooperative. By eliminating these costs, this proposed alternative would greatly improve the position of ICVs under the AFA.

Two principal objections to this proposed rule change have been expressed to us by representatives of inshore processors. The first objection rests on two assertions. One, annual withdrawal clauses, together with the elimination of the open access requirement, would mean that cooperative agreements would effectively be annual contracts, regardless of their legal duration. Two, this would be very disadvantageous to processors, who need long-term agreements for operational purposes. We agree with the first assertion. We do not have sufficient technical knowledge of the industry to independently evaluate the second assertion, but note that fully binding long-term contracts do not appear to have been the norm in this fishery. Moreover, as discussed in Section V.B long-term contracts are difficult to implement.

The second objection is that the proposed rule change would give CVs too much bargaining power. This objection can also be expressed in terms of two assertions. One, elimination of the open access requirement is equivalent to adopting the Dooley-Hall proposal, because ICVs would be able to sell their fish to the highest bidder. Two, the effect on processors of the Dooley-Hall proposal would be disastrous because of the existence of excess capacity with the end of the race for fish. We have already discussed the effect on processors of the Dooley-Hall proposal in section VI.A, and therefore will address only the first of these assertions here.

We do not agree that the elimination of the open access requirement is equivalent to adoption of the Dooley-Hall proposal. The most important difference between the two proposals is the organization of the cooperatives. Under the Dooley-Hall proposal, cooperatives would have a number of advantages relative to cooperatives organized under the current, no open access, proposal. First, they could be organized independently of processors, whereas under the open access proposal the qualification rule implies that cooperatives would still need the approval of a single processor in the form of an agreement to process. Second, ICVs could form cooperatives that did not have any PCVs, whereas under the open access proposal each processor's cooperative could contain all of that processor's PCVs, giving the processor influence, and perhaps even control, over the cooperative's decision making. Third, a cooperative would not have to sell 90% of its fish to a single processor, but instead could negotiate with several processors for the sale of some or all of its fish, giving it informational and bargaining advantages. Fourth, ICVs could choose the number and size of cooperatives in whatever form they felt would maximize their bargaining power.

On the other hand, there is one potentially important way in which the Dooley-Hall proposal would be less advantageous to ICVs. Under the Dooley-Hall proposal, PCVs could form their own cooperatives to protect their catch histories, without requiring the participation or approval of ICVs, whereas under the open access proposal the 80% rule implies that the approval of at least some of the qualified ICVs would be required for cooperatives to form. This gives ICVs some bargaining power by making it potentially possible for them to block the formation of a cooperative, or to break it after it has been formed.

Depending on the degree of competition, this could be a valuable negotiating advantage for ICVs. Under conditions of cutthroat competition, the ICVs qualified for a particular processor could threaten to break its cooperative. If the threat were carried out, ICVs could join another cooperative and the original processor would not even be able to protect the catch history of its own PCVs in its cooperative. However, this requires that a processor would be ready to "steal" ICVs from another processor, knowing that by doing so it would break its competitor's cooperative. This behavior would ineluctably entail a reaction from the competitor that could lead to a disastrous outcome under cutthroat competition. At the other extreme, if the processors behave as a monopsony, the equilibrium outcome would be essentially the same as the much more favorable (for the processors) equilibrium we derived under AFA cooperatives.

Under the conditions of moderate competition, which we consider to be the most likely to prevail, the proposal to eliminate the qualification requirement for cooperative membership can be expected to be more favorable to ICVs than the AFA rules, but less favorable than the Dooley-Hall proposal.

D. The AP proposal

The AP proposal is described in Table 3. The most important provisions of the AP proposal are that ICVs could change processors without going through an open access year, and that the 80% rule would apply only in the first calendar year in which a cooperative received its allocation pursuant to the AFA. As discussed in the previous section, eliminating the open access requirement would enhance the bargaining power of ICVs. However, having the 80% rule apply only in the first year rather than in every year, as we understand would be the case with the original AFA rules, would decrease the bargaining power of ICVs.

Because the cooperatives have now been formed, and the duration of the cooperatives has been defined as the effective life of the AFA, the AP proposal would effectively result in the elimination of the 80% rule. The importance of the 80% rule depends on the degree of competition. Under the conditions of moderate competition, the AP proposal would be clearly less favorable to ICVs than simply eliminating the qualification requirement, as in the proposal discussed in the previous section, but would be likely to be more favorable for ICVs than the AFA rules for cooperatives. However, under conditions of cutthroat competition, the AP proposal might be less favorable for ICVs than the original AFA rules for cooperatives.

Among the other provisions of the AP proposal is the recommendation of changing the definition of which vessels may be eligible to join a cooperative to "legally entitled under the 1934 law governing the cooperatives." We understand that this recommendation was intended to deal with possible complications that would have arisen if the Department of Justice had ruled that PCVs could not belong to cooperatives. Now that the Department of Justice has ruled that PCVs can in fact be members, this provision appears to be moot.

The AP proposal also recommends "removing the requirement of a qualified vessel to make a delivery every year in order to be qualified the following year." This rule should help rationalization. As currently written, the AFA impedes rationalization and imposes needless costs since CVs cannot be mothballed. A CV must be fitted up and crew hired to make at least one delivery to preserve its history in a cooperative.

Lastly, the AP recommends that section 210 (b) relating to catcher vessel inshore cooperatives be amended as detailed in Table 3. We understand that the amendments are intended to address the potential problems noted in the previous section that could arise if it were mandatory for cooperatives to accept as members all CVs that wished to join. The intent of this provision appears to be the same as suggested there, namely making the rule mandatory with respect to qualified CVs, as currently drafted, but permissive for eligible but not qualified CVs. This provision would appear to increase efficiency without imparting any clear bias with respect to bargaining positions.

E. The October 1999 Council Proposals

At the October 1999 meeting, the Council added three new options that could be used singly or in combination to modify other alternatives.

1. Annual vs. Biennial Open Access Exemption

The first option is to allow a catcher vessel that is eligible to participate in the inshore sector of the BSAI pollock fishery to change cooperatives without having to participate in the open access portion of the inshore sector BSAI pollock fishery. The sub-options are to allow such a change:

a. once every calendar year, or
b. once every other calendar year.

We interpret sub-option *a* as being identical to the alternative discussed in section VI.C. We understand that, as assumed in that section, the Council intends that the 80% rule would apply in every year of the cooperative's existence.

We therefore focus our analysis on sub-option *b*. This sub-option makes it more costly for an ICV to switch two years in succession. Indeed, an ICV that has just joined a cooperative could find itself in a difficult bargaining position at the beginning of its second year when negotiating its ex-vessel price. The processor knows that the ICV's outside option is open access and could use the weakened bargaining position of the ICV to impose a smaller ex-vessel price. The ICV could protect itself from such behavior by requiring a two-year price contract with the processor at the beginning of the cooperative agreement. However, it is our understanding that market conditions vary so much from one year to another that multi-year price contracts are often considered as unfeasible because they could impose too much risk on the ICV or the processor.

Therefore we conclude that the two-year option is worse for ICVs than the one-year option. However, under conditions of moderate competition, the two-year option would be expected to be more favorable to ICVs than the AFA rules. We do not expect that the choice of sub-option would affect the amount of movement of ICVs as much as their relative bargaining power.

2. Prohibit a Processor's PCVs from Open Access unless It Has No Cooperative

This option would prohibit a processor-owned catcher vessel (as defined in the initial discussion paper) from entering the open access portion of the inshore BSAI pollock fishery unless there was not a cooperative associated with the processor for which the vessel was qualified. Therefore the only way that a PCV could be in open access would be if the processor for which it was qualified, which would usually be the one that owned it, did not have a cooperative.

This rule would be binding only on a processor that wanted to have the ability to have one or more of its PCVs in open access while also having a cooperative. It would not affect a processor that wanted to have the ability to place its PCVs in open access instead of having a cooperative, because such a processor could still simply veto the formation of a cooperative. It also would obviously not affect a processor that had no interest in the open access alternative.

Therefore the most likely case in which the rule would be binding is that of a processor that had one or more under-vested PCVs but that would also gain significantly from having a cooperative. If enough of the qualified CVs were in favor of the cooperative to satisfy the 80% rule without the participation of one or more of its under-vested PCVs, the processor could prefer to have the under-vested PCVs in open access where they might be able to harvest more than their allocation under the cooperative. Prohibiting such vessels from entering open access would reduce the potential costs of open access to ICVs, and therefore improve their outside option.

There are two ways in which this proposed rule could benefit ICVs. First, to the extent that it reduced the actual cost of open access, it would improve the outside option for ICVs in general. As discussed in Section V.A, a plausible open access scenario is one consisting mainly of under-vested CVs, making open access very costly to any fully-vested ICV. Reducing the number of under-vested PCVs in open access would reduce this cost, though the continued possible presence of under-vested ICVs would imply that open access could remain costly for fully-vested ICVs.

Second, the proposed rule could affect the bargaining power of the specific ICVs qualified for a processor for which the rule was binding. This can be illustrated by reconsidering another open access scenario considered in section V.A. If all cooperatives were formed, with almost all CVs in them, an individual ICV might find it tempting to switch to another processor by going through open access. But if its current processor controlled one or more substantially under-vested CVs, it could threaten to send them into open access as well in order to raise the potential cost of open access to ICVs contemplating a switch to another cooperative.

However, the proposed rule could also cut the other way. This could happen if a processor with two or more under-vested PCVs most preferred choice was to have a cooperative with some of its under-vested PCVs in it, but to also have one or more PCVs in open access. The proposed rule would prohibit this, and therefore the processor would have to choose between having a cooperative, and no PCVs in open access, or not having a cooperative. If the latter alternative was preferred to the former, it could veto the cooperative and place all its PCVs in open access. Even if not having a cooperative were not its preferred choice, the processor could threaten that it would be in bargaining with its qualified ICVs.

For a processor to choose not to have a cooperative (in order to have its PCVs in open access), or for its threat of choosing this alternative to be credible, a processor must have very efficient and severely under-vested PCVs that could catch enough fish in open access to outweigh its losses from not having a cooperative. We consider this to be unlikely in general. Furthermore, for the proposed rule to affect the processor's behavior in a way adverse to ICVs, it would have to be the case that the processor’s first choice would have been to have both a cooperative and some PCVs in open access. We do not believe such a situation is likely to arise, and therefore we believe that the proposed rule would in fact enhance the bargaining power of ICVs.

3. Prohibit Mothership CVs from Open Access unless They Have No Cooperative

This option would prohibit a catcher vessel that is eligible to participate in both the mothership and inshore sectors of the BSAI pollock fishery from entering the open access portion of the inshore sector BSAI pollock fishery unless there was not a cooperative associated with the inshore processor for which the vessel was qualified. The purpose of prohibiting mothership CVs (MSCVs) from entering inshore open access is presumably to reduce the cost of open access to inshore ICVs.

There are 15 CVs from the MS fleet that are dual qualified, one of which is sunk. Two of the MSCVs have substantial inshore history and would be expected to prefer to belong to cooperatives. Of the other qualified MSCVs, two have catch histories equal to about 10% of their maximum annual catch, and the rest are all under 5%. For these vessels, a potentially profitable alternative to joining an inshore cooperative would be to rent or sell their allocations in the mothership sector in order to be able to fish full-time in the inshore open access fishery.

These vessels could have a significant impact on open access because they are substantially under vested in terms of the inshore fishery. The sum of their maximum harvests, omitting the sunken vessel, is about 85,000 metric tons greater than their total share of the inshore allocation, although this probably overstates their maximum potential impact for several reasons. First, their maximum harvests in the offshore sector were attained under conditions substantially different than those in the inshore sector, especially with regard to trip length. Second, the MSCVs are on average smaller than the inshore CVs. Third, the amount of excess capacity created in the mothership sector by ending the race to fish is unlikely to be enough to allow all of these vessels to fully participate in the inshore sector. At the present time, only six of these MSCVs, including the sunken one, have not joined inshore cooperatives. For the five operational MSCVs in the inshore open access, the sum of their maximum harvests exceeds their inshore allocations by about 31,000 metric tons.

Although the magnitude of the effect is difficult to determine, prohibiting MSCVs from open access would reduce the cost of open access to inshore ICVs and therefore enhance their bargaining power, assuming that the open access requirement is retained. However, this benefit for inshore ICVs would be attained only at significant cost to the mothership sector, which is already receiving the least net benefits from the AFA. We understand from participants in the mothership sector that the ability to fish inshore was in fact presented as a form of compensation for their losing some of their traditional share of TAC as part of the AFA.

Because all the inshore processors for which the MSCVs are qualified have formed cooperatives, the proposed rule would exclude all MSCVs from the inshore open access. This would impose three types of costs on the MSCVs. First, they would lose the potential benefits from fish harvested in open access. Two, because the proposed rule would presumably only be adopted if the open access requirement was retained, the MSCVs would be denied the ability to leave their original processors in response to a better offer from a different processor. Third, because they would have no outside option, their negotiating position with the processor, as well as within the cooperative, would be extremely unfavorable. This would be likely to impose an especially large cost on the two MSCVs with substantial inshore catch histories.

F. Other alternatives

In our earlier discussion paper, we suggested two other alternatives that would reduce, but not eliminate, the costs of going through open access. The alternatives suggested were limiting catch in open access, and partially guaranteeing harvest allocation in open access. For completeness, we repeat the discussion of these alternatives here.

Limiting Catch in Open Access

As discussed in Section V.A, if all the CVs in open access were fully vested (i.e., had harvest allocations consistent with their catching power), open access would not be very costly for them. What can put a particular CV at a disadvantage is the presence of under-vested CVs with catching power much larger than their harvest allocations. One possible approach, therefore, would be to limit the extent to which a vessel's harvest in open access could exceed its harvest allocation. For example, the limit on open access catch could be equal to (100+C)% of its harvest allocation, where C is greater than zero.

If C were close to zero, outcomes for all CVs in open access would be expected to be similar to their harvest allocations. If C were large, the outcomes would be similar to those under the AFA, with open access being potentially very costly for fully-vested CVs.

Guaranteeing Harvest Allocation in Open Access

An alternative approach is to guarantee any CV in open access the opportunity to catch a share, F%, of its harvest allocation. If F were close to 100%, open access would be very similar to a guaranteed harvest allocation for a CV. If F were close to zero, the outcomes would be similar to those under the AFA, with open access being potentially very costly for fully-vested CVs.

The open access pool would be reduced to reflect the guaranteed catch. Each CV would be expected to catch more than F% of its harvest allocation, because it would be able to harvest fish from the remaining open access pool in addition to its guaranteed catch. In aggregate, the total catch would not exceed the original open access pool.

Either approach could have the effect of lowering the incentives to join a cooperative if the parameters were set too generously, that is, if C were set too low or F were set too high. For instance, if F were too high, CVs might choose to stay in open access and rationalization would be reduced because they would still race for a fraction (1-F) of the fish. Limiting the number of years a CV could remain in open access would be one possible amendment to these approaches. Other things equal, the shorter the time limit, the less these approaches would increase the bargaining power of ICVs.

TABLE 1

AFA RULES FOR INSHORE SECTOR COOPERATIVES

a. Such cooperatives can be implemented beginning in 2000.

b. The contract implementing a cooperative must be signed by the owners of 80 percent or more of the qualified catcher vessels that delivered pollock for processing by a inshore processor in the directed pollock fishery in the year prior to the year in which the fishery cooperative will be in effect.

c. The contract must specify, except as provided in item j, that such catcher vessels will deliver pollock in the directed pollock fishery only to such inshore processor during the year in which the fishery cooperative will be in effect and that such inshore processor has agreed to process such pollock.

d. The share of the inshore sector allocation available to the vessels in a specific cooperative will equal the percent of the inshore sector harvest of pollock in the pollock fisheries in 1995-97 accounted for by the vessels in that cooperative and the contract will prevent the members of a cooperative from catching more than that share. The Council is considering alternative catch history rules.

e. The contract must allow the owners of other qualified catcher vessels to enter into such contract after it is filed and before the calendar year in which fishing will begin under the same terms and conditions as the owners of the qualified catcher vessels who entered into such contract upon filing.

f. A catcher vessel shall be considered a "qualified catcher vessel" if, during the year prior to the year in which the fishery cooperative will be in effect, it delivered more pollock to the inshore processor to which it will deliver pollock under the fishery cooperative than to any other inshore processor.

g. The contract shall, to the extent practicable, provide fair and equitable terms and conditions for the owners of qualified catcher vessel that delivered pollock to factory trawlers or motherships during 1995-97.

h. The share of the inshore sector allocation not apportioned to the AFA cooperatives will in aggregate be available to the vessels that do not participate in a cooperative. Due to 1995-97 catch by catcher vessels that will not be eligible to participate in the inshore sector pollock fishery, that share will be greater than the percent of the inshore sector harvest of pollock in the pollock fisheries in 1995-97 accounted for by the vessels that do not participate in an inshore cooperative.

i. The eligible vessels that are not in a cooperative may deliver pollock to any eligible inshore processor(s).

j. A contract may provide for up to 10 percent of the pollock harvested under such cooperative to be processed by an eligible inshore processor other than the principal inshore processor to which pollock will be delivered under the contract.

k. There are no provisions to allow one cooperative to transfer pollock to another cooperative. Therefore, for example, if one cooperative exceeded its apportionment, it could not correct for this error by acquiring pollock from another cooperative.

TABLE 2

INITIAL ALTERNATIVES FOR INSHORE SECTOR COOPERATIVES

1. The Dooley-Hall Independent Catcher Vessel Owner Proposal

a. No change.

b. Substantial change. The contract implementing a cooperative must be signed by the owners of five or more catcher vessels eligible to harvest pollock in the directed pollock fishery and deliver it to an eligible inshore processor.

c. Rule eliminated: A cooperative could deliver pollock from the BSAI pollock fishery to any eligible inshore processor(s).

d. No change.

e. Some change: The contract must allow the owners of other ~~qualified~~ eligible catcher vessels to enter into such contract after it is filed and before the calendar year in which fishing will begin under the same terms and conditions as the owners of the ~~qualified~~ eligible catcher vessels who entered into such contract upon filing.

f. Rule eliminated.

g. Some change. The contract shall, to the extent practicable, provide fair and equitable terms and conditions for the owners of ~~qualified~~ eligible catcher vessel that delivered pollock to factory trawlers or motherships during 1995-97.

h. No change.

i. No change.

j. Rule eliminated: A cooperative would be able to decide what part of its allocation to deliver to any or each eligible inshore processor.

k. No change.

2. Replace the 10% transfer limit with a higher limit

No change in the current AFA rules with the exception of item j.

j. A contract may provide for up to x percent of the pollock harvested under such cooperative to be processed by an eligible inshore processor other than the principal inshore processor to which pollock will be delivered under the contract. The value of x has not been determined but it would be greater than 10.

3. Allow any eligible catcher vessels to belong to any inshore cooperative (eliminate the qualified catcher vessel requirement

No change in the current AFA rules with the exception of item e.

e. The contract must allow the owners of other ~~qualified~~ eligible catcher vessels to enter into such contract after it is filed and before the calendar year in which fishing will begin under the same terms and conditions as the owners of the qualified catcher vessels who entered into such contract upon filing.

TABLE 3

EXPANDED ALTERNATIVES FOR INSHORE SECTOR COOPERATIVES

The Alternative Recommended by the AP

The following is taken from the minutes of the AP's meeting in October 1999.

The AP recommends the Council amend the AFA to allow onshore catcher vessels to change processors without going through an open access year.

AP also recommends 80% or more of the qualified catcher vessels participating in any inshore cooperative be limited to the first calendar year in which the cooperative will receive its allocation pursuant to the AFA.

Furthermore, the AP recommends:

1. Changing the definition of which vessels may be eligible to join a cooperative to "legally entitled under the 1934 law governing the cooperatives."

2. Removing the requirement of a qualified vessel to make a delivery every year in order to be qualified the following year.

Additionally, the AP recommends section 210 (b) relating to catcher vessel inshore cooperatives be amended to add the following new subsections:

1. Cooperative Accepted Catcher Vessels. In addition to the rights of those catcher vessels defined as Qualified Catcher Vessels all 208 (a) onshore catcher vessels whether such vessels harvested pollock in the directed pollock fishery or not, shall be eligible to join any existing AFA onshore cooperative provided:

    a. The owner of the catcher vessel is accepted for membership in the AFA cooperative based on criteria provided by the individual cooperative on a case by case basis; and

    b. Prior to the calendar year in which the vessel participates in the cooperative, which shall not be before the year 2001, the owner of the catcher vessel becomes a party to the contract which implemented the fishery cooperative under the same terms and conditions as were accepted by the owners of "qualified catcher vessels."

Other Alternatives Added by the Council in October 1999

In addition to the alternative recommended by the AP, the Council added three options. Any one of the options or any combinations of the options could be used to modify other alternatives. The options are as follows:

2. Allow a catcher vessel that is eligible to participate in the inshore sector of the BSAI pollock fishery to change cooperatives without having to participate in the open access portion of the inshore sector BSAI pollock fishery. The sub-options are to allow such a change:
    a. once every calendar year or
    b. once ever other calendar year.

3. Prohibit a processor-owned catcher vessel (as defined in the initial discussion paper) from entering the open access portion of the inshore sector BSAI pollock fishery unless there is not a cooperative associated with the processor for which the vessel is qualified.

4. Prohibit a catcher vessel that is eligible to participate in both the mothership and inshore sectors of the BSAI pollock fishery from entering the open access portion of the inshore sector BSAI pollock fishery unless there is not a cooperative associated with the inshore processor for which the vessel is qualified.

TABLE 4

ESTIMATES OF CAPACITY IN THE BERING SEA POLLOCK FISHERY

Estimate of 1999 Capacity

1999 Days Actually Fished	1999 Total Possible Days	Capacity Utilization Rate	Excess Capacity as Percent of Total Capacity	Excess of Total Capacity over Required Capacity	1999 Inshore Quota (mt)	Average Deliveries per Day (mt)
82	172	47.7%	52.3%	109.8%	424,187	5,173

Estimates of 2000 Capacity

Expected 2000 Inshore Quota* (mt)	1999 Deliveries per Day (mt)	Percent Slowdown	Deliveries per Day (mt)	Days Needed to process Quota	Total Possible Days	Capacity Utilization Rate	Excess Capacity as Percent of Total Capacity	Excess of Total Capacity over Required Capacity
470,250	5,173	0%	5,173	90.9	233	39.0%	61.0%	156.3%
470,250	5,173	10%	4,656	101.0	233	43.3%	56.7%	130.7%
470,250	5,173	20%	4,138	113.6	233	48.8%	51.2%	105.1%
470,250	5,173	30%	3,621	129.9	233	55.7%	44.3%	79.4%

* 2000 Inshore Quota is based on an expected TAC of 1,100,000 mt.

TABLE 5

COOPERATIVE DATA BASED ON INTERIM PERMITS

	Share of Inshore Allocation	Cumulative Share of Inshore Allocation	Processor Controlled Vessels as Percent of Cooperatives'	
			Total Vessels	Share of Inshore Allocation
Cooperatives By facility:				
Akutan	28.3%	28.3%	51.9%	80-89%
UniSea	24.1%	52.4%	0.0%	0-9%
Westward	16.8%	69.2%	41.7%	60-69%
Alyeska	11.7%	80.9%	54.5%	80-89%
Northern Victor	6.8%	87.7%	40.0%	50-59%
Arctic Enterprise	5.5%	93.2%	100.0%	90-100%
Peter Pan	0.7%	93.9%	40.0%	10-19%
By company:				
Trident*	33.8%	33.8%	58.1%	80-89%
Nippon Suisan	24.1%	57.9%	0.0%	0-9%
Westward	16.8%	74.7%	41.7%	60-69%
Alyeska	11.7%	86.4%	54.5%	80-89%
Icicle*	6.8%	93.2%	40.0%	50-59%
Peter Pan	0.7%	93.9%	40.0%	10-19%
Total cooperatives			42.2%	55.1%
Open access				
Qualified vessels	1.9%	1.9%		
Unassigned	4.2%	6.1%		

* Trident and Icicle each also have one PCV in open access.

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Appendix 1. Lessons from Agricultural Marketing and Bargaining Cooperatives

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Draft membership agreements for pollock fishery cooperatives pay particular attention to the allocation of quota among cooperative members. Since the impetus for cooperative organization among pollock fishing boats derives largely from the opportunity provided by transferable quotas, this emphasis is not surprising. However, a cooperative structure requires attention to other important issues as well. Below, we review the following issues, with particular attention to the lessons from agricultural marketing and bargaining cooperatives:

(a) features of a marketing/bargaining cooperative
(b) control of a marketing/bargaining cooperative
(c) functions of a bargaining cooperative in particular
(d) combinations of marketing and bargaining functions
(e) the bargaining process
(f) possible pricing structures
(g) prospects for success and ideas for the future

The terms "cooperative member," "producer," and "raw product supplier" will be used here interchangeably.

Features of a Marketing/Bargaining Cooperative

A cooperative is a firm that is owned by those who use its services, as distinguished from an investor-owned firm, namely one whose owners are not necessarily its users. Cooperatives which market their members' products are further divided into those which take title to their members' products in order to handle or process them, and those which do not take title but instead provide other services. Agricultural bargaining cooperatives normally fall into the latter category, although some bargaining cooperatives do take title to their members' products.

It is helpful to look briefly at the manner in which cooperatives which do take title allocate their net returns among members. Return allocation procedures fall into two alternative categories: allocation by individual account, and allocation by pool. In the individual account method, the cooperative segregates each member's product (in the fisheries case, the member's catch), sells it separately, and returns the revenue to the member less the variable and overhead costs of the cooperative's services. (Procedures for covering fixed or capital costs are discussed three paragraphs below.)

In the pooling method, the cooperative instead adds the revenue from the sale of all (or of a given subset) of its members' products, deducts the cooperative's variable and overhead costs, then allocates this pooled net revenue to each member according to a prearranged rule. A typical rule is that each member's share of the net revenue is determined by the proportion of the total value of raw product that the member contributed to the pool that year. That is, the member's share of the pooled net revenue equals the share of the raw product value he contributed to the pool. Computing such a share requires estimating the "prices" of the raw products delivered by each member. These prices are often known in agricultural marketing cooperatives as "established" or transfer values and play a critical role in a cooperative's organization. A cooperative may conduct one or more pools at a given time. Members' products need not be physically commingled in order to sell them on a pool basis. However, once products are commingled, member incomes must be allocated through a pool because payment by individual account is no longer feasible.

Cooperatives that do not take title to members' goods instead provide services to members, such as bargaining for contract terms with processors and providing member information. These cooperatives have no revenues from which to deduct their costs, so must finance themselves in another way. Most typically, agricultural bargaining cooperatives charge members a fixed rate either per unit of product or per dollar of raw product value the member sells. If the charge is on a per-dollar-of-raw-product-value basis, "established values" must again be used.

Whether or not the cooperative takes title to product, it must subscribe equity capital from its members in order to cover fixed or capital costs. Cooperatives do so in one or more of three ways: membership application fees, withheld patronage dividends, and capital retains. Typically, little capital is raised through application fees. The second or withheld patronage dividend approach involves holding back a percentage of each member's net return allocation each year. That is, part of the cooperative's payment to a member is made in the form of an equity certificate, which is recorded in the cooperative's books in the member's name. The third or capital retains approach is to charge each member a fixed fee per unit or per unit value of the raw product that the member delivers to the cooperative. As with the withheld patronage dividend approach, an equity certificate is exchanged for this fee, which is recorded in the cooperative's books in the member's name.

The capital retains approach is used heavily by bargaining cooperatives because these cooperatives typically do not have any revenues as such and so have no patronage dividends to distribute to members. Even cooperatives that do earn revenues often draw part or all of their capital through capital retains. Most cooperatives revolve members' capital back to them after a certain period, either as determined annually by the board of directors or according to a fixed time interval as stated in the bye-laws. Interest may or may not be paid on the member's withheld capital, but usually is not paid. Nonpayment of interest creates no efficiency or fairness problem as long as each member's share of the cooperative's total equity capital stays roughly in proportion to that member's share of the value of product delivered.

Control of a Marketing/Bargaining Cooperative

The cooperative's constitution and bylaws distribute decision-making power among the board of directors, members, and hired employees. Some cooperatives choose to become members of a cooperative federation, which is a cooperative whose members are individual cooperatives. In that case, the constitution both of the cooperative federation and of the member cooperative determine the distribution of decision-making power between the federation and the member cooperative. Cooperative federations perform such functions as exporting or further-processing members' goods, purchasing supplies, serving as information clearing houses, and representing members to the public and to policy makers. Cooperative federations are run democratically by the member cooperatives, just as member cooperatives are run democratically by the individual raw product suppliers.

Despite the compelling reasons raw product suppliers often have for forming a cooperative, a potential always exists for some members to free-ride on others. For example, if the cooperative's per-unit costs decline as its volume grows (increasing returns to size), larger members can argue reasonably that they contribute more to the cooperative's economic success than do smaller members. If, then, all members receive equal benefits per unit from patronizing the cooperative, smaller members free-ride on larger ones. On the other hand, larger members free-ride on smaller ones if the cooperative faces decreasing returns to size. Other sources of free-riding may also be present.

Claims that some members free-ride on others are a major source of cooperative failure. Why, then, do many cooperatives succeed? The academic literature suggests that cooperatives whose members are relatively homogeneous -- especially with regard to their size and to the type of product they harvest -- are more likely to be successful than are cooperatives whose members are relatively heterogeneous. The principal reason is that the greater the homogeneity, the less likely it is that some members can point to others as free-riding.

Cooperatives whose members are very heterogeneous must do the best they can to limit the circumstances in which some members think that others are free-riding. One way of doing so is to use sliding scales when charging members for the cooperative's services. Another way of doing so is to give some members more votes than others have. In our own survey of forty-three agricultural marketing cooperatives, 63% allocated one vote to each member regardless of size, 9% allocated votes in proportion to a member's dollar volume of business with the cooperative, 7% allocated one vote to each member plus additional votes according to volume of business, and 14% allocated votes in proportion to each member's stock ownership in the cooperative. (Seven percent of the respondents did not answer the question.)

Functions of a Bargaining Cooperative in Particular

The subset of marketing cooperatives known as bargaining cooperatives see their chief service as negotiating with processor/buyers over prices and terms of trade. Numerous agricultural bargaining cooperatives are organized under the Capper-Volstead Act, that is are exempt from certain anti-trust provisions by virtue of that Act. Although bargaining cooperatives are registered under incorporation laws in their own states, only a few states, such as Michigan and California, have laws regulating their activities as specifically bargaining cooperatives.

Through the membership document, each member agrees that the bargaining cooperative will be the member's sole agent in negotiating contractual terms with processors. In agricultural cooperatives, membership usually is specified for a given quantity of the farmer's acreage rather than for a given quantity of the goods produced from it, since the quantity produced typically isn't known at the time of contract negotiations. Membership may or may not be closed; that is, the cooperative may or may not reserve the right to restrict the entry of given individuals or of given acreage to the cooperative. Although a cooperative normally wants as many members as possible, the demand for its product may sometimes be such that restricting entry of new members or of new acreage is in the best interest of the incumbent members.

Agricultural bargaining cooperatives normally distinguish between bargaining for "price" and bargaining for "terms of sale." "Price" refers to the base price corresponding to a reference product specification, which often is the lowest or highest grade of product available from members, or a grade that members commonly deliver. Anti-trust law, and perhaps the cooperative's self-interest, prohibits agricultural bargaining cooperatives from agreeing with processors on a particular price. Rather, agreement is reached on a minimum price that processors will pay for the reference product specification. Processors are free during the season to pay prices higher than this.

Agricultural bargaining cooperatives sometimes negotiate different base prices with different processors. However, they do so only to account for such cost factors as the differing locations of these processors. The reason is that bargaining cooperatives have a strong incentive to equalize the price paid to all members for a given quality of product. The literature of virtually every bargaining cooperative refers specifically to this equalization goal. In the absence of equalization, farmer dissension grows, sub-coalitions form among them, processors move to take advantage of the division, and members drop out.

In contrast to the base price, "terms of sale" refer to any combination of: (a) discounts and premia for selected grade standards, for selected varieties or species of product, or for alternative dates and places of delivery; (b) conditions under which the processor can refuse an entire lot; (c) division of responsibility for containers and for off-loading of product; (d) changes in the base price according to the portion of the season in which the product is delivered; (e) members' delivery schedules and permissible adjustments to these schedules to account for unforeseen events; and (f) means of redress of grievances between cooperative and processor. Terms of sale typically are included in a document, often called the "Master Document," separate from that stipulating the base price. In many cases, the Master Document is renegotiated only every two or three years, whereas base price is renegotiated every year. Terms of sale are nearly always the same for every member except for allowances regarding the plant or processor to which the product is shipped.

Besides negotiating over price and terms of sale, agricultural bargaining cooperatives offer other member services. The most important is regular dissemination of information about supply and demand conditions in the industry. Economic information of this sort not only helps members estimate the value of the bargaining cooperative's services, but also assists them in making short-term management and long-term investment decisions. Cooperative managers agree that the principal key to a bargaining cooperative's success is full and frequent communication among the manager, board, and members.

Combinations of Marketing and Bargaining Functions

The distinction between a bargaining cooperative and one that takes title to or processes members' product is not straightforward. Some bargaining cooperatives, the California Canning Peach Bargaining Association in particular, take title to their members' products even though their principal goal is only to bargain for prices. The advantage of taking title is that members cannot drop out during the bargaining process; knowledge of this fact probably gives the cooperative greater bargaining leverage with processors. In addition, the cooperative can use its ownership of the product to perform marketing services for members, for example coordinating sales with individual processors and commingling the products of a group of members prior to a particular sale.

Most of the product which the Canning Peach Bargaining Association sells to processors is segregated by member. That is, payments to individual members are determined mostly by individual account rather than through a pool. However, the Association's ownership of the member's product permits it to pool product across members if market conditions warrant. In particular, product which does not move readily at prices the Association has negotiated is often commingled together and held in a pool, to be sold later. Returns from this pool are allocated according to the principles outlined above.

Obtaining title to members' products gives the bargaining cooperative another advantage: if the cooperative considers that prices and trade terms negotiated with processors are inadequate, it may seek a co-packing arrangement with one of the processors. In a co-packing arrangement, the cooperative and processor agree to share the proceeds of the pack in some manner. Such arrangements include profit-sharing or an agreement under which the processor is paid a fixed fee for its services and the cooperative bears the full profit risk. Pollock cooperatives now forming in the Alaska fishery largely envisage themselves as bargaining with a single processor over prices and trade terms. However, they should bear in mind that pooling and/or co-packing generally remain as alternatives in the event that negotiations prove unfruitful.

The Bargaining Process

Before negotiating with processors each year, an agricultural bargaining cooperative must ensure that it has sufficient support from farmers in the industry. Normally, support is reckoned in terms of the percentage of the acreage in that industry which is signed up with the cooperative in the form of a membership agreement. Some bargaining cooperatives say they need as little as 40% of the acreage in their industry in order to bargain effectively with processors. Other cooperatives say they need a minimum of 70%. An informal survey of agricultural bargaining cooperatives suggests that they represent between 45% and 80% of the acreage in their industries. Often, much of the remaining acreage is committed to another cooperative which takes title to and processes the members' goods. This, for example, is the case in the California raisin industry, where much of the acreage not represented by the Raisin Bargaining Association (RBA) is sold through a processing/marketing cooperative. The RBA and the latter cooperative have close informal ties with one another.

Because processors are forbidden by anti-trust law from colluding in the establishment of prices or terms of trade, a bargaining cooperative must negotiate individually with each processor. Some cooperatives seek first to bargain with the smaller or weaker processors, then move to the larger ones. However, the most frequent strategy seems to be to begin negotiating first with the larger processing firms. Only in California and in several other states are processors required to bargain. In any event, processors are free to offer different terms to different farmers, and in general to find various ways to encourage individual farmers to break from their cooperative organization. For example, processors are free to pay to cooperative nonmembers prices different than those that they pay to members.

Many bargaining cooperatives feel it is important to agree with processors first concerning terms of trade and only then concerning base price. Such a sequence helps assure farmer-members of a home for their product because, unlike base price, terms of trade are negotiated on a multi-year basis. In addition, agreeing first about trade terms helps processor and cooperative become familiar with one another’s bargaining strengths and attitudes before they begin negotiations over the price level itself. Furthermore, trade term negotiations allow the cooperative to reveal the interests that it holds in common with the processor, such as the establishment of a price premium/discount schedule best suited to maintaining high product standards and timely raw product deliveries. Overall, agricultural bargaining managers seem to agree that it is usually better to discuss first the issues on which producer and processor are likely to agree.

Some agricultural bargaining cooperatives authorize a single negotiating team to bargain with all processors. Others establish a separate negotiating committee to work with each processor or plant. These processor-level committees come under the central direction of the cooperative manager and board. In any event, if agreement cannot be reached with a processor before the onset of the harvest season, the cooperative and processor may turn to a mediator, and if that is not successful, to an arbitration board. However, cooperatives usually try to avoid arbitration because it tends to undermine members’ estimation of the cooperative's value.

Possible Pricing Structures

Most agricultural bargaining cooperatives confine themselves to negotiating a base price (and associated terms of trade) to be paid in cash during that harvest season to the cooperative’s members. Many cooperatives in earlier years tried instead to utilize a price formula in which the price which processors would pay would depend upon such industry aggregate data as cold-storage inventories at time of delivery. However, these formulae proved too simplistic to capture all the factors that affect supply and demand, and hence value, of raw product.

Despite the failure of price formulae based on industry aggregate data, other alternatives to a simple annual cash price remain. One set of possibilities pertains to multi-year contracts. The California Tomato Growers Association presently is proposing to sign a two-year contract with canners in which a price would be set for each of the succeeding two years. The contract would state that, at the end of the first year of the contract, the second-year price would be renegotiated. Simultaneously, the price for the following (i.e. third) year would be determined. That is, contracts would be "rolling two-year-term" ones in which the second-year price would be renegotiated even as the following-year price is *originally* negotiated. Such an arrangement might help producer and processor plan for the future because, even though second-year prices could be changed through negotiation, they likely would not be changed appreciably unless both parties saw it in their interest to do so.

Along the same lines, the California Canning Peach Bargaining Association frequently utilizes rolling-ten-year contracts with processors. The Master Document in these instances allocates a given member's acreage to a given processor for the ten-year period, but states in only a general way how the price per ton will be determined each year.

In addition to multi-year contracts, the cooperative might negotiate price formulae in which raw product price is tied to the processor's performance. "Sales-minus" or revenue-share contracts are a case in point. In these contracts, the producer is paid a fixed percentage of the processor's resale price. If some of the processor's per-unit costs are deducted first from this resale price before the producer's share is computed, the contract instead is called a net-revenue-share or profit-share one. The latter contracts essentially treat the cooperative as if it were a full-fledged marketing cooperative, that is, as if it owned equity in the processing firm. The advantage of doing so is that producers are encouraged to act in accordance with the processor's interests, so that both producer and processor work to maximize the joint profit of the production and processing operation.

Except in cases in which the cooperative owns equity in the processor, agricultural bargaining cooperatives have not for the most part succeeded in negotiating revenue-share or net-revenue-share contracts with processors. One reason is that the processors' owners have been unwilling to share processing profit or revenue with those, like bargaining cooperative members, who do not bear the risk associated with equity ownership. Even bargaining cooperatives perceive that profit- or revenue-share contracts can be injurious to cooperative members. In the first place, processors can, in one cooperative leader's words, engage in "creative accounting" when computing the processor's revenues or costs. For example, prices to some of the processor's customers may be subject to adjustment because of discounts offered to these customers or because of special services provided to them. Costs may be subject to similar adjustment. In the second place, agricultural bargaining cooperatives acknowledge that when a processor must pay a portion of its revenues to cooperative members, the processor becomes ill-inclined to obtain the maximum price possible for its product. This hurts cooperative members because the processor then has less net revenue from which to pay for raw product supplies. As the manager of the California Canning Peach Bargaining Association said, revenue-share contracts for raw product can be similar to raw product sales by consignment, because as the revenue share payable to the producer rises, the processor becomes simply a sales agent for the cooperative.

Nevertheless, profit- and revenue-share contracts have been used in a number of instances. Profit-share contracts between bargaining cooperatives and processors have been employed from time to time in the Florida citrus industry. And the Oregon Hazelnut Growers' Bargaining Association has, since 1983, obtained revenue shares from processors in the following way: If the processor's resale price (minus a discount if the processor adds much value through dicing, say, or adding chocolate) exceeds or falls short of the raw product price originally negotiated between cooperative and processor, producer and processor share the difference on a 50-50 basis. Recently, this arrangement has been amended as follows: If the resale price (possibly as discounted for costs as described above) drops *below* the originally negotiated raw product price, the raw product price is not reduced; but if the resale price rises *above* the originally negotiated raw product price, processors get the first three cents per pound of increase and producers get anything above that. In order for a revenue-share formula to be implemented, the processor's sales books must by audited by an independent auditor. The Hazelnut Bargaining Association acknowledges that, despite the overall success of its formula, processors are never happy about the auditing process.

Prospects for Success and Ideas for the Future

Managers of agricultural bargaining cooperatives say it is unrealistic to expect cooperative bargaining to bring dramatic gains to members. Processor-cooperative bargaining is part of the process of discovery of the raw product price. The process requires both parties to take into account current information about the supply and demand for the processed product as well as about the cost of raw product production. When raw product suppliers conduct their bargaining process as a group, they probably enhance price "a little bit" relative to what the price would be if suppliers each negotiated prices independently of one another. This may be enough justification for the bargaining cooperative's existence.

As we have mentioned, cooperatives offer other valuable services as well, principally in supplying information to their members. Indeed, a bargaining cooperative is primarily in the information business. Effective information provision requires that the cooperative maintain wide contacts in its own industry and in related ones. For this and other reasons, a pollock fishery bargaining cooperative tied to a particular processor may well want to explore the possibility of joining with other Alaska pollock cooperatives in a cooperative union or federation. One role of the federation would be to gather and disseminate, to each member cooperative, information obtained from the other member cooperatives and from the industry and general economy. Centralized information processing reduces fixed costs and enables the member cooperatives to benefit in a timely manner from the other cooperatives' experiences. A pollock fisheries cooperative federation likely would also serve as the cooperatives' spokesman to individuals and groups outside the industry.

Appendix 2. Ownership Links, Co-op Membership and Sector Eligibility for Vessels with American Fisheries Act Catcher Vessels Interim Permits for the BSAI Pollock Fishery

<u>Independent vessels with no clear ownership link either to other AFA eligible catcher vessels or to an AFA eligible processor</u>

	Vessel Name	ADFG	Ins. Co-op	c/p	mth	ins
1.	AJ	57934	Westward	N	N	Y
2.	ALEUTIAN CHALLENGER	50570	na	N	Y	N
3.	AMBER DAW	00028	Peter Pan	N	Y	Y
4.	AMERICAN CHALLENGER	62152	na	Y	N	N
5.	AMERICAN EAGLE	00039	UniSea	N	N	Y
6.	DEFENDER	56676	UniSea	N	N	Y
7.	EXCALIBER II	54653	N. Victor	N	N	Y
8.	EXODUS	33112	Akutan	N	N	Y
9.	FIERCE ALLEGIANCE	55111	Westward	N	N	Y
10.	FORUM STAR	59687	na	Y	N	N
11.	GOLD RUSH	40309	N. Victor	N	N	Y
12.	GOLDEN PISCES	32817	Akutan	N	N	Y
13.	HICKORY WIND	47795	Westward	N	N	Y
14.	MARCY J	00055	Akutan	N	N	Y
15.	MARGARET LYN *	31672	None	N	Y	Y
16.	MARK I *	06440	None	N	Y	Y
17.	MESSIAH	66196	Unalaska	N	N	Y
18.	MISS BERDIE	59123	Akutan	N	N	Y
19.	MS AMY	56164	Unalaska	N	N	Y
20.	MUIR MILACH	41021	na	Y	N	N
21.	OCEAN HARVESTER	00101	na	Y	N	N
22.	OCEANIC *	03404	Peter Pan	N	Y	Y
23.	PACIFIC CHALLENGER	06931	None	N	Y	Y
24.	PACIFIC MONARCH	54645	UniSea	N	N	Y
25.	PEGASUS	57149	Akutan	N	N	Y
26.	PEGGY JO	09200	Akutan	N	N	Y
27.	RAVEN	56395	Akutan	N	N	Y
28.	ROYAL AMERICAN	40840	Akutan	N	N	Y
29.	SEEKER	59476	Akutan	N	N	Y
30.	TRACY ANNE	54654	na	Y	N	N
31.	VESTERAALEN *	38342	na	N	Y	N
32.	WESTERN DAWN	22294	Unalaska	N	Y	Y

Independent vessels with an apparent ownership link to one or more eligible catcher vessels

Group 1

These two vessels are owned by one of the partners in the Northern Victor and they fish for the Northern Victor. That partner also is a partner in the Arctic Wind which fishes for UniSea and which is in Group 9 based on its other owners.

	Vessel Name	ADFG	Ins. Co-op	c/p	mth	ins
33.	POSEIDON	37036	N. Victor	N	N	Y
34.	ROYAL ATLANTIC	00046	N. Victor	N	N	Y

Group 2

35.	AURIGA	56153	UniSea	N	N	Y
36.	AURORA	56154	UniSea	N	N	Y

Group 3

37.	BLUE FOX	62892	Akutan	N	N	Y
38.	SEADAWN	00077	UniSea	N	N	Y

Group 4

39.	CAITLIN ANN	59779	Westward	N	N	Y
40.	PACIFIC PRINCE	61450	Westward	N	N	Y

Group 5

41.	GUN-MAR	41312	UniSea	N	N	Y
42.	MAR-GUN *	12110	None	N	Y	Y

Group 6

43.	ELIZABETH F	14767	None	N	N	Y
44.	WALTER N	34919	Peter Pan	N	N	Y

Group 7

45.	LESLIE LEE	56119	Akutan	N	N	Y
46.	TRAVELER	58821	None	N	Y	Y

Group 8

	Vessel Name	ADFG	Ins. Co-op	c/p	mth	ins
47.	ARCTIC WIND	01112	UniSea	N	N	Y
48.	NORDIC STAR	00961	UniSea	N	N	Y
49.	STARFISH	00012	UniSea	N	N	Y
50.	STARLITE	34931	UniSea	N	N	Y
51.	STARWARD	39197	UniSea	N	N	Y

Group 9

52.	PERSEVERANCE	12668	Akutan	N	N	Y
53.	PREDATOR	33744	Akutan	N	N	Y

Group 10

54.	ALSEA	40749	UniSea	N	N	Y
55.	ARGOSY	38547	UniSea	N	N	Y
56.	PROGRESS	00006	Unalaska	N	N	Y
57.	VANGUARD	39946	Unalaska	N	Y	Y

Group 11

58.	NORDIC FURY *	00200	N. Victor	N	Y	Y
59.	PACIFIC FURY *	00033	N. Victor	N	Y	Y

Group 12

60.	OCEAN HOPE I	48171	None	N	N	Y
61.	OCEAN HOPE III	48173	Westward	N	N	Y

Group 13

Operational/ownership link to the Excellence

62.	ALYESKA	00045	Westward	N	Y	Y
63.	CALIFORNIA HORIZON	33697	na	N	Y	N
64.	MISTY DAWN	68858	na	N	Y	N
65.	PAPADO II	55512	na	N	Y	N
66.	PACIFIC ALLIANCE	38294	na	N	Y	N

Group 14

67.	NEAHKAHNIE	32858	na	Y	N	N
68.	SEA STORM	40969	na	Y	N	N

Vessels with an apparent ownership link to an eligible inshore processor

Alyeska Seafoods

Alyeska did not comment on this list (8/3/99).

	Vessel Name	ADFG	Ins. Co-op	c/p	mth	ins
69.	ALASKA ROSE	38989	Unalaska	N	N	Y
70.	BERING ROSE	40638	Unalaska	N	N	Y
71.	DESTINATION	60655	Unalaska	N	N	Y
72.	GREAT PACIFIC	37660	Unalaska	N	N	Y
73.	MORNING STAR	38431	Unalaska	N	N	Y
74.	SEA WOLF	35957	Unalaska	N	N	Y

UniSea Seafoods

None

Victor Seafood

Victor Seafood agreed with the list, these are catcher vessels owned by the same individuals who own the Northern Victor (8/6/99).

75.	ANITA J	00029	None	N	N	Y
76.	COMMODORE	53843	N. Victor	N	N	Y
77.	HALF MOON BAY	39230	N. Victor	N	N	Y
78.	STORM PETREL	39860	N. Victor	N	N	Y
79.	SUNSET BAY	35527	N. Victor	N	N	Y

Westward Seafoods

Westward agreed with the list (7/29?/99)

80.	ALASKAN COMMAND	57321	Westward	N	N	Y
81.	CHELSEA K	62906	Westward	N	N	Y
82.	PACIFIC KNIGHT	54643	Westward	N	N	Y
83.	VIKING	00008	Westward	N	N	Y
84.	WESTWARD I	53247	Westward	N	N	Y

Westward has at least partial ownership of these vessels but has direct control only of the Pacific Knight

Peter Pan Seafoods

85.	AMERICAN BEAUTY	24255	Peter Pan	N	Y	Y
86.	OCEAN LEADER	00032	Peter Pan	N	Y	Y

Trident Seafoods (including Tyson)

Trident agreed with the list (8/3/99).

	Vessel Name	ADFG	Ins. Co-op	c/p	mth	ins
87.	ALDEBARAN	48215	Akutan	N	N	Y
88.	ARCTIC I	51092	Akutan	N	N	Y
89.	ARCTIC III	55923	Arctic Ent	N	N	Y
90.	ARCTIC IV	57440	Arctic Ent	N	N	Y
91.	ARCTIC VI	64105	Akutan	N	N	Y
92.	ARCTURUS	45978	Akutan	N	N	Y
93.	COLUMBIA	39056	Akutan	N	N	Y
94.	DOMINATOR	08668	Akutan	N	N	Y
95.	DONA LILIANA	55199	Akutan	N	N	Y
96.	DONA MARTITA	51672	Akutan	N	N	Y
97.	DONA PAULITA	55153	Akutan	N	N	Y
98.	FLYING CLOUD	32473	Akutan	N	N	Y
99.	GOLDEN DAWN	35687	Akutan	N	N	Y
100.	MAJESTY	60650	Akutan	N	N	Y
101.	NORTHWEST ENTERPRISE	36808	None	N	N	Y
102.	OCEAN ENTERPRISE	51073	Arctic Ent	N	N	Y
103.	PACIFIC ENTERPRISE	50759	Arctic Ent	N	N	Y
104.	PACIFIC VIKING	00047	Akutan	N	N	Y
105.	VIKING EXPLORER	36045	Akutan	N	N	Y

Notes: The AFA interim permit information is as of February 3, 2000. Permit applications may be submitted later for additional vessels or for additional sector endorsement for some of the vessels listed above.

* The owner of this vessel is a partner in the Ocean Phoenix.

na Not Applicable since the vessels does not have an inshore endorsement.

none Vessel has an inshore endorsement but has not joined an inshore sector co-op.

Sources: National Marine Fisheries Service, Restricted Access Management list of AFA catcher vessel permits as of February 3, 2000 and NMFS vessel permit database.

Appendix 3 Participants in Research Discussions

Gregory Baker; Westward Seafoods
Chris Blackburn; Alaska Groundfish Data Bank
Al Burch; Alaska Draggers Association
Jim Chase, F/V Forum Star
Bob Desautel; Nina Fisheries
John Dooley; F/V Pacific Prince, F/V Caitlin Ann
Dave Fraser, F/V Muir Milach
David W. Galloway, Ocean Phoenix, Premier Pacific Seafoods
Chris Garbrick, F/V Mark I, F/V Royal American
Jeff Hendricks, Alaska Ocean Seafood, F/V Auriga, F/V Aurora
Mike Hyde, American Seafoods
Dan Holland; National Marine Fisheries Service
John Iani; UniSea
Levis Kochin; University of Washington, Trident Seafoods
Lil Kuhr; Nina Fisheries
Todd Lee; National Marine Fisheries Service
Kent Lind; National Marine Fisheries Service
Jim McManus; Trident Seafoods
Steve Olson, F/V Western Dawn
Einar H. Pedersen, F/V Vesteraalen
Joe Plesha; Trident Seafoods
Edward J. Richardson; At-Sea Processors Association
Chris Riley; Trident Seafoods
Kathy Shepard; Nina Fisheries
Dave Stanchfield; F/V Morningstar
Peter Stitzel; Fisheries Business Consultant
Joseph M. Sullivan; Mundt, MacGregor
Joe Terry; National Marine Fisheries Service
Richard S. Wood, Ocean Phoenix, Premier Pacific Seafoods
John G. Young; Young, deNormandie, and Oscarsson

Appendix E: List of AFA eligible vessels

Listed Catcher/processors

NAME	*USCG*	*LOA*
ALASKA OCEAN	637856	376
AMERICAN DYNASTY	951307	272
AMERICAN ENTERPRISE	594803	210
AMERICAN TRIUMPH	646737	285
ARCTIC FJORD	940866	275
ARCTIC STORM	903511	334
ENDURANCE	592206	278
HIGHLAND LIGHT	577044	270
ISLAND ENTERPRISE	610290	304
KATIE ANN	518441	296
KODIAK ENTERPRISE	579450	275
NORTHERN EAGLE	506694	341
NORTHERN GLACIER	663457	201
NORTHERN HAWK	643771	341
NORTHERN JAEGER	521069	336
OCEAN ROVER	552100	256
PACIFIC GLACIER	933627	276
SEATTLE ENTERPRISE	904767	270
STARBOUND	944658	240
U.S. ENTERPRISE	921112	224

Unlisted catcher/processors

NAME	*USCG*	*LOA*
OCEAN PEACE	677399	219

Motherships

NAME	*USCG*	*LOA*
EXCELLENCE	967502	367
GOLDEN ALASKA	651041	305
OCEAN PHOENIX	296779	688

Catcher vessels delivering to catcher/processors

NAME	*USCG*	*LOA*
AMERICAN CHALLENGER	633219	106
FORUM STAR	925863	97
MUIR MILACH	611524	86
NEAHKAHNIE	599534	110
OCEAN HARVESTER	549892	108
SEA STORM	628959	123
TRACY ANNE	904859	95

Catcher vessels delivering to motherships only

NAME	*USCG*	*LOA*
ALEUTIAN CHALLENGER	603820	86
CALIFORNIA HORIZON	590758	90
MISTY DAWN	926647	107
POPADO II	536161	118
VESTERAALEN	611642	124

Catcher vessels delivering to both ms and inshore

NAME	*USCG*	*LOA*
ALYESKA	560237	122
AMBER DAWN	529425	97
AMERICAN BEAUTY	613847	123
MARGARET LYN	615563	123
MAR-GUN	525608	113
MARK I	509552	98
NORDIC FURY	542651	110
OCEAN LEADER	561518	120
OCEANIC	602279	122
PACIFIC CHALLENGER	518937	104
PACIFIC FURY	561934	110
TRAVELER	929356	109
VANGUARD	617802	94
WESTERN DAWN	524423	113

NAME	*USCG*	*LOA*	*NAME*	*USCG*	*LOA*
Catcher vessels delivering to inshore processors only					
AJ	599164	150	OCEAN HOPE 3	652397	111
ALASKA ROSE	610984	111	PACIFIC EXPLORER	678237	155
ALASKAN COMMAND	599383	184	PACIFIC KNIGHT	561771	185
ALDEBARAN	664363	132	PACIFIC MONARCH	557467	166
ALSEA	626517	124	PACIFIC PRINCE	697280	149
AMERICAN EAGLE	558605	120	PACIFIC RAM	589115	82
ANITA J	560532	130	PACIFIC VIKING	555058	127
ARCTIC EXPLORER	936302	155	PEGASUS	565120	96
ARCTIC WIND	608216	123	PEGGY JO	502779	99
ARCTURUS	655328	132	PERSEVERANCE	536873	87
ARGOSY	611365	124	POSEIDON	610436	117
AURIGA	639547	193	PREDATOR	547390	90
AURORA	636919	193	PROGRESS	565349	114
BERING ROSE	624325	125	RAVEN	629499	92
BLUE FOX	979437	85	ROYAL AMERICAN	624371	105
BRISTOL EXPLORER	647985	180	ROYAL ATLANTIC	559271	124
CAITLIN ANN	960836	103	SEA WOLF	609823	125
CAPE KIWANDA	618158	76	SEADAWN	548685	124
CHELSEA K	976753	150	SEEKER	924585	98
COLUMBIA	615729	123	STAR FISH	561651	123
COMMODORE	914214	133	STARLITE	597065	123
DEFENDER	554030	200	STARWARD	617807	123
DESTINATION	571879	169	STORM PETREL	620769	123
DOMINATOR	602309	124	SUNSET BAY	598484	122
DONA LILIANA	651752	152	TOPAZ	575428	85.5
DONA MARTITA	651751	152	VIKING	565017	144
DONA PAULITA	637744	152	VIKING EXPLORER	605228	124
OCEAN HOPE 1	652395	108	WALTER N	257365	99

Table 3.3.4 Production and value of groundfish products in the fisheries off Alaska by species and product type, 1995-99, (1,000 metric tons product weight and million dollars).

	1995		1996		1997		1998		1999	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Pollock										
Whole fish	2.8	$2.6	3.2	$2.7	2.9	$2.1	2.1	$1.3	5.0	$1.8
H&G	.9	$.7	.7	$.5	.8	$.5	7.8	$5.0	6.8	$5.1
Roe	15.9	$217.5	14.5	$176.2	18.7	$167.3	12.8	$84.4	11.6	$139.9
Deep-skin fillets	34.9	$87.9	36.8	$100.1	29.3	$81.2	31.5	$95.5	36.9	$129.9
Other fillets	24.7	$59.8	23.4	$53.0	16.1	$32.8	35.2	$89.3	21.6	$60.3
Surimi	178.2	$439.8	160.9	$298.3	159.9	$363.2	148.0	$285.1	153.5	$332.9
Minced fish	9.8	$8.9	14.2	$15.2	9.5	$9.3	17.5	$20.0	9.8	$11.0
Fish meal	50.9	$28.4	46.9	$28.2	46.4	$28.1	48.1	$44.3	50.9	$32.4
Other products	15.1	$5.3	13.6	$5.8	12.0	$5.2	14.4	$7.9	17.1	$8.0
All products	333.2	$851.0	314.0	$680.0	295.5	$689.7	317.4	$632.9	313.2	$721.3
Pacific cod										
Whole fish	3.7	$5.2	8.1	$8.7	5.4	$5.7	2.9	$2.5	2.9	$3.4
H&G	60.9	$91.3	57.7	$98.2	69.0	$90.9	62.9	$126.7	67.5	$172.6
Salted/split	7.6	$18.5	10.8	$23.6	5.5	$12.0	4.6	$11.2	4.6	$17.3
Fillets	19.2	$79.0	19.3	$71.8	24.5	$98.5	18.3	$74.9	17.4	$95.5
Other products	17.3	$23.8	17.0	$22.2	18.9	$19.1	12.0	$13.4	14.2	$18.0
All products	108.6	$217.8	112.9	$224.6	123.3	$226.1	100.7	$228.6	106.7	$306.9
Sablefish										
H&G	12.3	$109.5	10.7	$96.8	9.2	$89.9	9.1	$65.2	8.5	$70.9
Other products	.2	$1.4	.1	$.3	.1	$.6	.3	$1.5	.2	$1.3
All products	12.6	$111.0	10.8	$97.1	9.3	$90.5	9.4	$66.8	8.7	$72.2
Flatfish										
Whole fish	55.2	$53.8	35.0	$31.2	52.5	$34.0	34.0	$23.9	12.8	$14.5
H&G	28.7	$60.1	37.6	$68.7	52.0	$71.3	39.7	$50.9	38.0	$49.1
Kirimi	6.3	$10.3	14.5	$22.6	15.9	$17.8	6.5	$4.1	4.3	$4.5
Fillets	2.1	$10.2	2.4	$11.8	1.8	$7.7	1.1	$5.8	.8	$3.1
Other products	3.1	$2.5	2.8	$.9	3.9	$3.7	1.1	$.6	1.3	$1.9
All products	95.3	$136.9	92.3	$135.2	126.2	$134.5	82.4	$85.4	57.1	$73.1
Rockfish										
Whole fish	1.4	$1.8	2.5	$2.5	1.4	$1.9	2.5	$2.9	5.9	$4.8
H&G	11.3	$26.8	11.5	$20.3	11.2	$18.4	9.1	$11.5	10.0	$12.4
Other products	.6	$2.5	1.0	$3.4	1.1	$4.1	1.4	$5.4	1.5	$4.6
All products	13.3	$31.1	15.0	$26.2	13.8	$24.4	13.0	$19.8	17.5	$21.8
Atka mackerel										
Whole fish	6.4	$5.3	16.7	$15.1	6.8	$4.2	4.9	$2.5	10.1	$4.7
H&G	28.6	$36.3	38.8	$52.9	22.3	$30.0	22.0	$15.1	22.2	$18.2
Other products	1.4	$2.6	.8	$.8	1.8	$2.5	1.1	$.8	.0	$.0
All products	36.4	$44.3	56.4	$68.7	31.0	$36.7	27.9	$18.4	32.4	$22.9
Total	599.3	$1,391.9	601.4	$1,231.7	599.0	$1,201.9	550.9	$1,051.7	535.6	$1,218.2

Notes: Includes only catches counted against Federal TACs.
Source: Weekly processor report data and annual processor price survey, National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Tables 4.3.1 and 4.3.2 present the criteria for determining significance of effects to pinnipeds and cetaceans.

Table 4.3.1 Criteria for determining significance of effects to pinnipeds and sea otters.

Effects	Score					
	S-	**CS-**	**I**	**CS+**	**S+**	**U**
Incidental take/ entanglement in marine debris	Take rate increases by >50%	Take rate increases by 25-50%	Level of take below that which would have an effect on population trajectories	NA	NA	Insufficient information available on take rates
Harvest of prey species	Removals of one or more key prey species increased by more than 20%	Removals of one or more key prey species increased by more than 5%	Removals of one or more key prey species increased or decreased by less than 5%	Removals of one or more key prey species reduced by more than 5%	Removals of one or more key prey species reduced by more than 20%	Insufficient information available on key prey species
Spatial/ temporal concentration of fishery	Much more temporal and spatial concentration in all key areas	Similar temporal and spatial fishery distribution in some, but not all, key areas	Marginally less temporal and spatial concentration than 1998 fisheries	Much less temporal and spatial concentration in some, but not all key areas	Much less temporal and spatial concentration in all key areas	Insufficient information as to what constitutes a key area
Disturbance	Much more disturbance (all closed areas reopened)	Marginally more disturbance (some closed areas reopened)	Similar level of disturbance as that which was occurring in 1998	NA	NA	Insufficient information as to what constitutes disturbance

S = Significant, CS = Conditionally Significant, I = Insignificant, U = Unknown, NA = Not Applicable
TAC = Total Allowable Catch

Table 4.3.2 Criteria for determining significance of effects to cetaceans.

Effects	Score					
	S-	**CS-**	**I**	**CS+**	**S+**	**U**
Incidental take/ entanglement in marine debris	Take rate increases by >50%	Take rate increases by 25-50%	Level of take below that which would have an effect on population trajectories	NA	NA	Insufficient information available on take rates
Harvest of prey species	TAC removals of one or more key prey species increased by more than 20%	TAC removals of one or more key prey species increased by 5%-20%	TAC removals of prey species equivalent to 1998 harvests (within ± 5%)	TAC removals of one or more key prey species reduced by 5%-20%	TAC removals of all key prey species (pollock, Pacific cod, Atka mackerel) reduced by more than 20%	Insufficient information available on key prey species
Spatial/ temporal concentration of fishery	Much more temporal and spatial concentration in all key areas	Marginally more temporal and spatial concentration than 1998 fisheries	Similar temporal and spatial fishery distribution as in 1998 fisheries	Much less temporal and spatial concentration in some, but not all key areas	Much less temporal and spatial concentration in all key areas	Insufficient information as to what constitutes a key area
Disturbance	Much more disturbance (all closed areas reopened)	Marginally more disturbance (some closed areas reopened)	Similar level of disturbance as that which was occurring in 1998	NA	NA	Insufficient information as to what constitutes disturbance

S = Significant, CS = Conditionally Significant, I = Insignificant, U = Unknown, NA = Not Applicable
TAC = Total Allowable Catch

Table 4.3.7 2000 BSAI AFA catcher vessel aggregate groundfish sideboard harvests.

SPECIES	FISHERY	2000 Sideboard	2000 Harvest	Over (under)
Pacific Cod	Fixed Gear, 1/1 - 4/30	39	0	(39)
	Fixed Gear, 5/1 - 8/31	0	0	0
	Fixed Gear, 9/1 - 12/31	16	0	(16)
	Trawl, Catcher Vessel	32,316	28,498	(3,818)
	Trawl, Catcher Proc.	0	0	0
Sablefish	BS Trawl	0	0	0
	AI Trawl	0	0	0
Atka Mackerel	BS & Eastern AI Jig	0	0	0
	BS & Eastern AI Other			
	1/1 - 4/15	23	0	(23)
	9/1 - 11/1	23	0	(23)
	Central AI			
	1/1 - 4/15	1	1	0
	1/1 - 4/15 Inside CH	1	0	(1)
	9/1 - 11/1	1	0	(1)
	9/1 - 11/1 Inside CH	1	0	(1)
	Western AI			
	1/1 - 4/15	0	0	0
	1/1 - 4/15 Inside CH	0	0	0
	9/1 - 11/1	0	0	0
	9/1 - 11/1 Inside CH	0	0	0
Yellowfin Sole	BSAI	7,460	1,895	(5,565)
Rock Sole	BSAI	2,921	1,235	(1,686)
Flathead Sole	BS	2,193	1,235	(958)
Greenland Turbot	BS	233	39	(194)
	AI	6	1	(5)
Arrowtooth Flounder	BSAI	6,492	682	(5,810)
Other Flatfish	BSAI	3,975	505	(3,470)
Pacific Ocean Perch	BS	225	2	(223)
	Eastern AI	14	4	(10)
	Central AI	4	2	(2)
	Western AI	0	0	0
Other Red Rockfish	BS	5	14	9
Sharpchin / Northern	AI	7	10	3
Shortraker / Rougheye	AI	1	0	(1)
Other Rockfish	BS	12	9	(3)
	AI	2	0	(2)
Squid	BSAI	651	1	(650)
Other Species	BSAI	754	1,028	274

Source: United Catcher Boats, 2001.

Table 4.3.8 2000 GOA AFA catcher vessel aggregate groundfish sideboard harvests.

SPECIES	*FISHERY*	*2000 sideboard limit*	*2000 sideboard catch*	*Over (under)*
Pollock	Eastern GOA	3,205	0	(3,205)
	Shelikof A Season	2,339	612	(1,727)
	610 A Season	4,677	0	(4,677)
	620 A Season	69	0	(69)
	630 A Season	1,056	0	(1,056)
	Shelikof B Season	1,170	636	(534)
	610 B Season	2,339	255	(2,084)
	620 B Season	34	0	(34)
	630 B Season	528	0	(528)
	610 C Season	7,177	1,586	(5,591)
	620 C Season	864	0	(864)
	630 C Season	1,787	749	(1,038)
	610 D Season	5,981	4,954	(1,027)
	620 D Season	720	0	(720)
	630 D Season	1,489	270	(1,219)
Pacific Cod	WGOA Inshore	1,945	542	(1,403)
	WGOA Offshore	169	0	(169)
	CGOA Inshore	1,330	109	(1,221)
	CGOA Offshore	197	0	(197)
	EGOA Inshore	0	0	0
	EGOA Offshore	3	0	(3)
Flatfish Deep-water	WGOA	0	0	0
	CGOA	168	87	(81)
	EGOA	5	0	(5)
Rex Sole	WGOA	5	3	(2)
	CGOA	66	11	(55)
	EGOA	7	0	(7)
Flathead Sole	WGOA	26	1	(25)
	CGOA	49	30	(19)
	EGOA	2	0	(2)
Flatfish Shallow-water	WGOA	117	0	(117)
	CGOA	544	109	(435)
	EGOA	21	0	(21)
Arrowtooth Flounder	WGOA	24	0	(24)
	CGOA	515	39	(476)
	EGOA	8	0	(8)
Sablefish	WGOA Trawl	1	0	(1)
	CGOA Trawl	44	37	(7)
	EGOA Trawl	7	2	(5)
Pacific Ocean Perch	WGOA	6	0	(6)
	CGOA	639	383	(256)
	EGOA	57	47	(10)
Shortraker / Rougheye	WGOA	0	0	0
	CGOA	13	1	(12)
	EGOA	6	2	(4)
Other Rockfish	WGOA	0	0	0
	CGOA	3	194	191
	EGOA	0	4	4
Northern Rockfish	WGOA	0	0	0
	CGOA	138	101	(37)
Pelagic Shelf Rockfish	WGOA	0	0	0
	CGOA	0	0	0
	EGOA	9	0	(9)
Demersal Shelf Rockfish	SEO	0	0	0
Thornyhead	Gulfwide	28	9	(19)
Atka Mackerel	Gulfwide	27	0	(27)
Other Species	Gulfwide	95	5	(90)

Table 4.3.13 Estimated Total Incidental Catch of Seabirds by Species or Species Groups [a] in the Combined Bering Sea and Aleutian Islands and Gulf of Alaska Trawl Fisheries, 1993–1999

Year	Actual Number Taken [b]	STAL	BFAL	LAAL	NFUL	Gull	SHWR	Unidentified Tubenoses	Alcid	Other	Unidentified ALB	Unidentified Seabird	Total
1993	25	0	0	0	0	0	552	10	204	0	291	179	1,236
1994	45	0	0	0	166	12	170	0	0	0	0	12	360
1995	21	0	0	0	64	0	85	0	64	0	163	443	819
1996	20	0	0	0	50	12	8	19	8	12	0	770	879
1997	55	0	0	6	113	0	521	0	192	0	0	1,171	2,003
1998	45	0	0	854	794	3,620	115	5	474	5	0	30	5,897
1999	154	0	0	37	2,226	0	442	0	3,478	18	0	46	6,247
Average Annual Estimate													
1993–1996		0	0	0	74	6	179	7	61	3	104	367	801
1997–1999		0	0	305	1,124	1,229	358	2	1,500	8	0	378	4,904
1993–1999		0	0	113	462	459	244	5	594	5	65	368	2,315

Notes:
[a]Species or species group codes.
[b]Actual number taken is the total number of seabirds recorded dead in the observed hauls.
STAL – Short-tailed albatross
LAAL – Laysan's albatross
BFAL – Black-footed albatross
NFUL – Northern fulmar
Gull – Unidentified gulls (herring gulls, glaucous gulls, glaucous-winged gulls)
SHWR – Unidentified shearwaters (unidentified dark shearwaters, sooty shearwaters, short-tailed shearwaters)
Unidentified Tubenose – Unidentified procellariiformes (albatrosses, shearwaters, petrels)
Alcid – Unidentified alcids (guillemots, murres, puffins, murrelets, auklets)
Other – Miscellaneous birds (could include loons, grebes, storm-petrels, cormorants, waterfowl, eiders, shorebirds, phalaropes, jaeger/skuas, red-legged kittiwakes, black-legged kittiwakes, terns)
Unidentified ALB – Unidentified albatrosses (could include short-tailed albatrosses, Layson's albatrosses, black-footed albatrosses)

Source: Draft Table 3.5.6 from Draft Programmatic SEIS (NMFS 2001a)

Table 4.4.8 Catch history summaries and possible sideboard management approaches for Pacific cod, rock sole, and yellowfin sole using 1997 only for Pacific cod and 1995-1997 for rock sole and yellowfin sole.

	1995-1997 average annual catch by 208 Vessels only						1995-1997 average annual catch by 208 and 209 Vessels					
	Retained catch			Total catch			Retained catch			Total catch		
Sideboard species	Target fishery	Non-pollock	All targets	Target fishery	Non-pollock	All targets	Target fishery	Non-pollock	All targets	Target fishery	Non-pollock	All targets
PACIFIC COD (1997 only)	5,183	5,636	6,058	5,237	6,576	9,249	11,163	11,876	12,527	11,514	13,547	17,509
ROCK SOLE	312	1,417	1,485	794	3,410	4,144	744	1,973	2,106	1,293	4,918	6,086
YELLOWFIN SOLE	28,040	28,607	28,636	33,992	34,665	35,093	32,644	33,362	33,397	39,963	41,001	41,698

Sideboard ratios based on 1995-1997 average annual catch histories divided by average annual catches

PACIFIC COD	0.10	0.11	0.12	0.10	0.13	0.18	0.22	0.23	0.24	0.22	0.26	0.34
ROCK SOLE	0.00	0.02	0.02	0.01	0.05	0.06	0.01	0.03	0.03	0.02	0.07	0.09
YELLOWFIN SOLE	0.16	0.16	0.16	0.19	0.20	0.20	0.19	0.19	0.19	0.23	0.23	0.24

Sample 2002 sideboard amounts in mt generated by multiplying sideboard ratios by 2002 TACs

PACIFIC COD	4,379	4,762	5,119	4,426	5,556	7,815	9,433	10,035	10,585	9,729	11,447	14,795
ROCK SOLE	212	965	1,012	541	2,323	2,823	507	1,344	1,435	881	3,351	4,146
YELLOWFIN SOLE	11,668	11,904	11,916	14,145	14,425	14,603	13,584	13,883	13,898	16,630	17,062	17,352

Comparison of sideboard amounts against baseline of retained catch in all targets by 208 vessels only.

			Baseline						Alt 3 & 5		Alt 2	Alt 4
PACIFIC COD			5,119				184%	196%	207%	190%	224%	289%
ROCK SOLE			1,012				50%	133%	142%	87%	331%	410%
YELLOWFIN SOLE			11,916				114%	117%	117%	140%	143%	146%

Comparison of sideboard amounts against baseline of total catch in all targets by 208 vessels only

						Baseline						
PACIFIC COD						7,815	121%	128%	135%	124%	146%	189%
ROCK SOLE						2,823	18%	48%	51%	31%	119%	147%
YELLOWFIN SOLE						14,603	93%	95%	95%	114%	117%	119%

Comparison of sideboard amounts against baseline of total catch within target fisheries by 208 vessels only

				Baseline								
PACIFIC COD				4,426			213%	227%	239%	220%	259%	334%
ROCK SOLE				541			94%	249%	265%	163%	619%	767%
YELLOWFIN SOLE				14,145			96%	98%	98%	118%	121%	123%

Table 4.4.12 2001 AFA catcher vessel PSC sideboard amounts[1] for the BSAI.

PSC species	***Target fishery category[2] and season***	***Ratio of 1995-1997 AFA CV retained catch to total retained catch***	***2001 PSC Limit***	***2001 AFA catcher vessel PSC sideboard***
Halibut	Pacific cod trawl	0.6183	1,334	825
	Pacific cod hook-and-line or pot	0.0022	755	2
	Yellowfin sole			
	Jan. 20 - Mar. 31	0.1144	286	33
	Apr. 1 - May 20	0.1144	196	22
	May 21 - July 3	0.1144	49	6
	July 1 - Dec. 31	0.1144	380	43
	Rock sole/Flathead sole/Oth. flat			
	Jan. 20 - Mar. 31	0.2841	498	141
	Apr. 1 - July 3	0.2841	179	51
	July 1 - Dec. 31	0.2841	177	50
	Turbot/Arrowtooth/Sablefish	0.2327	0	0
	Rockfish	0.0245	69	2
	Pollock/Atka mackerel/Other sp.	0.0227	232	5
Red King Crab	Pacific cod	0.6183	11,664	7,212
Zone 1	Yellowfin sole	0.1144	11,664	1,334
	Rock sole/Flathead sole/Oth. flat	0.2841	64,782	18,405
	Pollock/Atka mackerel/Other sp.	0.0227	1,615	37
C. opilio	Pacific cod	0.6183	524,736	324,444
COBLZ[3,4]	Yellowfin sole	0.1144	2,876,981	329,127
	Rock sole/Flathead sole/Oth. flat	0.2841	469,130	133,280
	Pollock/Atka mackerel/Other sp.	0.0227	72,428	1,644
	Rockfish [5]	0.0245	40,237	986
	Turbot/Arrowtooth/Sablefish	0.2327	40,238	9,363
C. bairdi	Pacific cod	0.6183	136,400	84,336
Zone 1	Yellowfin sole	0.1144	253,894	29,045
	Rock sole/Flathead sole/Oth. flat	0.2841	272,126	77,311
	Pollock/Atka mackerel/Other sp.	0.0227	12,830	291
C. bairdi	Pacific cod	0.6183	225,941	139,699
Zone 2	Yellowfin sole	0.1144	1,246,502	142,600
	Rock sole/Flathead sole/Oth. flat	0.2841	415,501	118,044
	Pollock/Atka mackerel/Other sp.	0.0227	19,148	435
	Rockfish	0.0245	7,658	188

[1] Halibut amounts are in metric tons of halibut mortality. Crab amounts are in numbers of animals.

[2] Target fishery categories are defined in regulation at § 679.21(e)(3)(iv).

[3] *C. opilio* Bycatch Limitation Zone. Boundaries are defined at Figure 13 of 50 CFR part 679.

[4] The Council at its December 2000 meeting limited red king crab for trawl fisheries within the RKCSS to 35% of the total allocation to the rock sole, flathead sole, and other flatfish fishery category (§ 679.21(e)(3)(ii)(B)).

[5] The Council at its December 2000 meeting apportioned the rockfish PSC amounts from July 1 - December 31 to prevent fishing for rockfish before July 1, 2001.

Table 4.5.3 Summary of benefit-cost analysis.

Benefit/Cost	***Alternative 1***	***Alternative 2***	***Alternative 3 (preferred)***	***Alternative 4***	***Alternative 5***
Organizing theme	*Open access "race for fish" under pre-AFA inshore/offshore regime*	*Implement minimum requirements of AFA without changes*	*Foster development of co-ops and inter-co-op agreements with NMFS-industry co-management of pollock and sideboard fishing*	*Maximize autonomy for individual co-ops to manage pollock and sideboard fishing at the individual co-op level*	*Increased market freedom for independent catcher vessels.*
Capital and operating cost reductions	Least	This alternative allows co-ops in the catcher/processor sector but imposes higher costs (that in Alternatives 3-5) for inshore catcher vessel co-ops. Benefits are greater than for Alternative 1, but less than for Alternatives 3 to 5.	This alternative facilitates co-ops in the inshore sector as well as the catcher/processor sector. It is thus expected to produce significantly larger social net benefits than Alternatives 1 and 2.	This alternative facilitates co-ops in the inshore sector as well as the catcher/processor sector. It is thus expected to produce significantly larger social net benefits than Alternatives 1 and 2.	This alternative facilitates inshore co-op formation in a way that is similar to Alternative 3. In addition, it allows inshore catcher vessels more flexibility to switch co-ops than does Alternative 3. Therefore, it may produce larger social net benefits.
Management expenses	Least	Second least expensive	Tied for third least expensive	Most expensive due to subdivision of groundfish and PSC sideboards at co-op level.	Tied for third least expensive
Consumer benefits and revenues from abroad	Least	Higher due to cooperative flexibility	Higher due to cooperative flexibility	Higher due to cooperative flexibility	Higher due to cooperative flexibility
Impacts on other fisheries	No large and systematic distinction identified among these alternatives.				
Estimated relative ranking (from 1=highest net benefits to 5 = lowest net benefits)	5	4	2	3	1

Table 4.9.1 Cumulative effects on Steller sea lion

PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							
	Human Controlled				Natural Events			
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence? Y/N
Incidental Take	-	-	-	-	0	0	0	Y
Prey Availability	-	-	0	0	0	+ / -	+ / -	Y
Spatial/Temporal	-	-	0	0	0	0	0	Y
Disturbance	-	-	-	-	0	0	0	Y

ALTERNATIVE 1: No Action - PAST, PRESENT, AND PREDICTED

Direct/Indirect Effects of Groundfish Fishery		External Effects								
	Rating	Human Controlled			Natural Events					
Category	Alt. 1	Foreign Fisheries	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Incidental Take	I	-	-	-	0	0	0	Y	Y	N
Prey Availability	I	-	-	0	0	+ / -	+ / -	Y	Y	Y
Spatial/Temporal	CS(-)	-	-	0	0	0	0	Y	Y	Y
Disturbance	I	-	-	0	0	0	0	Y	Y	N

ALTERNATIVES 2 through 5 - PAST, PRESENT, AND PREDICTED

Direct/Indirect Effects of Groundfish Fishery		External Effects								
	Rating	Human Controlled			Natural Events					
Category	Alt. 2-5	Foreign Fisheries	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Incidental Take	I	-	-	-	0	0	0	Y	Y	N
Prey Availability	CS(+)	-	-	0	0	+ / -	+ / -	Y	Y	Y
Spatial/Temporal	CS(+)	-	-	0	0	0	0	Y	Y	N
Disturbance	I	-	-	0	0	0	0	Y	Y	

N

Table 4.9.2 Cumulative effects on great whales (ESA listed)

PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							Past Influence Y/N
	Human Controlled				Natural Events			
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	
Incidental Take	0	-	-	-	0	0	0	Y
Prey Abundance	0	0	0	0	0	+ / -	+ / -	Y
Spatial/Temporal	0	0	0	0	0	0	0	N
Disturbance	-	-	-	-	0	0	0	Y

ALTERNATIVES 1 through 5 - PAST, PRESENT, AND PREDICTED**

Direct/Indirect Effects of Groundfish Fishery		External Effects					Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
	Rating	Human Controlled		Natural Events					
Category	Alt. 1	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift			
Incidental Take	I*	-	-	0	0	0	Y	N	
Prey Abundance	I*	-	0	0	+ / -	+ / -	Y	N	
Spatial/Temporal	I	0	0	0	0	0	N	N	
Disturbance	I	-	0	0	0	0	Y	Y	N

Notes: *Effect is extremely negligible; essentially no actual effect

** Present and predicted effects are similar for all alternatives.

Table 4.9.3 Cumulative effects on other cetaceans (not ESA listed)

PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							
	Human Controlled				Natural Events			
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N
Incidental Take	-	-	0	-	0	0	0	Y
Effect on Prey	0	0	0	0	0	+ / -	+ / -	N
Spatial/Temporal	0	0	0	0	0	0	0	N
Disturbance	0	-	0	-	0	0	0	Y

ALTERNATIVES 1 through 5 PAST, PRESENT AND PREDICTED**

Direct/Indirect Effects of Groundfish Fishery		External Effects							
	Rating	Human Controlled		Natural Events					
Category	Alt. 1	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Incidental Take	I*	-	-	0	0	0	Y	N	
Effect on Prey	I*	0	0	0	+ / -	+ / -	Y	N	
Spatial/Temporal	I*	0	0	0	0	0	N	N	
Disturbance	I*	0	0	0	0	0	Y	N	

Notes: *Effect is extremely negligible, or essentially no effect. ** Past and Predicted are the same for all alternatives

Table 4.9.4 Cumulative effects on northern fur seals

PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							Past Influence? Y/N
	Human Controlled			Natural Events				
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	
Incidental Take	-	-	-	-	0	0	0	Y
Prey Availability	-	-	0	0	0	+ / -	+ / -	Y
Spatial/Temporal	-	-	0	0	0	0	0	Y
Disturbance	-	-	-	-	0	0	0	Y

ALTERNATIVES 1 through 5 - PAST, PRESENT, AND PREDICTED**

Direct/Indirect Effects of Groundfish Fishery		External Effects						Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Category	Rating	Human Controlled			Natural Events					
	Alt. 1	Foreign Fisheries	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift			
Incidental Take	I	-	-	-	0	0	0	Y	Y	N
Prey Availability	CS(-)	-	-	0	0	+ / -	+ / -	Y	Y	Y
Spatial/Temporal	CS(-)	-	-	0	0	0	0	Y	Y	Y
Disturbance	CS(-)	-	-	0	0	0	0	Y	Y	

** Past and Predicted are the same for all alternatives

N

Table 4.9.5 Cumulative effects on harbor seals

STATUS QUO PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							Past Influence Y/N
	Human Controlled				Natural Events			
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	
Take	-	-	-	-	0	0	0	Y
Prey	-	-	0	0	0	+ / -	+ / -	Y
Spatial/Temporal Distribution (prey)	-	-	0	0	0	0	0	Y
Disturbance	-	-	0	-	0	0	0	Y

ALTERNATIVES 1 through 5 **- PAST, PRESENT, AND PREDICTED

Direct/Indirect Effects of Groundfish Fishery		External Effects					Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Category	Rating	Human Controlled		Natural Events					
	Alt. 1	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift			
Take	I*	0	-	0	0	0	Y	N	
Prey	I*	-	0	0	+ / -	+ / -	Y	N	
Spatial/Temporal	I*	-	0	0	0	0	N	N	
Disturbance	I	-	0	0	0	0	Y	Y	N

Notes: *Extremely negligible effect not seen at the population level; essentially no effect.
**Present and predicted effects for are the similar for all alternatives.

Table 4.9.6 Cumulative effects on other pinnipeds

PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							
	Human Controlled				Natural Events			
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N
Incidental Take	-	-	-	-	0	0	0	Y
Effects on Prey	-	-	0	0	0	+ / -	+ / -	Y
Spatial/Temporal	0	0	0	0	0	0	0	N
Disturbance	-	-	-	-	0	0	0	Y

ALTERNATIVES 1 through 5 **- PAST, PRESENT, AND PREDICTED

Direct/Indirect Effects of Groundfish Fishery		External Effects							
	Rating	Human Controlled		Natural Events					
Category	Alt. 1	Other Fisheries	Subsistence Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Take	I*	0	-	0	0	0	Y	N	
Prey	I*	-	0	0	+ / -	+ / -	Y	N	
Spatial/Temporal	I*	-	0	0	0	0	N	N	
Disturbance	I	-	0	0	0	0	Y	Y	N

Notes: *Extremely negligible effect not seen at the population level; essentially no effect.
**Present and predicted effects for are the similar for all alternatives.

Table 4.9.7 Cumulative effects on sea otters

PAST INFLUENCE

Direct/Indirect Effects of Groundfish Fishery	External Effects							
	Human Controlled							
Category	Foreign/Joint Venture Fisheries	Other Fisheries	Subsistence Harvest	Commercial Harvest	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N
Take	-	-	-	-	0	0	0	Y
Prey	0	0	0	0	0	+ / -	+ / -	N
Spatial/Temporal	0	0	0	0	0	0	0	N
Disturbance	0	-	-	-	0	0	0	N

ALTERNATIVES 1 through 5- PAST, PRESENT, AND PREDICTED**

Direct/Indirect Effects of Groundfish Fishery		External Effects								
	Rating	Human Events			Natural Events					
Category	Alt. 1	Other Fisheries	Subsistence Harvest	Pollution	Short-term Climate	Long-term Climate	Regime Shift	Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
Take	I*	-	-	-	0	0	0	N	N	
Prey	I*	-	0	0	0	+ / -	+ / -	N	N	
Spatial/Temporal	I*	0	0	0	0	0	0	N	N	
Disturbance	I*	0	0	0	0	0	0	N	N	

Notes: *Effect is extremely negligible; essentially no effect.
** Present and Predicted for effects are the same for all alternatives.

Table 4.9.8 Cumulative effects on pollock.

PAST EFFECTS

Direct/Indirect Effects of Groundfish Fishery	Past External Effects							Lingering Past Influence? Y/N
	Human Controlled				Natural Events			
Category	**Foreign Fisheries**	**JV**	**Seal Harvest**	**Whaling**	**Short-term Climate**	**Long-term Climate**	**Regime Shift**	
Fishing Mortality	-	-	+	+	0	0	0	Y
Spatial Temporal Conc.	U	U	0	0	0	0	0	N
Habitat Suitability	0	0	0	0	+/-	+/-	+/-	Y
Prey Availability	+	+	0	+	+/-	+/-	+/-	Y

ALTERNATIVES 1 through 5

Direct/Indirect Effects of the Groundfish Fishing		External Effects				Lingering Past Influence Y/N	Cumulative Effect Y/N	Conditionally Significant Y/N
	Rating	**Human Controlled**	**Natural Events**					
Category		**Russian Fishing**	**Short-term Climate**	**Long-term Climate**	**Regime Shift**			
Fishing Mortality	I	-	0	0	0	Y	Y	N
Spatial Temporal Conc.	I	0	0	0	0	N	N	
Habitat Suitability	I	0	+/-	+/-	+/-	Y	Y	N
Prey Availability	I	0	+/-	+/-	+/-	Y	Y	N

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AFA EIS
C-0083

Dr. James Balsiger
Regional Administrator
NMFS- F/AKR
P.O. Box 21668
Juneau, AK 99802

December 9,2001

Re: Draft EIS for the American Fisheries Act (Amendments 61/61/13/8)

Dear Dr. Balsiger:

The Groundfish Forum has reviewed NMFS' draft EIS on the American Fisheries Act and appreciates the opportunity to provide comment on this important action. In our comments below, we focus on two areas where we feel the draft could be improved, specifically the section on potential effects of the action on spectacled eiders (Section 2.9.1) and Section 3.3.4 which evaluates affected fishing communities. We hope that NMFS will give sufficient consideration to the revisions we propose because we feel the draft document does not currently reflect the best available data and scientific information.

<u>Section 2.9.1 Spectacled Eiders page (2-43)</u>. This section lists bottom trawling as a possible cause for the decline in the population of spectacled eiders. The document argues that bottom trawling would negatively affect benthic habitat in marine areas proposed for designation as critical habitat (CH) for spectacled eiders off Alaska in 1999. For several reasons, we feel this assertion is baseless and that this section should be revised to be very clear that there is sufficient evidence to conclude that bottom trawling does not and has never occurred in areas designated as CH for spectacled eiders. Further, if it is still even necessary to postulate that benthic disturbance, such as the disturbance that occurs from on-bottom trawling, could conceivably negatively affect benthic habitat used by eiders (if trawling were to occur there), then the document should be careful to point out that this theory has never been tested empirically.

It is true that if trawling occurred in areas used by spectacled eiders, there is scientific evidence for the expectation that trawling would create benthic disturbance and could modify substrates and benthic communities. There is, however, no scientific information to support the EIS' theoretical expectation that such disturbance would necessarily have any effect on eiders or would necessarily have a negative effect on them. The degree of trawl disturbance would have to be considered relative to other types of natural disturbance that routinely occur in the shallow areas used by spectacled eiders: storm surges, ice edge movements, and foraging from walruses and whales. At this point, we believe there is no more scientific evidence to conclude that trawl disturbance would negatively affect foraging opportunities for spectacled eiders as it would affect it positively, or have no measurable effect. It is certainly possible that trawling at low levels of intensity could do nothing more than serve to increase the exposure of certain types of invertebrates that spectacled eiders eat, thus facilitating their feeding. *An* empirical determination of the direction of effects by trawling, if trawling occurred in CH areas, would likely have to consider the intensity of trawling relative to natural disturbances and how trawling affected substrates in terms of area, season, degree of physical impact, etc. Given the untested nature of the theoretical discussion of potential trawl effects in the document?and the fact that trawls are not even fished in the areas in question, we suggest that the statement that trawling is a potential cause of the decline on spectacled eiders or a potential source of negative effects on their habitat be deleted.

In 1999, United States Fish and Wildlife Service released for public comment a proposed rule to designate critical habitat for spectacled eiders. Comments submitted by the At-sea Processors Association challenged the assertion in the proposed rule that bottom trawling affects areas proposed for critical habitat for spectacled eiders. This industry comment pointed out that NMFS' observer data and other relevant information indicates that bottom trawling does not even occur in any of the areas proposed for spectacled eiders CH designation. Fish and Wildlife's mistaken assumption that bottom trawling occurs in areas proposed for CH was acknowledged in a presentation to the North Pacific Fishery Management Council in 2000 by a representative of Fish and Wildlife Service who sits on the North Pacific Fishery Management Council. Further, the final rule on that proposed action (February 6,2001 Federal Register vol. 66 number 25, pages 9145-9185) reflected this correction.

We feel that NMFS' EIS on the American Fisheries Act should reflect that Fish and Wildlife has already acknowledged its initial mistake and avoid the continued dissemination of incorrect information. Further, the listing of bottom trawling as a potential cause of negative effects on CH, if trawling occurred there, is not substantiated empirically and overlooks the theoretical possibility that trawling would have no effect or even positive effects under certain conditions. While the AFA is not an action that is closely related to effects on sea birds, we feel that it is important these deficiencies are corrected in this public document.

<u>H&G Employment information presented in the EIS</u>: Page 3-157 of the AFA EIS draft document presents information on the estimated number of persons employed in the non-AFA qualified trawl catcher processor sector. That sector is referred to in the document as the "H&G sector" (heading and gutting of fish as the predominant type of primary processing). The estimated employment of the sector is reported in a standardized format of units referred to as "full time equivalents" (FTE) employment units.

Groundfish Forum believes that the baseline employment information reported in the draft EIS greatly understates the actual FTE employment attributable to the H&G sector. The analysis attempts to describe employment on H&G vessels in 1992 and 1996. This is a period of time when there were more active H&G vessels than today (approximately 30 compared to 24 in 2001) and the number of laborers per vessel was likely slightly greater than today due to an increase in the use of labor-reducing equipment in recent vears. Despite the fact that today's numbers of FTE employment would be expected to be somewhat lower than for the time periods described in the document, we estimate that the number of FTEs currently attributable to the H&G sector is 1,535. By way of contrast, the AFA EIS reports only 572 FTEs in 1992 and 796 in 1996.

In the attached information, we have attempted to provide a reasonable estimate of current employment on H&G vessels. The explanation also details how we derived our estimates. We believe the industry information that went into our estimation accurately reflects current technical labor specifications for the fishing vessels in question which are exclusively engaged in the fisheries off Alaska. The methodologies applied in the estimation are standard, as described in the attached information on FTE employment calculation.

In light of the discrepancy, we hereby request NMFS review the information we have provided and consider revising the AFA report. Although we do not have employment information for other fishing sectors described in the report, it may be prudent to review that information as well. If contacted, the trade associations for the other fishing sectors may be able to provide their own data and estimates as well.

Thanks in advance for providing this opportunity to comment on the draft EIS on the American Fisheries Act. Please feel free to contact us if you have questions or require additional information.

Sincerely,

John R. Gauvin
Director

Groundfish Forum's Evaluation of the Number of Full Time Equivalent Jobs for the H&G Fleet as Estimated in the Draft Environmental Impact Statement for the American Fisheries Act

On page 3-157 of the Draft Environmental Impact Statement, the analysis estimated that the H&G fisheries employed between 572 (1992) and 769 (1996) full time equivalentjobs. We believe this underestimates the full time equivalentjobs of the H&G sector. Please consider the methodology and spreadsheet below.

Calculation of Full Time Equivalent Jobs (FTE)
A FTE job is defined as a job for each 2000 hours of employment regardless of how many people work those hours.[1]

Key points for the attached spreadsheet:

- Fishing days is the estimated number of days a vessel is fishing/processing per year.
- Full crew is the estimated number of people on the vessel when it is fishing/processing.
- Transit days are the estimated number of days a vessel is in transit to or from Alaska per year. Transit days require 25% of the full crew.
- Other days is an estimate of any other day a crew is used, but the vessel is not fishing or in transit, i.e., at dock for preparation for beginning a season, loading/unloading and ending of a season. Other days require 10% of the full crew.

The following is a method to more accurately estimate the number of FTE's annually employed on the H&G fishing vessels actively engaged in fishing/processing in the fisheries off Alaska.

Calculation of the number of FTE's for each vessel:

1. Multiply the number of full crew for each vessel by the number of fishing days.
2. Multiply the number of full crew for each vessel by the number of transit days for the vessel, multiplied by 0.25, representing the 25% crew needed on the vessel during transit days.
3. Add the sums of 1 and 2 above, multiply by 16 for the number of hours a crew member works per day on a vessel when the vessel is fishing and transiting.
4. Divide by 2000, which represents the number of hours of employment in a year to constitute an FTE.
5. Multiply the number of full crew for each vessel by the number of other days for the vessel, multiplied by 0.10, representing the 10% crew needed on the vessel during other days.
6. Multiply the sum of 5 above by 10 for the number of hours a crew member works per day on a vessel when the vessel is using crew for days other than when fishing or transiting.
7. Divide by 2000, which represents the number of hours of employment in a year to constitute an FTE.
8. Add the sums of 4 and 7 to get the FTE's for each vessel.

---

[1] Source: The New York Sea Grant Institute: The Economic Contribution of the Sport Fishing, Commercial Fishing, and Seafood Industries to New York State; Executive Summary Overview.

Alaska Groundfish Fishery H&G Fleet
Full Time Equivalent Jobs

Active H&G Vessels	***Length***	***Full Crew***	***Fishing Days***	***Transit Days***	***Other Days***	***FTEs***
Golden Fleece	104	12	240	14	111	24.0
Arica	186	45	240	14	111	90.2
Cape Horn	156	32	240	14	111	64.1
Rebecca Irene	140	30	240	14	111	60.1
Unimak Enterprise	184	45	240	14	111	90.2
Constellation	165	32	240	14	111	64.1
Defender	124	18	240	14	111	36.1
Enterprise	124	18	240	14	111	36.1
Alaskan Rose	124	18	240	14	111	36.1
Seafisher	211	48	240	14	111	96.2
Vaerdahl	115	18	240	14	111	36.1
Legacy	132	24	240	14	111	48.1
Alliance	107	12	240	14	111	24.0
Ocean Peace	220	48	240	14	111	96.2
Alaska Seafreeze	297	56	240	14	111	112.2
Alaska Juris	238	49	240	14	111	98.2
Alaska Ranger	204	48	240	14	111	96.2
Alaska Spirit	227	48	240	14	111	96.2
Alaska Victory	221	48	240	28	97	97.2
Alaska Warrior	215	48	240	28	97	97.2
U.S. Interpid	185	36	240	14	111	72.1
America No. 1	160	32	240	14	111	64.1
Totals		**765**	**5280**	**336**	**2414**	**1534.7**

Fishing Days/full crew
Transit days/25% crew
Other days/10% crew
FTE - 2000 hours/yr.
16 hour work days

The Economic Contribution of the Sport Fishing, Commercial Fishing, and Seafood Industries to New York State

New York has a diverse economy with concentrations of employment in many industries including the sport fishing, commercial fishing, and seafood industries. This report presents the results of a study to estimate the contribution of these three industries to the state's economy, an estimate that had previously been unknown. The study was sponsored by New York Sea Grant and conducted in consultation with an Advisory Committee of stakeholders from industry and government.

Economic contribution is expressed in terms of dollar value (in 1999 dollars) and employment. Employment contributions have two parts – jobs in the industries themselves and full-time equivalent jobs created as an impact of the economic activity within the three industries. The two employment impacts are not additive because one is measured in jobs and the other in full-time equivalent jobs (i.e., a job for each 2000 hcurs of employment regardless of how many people work those hours). The dollar value of economic contribution is also expressed in two ways— first, the value of activity in the industiy itself, and then the impact of this activity on total output (i.e., the sales of goods and services by New York businesses).

The economic contribution of the sport fishing, commercial fishing, and seafood industries are presented below. First, the overall contribution of the three industries combined is presented and then each individual industry.

It is useful to note that, although the three industries are presented collectively here, comparisons across these three industries are difficult. Sport fishing is an industry with customers who are final consumers of these recreational services and goods. As a result, the impacts made by anglers are the final contribution to the economy. By contrast, commercial fishing, like farming, is the beginning of a chain of value-added events each of which contribute to the economy. Almost all fish landed by commercial fishers are sold to seafood industry establishments which process, distribute, prepare, or sell at retail the fish or seafood harvested by commercial fishers. The seafood industiy is a mix of establishments, all buying fish and seafood from other businesses. Some seafood industiy establishments like restaurants and retail markets sell directly to final consumers, but many others sell their products to other seafood industry establishments. Each time one seafood establishment sells its products to another seafood establishment (rather than a final consumer), there is another opportunity to add value and to increase the industry's overall contribution to the economy.

Given the close ties between the commercial fishing and seafood industries, these industries can be seen as one integrated industry. In response to the original charge for this study, this report presents them as separate industries.

The estimates of economic contribution were made using an econometric model. Basic expenditures for each industry were the drivers for these estimates, which were made using inputs from the IMPLAN

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Dec. 10, 2001

AFA EIS
C-0002

AFA Summary Comments on EIS Conclusion: Alternative 5 More Efficient than Alternative 3

- **Conclusion by assumption**
  No evidence whatsoever was provided to support the argument that Alt 5 is more efficient than 3.

- **The conclusion is internally inconsistent**
  The summary statement highlights the inconsistency, noting that this EIS can't be certain Alt **3** is less efficient than Alt 5.

- **Fails to examine all empirical evidence**
  - **No mention of cross-cooperative consolidation**
    Four vessels changed cooperatives.

  - **"Market Freedom" was maintained,**
    None of the 4 vessels spent a year in open access.

  - **There was no additional consolidation.**
    The central hypothesis is falsified by the facts. Table 4.5.1 suggests consolidation occurred before cross-cooperative acquisition. More importantly, there is no discussion of possible efficiency losses that may have resulted in the processing sector.

  - **There is no discussion of impacts in the processing sector.**
    This **EIS** focuses on vessels, with the one lone exception in the distribution section. The central concern of processors (wealth redistribution) is ignored.

- **Why are there neither citations nor discussion of germane, peer-reviewed literature?**
  - Matulich et al 2001 is published and the NPFMC had copies – released with permission from the editor – months before this EIS hit the web.

  - The authors had copies of the submitted version of the above paper because the Chairman invited it into the June hearing.

- **Comparison of the alternatives is revisionist,**
  AFA would never have passed under Alt 5 rules.

14.4

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January 20, 2000

VIA FAX to (907) 586-7465

Sue Salveson
Assistant Regional Administrator
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802
Attn: Lori Gavel

Re: Section 210(c) of the American Fisheries Act

Dear Ms. Salveson:

We write to you on behalf of Greenpeace concerning section 210(c) of the American Fisheries Act (AFA). Specifically, we want to discourage any reliance by NMFS on the Office of General Counsel's legal opinion on the meaning of section 210(c) of the act. These comments expand on and memorialize the testimony we presented to the Council last month. This letter also responds to the Federal Register notice and request for comments on the AFA dated January 5, 2000 by addressing our NEPA concerns with implementation of the AFA.

Given the intense pressure the huge groundfish fishery puts on the Bering Sea ecosystem -- as evidenced by declining populations of so many Bering Sea marine mammal and seabird species -- and a dangerous overcapitalization of that fishery that makes it non-sustainable, it is in our interest to further the decapitalization and rationalization purposes of the AFA. If the fishery is conducted in a sustainable manner, the participation in the fishery of coastal Alaska residents offers great hope on a challenging economic landscape. As importantly, the participation of local residents in a fishery that occurs in the environment which sustains so many other aspects of life in coastal Alaska only makes sense. The people of Alaska's Bering Sea coast are an important part of that ecosystem, and the congressional guarantee that they can directly participate in commercial fisheries ensures that they remain in position to be its greatest stewards.

These principles are firmly embodied in the law, including section 210(c) of the AFA and elsewhere. And it is these principles which are undermined by OGC's interpretation of section 210(c).

Section 210(c) provides:

> (c) CATCHER VESSELS TO CATCHER/PROCESSORS. --
>
> Effective January 1, 1999, not less than 8.5 percent of the directed fishing allowance under section 206(b)(2) shall be available for harvest only by the catcher vessels eligible under section 208(b). The owners of such catcher vessels may participate in a fishery cooperative with the owners of the catcher/processors eligible under paragraphs (1) through (2) of section 208(e). The owners of such

> catcher vessels may participate in a fishery cooperative that will be in effect during 1999 only if the contract implementing such cooperative establishes penalties to prevent such vessels from exceeding in 1999 the traditional levels.

American Fisheries Act, § 210(c) (emphasis added).

Rather than look to the plain meaning of this provision and its legislative history, OGC looks to other provisions of the AFA to determine whether Congress intended the 8.5% to be a directed fishing allowance available only to the 208(b) catcher vessels. It then concludes that:

> in section 210(c), Congress uses the phrase "available for harvest only by the catcher vessels" to allocate part of the offshore directed fishing allowance as a set aside for the offshore catcher vessels. It does not state that at least 8.5% "shall be allocated as a directed fishing allowance" for harvest by the catcher vessels. Therefore, notwithstanding the word "only" in the first sentence, we believe Congress intended to protect the offshore catcher vessels' historical harvesting opportunities by ensuring at least 8.5% of the offshore pollock TAC would be available to them as a group. This goal is accomplished in the first sentence. From the inclusion of the second sentence authorizing the formation of a cooperative between the catcher vessels and the named catcher/processors immediately following the first sentence, we infer that Congress somehow was relating the set-aside with the formation of a cooperative. We believe this strongly suggests that Congress anticipated that the catcher vessels would bring the 8.5% to a co-op if a co-op were formed.

Memo from Lisa Lindeman, OGC, to Steve Pennoyer, May 26, 1999. OGC thus concludes that the 8.5% is not available only to catcher vessels, as the Act states, but may be harvested by catcher/processors as well. This interpretation turns the language of the statute on its head.

This is not, however, "a difficult provision to interpret", as OGC states. A reading of the plain meaning of the statute compels the conclusion that 8.5 percent of the 40 percent of the harvest allocated to catcher/processors in section 206(b)(2) can be harvested "only" by catcher vessels. AFA, Section 210(c). As a quick reference to a dictionary confirms, the word "only" means "solely" or "exclusively." New Lexicon Webster's Dictionary (1989 ed.). Given the clarity of this statutory provision, no further analysis is necessary. See, e.g., Demarest v. Manspeaker, 498 U.S. 184, 190 (1991) (when the terms of a statute are unambiguous, judicial inquiry is complete except in rare and exceptional circumstances).

Moreover, although it is unnecessary to consult it, the legislative history of section 210(c) speaks directly to this issue. The conference report states:

> Subsection (c) requires at least 8.5 percent of the pollock allocated under section 206(b)(2) for processing by catcher/processors to be available for harvesting by the catcher vessels eligible under section 208(b). This requirement will help ensure that the traditional harvest of those catcher vessels will not be reduced.

129 Cong. Rec. S12780 (Oct. 21, 1998) (emphasis added). This legislative history underscores the plain meaning of section 210(c) and further provides Congress' reasoning for including this important provision within the law: decapitalizing and rationalizing the fishery by ensuring that a certain portion of the off-shore harvest is caught only by the section 208(b) boats. To allow otherwise would render the 8.5% allocation a nullity, because the cooperative could enter into an agreement that allows the entire catch of this industry sector to be caught by catcher/processors.

As we stated in our testimony to the Council last month, the effect of such an interpretation is to undermine the decapitalization and rationalization intent of the AFA. If the section 208(b) catcher vessels are not required to harvest their quota themselves, and yet get paid for it anyway, this leaves them free to fish more heavily in other fisheries. Although they are capped at their traditional participation in the non-pollock fisheries by the section 211 sideboards,[1] it is much more likely that these vessels will actually fish in those other fisheries, thereby increasing the race for fish and the competition in non-pollock fisheries. We are aware of at least two of these boats that are fishing full time in the Gulf of Alaska and Aleutian Islands while their co-op share is being fished by factory trawlers. It is counter to the intent of the idea of "sideboards" to allow vessels that specifically asked for the AFA in order to relieve the overcapitalization in the pollock fishery to lease their quota and move into any fishery where the TAC is currently being taken. Such an effect cannot be squared with the intent of the law.

Perhaps more fundamentally, though, allowing leasing of this quota share effectively creates an illegal individual fishing quota (IFQ). The Magnuson-Stevens Act contains a moratorium on the creation of new IFQs through October 1, 2000. 16 U.S.C. § 303(d)(1)(A). The AFA does not repeal this provision with respect to the North Pacific, and repeals by implication are extremely disfavored. In re Glacier Bay, 944 F.2d 577, 581 (9th Cir. 1991). Allowing these eight boats to freely lease their quota shares creates the equivalent of an IFQ, which is explicitly barred by the MSA.

We offer these views to discourage any reliance on OGC's section 210(c) legal opinion and urge that the 8.5% of the harvest allocated by Congress to catcher vessels remain solely with those vessels. Action taken consistent with OGC's opinion would undermine the substantive promise of the AFA to "decapitalize, rationalize, and Americanize" the North Pacific fishery. It would also result in a direct violation of the AFA. Further, this interpretation results in the creation of a new IFQ, in direct violation of the MSA.

Finally, we state once again that NMFS must prepare an environmental impact statement (EIS) on the implementation of the AFA. NEPA requires an EIS for any action that may significantly affect the quality of the human environment. 42 U.S.C. § 102(2)(C). Effects can be significant "even if on balance the agency believes that the effect[s] will be beneficial." 40 C.F.R. § 1508.8. There can be little question that, by radically altering the prosecution of the Bering Sea pollock fisheries, the AFA has had, and continues to have, a significant affect on the human environment, especially in terms of the human participants in that fishery. Many of the effects of the AFA are highly uncertain and highly controversial. It is quite possible that there may be adverse effects on the endangered Steller sea lion resulting from the increased rate at which the inshore fleet has harvested its quota under the act. All of these factors point in the direction of necessitating an EIS. See 40 C.F.R. § 1508.27(b). Furthermore, many of the measures of the AFA are being implemented piecemeal, with a new analysis each time a new idea is presented. This kind of segmentation is not allowed under NEPA. See 40 C.F.R. § 1598.27(b)(7); Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1215 (9th Cir. 1998), cert. denied, ___ U.S. ___ (1999) (significance cannot be avoided by breaking down an action into small component parts). As with the 2000 TAC specifications, NMFS may not "tier" its EA for the AFA to the 1998 SEIS. We hereby incorporate by reference our Jan. 12, 2000 comments on the TAC specifications on this issue and will not repeat those arguments here. In conclusion, because the AFA has not only potential, but actual, significant environmental impacts, implementation of the AFA must be addressed in an EIS and the current EA/FONSI is inadequate.

[1] With respect to the sideboards, we hereby adopt by reference previous comments submitted on this issue on behalf of the Alaska Marine Conservation Council. See Letters of January 29, 1999 and June 1, 1999.

Thank you for your consideration of our comments on this matter. As always, should you have any questions or comments, please do not hesitate to call.

Sincerely yours,

Jack Sterne
Staff Attorney

cc: Steven Pennoyer
Richard B. Lauber
Sen. Ted Stevens
David Benton

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A Nonprofit Public Interest Law Firm Providing Counsel to Protect and Sustain Alaska's Environment

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June 1, 1999

Richard B. Lauber, Chairman
North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501-2252

Re: Catcher/Processor Sideboards Under § 211(b)(2) of the AFA

Dear Mr. Lauber:

Please accept these comments with respect to the catcher/processor sideboards under section 211(b)(2) of the American Fisheries Act (AFA or Act). Trustees for Alaska submits these comments on behalf of the Alaska Marine Conservation Council (AMCC). We previously submitted comments to NMFS explaining our understanding of this section of the AFA. We now provide that interpretation to the Council, together with additional observations.

As an initial and overriding matter, we note that NMFS, the Council, and the catcher/processor fleet have all advanced an interpretation of section 211(b)(2) that results in identically-worded statutory provisions being interpreted inconsistently with each other. This interpretation grants the catcher/processor coop groundfish "caps" based upon their non-pollock and pollock fishing history, PSC "caps" from non-pollock fishing history only, and then applies both "caps" only to non-pollock fishing by coop vessels. This distorted result turns the will of Congress – to reduce bycatch and provide protections for other fisheries – on its head. It thus nullifies the main conservation benefit that could be realized from implementation of this provision. As detailed below, the text of the statute, accepted conventions of statutory construction, the legislative history, and common sense all mandate that section 211(b)(2) must result in hard caps that apply equally to both pollock and non-pollock fishing, and are calculated based on historical participation in both fisheries.

Our starting point is the language of the Act itself. The section of the AFA entitled "Protections for Other Fisheries; Conservation Measures" contains the following subsection:

> (2) BERING SEA FISHING. – The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from, <u>in the aggregate</u>—
>
> > (A) exceeding the percentage of the harvest available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total harvest by

> such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997.
>
> (B) exceeding the percentage of the prohibited species available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total of the prohibited species harvested by such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount of prohibited species available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997.

AFA § 211(b)(2) (emphasis added). Thus, the Act sets absolute caps on the amounts of directed catch (subparagraph (A)) and "prohibited species" catch (subparagraph (B)), and then creates a formula for calculating those caps. Significantly, the Act uses identical language to establish the formula for each type of catch.

First, the provision, by its plain language, applies "in the aggregate." In other words, when all of the catch brought in by the listed catcher/processors is totaled, it will not exceed the amounts set forth in subsections (A) and (B). Thus, bycatch taken in the directed pollock fisheries will count against the aggregated caps established in subsections (A) and (B). This interpretation is supported not only by the text of the statute, it is the only one that is consistent with Congress' intent to reduce bycatch and protect other fisheries.

Second, accepted conventions of statutory construction also favor our interpretation. It is textbook law that similar language must be interpreted similarly. This canon is supported by common sense, as it is only logical that the same language must mean the same thing each time it is used. As stated earlier, NMFS and the Council have so far interpreted identical language in subsections (A) and (B) in different ways, both of which fail to secure the conservation promise of the AFA. With respect to the groundfish caps in subsection (A), all fish harvested will count toward the caps - including bycatch in the pollock fishery. However, these are not true caps because once reached only non-pollock fishing is closed to coop vessels. These vessels may continue to harvest these groundfish species in the pollock fishery. With respect to prohibited species, the caps only apply to the non-pollock fisheries. Thus, despite virtually identical statutory language for paragraphs A and B, NMFS calculated paragraph A using both pollock and non-pollock history, while calculating paragraph B using only non-pollock history, and yet manages both for non-pollock fishing only. This interpretation violates the canon of statutory construction that similar language must be interpreted in the same way and mocks the will of Congress.

Notably, these interpretations undercut the conservation intent of the Act. The subparagraph (A) interpretation grants those boats groundfish caps in other fisheries that are not true caps, while the subparagraph (B) interpretation conflicts with the paragraph (A)

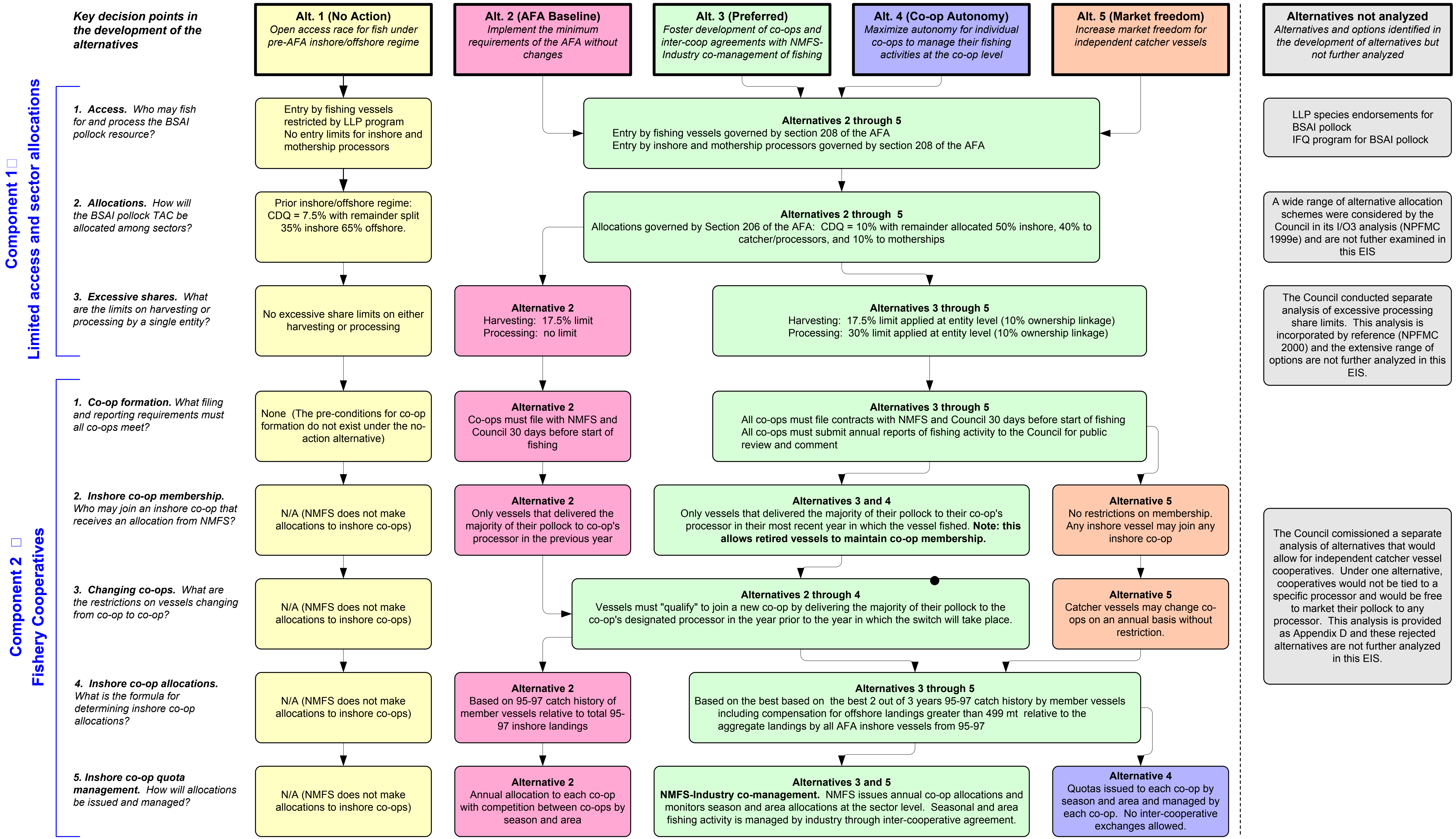


Figure 2.1.1 **Decision tree showing main decision points in the development of the five alternatives.**

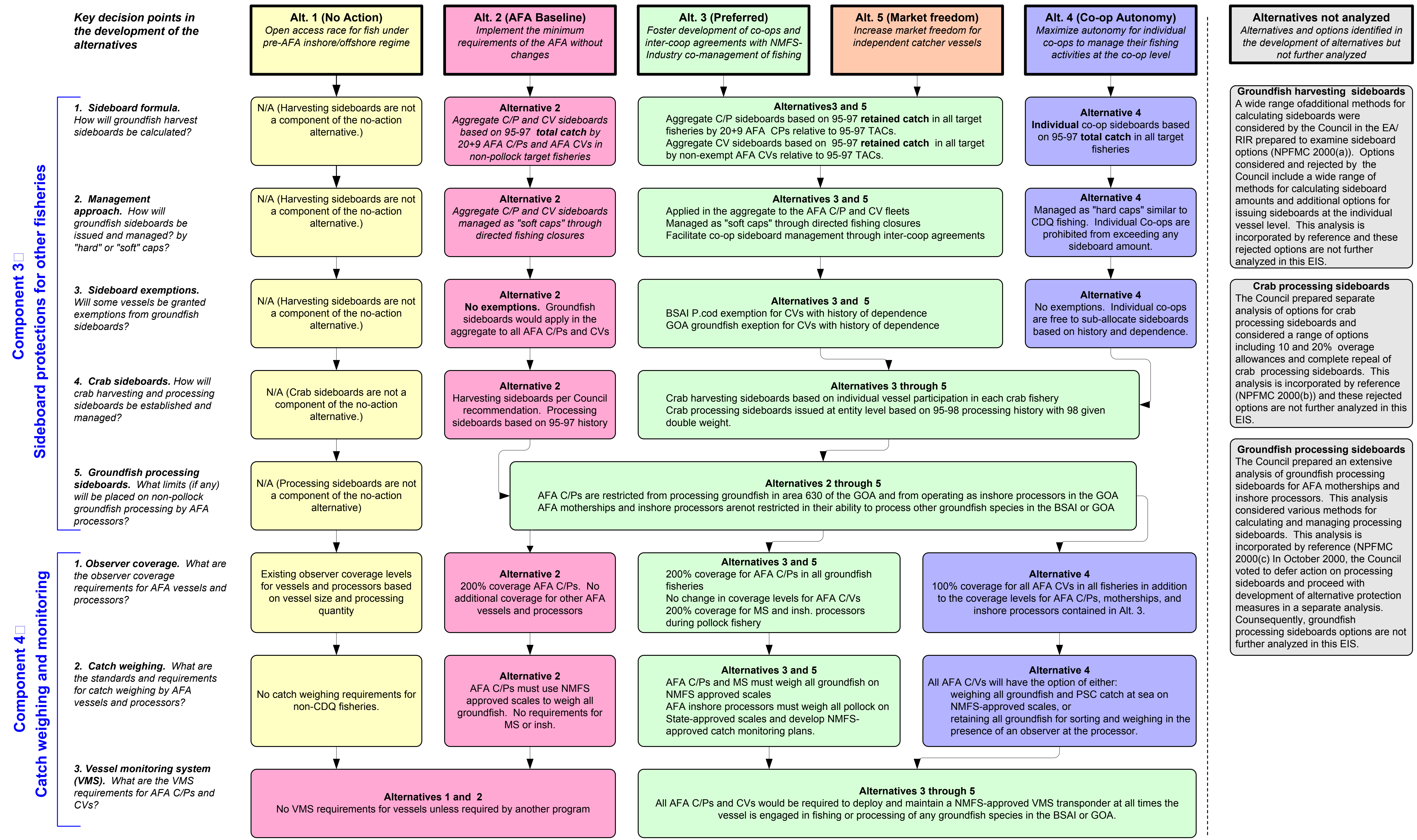


Figure 2.1.1 Decision tree showing main decision points in the development of the five alternatives (Continued).

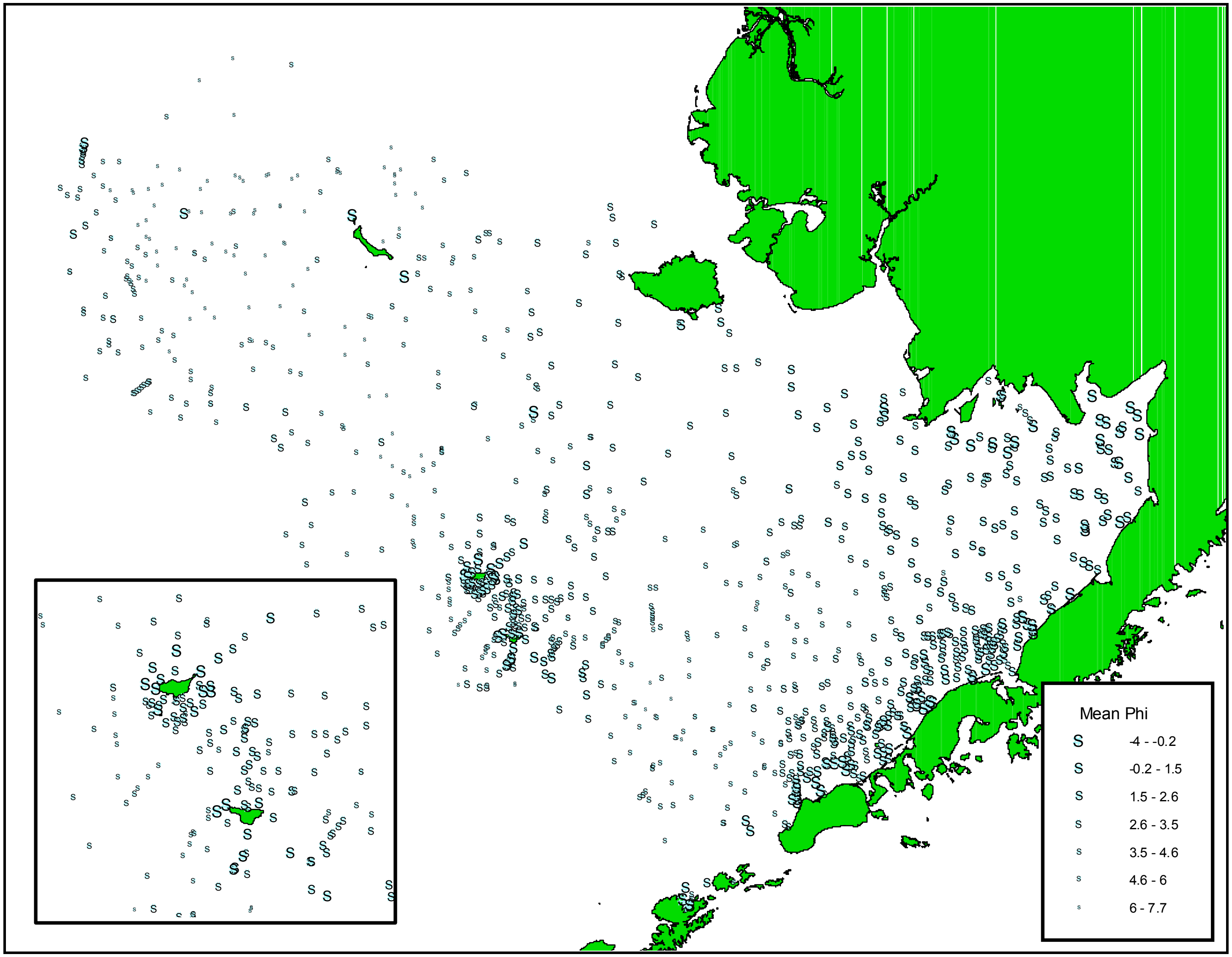


Figure 3.1.2 **Mean diameter of sediment grains at 994 sample locations. Inset is larger-scale view of St. George and St. Paul Pribilof Islands and vicinity. Source: Smith and McConnaughy 1999).**

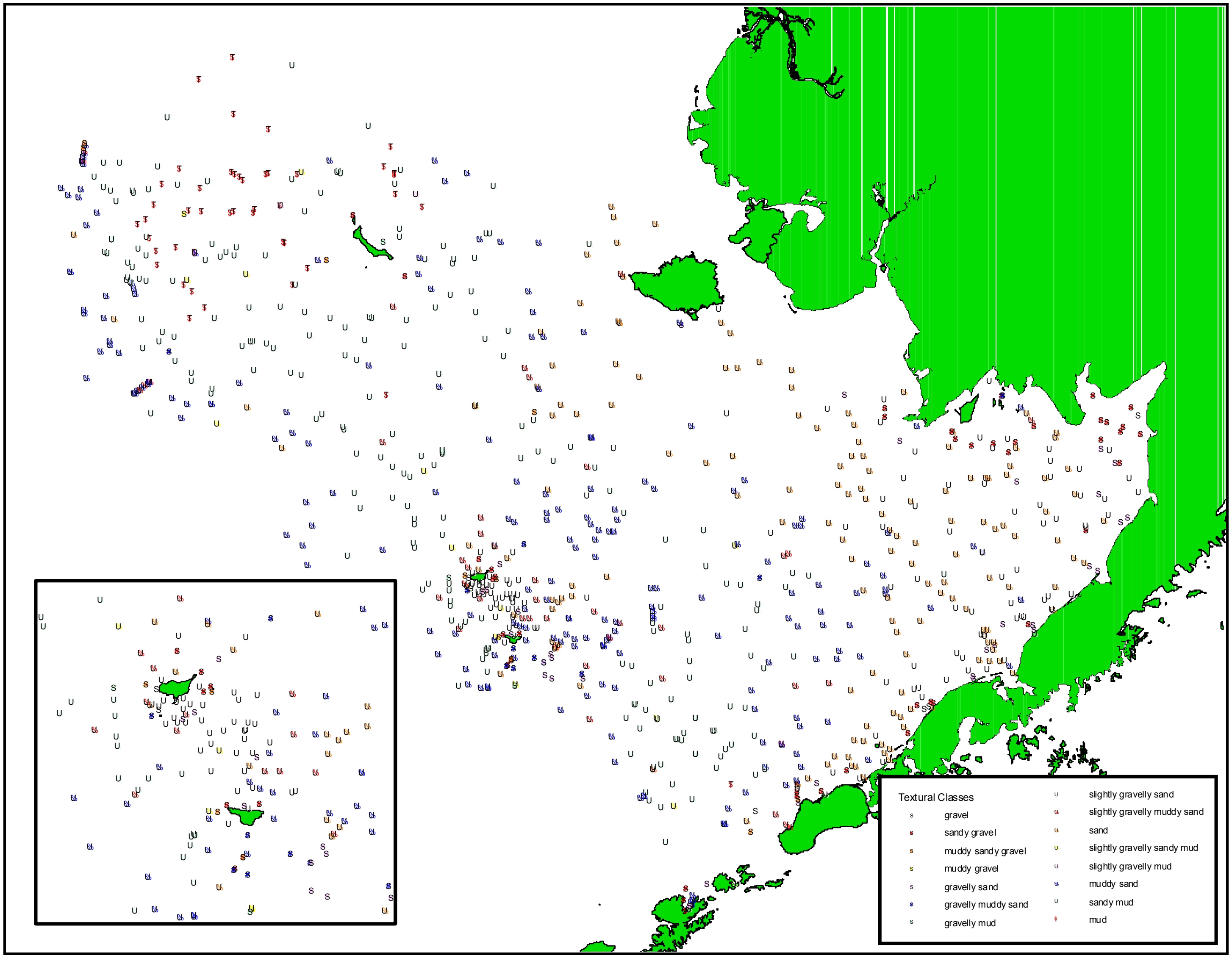


Figure 3.1.3 High resolution textural class of grain size analysis samples. Source: Smith and McConnaughey 1999).

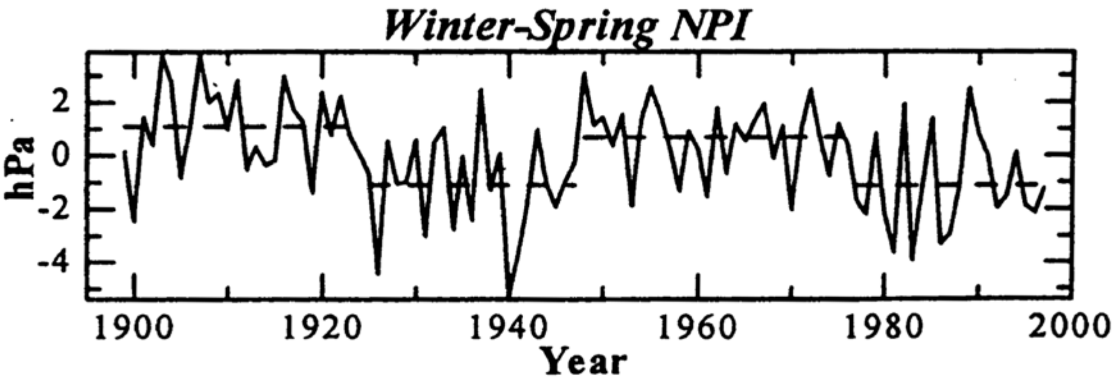


Figure 3.1.5 **The North Pacific Index (NPI) , area-averaged Sea Level Pressure anomaly in the region 160E-140W, 30-65N over winter-spring (Dec.-May) seasons (solid curve), and the respective averages for 1899-1924, 1925-1947, 1948-1976, and 1977-1997 (dashed lines), (Minobe, 1999).**

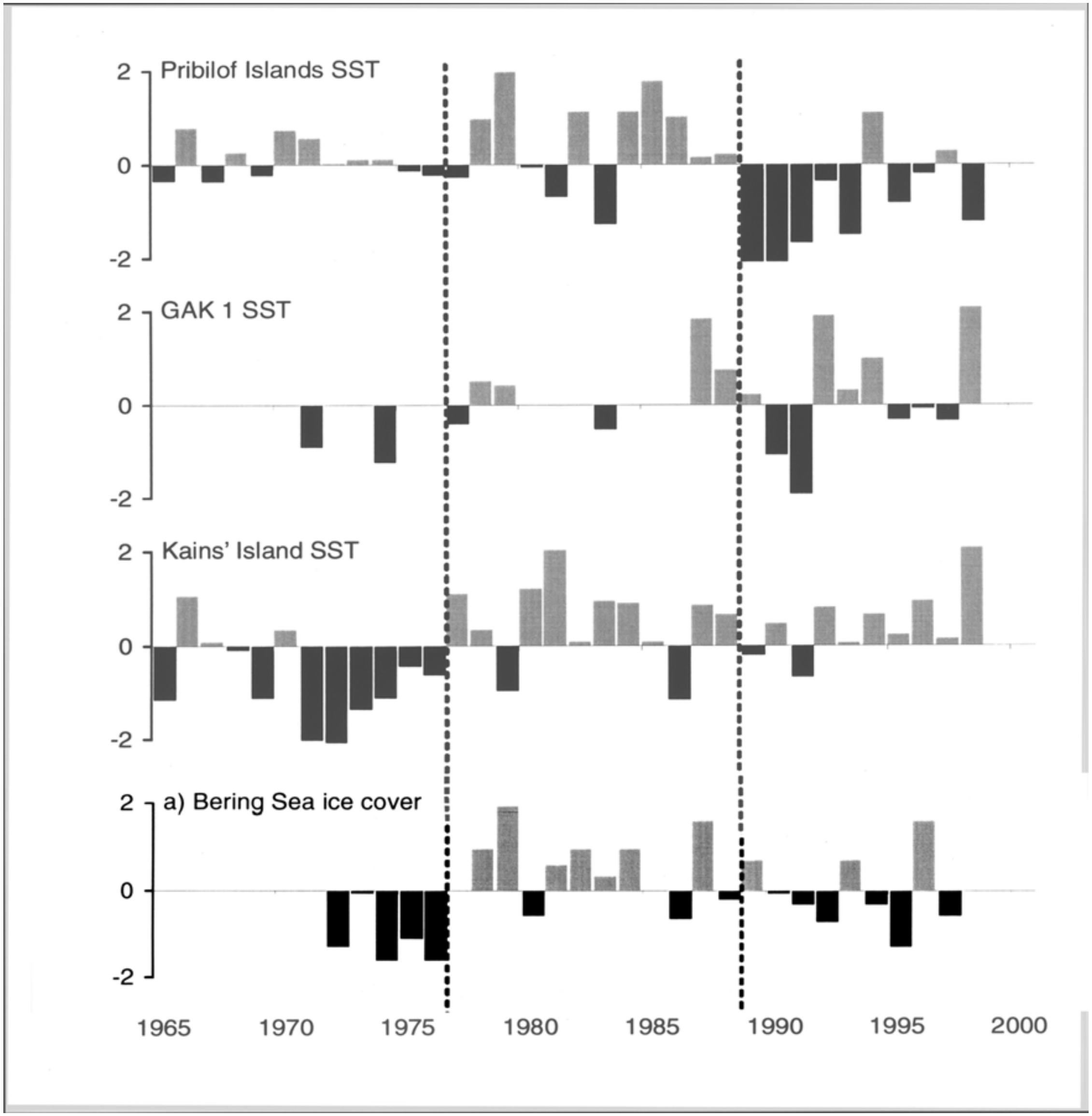


Figure 3.1.6 **Winter sea surface temperature anomalies at (a) the Pribilof Islands in the EBS, (b) at ocean station GAK 1 south of Seward Alaska in the Western GOA, (c) at Kains' Island in the southern GOA off the British Columbia coast, and (d) ice cover in the BS represented by the anomaly (° latitude) of the latitude of ice extent along 167°W. The ordinate (y-axis) of each graph has been normalized in units of standard deviation (Hare and Mantua, 2000).**

The INPFC and the U.S.- Canada International Pacific Halibut Commission (IPHC) began a joint monitoring program for halibut bycatch in Japanese trawlers in the eastern Bering Sea in 1972.

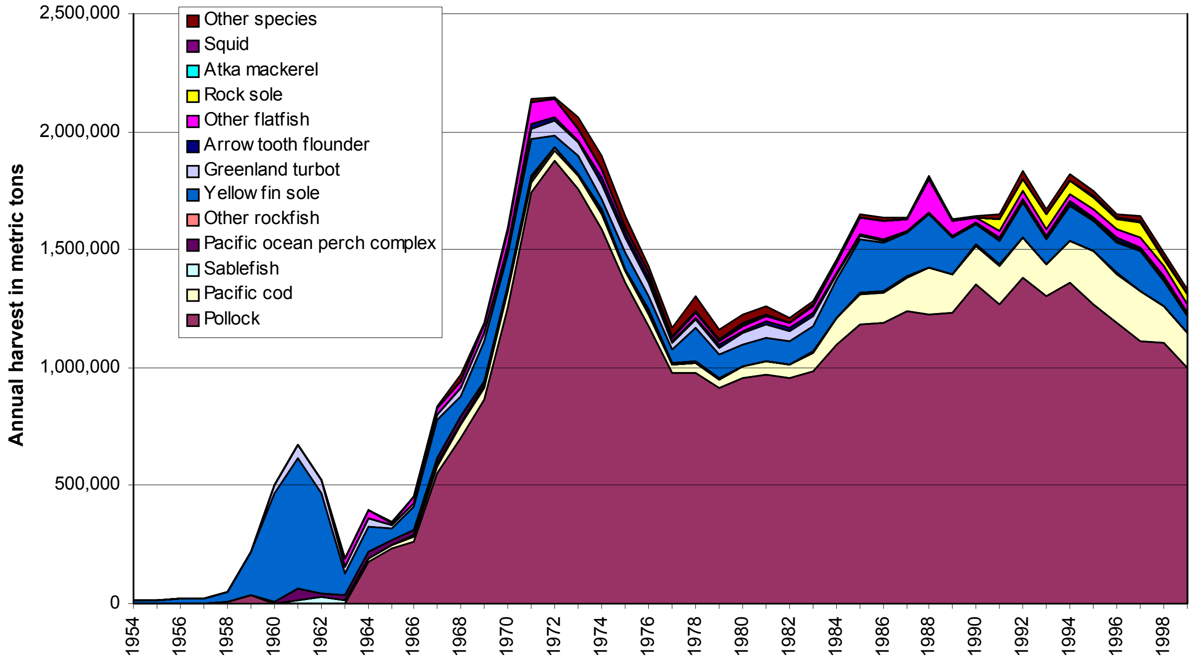


Figure 3.3.1 Groundfish harvests in the Bering Sea subarea by species, 1952-1999.

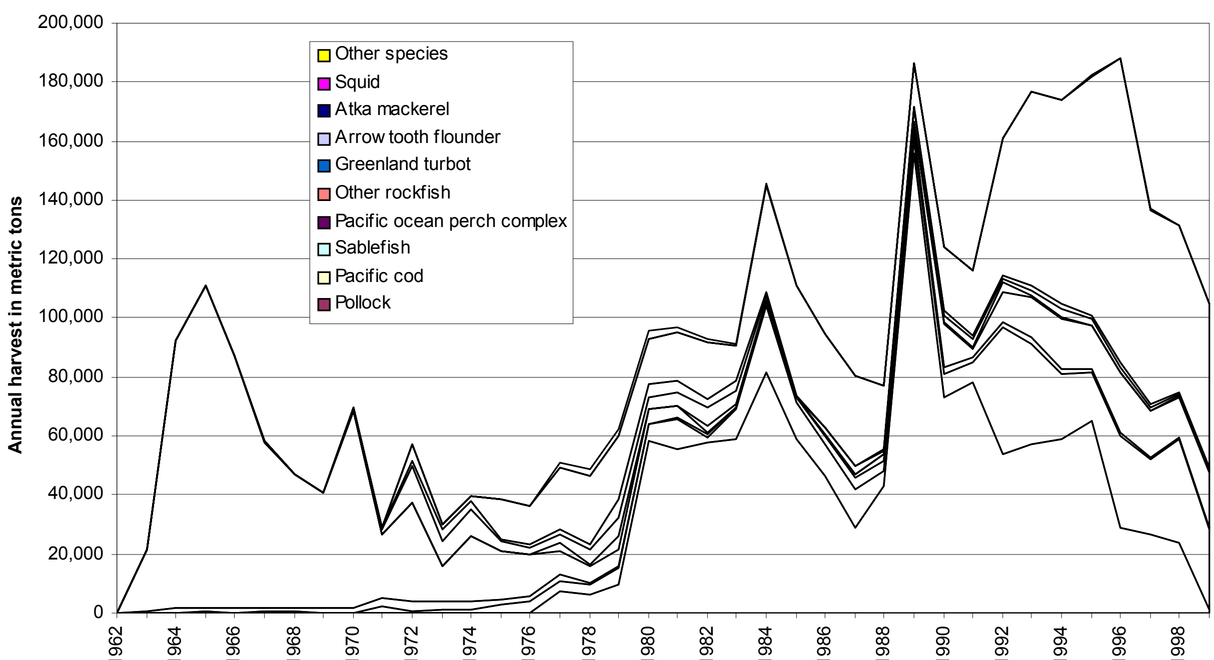


Figure 3.3.2 Groundfish harvests in the Aleutian Islands subarea by species, 1962-1999.

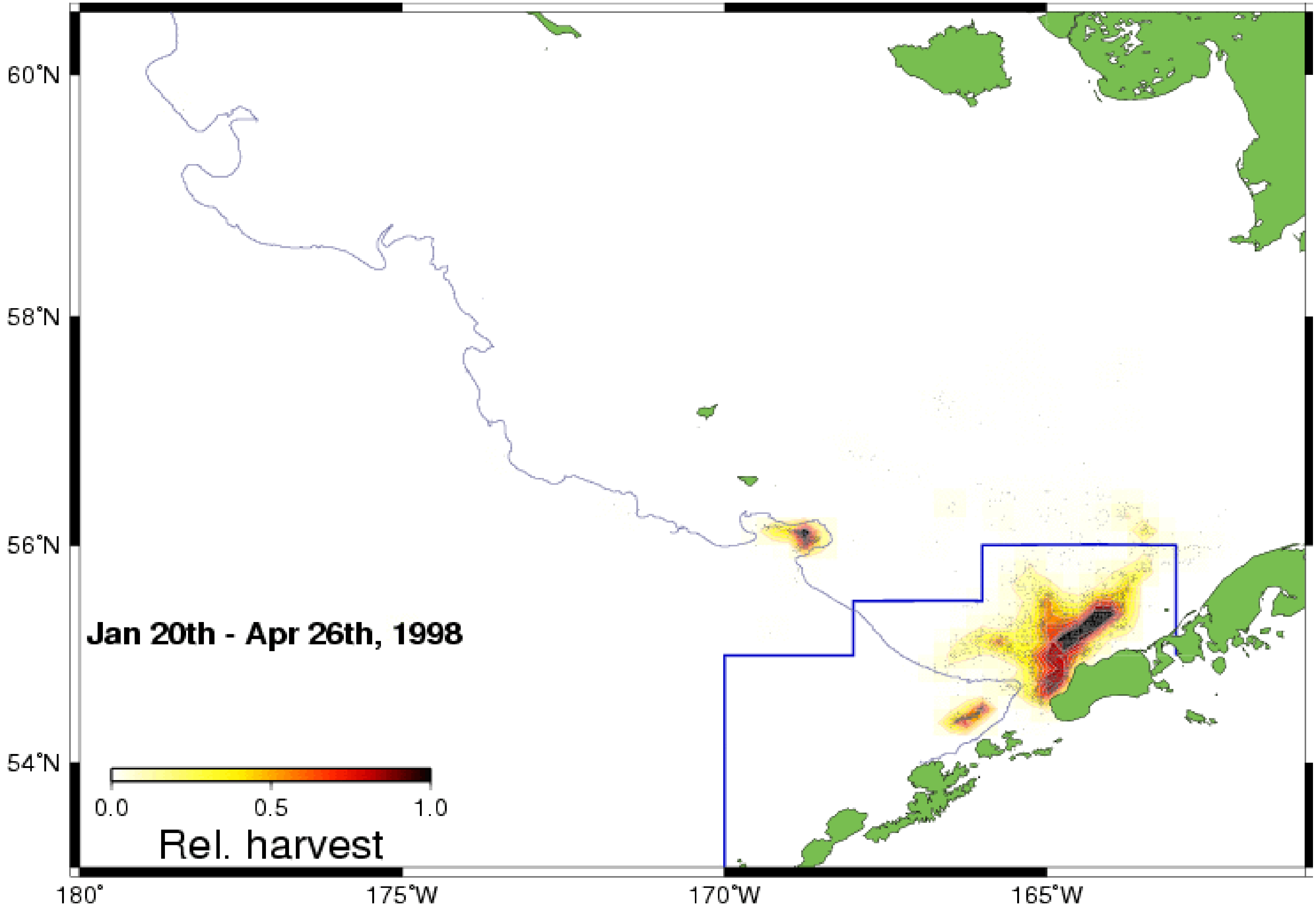


Figure 4.1.2 **Relative intensity of observed pollock harvest in the 1998 A/B (roe) season directed pollock fishery. Source: NMFS observer data.**

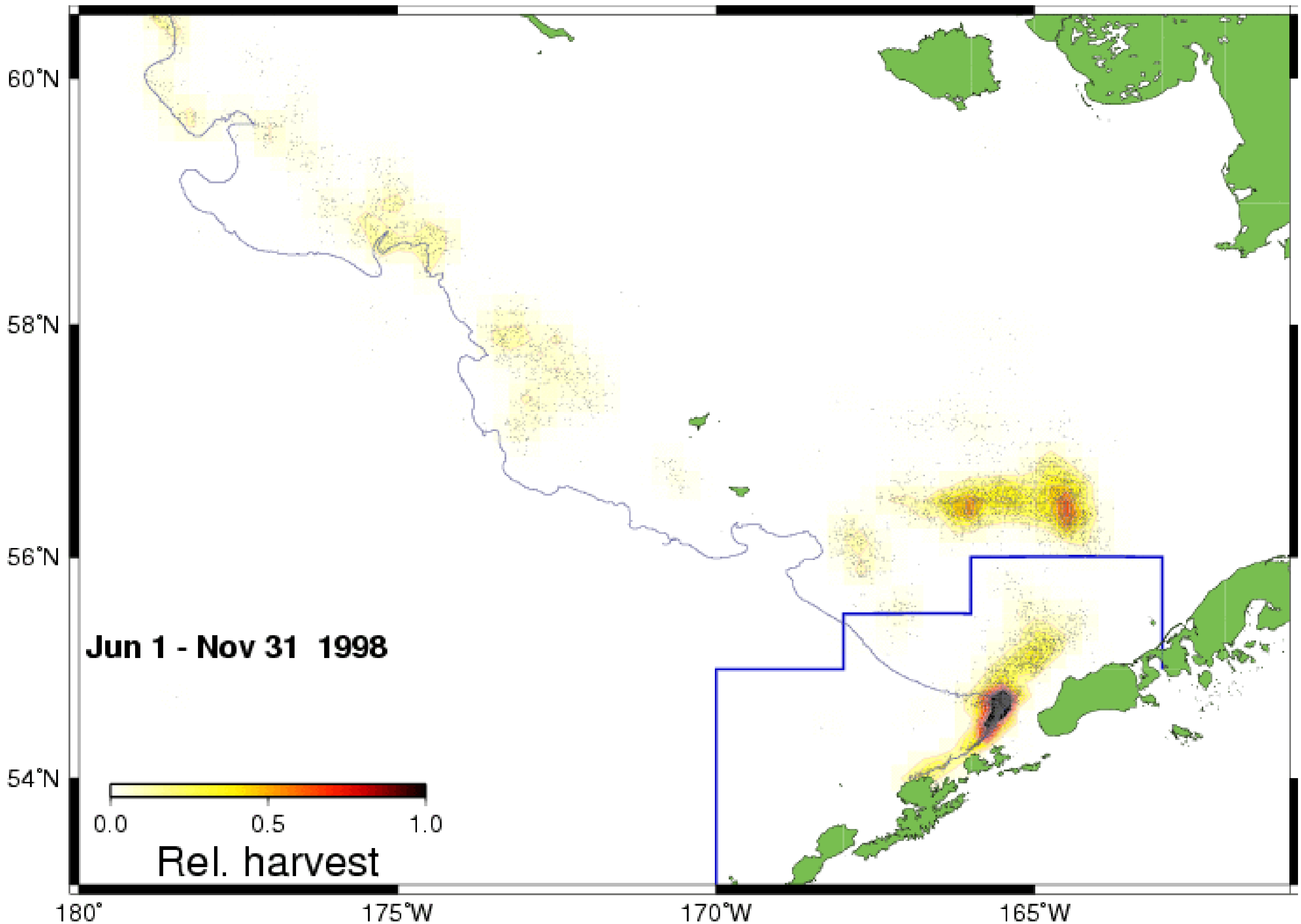


Figure 4.1.3 **Relative intensity of observed pollock harvest in the 1998 C/D (non-roe) season directed pollock fishery. Source: NMFS observer data.**

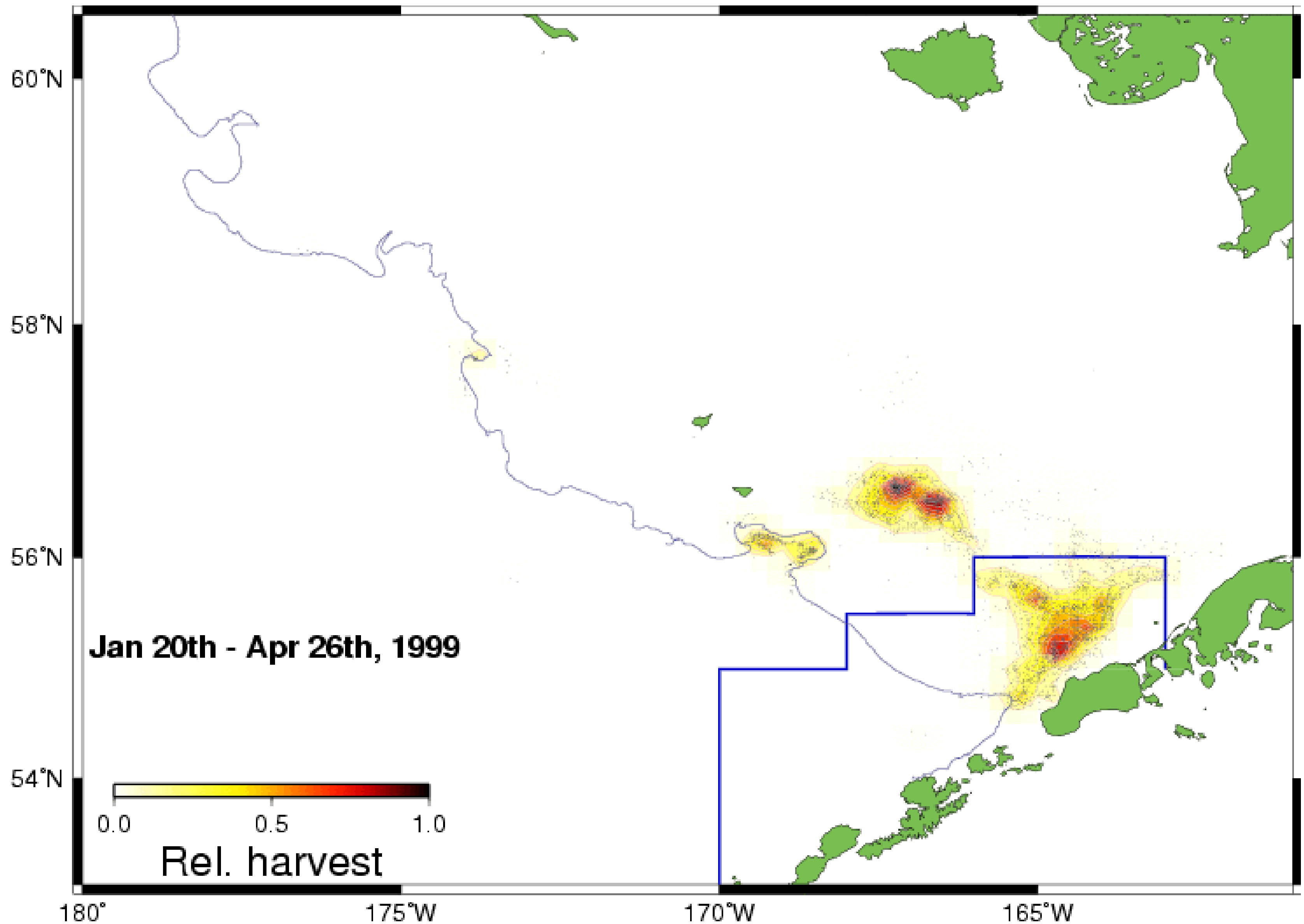


Figure 4.1.4 **Relative intensity of observed pollock harvest in the 1999 A/B (roe) season directed pollock fishery. Source: NMFS observer data.**

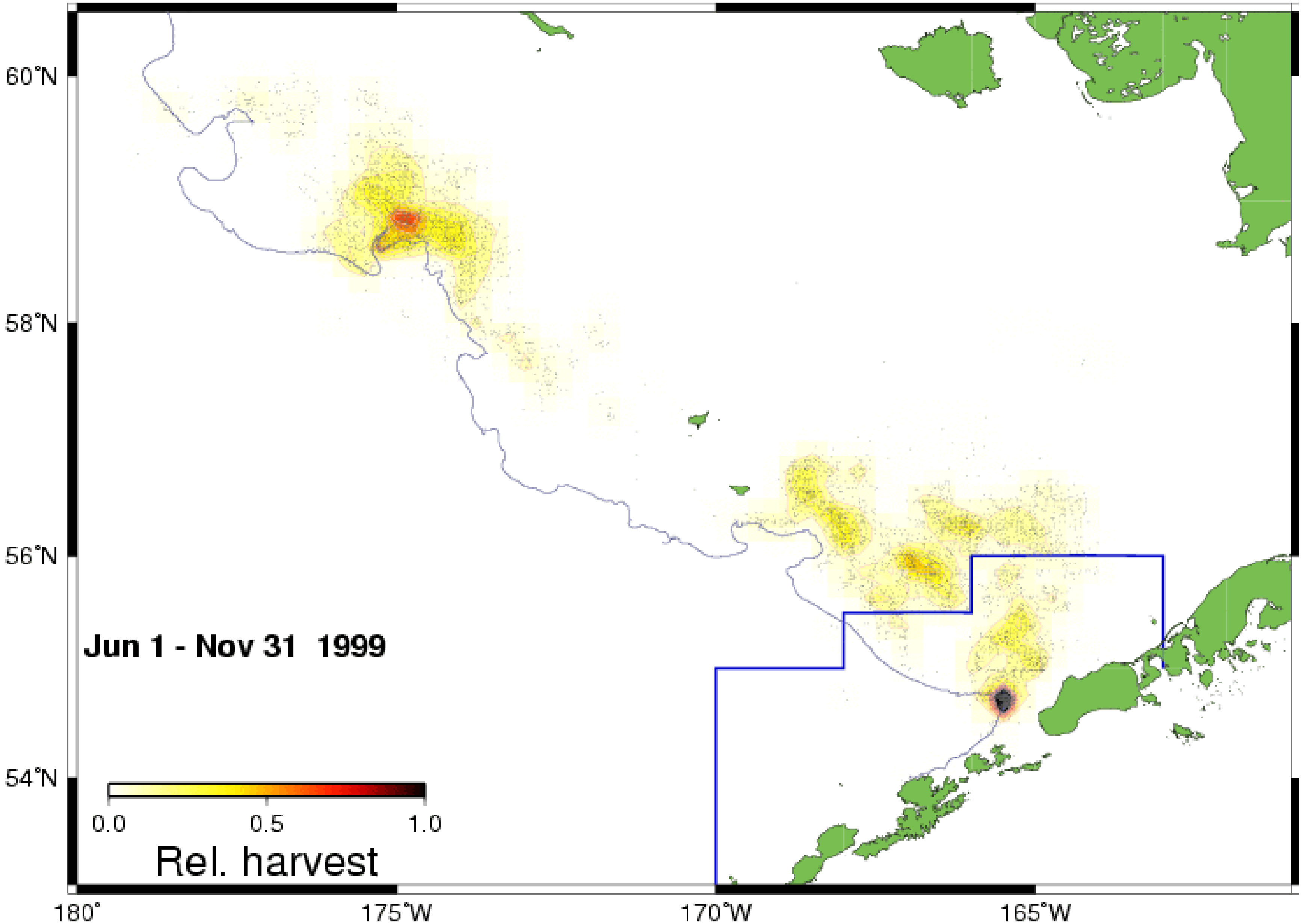


Figure 4.1.5 **Relative intensity of harvest in the 1999 C/D (non-roe) season directed pollock fishery. Source: NMFS observer data.**

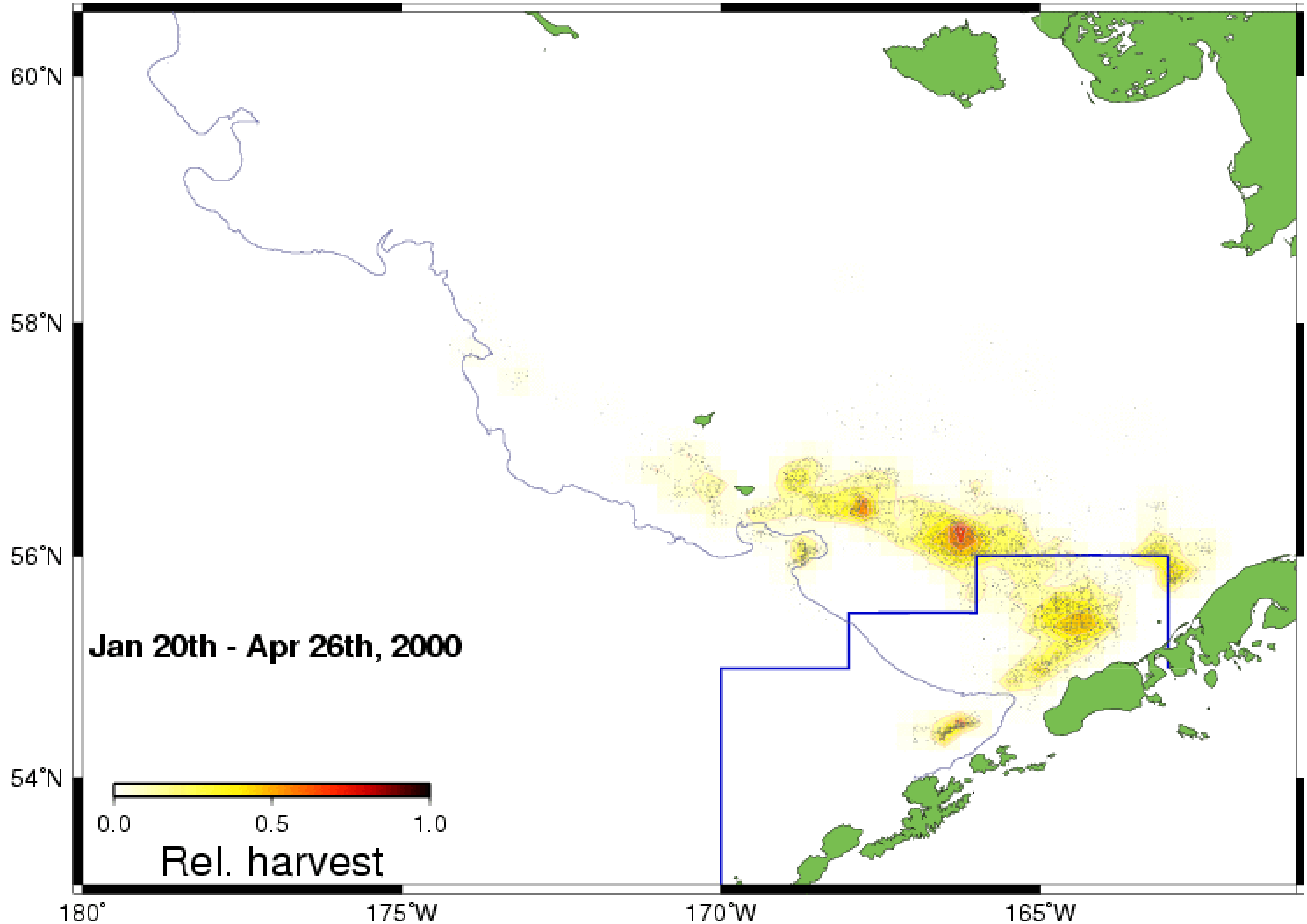


Figure 4.1.6 Relative intensity of harvest in the 2000 A/B (roe) directed pollock fishery. Source: NMFS observer data.

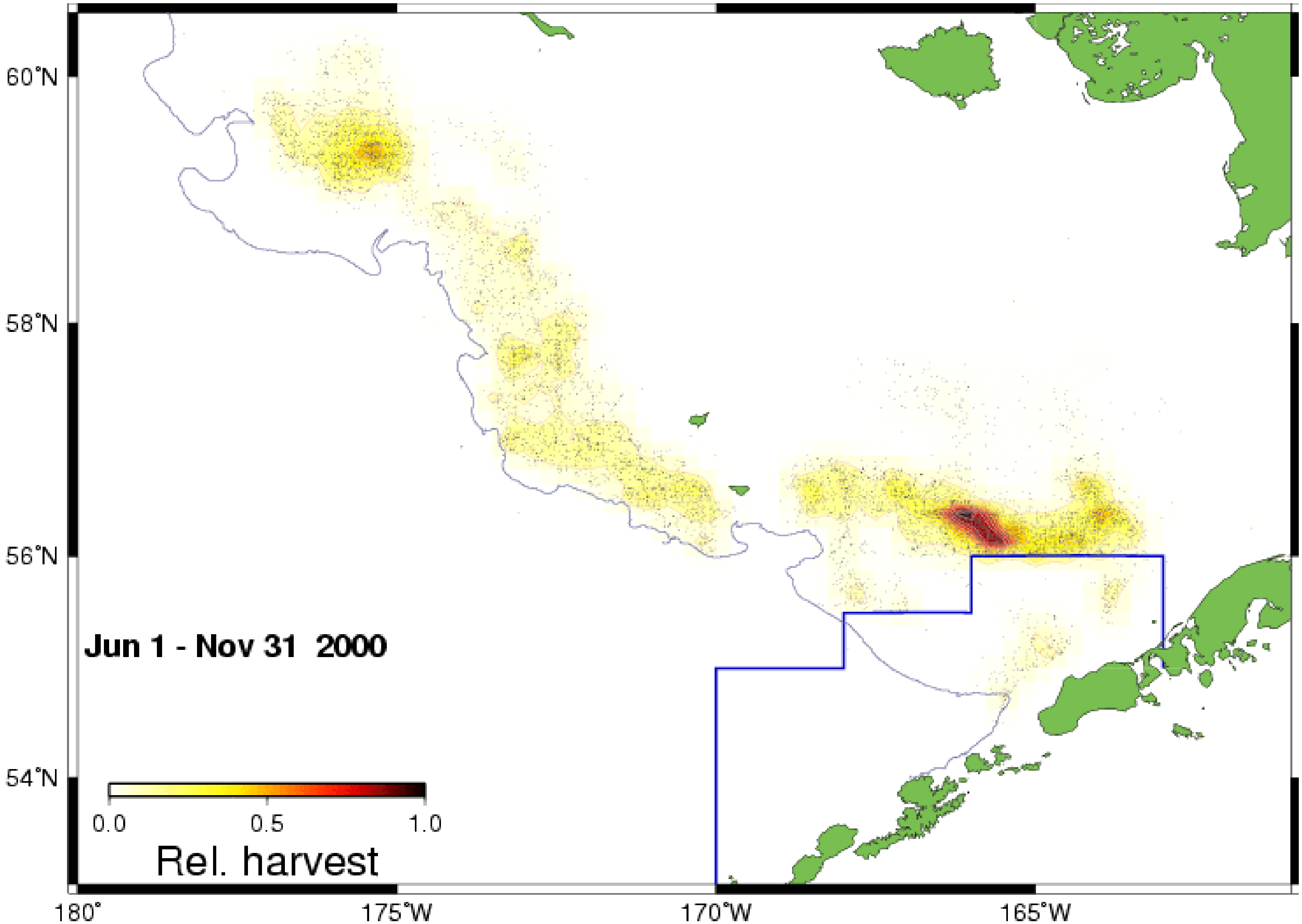


Figure 4.1.7 **Relative intensity of observed pollock harvest in the 2000 C/D (non-roe) season directed pollock fishery. Source: NMFS observer data.**

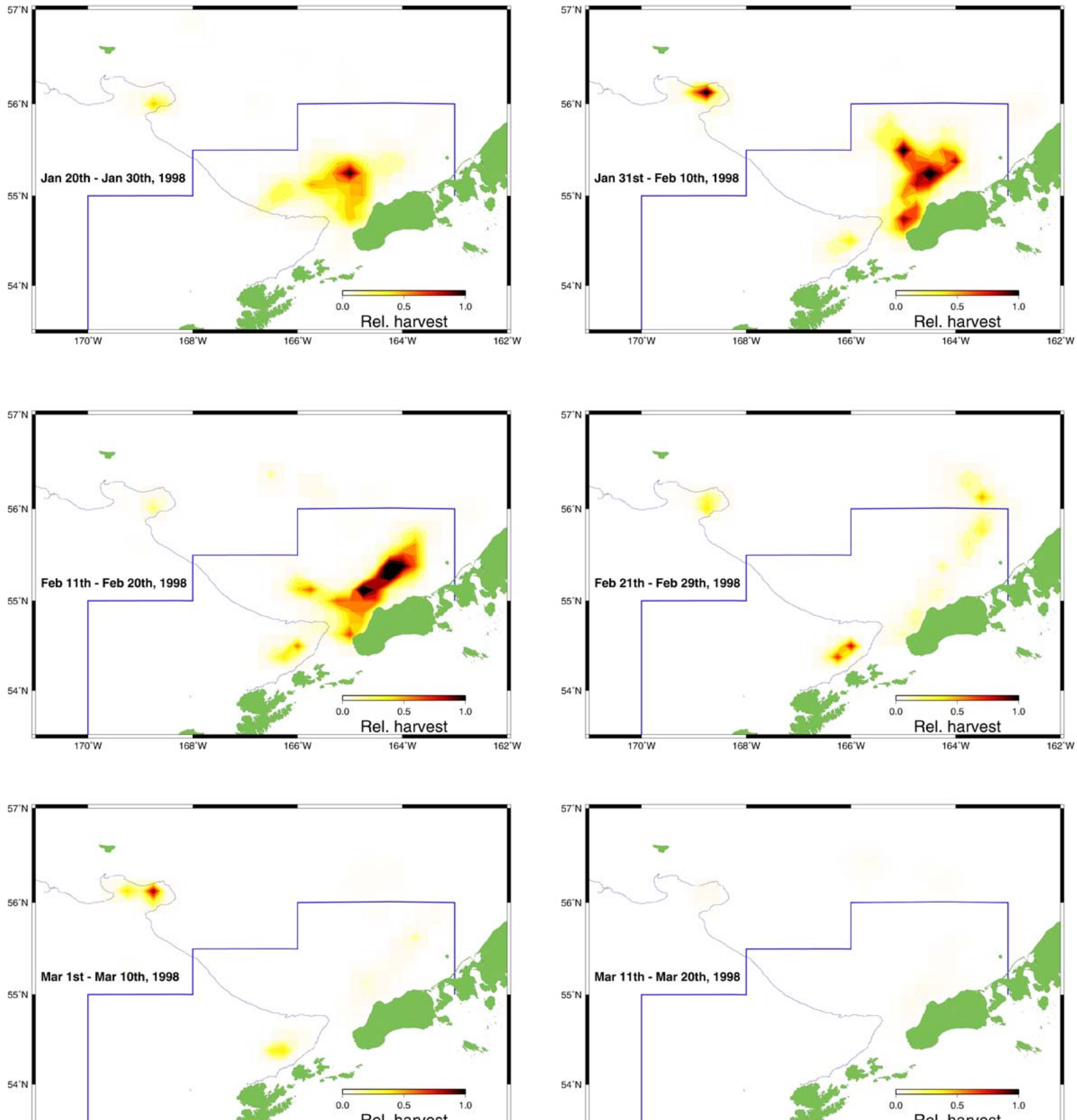


Figure 4.1.8 Intensity of observed pollock harvest in the 1998 A/B (roe) season over 10-day periods.

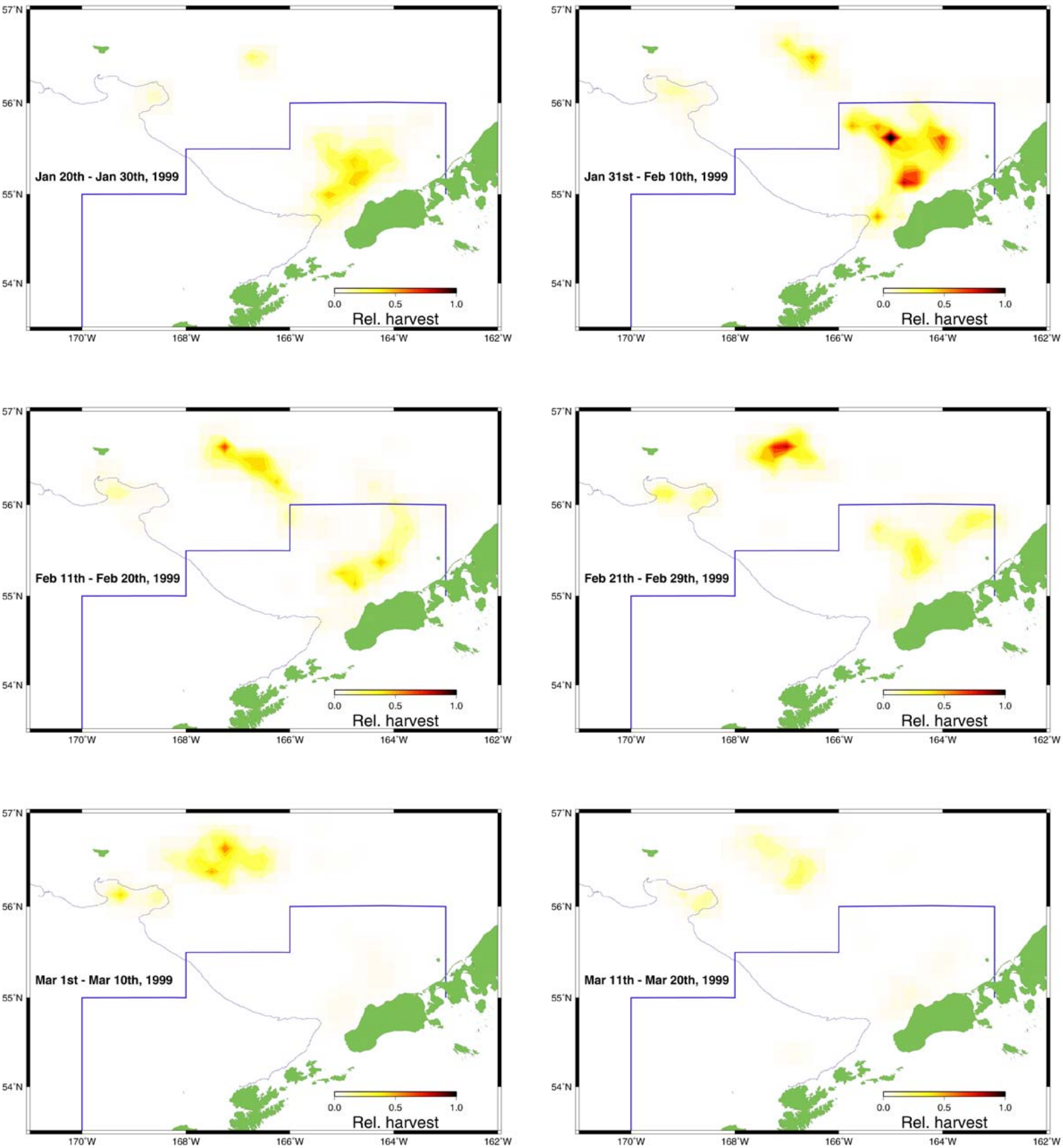


Figure 4.1.9 Intensity of observed pollock harvest in the 1999 A/B (roe) season over 10-day periods.

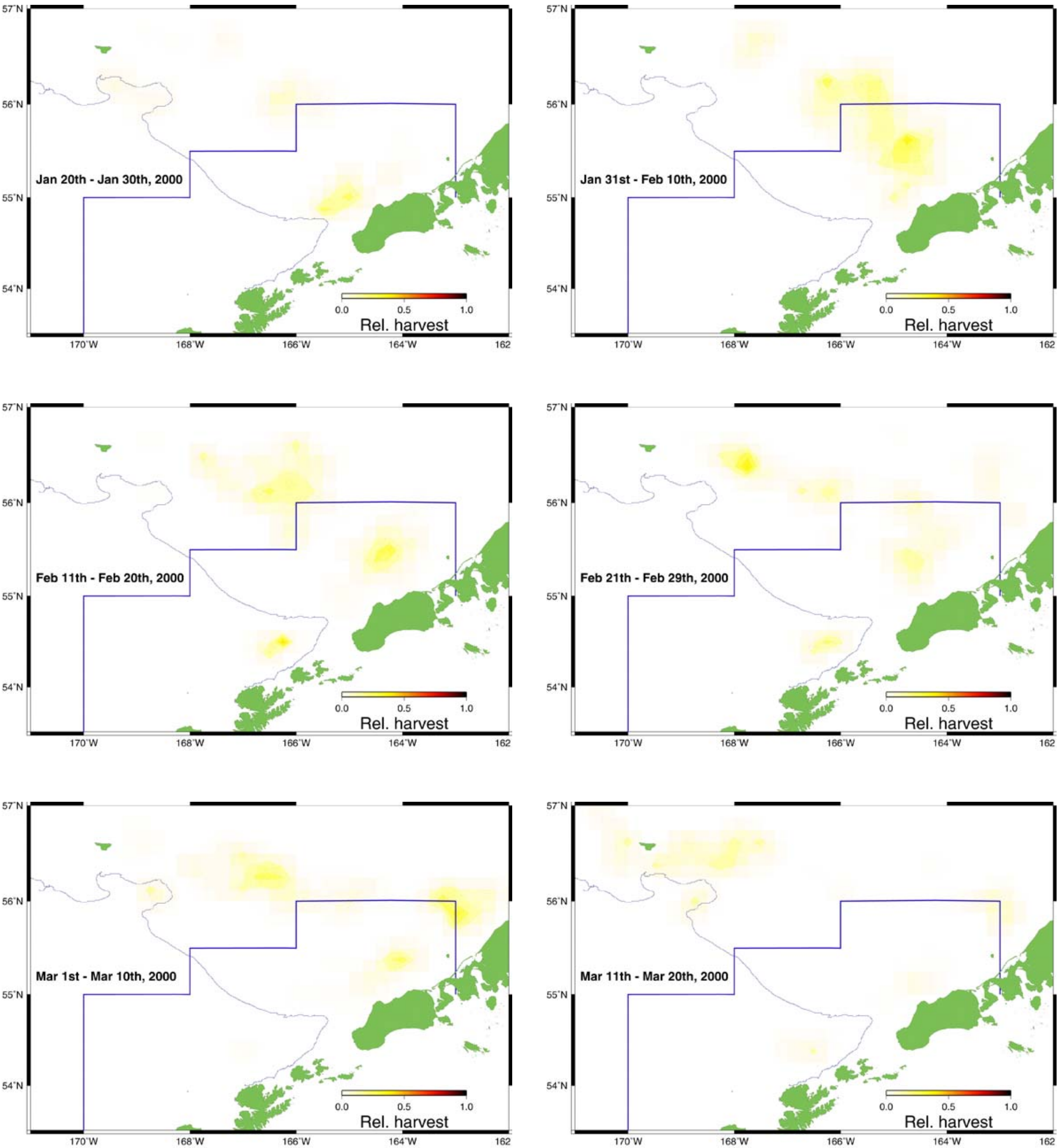


Figure 4.1.10 Intensity of observed pollock harvest in the 2000 A/B (roe) seasons over 10-day periods.

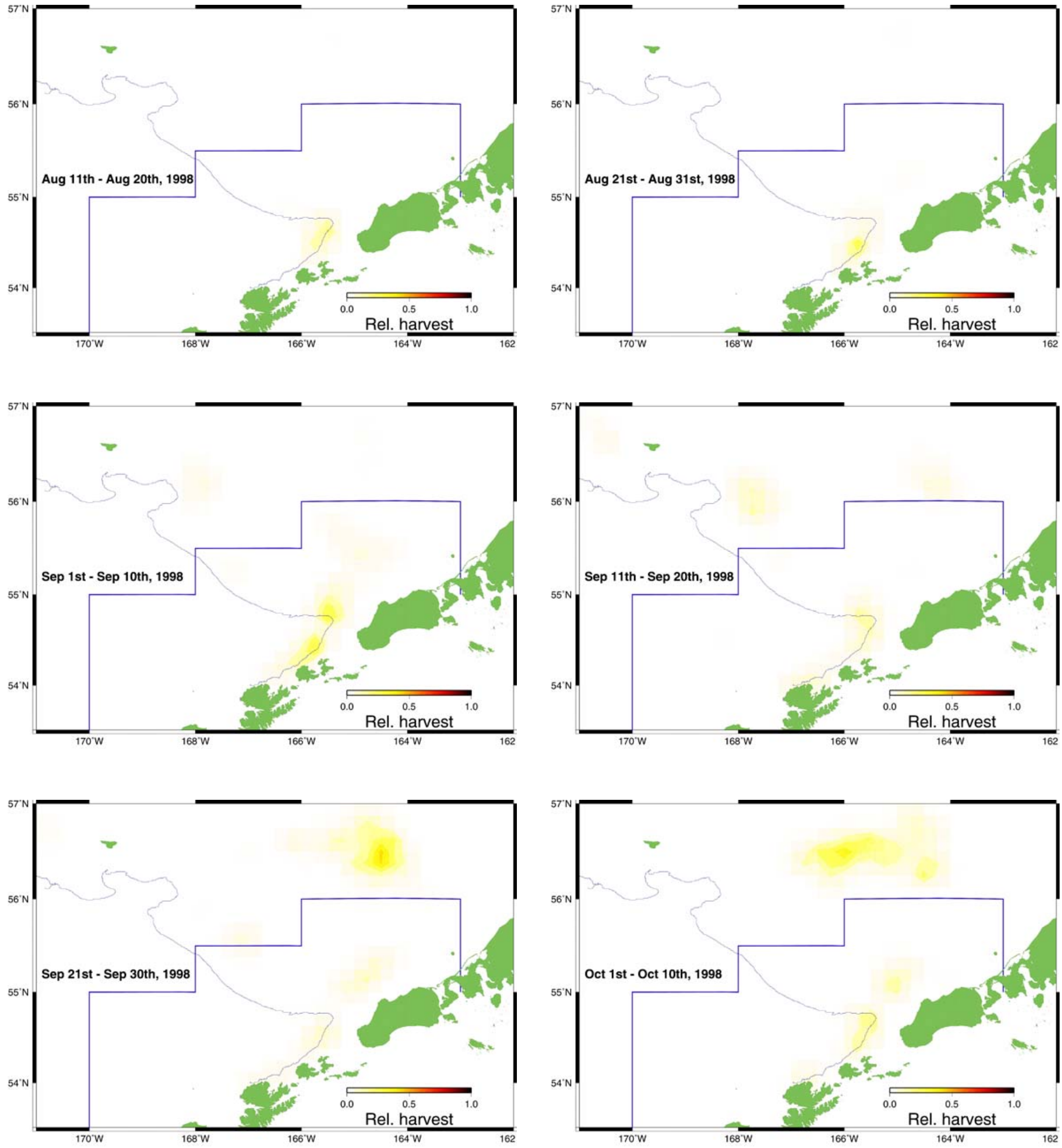


Figure 4.1.11 Intensity of observed pollock harvest in the 1998 C/D (non-roe) season over 10-day periods.

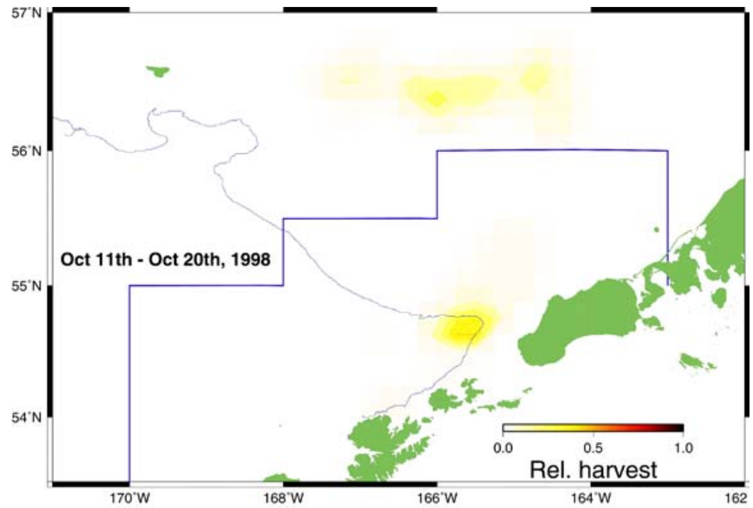


Figure 4.1.11 Continued.

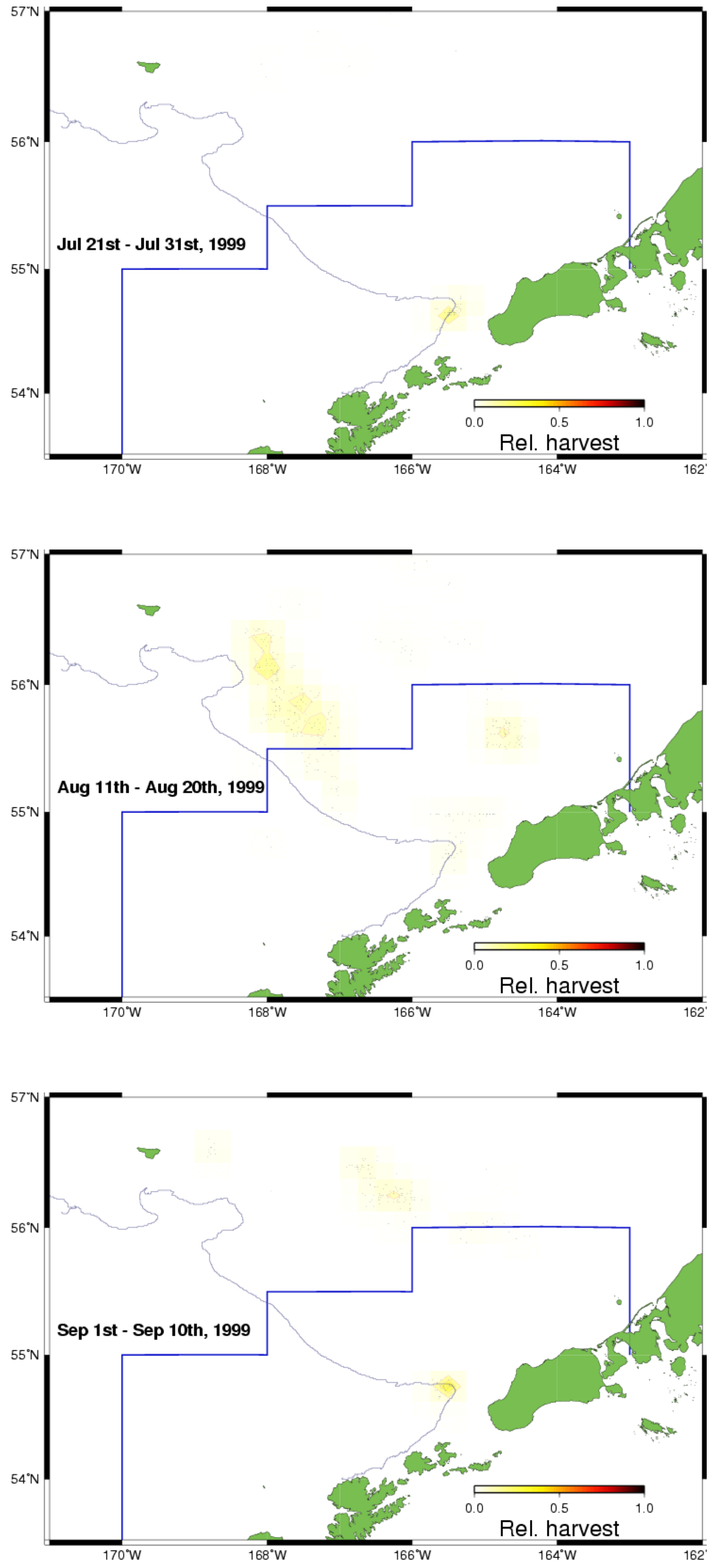


Figure 4.1.12 Intensity of observed pollock harvest in the 1999 C/D (non-roe) season over 10-day periods.

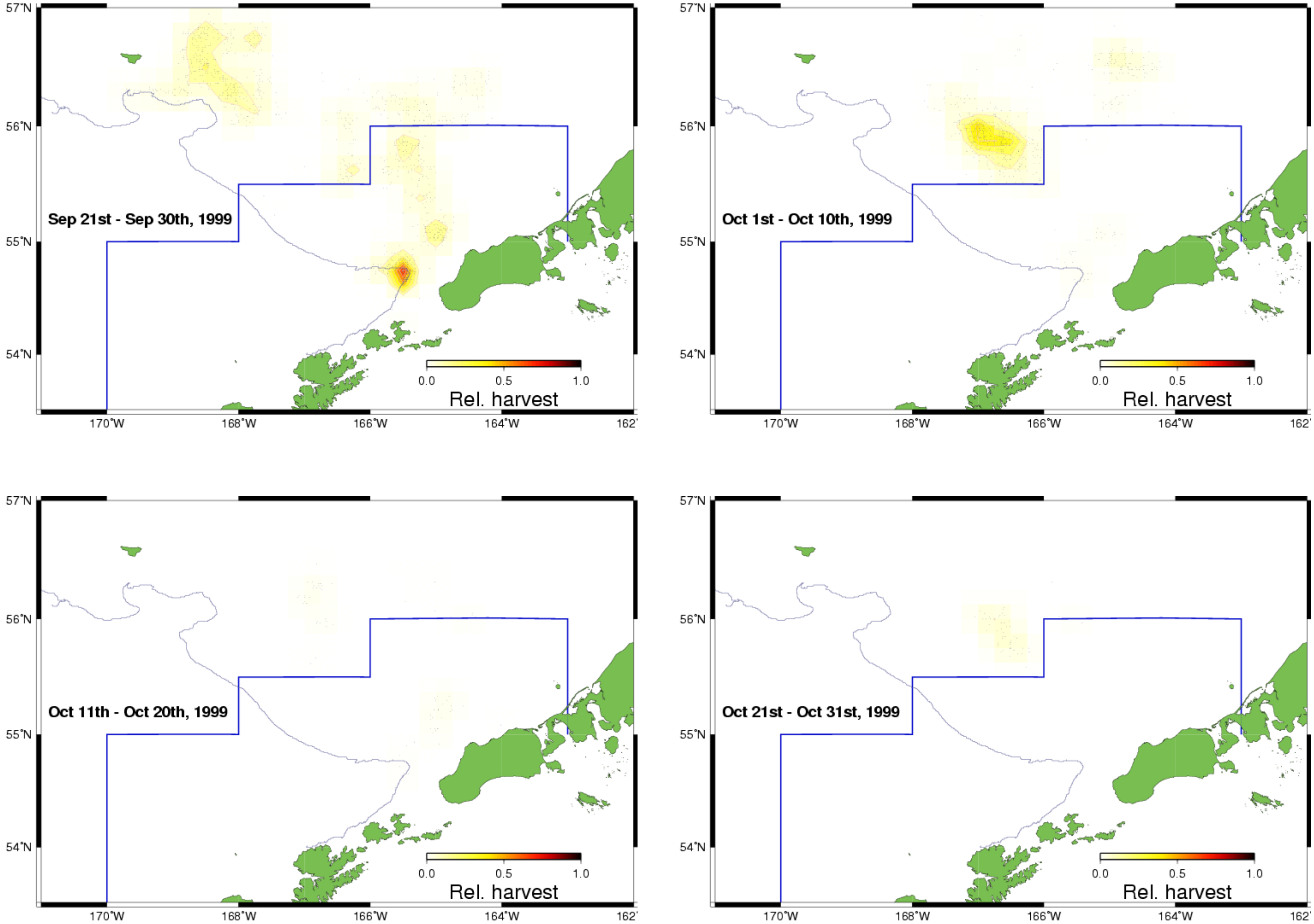
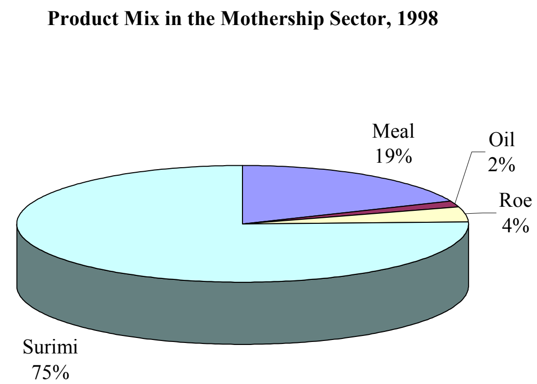
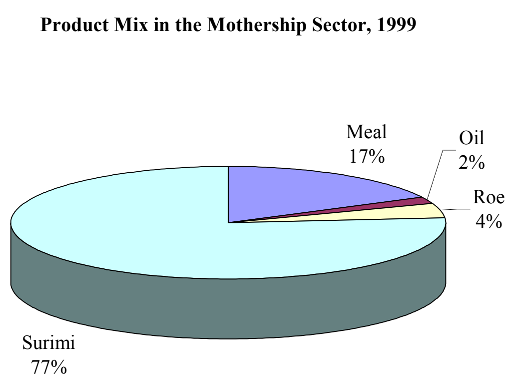


Figure 4.1.12 Continued.

Figure 4.1.13 Mothership sector product mix, 1998-2000.





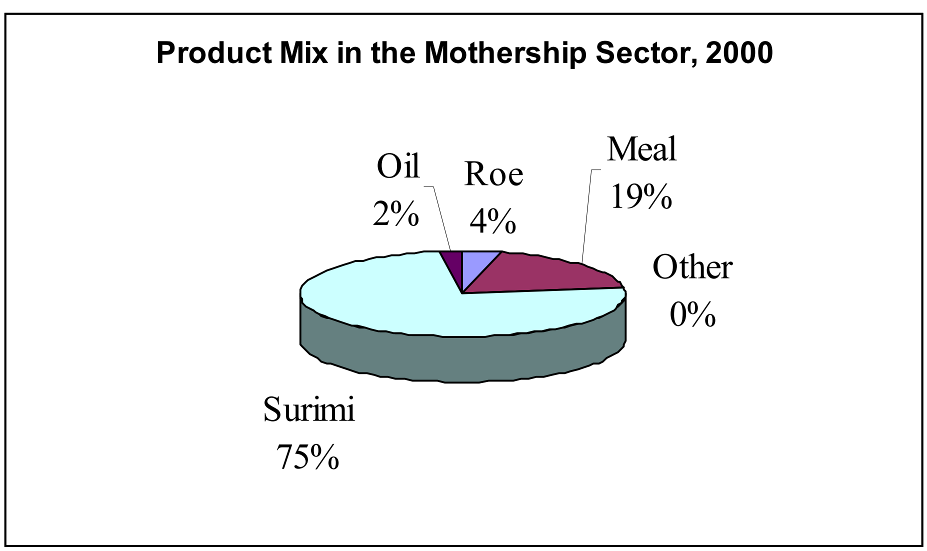
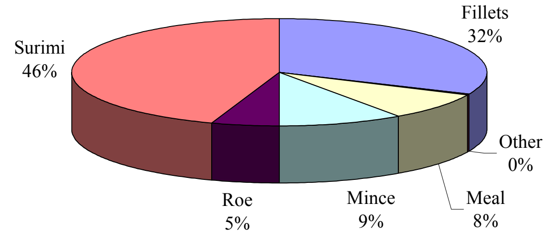
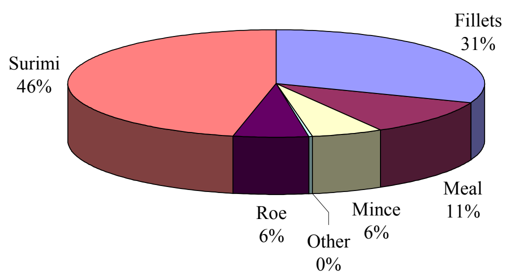


Figure 4.1.14 Catcher/processor sector production, 1998-2000.

Product Mix for AFA Catcher/Processors, 1998



Catcher/Processor Product Mix, 1999



Product Mix for AFA Catcher/Processors, 2000

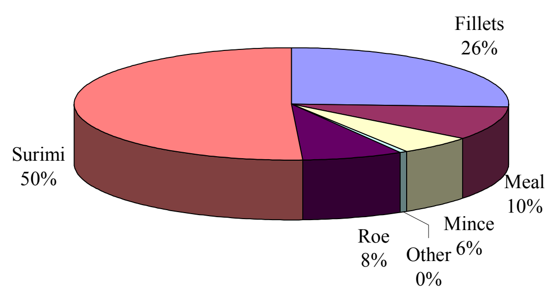
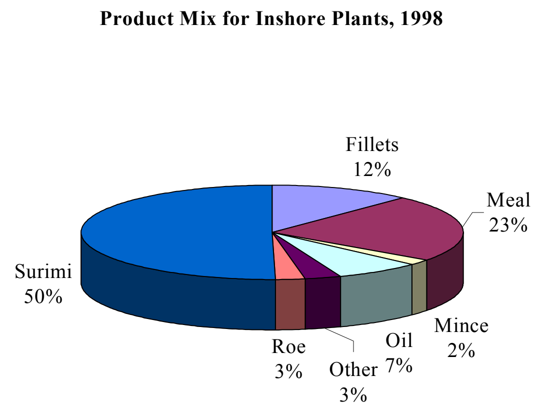
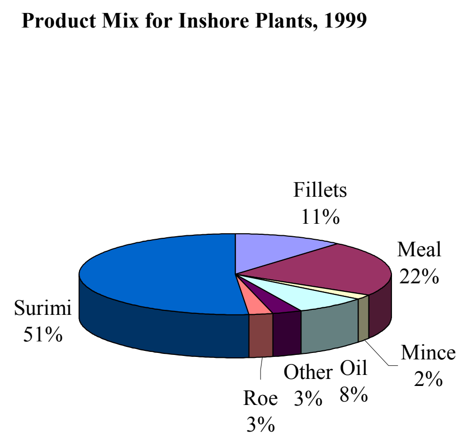
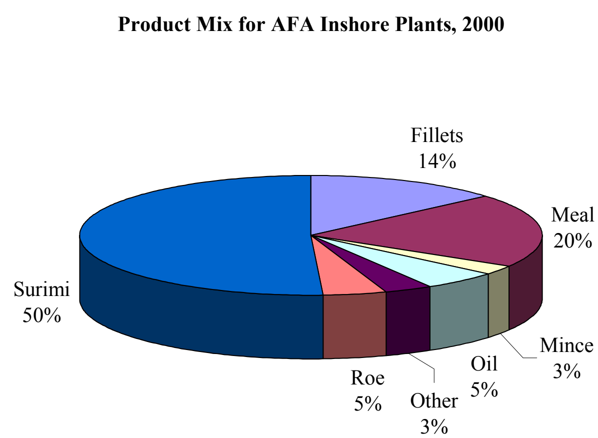


Figure 4.1.15 Inshore processing sector production, 1998-2000.







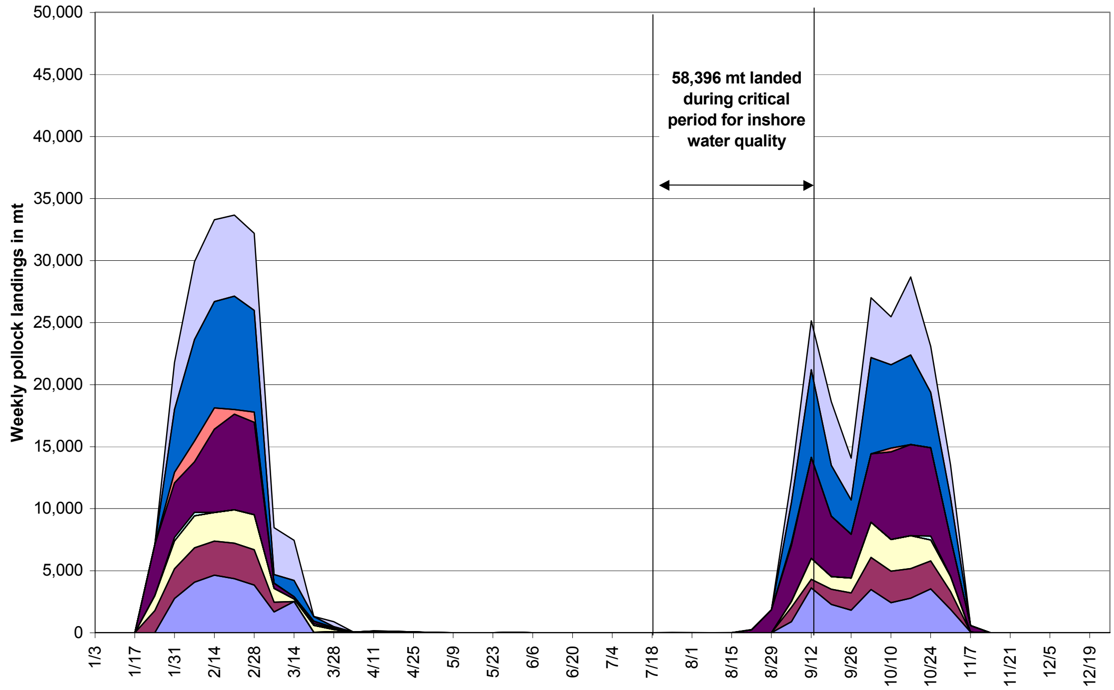


Figure 4.2.1 **1998 weekly pollock landings at AFA inshore processors showing total landings during the critical period for inshore water quality from July 15 to September 15. Source: NMFS weekly delivery reports.**

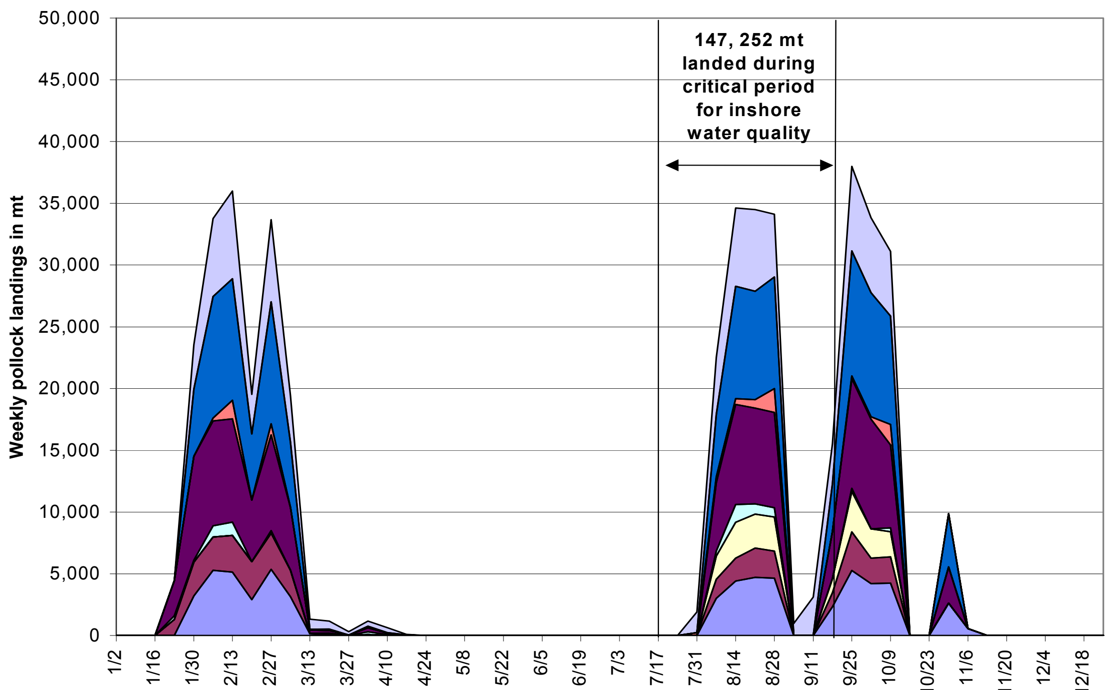


Figure 4.2.2 **1999 weekly pollock landings at AFA inshore processors showing total landings during the critical period for inshore water quality from July 15 to September 15. Source: NMFS weekly delivery reports.**

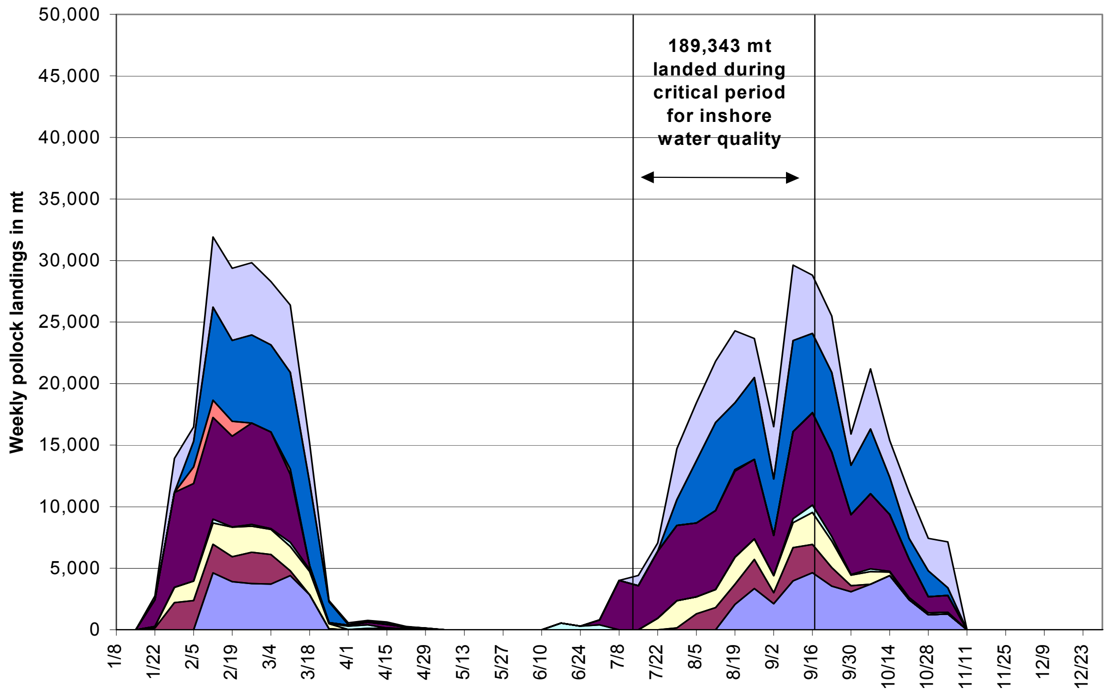


Figure 4.2.3 **2000 weekly pollock landings at AFA inshore processors showing total landings during the critical period for inshore water quality from July 15 to September 15. Source: NMFS weekly delivery reports.**

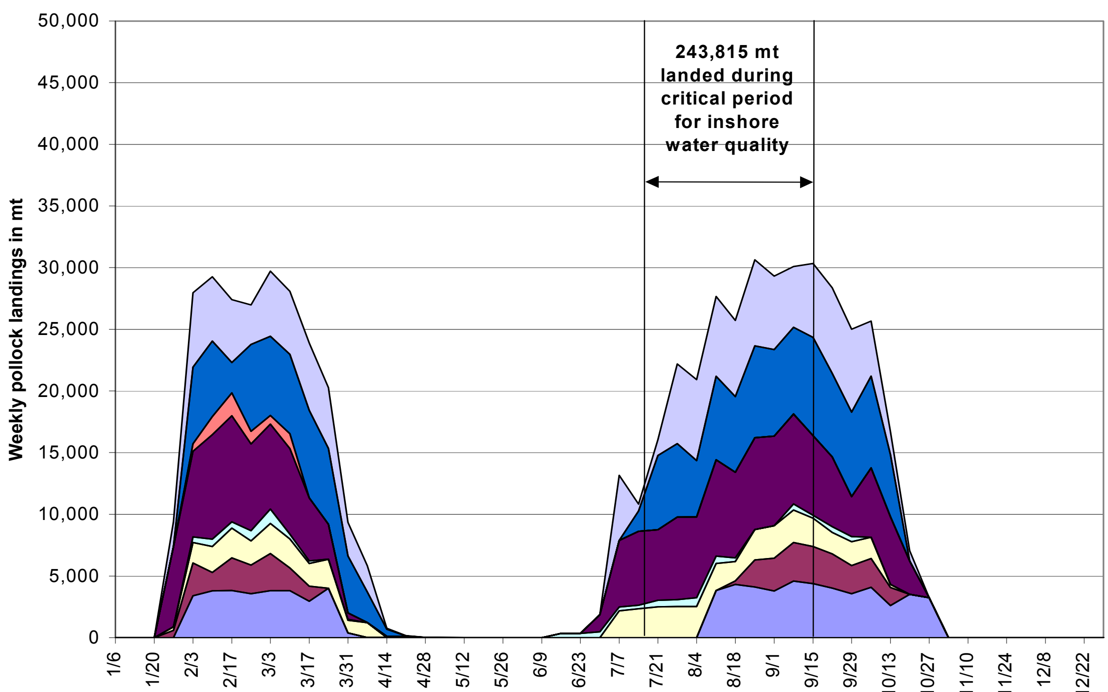


Figure 4.2.4 **2001 weekly pollock landings at AFA inshore processors showing total landings during the critical period for inshore water quality from July 15 to September 15. Source: NMFS weekly delivery reports.**

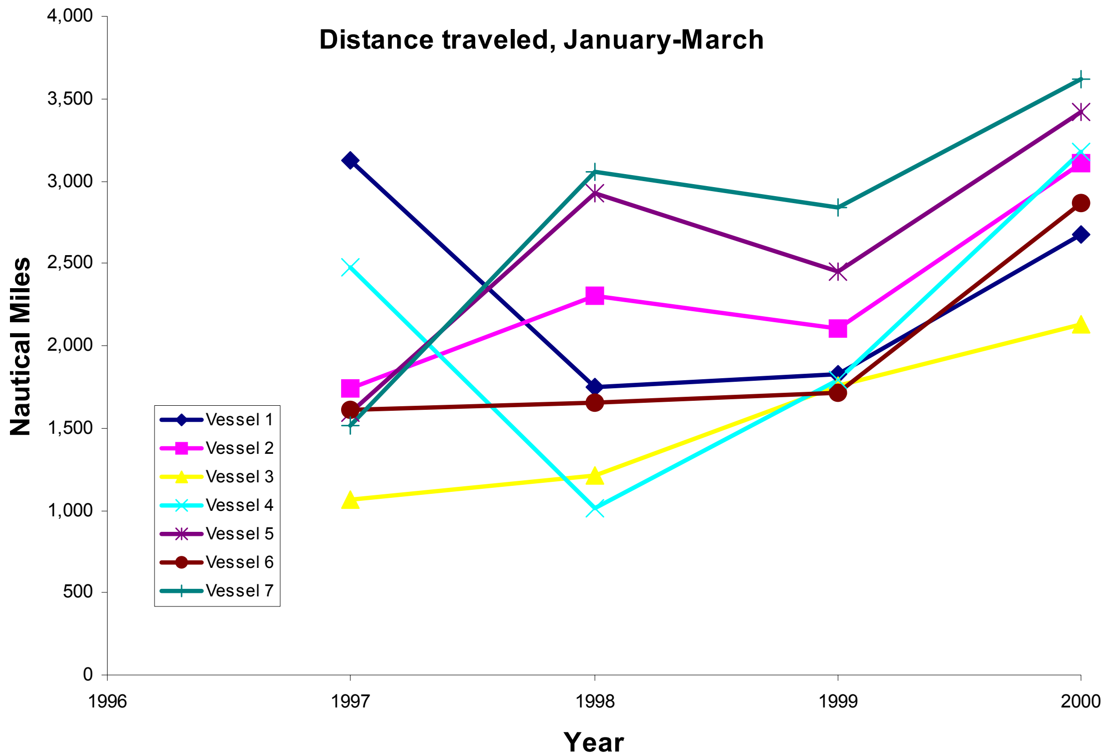


Figure 4.8.1 **Distance traveled by a random sample of catcher vessels during the pollock A season from 1997 through 2000.**

AFA EIS
C-0001

GREENPEACE

AMERICAN OCEANS CAMPAIGN

December 10, 2001

VIA FAX to 907-586-7249

James Balsiger
Alaska Regional Administrator
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802

Re: Comments to Draft Environmental Impact Statement for American Fisheries Act Amendments 61/61/13/8

Dear Mr. Balsiger,

Greenpeace and the American Oceans Campaign welcome this opportunity to comment on the Draft Environmental Impact Statement (EIS) for American Fisheries Act (AFA) Amendments 61/61/13/8. It is noted that as a result of an appropriations rider signed into law in November 2001, the American Fisheries Act is a federally mandated private access system for the North Pacific groundfish fisheries; therefore, concerns over allocation are now redundant.

The National Environmental Policy Act (NEPA) requires the National Marine Fisheries Service (NMFS) to conduct an environmental impact statement and offer a range of real management alternatives to the proposed action, but the draft EIS for the AFA does not accomplish this purpose. Congress intended that the NEPA requirements promote efforts "which will prevent or eliminate damage to the environment." 42 U.S.C. § 4321. In designing the alternatives and considering the environmental and economic consequences, NMFS claimed that "it is not practical to construct an EIS . . . of every permutation of suboptions considered by the Council . . ." EIS § 2.1.1. While NEPA does not require that every conceivable permutation be analyzed, it is NMFS's responsibility to undertake an evaluation of a reasonable range of alternatives, regardless of the burden it places on the agency. Lack of information is not a valid excuse for not complying with NEPA requirements.

However, all of the alternatives in the draft EIS appear to be very similar with only slight differences. In addition, all the alternatives seem to focus on minimizing operational burdens for NMFS and the industry, rather than on limiting the environmental impacts the fisheries have on the ocean ecosystems, which, as stated, is the purpose of conducting an EIS. NMFS offered a "no action" baseline for the purpose of comparison, but not a "no fishing" alternative, which is a requirement under NEPA. 40 C.F.R. § 1502.14(d).

The two areas that NMFS has the greatest authority under the AFA include sideboards and catch measurement and monitoring for the inshore and mothership sectors. NMFS should have offered real alternatives in this area by establishing alternatives that provide for hard caps for the sideboard allocations and ensure they are implemented by closing an entire fishing area if the hard caps are violated. We incorporate by reference the comments of the Alaska Marine Conservation Council on this issue (please see attached letter).

In terms of sideboard allocation, the question NMFS and the Council face is should the sideboard amounts be based on retained or total catch. Basing sideboards on total catch is unacceptable because vessels are then credited for non-selective fishing. Sideboard credit should only pertain to retained catch. NMFS must look at such alternatives in its EIS.

By treating sideboard amounts as hard caps and closing all fishing in the area when the sideboard is reached, vessels may be forced to permanently decrease their bycatch by implementing more selective gear. This requires extremely careful monitoring of bycatch by NMFS, rather than by the cooperatives, which is not reliable, and should not be considered only for the purpose of decreasing the burden on NMFS.

The AFA currently states that each catcher/processor must carry two NMFS certified observers and the fish must be weighed on NMFS approved scales. In terms of the inshore sector and motherships, the AFA also specifically "delayed the implementation of the fishery cooperatives in the inshore and mothership sectors or until 2000, Congress left it to the council and NMFS to develop adequate catch measurements and monitoring requirements for those two sectors." EIS § 2.1.1. NMFS should implement the same stringent observer and monitoring requirements for the inshore sector and motherships and require that all vessels have 100% observer coverage and all weighed by NMFS approved scales.

The industry should pay for the monitoring costs, as they receive the most profits of the industry, while causing environmental damage to a public domain. In addition, monitoring costs provide incentives for the industry to develop less destructive fishing techniques. The EIS should look at alternatives that consider these options.

In addition, there must be alternatives that consider the environmental impacts of allowing, or not allowing, leasing under § 210(c) of the AFA, as discussed in the attached comment letter, which we incorporate here by reference.

All alternatives are intended to refer to the impacts the fisheries have on ecosystems, predator prey relationships, habitat, other fish and bird species, but they have not done so. Under NEPA requirements, it is NMFS responsibility to "rigorously explore and objectively evaluate all reasonable alternatives" (40 C.F.R. § 1502.14(a)), which NMFS did not accomplish. Therefore, the draft EIS for the AFA is incomplete and did not meet the requirements under NEPA as intended by Congress.

Sincerely Yours,

Andrea Durbin
Campaigns Director
Greenpeace

Phil Kline
Fisheries Program Director
American Oceans Campaign

Gerry Leape
Marine Conservation Program Director
National Environmental Trust

cc: Scott Gudes
w/ attachments

AFA EIS
C-0004

December 10, 2001

Dr. Jim Balsiger
National Marine Fisheries Service
Alaska Regional Office
Post Office Box 21668
Juneau, Alaska 99802

Re: Draft Environmental Impact Statement for American Fisheries Act (AFA) Amendment #61

Dear Dr. Balsiger:

Each of the undersigned companies owns and/or operates one or more AFA-eligible pollock catcher-processors (C/Ps or AFA C/Ps) that also participate in the non-pollock groundfish fisheries in the Bering Sea/Aleutian Islands (BSAI). Pursuant to Section 211(b)(2)(a) of the AFA, our vessels are subject to certain caps or "sideboards" that limit their participation in such non-pollock groundfish fisheries.

The above-referenced EIS evaluates an amendment package (Amendment 61 to the BSAI Fishery Management Plan) that is designed to implement a number of AFA -related measures. Among other things, the EIS examines several alternatives that would supercede the formula that Section 211(b)(2)(a) of the AFA specifies for calculating the sideboards that apply to our vessels. As will be explained more fully below, we are opposed to any changes in the way our sideboards are calculated and believe that the North Pacific Council exceeded its authority when it recommended the proposed changes shortly after the AFA went into effect in 1999. For this reason, we support the C/P sideboard formula set forth in Alternative #2 - - the alternative that most closely reflects the purpose and intent of the AFA insofar as the specification of C/P sideboard provisions are concerned. With regard to all other measures, we support Alternative #3 - - the alternative identified in the EIS as the "preferred alternative".

Alternative #2 would calculate AFA C/P sideboards using a formula based on the total non-pollock catch history of the 20+9 pollock C/P vessels identified in Sections 208(e) and 209 of the AFA. This is the same approach specified in Section 211 (b)(2)(a). Alternative #3, on the other hand, would calculate the AFA C/P sideboards using a formula based on "retained" catch--an approach that would significantly reduce our vessels' opportunity to participate in the non-pollock groundfish fisheries in the BSAI. The draft EIS recognizes that Alternative #3's use of "retained catch" in the formula used to calculate the sideboards for the AFA C/Ps would represent a change from the sideboard formula specified in the AFA. (See, EIS at p. 2-21). Yet the AFA authorizes the Council to make changes that supercede provisions of the Act only when they are necessary "for conservation purposes or to mitigate adverse effects" caused by the AFA or fishery cooperatives. Even then, the AFA requires such changes to be made "in accordance with the Magnuson-Stevens Act". (See letter dated Oct. 7, 1999 from Lisa Lindeman, Alaska Regional Counsel, to the North Pacific Fishery Management Council, in which she explains the limits that Section 213 (C)(1) of the AFA places on Council authority to change or modify specific provisions of the AFA). [1]

Neither the draft EIS nor any of the other documents that have been prepared to date in connection with the AFA amendment package has ever identified an "adverse effect" that needs to be mitigated or a "conservation" rationale for the proposed change in the AFA's C/P sideboard provisions. Instead, the EIS candidly describes the sideboard provisions as "largely an allocation issue" (EIS p. 4-86) that is "not expected to have any effect on the environment" (EIS p. 4-50). Under such circumstances, where there is no adverse effect that needs mitigating or any bona fide conservation objective, the Council has no authority to recommend and the Secretary has no authority to approve the AFA C/P sideboard changes reflected in Alternative #3.

Furthermore, while we may agree that the sideboard issue is largely an allocation issue (or reallocation issue in the case of Alternative #3), we do not agree that no conservation issues are involved when the C/P sideboard provisions are changed. The problem is that the effects of such a change were never analyzed. As noted in the scoping comments referenced in footnote #1, the proposed reduction in the pollock C/Ps' sideboard caps would effectively transfer or reallocate fishing opportunities from the AFA C/P fleet to the non-AFA C/P fleet. The vessels that benefit from Alternative #3's approach have historically had significantly higher discard rates and PSC bycatch rates when fishing for non-pollock groundfish than have the AFA C/Ps. Thus, if there is any conservation or environmental effect that would flow from this reallocation of fishing privileges, it would be a negative effect--not a positive one. Unfortunately, there is no analysis of such potential effects.

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[1] For a full discussion of these issues, please see the comments submitted on behalf of the At-Sea Processors Association on May 8, 2000, in response to the (scoping) notice of intent to prepare the EIS. A copy of those comments is attached to this letter and incorporated herein by reference. A copy of the above-referenced letter from Ms. Lindeman to the NPFMC is also attached as part of these comments as well.

While some have suggested that using a "retained catch" approach vs a "total catch" approach in the calculation of the C/P sideboards is necessary to avoid rewarding vessels for their past discards, we would simply point out that Alternative #3 exacerbates that particular problem. It takes fishing opportunities away from vessels with relatively lower discard rates and transfers those fishing opportunities to vessels with higher discard rates--just the opposite of what the purported policy is supposedly designed to accomplish. Such an unanticipated consequence is discussed in the EA/RIR that was prepared in connection with the processing sideboard issue where, at pp. 45-46, the analysts note:

> While it may seem politically correct to use only retained catch in the numerator [of the sideboard formula], doing so will perhaps unduly reward non-AFA processors for their own discards...In effect, the non-AFA processors get credited with the discarded tons of the AFA processors and do not get penalized for their own discards.

Similar comments might have been made about the use of "retained" catch in the numerator of the formula used to calculate the C/Ps harvesting sideboards, but the possibility of using "retained" catch in connection with the C/P sideboards was never identified (much less analyzed) in the separate EA/RIR that was prepared in connection with the C/P harvesting sideboards. Thus, there was no comparative discard data available to the Council when it made its decision to switch to a retained catch formula for the C/P sideboards and it was impossible for the Council to know that its action would be penalizing the sector with the lowest discard rates and rewarding the sector with the highest.

Finally, the proposed change in the C/P sideboard calculation formula has never been evaluated in the context of the Magnuson- Stevens Act's requirement that management measures be "fair and equitable", "promote the achievement of optimum yield", "reduce bycatch" and otherwise comport with the national standards. Such an evaluation is routinely conducted in connection with allocation proposals, but it was not done here.

As indicated above, we oppose the use of the "retained catch" formula applied in Alternative #3 and support the use of the "total catch" formula reflected in Alternative #2. Otherwise, we support the remaining provisions of Alternative #3.

Thank you for the opportunity to present these comments. If you have any questions, please feel free to give any one of us a call.

American Seafoods Company

Michael Hyde, President

Highland Light

Michael Coleman, President

Glacier Fish Company

John Bundy, Principal

PREMIER PACIFIC SEAFOODS

333 First Avenue West, Seattle, WA 98119, U.S.A. Phone: (206)286-8584 Fax: (206)286-8810

December 11, 2001

James W. Balsiger, Regional Administrator
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802

Re: Comments regarding Draft EIS for AFA Amendments 61/61/13/8

Dear Dr. Balsiger,

Premier Pacific Seafoods, Inc. is pleased to provide the following comments regarding the Draft AFA EIS. Premier Pacific manages the AFA mothership processor OCEAN PHOENIX, one of the three processors eligible to harvest pollock allocated to the mothership sector by the American Fisheries Act. The OCEAN PHOENIX operates with a fleet of ten catcher vessels.

The primary intent of our comments is to note several inaccuracies that we've found in the document and to provide the correct information for use in the final draft of the EIS. Our comments are listed below by chapter.

Chapter 1

No comments.

Chapter 2

Page 2-12: Some of the vessel names are listed incorrectly. The full names of those vessels are AMBER DAWN, MARGARET LYN, MARK I, MISTY DAWN, NORDIC FURY, PAPADO II.

Page 2-12: Only 18 of the 19 vessels named in the AFA are listed on page 2-12. The TRAVELER was mistakenly not included in that list.

Chapter 3

Page 3-143: The statement that one mothership is "reportedly capable of processing 270 metric tons of pollock into roe and block fillets" per day seems seems misleading and inaccurate - first, all three of the motherships have a daily round fish processing capacity in excess of 270 metric tons; second, none of the motherships produces fillets blocks.

Page 3-144: The EIS states that the motherships "reportedly employ 102 crewmembers/processing workers on average." The statement is ambiguous and possibly erroneous. It is difficult to determine whether the statement is intended to represent that the average crew size on an AFA mothership vessel is 102 crewmembers, that the average cumulative number of crew working on all three AFA motherships is 102 crewmembers, or that the average cumulative number of crew employed per AFA mothership operating day is 102 crew members. Depending on the true meaning of the statement, the author may need to verify assumptions regarding mothership crew-size with the AFA mothership operators. The OCEAN PHOENIX, for example, has an average crew size of approximately 200 individuals.

Chapter 4

Page 4-6: The mothership sector did not operate under a cooperative agreement until 2000.

Page 4-30: The EIS states that the inshore sector was the only non-rationalized sector of the pollock industry in 1999. As noted above, the American Fisheries Act did not authorize the formation of a cooperative in the mothership sector prior to 2000.

Page 4-108: The EIS states that the mothership sector received a smaller allocation of pollock than it had traditionally harvested prior to the AFA and was not compensated for this loss. The EIS further states that the benefits of operating in a cooperative should offset the fish that was lost when the share percentage was reduced. This argument would be valid only if the benefits of operating in a cooperative were somehow greater to the mothership sector than to other AFA pollock sectors. The EIS does not demonstrate that the benefits stemming from a cooperative are relatively greater for the mothership sector. Therefore, the uncompensated reduction in its AFA pollock share relative to its historical share means that the mothership sector is, even under the cooperative management of the fishery, less "better off" than are the other sectors. This fact should be acknowledged in the EIS.

4-119: The EIS states that the 10% of the directed BSAI pollock TAC available to catcher vessels eligible to deliver pollock to AFA-qualified motherships was allocated to each vessel in proportion to its 1995-97 pollock catch history. The AFA is silent on the issue of how quota shares are determined for catcher vessels delivering to motherships. The formula used to in establishing quota share percentages for members of the Mothership fleet Cooperative was based on the best three years of catch history from 1995 through 1998.

Table 4.8.5: The table refers to "cons" to the catcher vessels delivering to catcher-processors. It should read as "cons" to catcher vessels delivering to motherships.

Chapter 5- 7

No comments.

Appendix A-D

No comments.

Appendix E

The EXCELLENCE, GOLDEN ALAKSA, and OCEAN PHOENIX are listed as catcher/processors rather than as motherships.

The OCEAN PHOENIX LOA is 688 feet rather than 635 feet.

Thank you in advance for your consideration of these comments. Please contact me at (206) 286-8584 if you have any questions regarding these comments. Likewise, please let me know if you need any assistance in gathering information or data in response to our comments.

Sincerely,

John Henderschedt
Operations and Fisheries Management Coordinator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

C-006

3pp

Reply To
Attn Of: ECO-088

DEC 21 2001

01-077-NOA

Kent Lind
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802

Dear Mr. Lind:

The Environmental Protection Agency (EPA) has reviewed the draft Environmental Impact Statement (EIS) for the proposed *American Fisheries Act (AFA) Amendments 61/61/13/8* (CEQ# 010395) in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and §309 of the Clean Air Act. The purpose of the draft EIS is to provide decision makers and the public with an evaluation of the environmental and economic effects of implementing proposed Amendments 61/61/13/8 and alternatives that allocate Total Allowable Catch (TAC) among selected vessels in the pollock fishery, monitor fishing activities to ensure compliance with TAC and bycatch limits, and prevent freed-up vessels and fishing time from being used to catch fish in other fisheries which coul d adversely affect those parties that currently fish for these other stocks.

EPA generally supports ending the traditional race for fish by implementing action alternatives presented in the draft EIS and has consequently rated the document LO (Lacking Objections). This rating and a summary of our comments will be published in the *Federal Register*. A copy of the rating system used in conducting our review is enclosed for your reference. We also suggest ways of improving the document in the latter part of our letter.

EPA sees the following positive outcomes of adopting action alternatives described in the EIS. The fishery, through AFA, would:

- use 20% more of the pollock biomass harvested,
- damage fish less during harvesting,
- cull less efficient fishing vessels from its fleet,
- time fishing activities to take advantage of market forces (i.e., fishing when prices are high), and
- make pollock fishing safer.

We are pleased that adoption of action alternatives would favor resource extraction activities that focus on quality over quantity, are more selective, and that add value over those that do not.

Adopting action alternatives described in the EIS would also benefit resources that EPA has jurisdiction over. EPA issues National Pollutant Discharge Elimination System (NPDES) permits for the point source discharge of fish parts that are a waste product following fish processing into waters of the United States. Using a greater portion of fish biomass reduces the overall amount of organic matter and biochemical oxygen demand dumped into the ocean and consequently, the depletion of dissolved oxygen. Discharging the same amount of processed fish waste over a longer fishing season reduces the impacts on dissolved oxygen as compared to the short and intense fishing, processing, and pollutant discharging season without AFA. The longer fishing season that results from AFA means that off-shore vessels are more likely to dump and discharge their wastes over a larger area as well as a over a longer time period. These changes will help prevent the massive dumping of fish wastes in a short period of time in more localized areas with associated spiked reductions in dissolved oxygen.

In addition, the culling of less efficient vessels from the pollock fishing fleet is consistent with pollution prevention objectives that EPA supports and Executive Order 12856. More efficient vessels will pollute less, including emissions of global greenhouse gases, and having fewer vessels in the fleet with the added discretion to fish in more favorable weather will likely reduce the risks of oil and fuel spills. Moreover, we are pleased that the EIS discusses the impacts of greenhouse gases and climate change on the fishery.

We are pleased by the good information found in the EIS and how easy it was to read the document. The EIS did a good job summarizing and highlighting relevant information and did not include reams of data of limited usefulness to the reader. The EIS followed the format recommended in the Council of Environmental Quality's NEPA implementation regulations at 40 CFR 1502.10. This along with the good organization of the document and a clear table of contents made it easy to find information in the document. The document contained limited jargon. Occasional use of terms and phrases like "anti trust exemptions in the mothership sector" caused confusion, but overall, the document was written in understandable English.

One section of the EIS that should be improved is section 4.2.2, "Effects of pollock processing on substrates and bottom habitats." This EIS presents the Clean Water Act (CWA) regulatory framework administered by EPA and Alaskan Department of Environmental Conservation[1], but does not describe the baseline information on water quality or the water quality effects of implementing action alternatives under the AFA as required by NEPA. In addition, it does not address the effect of seasonality on water quality. To address the latter, the EIS should describe how seasonality affects the water quality impacts, both off-shore and inshore in bays and harbors, of dumping and discharging fish wastes. This discussion should describe the predicted effects of shifting as much as 40% of the seafood processing and attendant discharges from off-shore to in-shore waters. The analysis in the water quality section should be done with the recognition that the worst time to discharge is between late July and early September when the water column is stratified by a summer thermocline.

In addition, the EIS should examine how adopting the AFA framework could benefit water quality. For example, fish processors could time and, in the case of off-shore processors, locate discharges to minimize impacts to water quality. Processors could also utilize a higher percentage of harvested fish to reduce the amount of fish waste discharged. Please contact Mr. Burney Hill at (206) 553-1761 to discuss EPA's CWA involvement with the discharge of fish process wastes.

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[1] EPA developed the total maximum daily load assessments for five waterbodies and 11 seafood processing discharges, including Udagak Bay and King Cove lagoon.

EPA also recommends that the EIS add to the existing discussion of environmental justice effects of adopting action alternatives. The reduction of the pollock fleet to more efficient vessels would likely reduce the level of pollution from the fishery, but might negatively affect minority and low income people. For example, the EIS broadly discusses project impacts on employment in coastal areas but does not examine impacts to the four fishing communities of Unalaska/Dutch Harbor, King Cove, Sand Point, and Akutan that would be most affected by implementation of AFA. Moreover, the EIS is almost completely silent on the effect of project implementation on members of federally recognized Indian tribes. The EIS should discuss federal tribal trust responsibilities and impacts to tribes with project implementation. The document should also describe consultations that the North Pacific Council and NMFS have had with tribes to demonstrate compliance with NEPA, and tribal trust responsibilities.

Thank you for the opportunity to review this draft EIS. If you would like to discuss these issues, please contact Chris Gebhardt at (206) 553-0253.

Sincerely,

Judith Leckrone Lee, Manager
Geographic Unit

Enclosure

cc: Robert D. Robichaud, EPA R10 NPDES Permit Unit