Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement

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Supplemental Environmental Impact Statement

Steller Sea Lion Protection Measures in the Federal Groundfish Fisheries Off Alaska

Implemented under the Fishery Management Plans for the
Groundfish of the Gulf of Alaska
and the
Groundfish Fishery of the Bering Sea and Aleutian Islands Area

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Abstract: The Gulf of Alaska and Bering Sea Aleutian Islands groundfish fisheries have been managed under fishery management plans since 1978 and 1981, respectively. The range of the Steller sea lion overlaps the waters where the fisheries are conducted. Under the Endangered Species Act, Steller sea lion west of Cape Suckling, Alaska, are listed as endangered; east of Cape Suckling they are listed as threatened. In the core region from the Kenai Peninsula to Kiska Island, counts of adult and juvenile Steller sea lions have declined by about 80% since the population size was estimated in the late 1950s. In 2000, a Biological Opinion prepared under Section 7 of the Endangered Species Act on all aspects of these fisheries 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. Changes in management measures vary the degree and direction of impacts the fisheries have on marine mammals, seabirds, prohibited species, target fish species, and the marine habitat. The changes also have impacts on fishers, processors, and coastal communities. Enforcement considerations and management complexity are inextricably tied to regulations. This SEIS evaluates alternatives to mitigate potential adverse effects as a result of competition for fish between Steller sea lions under a no action alternative as well as other alternatives that would substantially reconfigure these fisheries. Impacts are disclosed, both significantly positive and significantly negative as required by the National Environmental Policy Act. A biological opinion prepared according to the Endangered Species Act is included for the preferred alternative.

Executive Summary

Introduction

The purpose of this supplemental environmental impact statement is to: (1) provide information on potential environmental impacts that could occur from implementing a suite of fisheries management measures such that the western population of Steller sea lions existence is not jeopardized nor its critical habitat adversely modified by the groundfish fisheries in the Gulf of Alaska (GOA) and the Bering Sea and Aleutian Islands (BSAI); and (2) meet the National Environmental Policy Act's purpose (40 CFR Section 1500.1) of fostering excellent actions and better decisions that are based on understanding the environmental consequences of actions.

The fisheries management measures considered in this supplemental environmental impact statement (SEIS) were designed to allow commercial groundfish fishing in the North Pacific while assuring that the fisheries would neither jeopardize the continued existence of both western and eastern Steller sea lion stocks, nor adversely affect their critical habitat. The triggering mechanism for this supplemental environmental impact statement is a series of issues and events involving the Endangered Species Act, the National Environmental Policy Act, the Magnuson-Stevens Act, the Consolidated Appropriations Act of 2001 (Public Law 106-554), the National Marine Fisheries Service (NMFS), the North Pacific Fishery Management Council (the Council), the fishing community, the conservation community, and the U.S. District Court for the Western District of Washington.

Background

The western population of Steller sea lions declined by over 70% since the 1960s when the population was estimated to be 170,000-180,000. Declines were first observed for the eastern Aleutian Islands and they then moved to both the east and west with large reductions throughout the Gulf of Alaska and Aleutian Islands. The western population has been declining steadily at an annual rate of approximately 5% per year during the 1980s and 1990s, with a large increase in the rate of decline in the late 1980s of about 12% per year; the eastern population has been stable or increasing slightly during these two decades. In 2000, the minimum population estimate for the western population of Steller sea lions in Alaska was 34,600 sea lions and the same estimate for the eastern population in Southeast Alaska in 1998 was 15,000 sea lions.

The causes of the decline of the western stock of Steller sea lions are not clearly understood, and experts agree that these causes have probably changed over time. The marked change in the rate and spatial extent of the decline over the past decade suggests that the factors that contributed most strongly to the rapid declines prior to the 1990s may not be the primary factors currently inhibiting the recovery of this stock. Those factors that contributed to the decline prior to 1990 can be attributed to commercial harvest of sea lions, entanglement of juvenile sea lions in commercial fishing gear, intentional shooting, subsistence hunting, and nutritional stress. Factors such as disease and predation may have had an influence in the rapid decline as well. Hypotheses to explain the continued decline of the western stock of Steller sea lions include nutritional stress due to competition with fisheries for prey, and/or changes in the ocean environment due to climate change and subsequent effects on forage fish populations, and an increase in predation by sharks and killer whales. Although data are insufficient to isolate nutritional stress of juveniles as the causal factor of the continued decline, it remains a viable hypothesis due to lack of contemporary data from all life stages of Steller sea lions in all seasons.

A starting point explaining the need for this analysis is the comprehensive Biological Opinion NMFS issued November 30, 2000. The 2000 Biological Opinion concluded that fisheries for walleye pollock, Pacific cod and Atka mackerel being managed under the fisheries regulations in effect in the year 2000, jeopardized the survival and recovery of Steller sea lions and adversely modified their critical habitat. The 2000 Biological Opinion included a reasonable and prudent alternative (RPA) that included, among other things, areas closed to trawling. If implemented in its entirety, the 2000 RPA would have had substantial adverse impacts to the fishing industry and fishing communities. In order to assure the ongoing federal action (conducting groundfish fisheries) was brought into compliance with the Endangered Species Act, NMFS would have had to implement the RPA by emergency rule for 2001. Federal legislation (Public Law 106-554) allowed for a phase-in of the RPA for the 2001 fisheries.

In December 2000, the North Pacific Fishery Management Council moved to not adopt NMFS's conclusions or RPA in the 2000 Biological Opinion. The Council's Scientific and Statistical Committee concluded that the 2000 Biological Opinion was scientifically deficient, prompting the Council to ask for two independent scientific reviews. One review would consist of an independent team of four scientists and the other review by the National Academy of Sciences; both reviews are now underway. The Council also began a longer term process to consider other measures that could replace the 2000 Biological Opinion RPA and allow fisheries to operate in such a manner that would not jeopardize the continued existence of Steller sea lion and would prevent adverse modification of their critical habitat. To assist in developing alternative measures, the Council established an RPA Committee that included members from the fishing community, the conservation community, NMFS, the Council's Scientific and Statistical Committee, and the Alaska Department of Fish and Game.

Alternatives Considered

At the June 2001 meeting, the Council had agreed to a set of five alternatives for analytical purposes, including an alternative developed by the Council's RPA Committee. Each alternative incorporated a wide variety of changes to existing fisheries management regulations. While these five alternative suites of management measures were considered in detail, three additional alternatives were considered and set aside because the measures they contained were integrated within the alternatives developed. Suggested fisheries management measures include: where closed areas would be set, when areas would be closed, what kinds of fisheries would be closed, how total allowable catch would be established, how total allowable catch would be divided into seasons, how total allowable catch would be divided into various areas, the setting of maximum daily catch limits for certain fisheries, dividing harvest limits between inside and outside critical habitat, the use of spawning biomass in determining allowable biological catch, and dividing fishing vessels into two fleets and assigning a season to each fleet. The five alternatives were developed using a combination of some or all of these management measures. Comparisons of the management measures associated with each alternative are shown in Table ES-1, with definitions of terms and acronyms found in Chapter 2, Section 2.3. Maps showing locations of various management measures for the five alternatives are included as Figures 2.3-1 through 2.3-8 in the map packet. The following is a brief synopsis of each.

Alternative 1 No action. Regulatory measures implemented by emergency rule, and designed to protect Steller sea lions, would expire. *Note this alternative is presumed to violate the Endangered Species Act.*

Alternative 2 The low and slow approach. This alternative is derived from the Draft Programmatic SEIS for the Alaska groundfish fisheries (NMFS 2001a). Essentially, the approach is to establish lower total allowable catch levels (TACs) for pollock, Pacific cod, and Atka mackerel, prohibit trawling in critical habitat, and implement measures to spread out catches through the year.

Alternative 3 The restricted and closed area approach. This alternative is the RPA detailed in the November 30, 2000, Biological Opinion. Essential elements of this approach are to establish large areas of critical habitat where fishing for pollock, Pacific cod, and Atka mackerel is prohibited, and to restrict catch levels in remaining critical habitat areas.

Alternative 4 The area and fishery specific approach. This alternative was developed by the Council's RPA Committee. This approach allows for different types of management measures in the three areas (AI, BS, and GOA). Essential measures include fishery specific closed areas around rookeries and haulouts, together with seasons and catch apportionments. Three options for closure areas are examined for this alternative.

Option 1: Chignik small boat exemption.
Option 2: Unalaska small boat exemption.
Option 3: Gear specific zones for GOA Pacific cod fisheries.

Alternative 5 The critical habitat catch limit approach. This alternative is derived from the suite of RPA measures that were in place for the 2000 pollock and Atka mackerel fisheries, and measures considered for the Pacific cod fishery that include seasonal apportionments and harvest limits within critical habitat. Essentially, this alternative limits the amount of catch within critical habitat to be in proportion to estimated fish biomass.

Environmental Effects of the Alternatives

This supplemental environmental impact statement provides a scientific and analytic comparison of the five alternatives, providing significance determinations of the environmental effects of each alternative on all important factors that might be affected by those alternatives. Direct, indirect and cumulative effects are considered. 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, ecosystems, and human communities affected. The intensity of the action includes the type of impact (beneficial versus adverse), duration of impact (short versus long), magnitude of impact (minor versus major), and degree of risk (high versus low level of probability of an impact occurring). This supplemental environmental impact statement lists impacts as: significant (positive or negative), conditionally significant (positive or negative), insignificant or unknown. Criteria used for determining significance ratings are explained for each resource. The environmental impacts of the alternatives in comparative form, providing a basis for choice among options, are summarized in Table ES-2. Major conclusions about the direct and indirect effects of each alternative are highlighted below.

Effects on marine mammals

The effects of incidental catch and entanglement in marine debris was found to be insignificant under all alternatives for all marine mammals, except for killer whales where the effects are unknown. This is because the numbers of incidental takes and incidence of entanglement are at very low levels unlikely to affect marine mammals at the population level, and while reductions are desirable, even a rate of zero would not be significant at the population levels.

With respect to harvest levels of prey species, Alternatives 1, 4, and 5 which would alter TAC levels (and presumably harvest levels) the least, the anticipated effects were rated as conditionally significant negative for Steller sea lions, northern fur seals, and harbor seals (Alternatives 1 and 4 only) and as insignificant for other marine mammal groups. Alternative 2, which would reduce TAC levels the most and substantially lower the amount of pollock, Pacific cod, and Atka mackerel which could be taken in Steller sea lion critical habitat was rated as conditionally significant positive for Steller sea lions, humpback whales, and harbor seals, conditionally significant negative for northern fur seals, and insignificant for other marine mammals. Alternative 3, which would substantially reduce the harvest of prey species within Steller sea lion critical habitat was rated as conditionally significant positive for humpback whales, conditionally significant negative for northern fur seals, and insignificant for other marine mammals. Alternative 5 was rated conditionally significant negative for Steller sea lions and northern fur seals and insignificant for other marine mammals.

With respect to the temporal and spatial concentration of the fisheries, Alternative 1 was rated as conditionally significant negative for Steller sea lions, northern fur seals, and harbor seals, and insignificant for other marine mammals. Alternative 2 was rated conditional significant positive for Steller sea lions and harbor seals, conditionally significant negative for northern fur seals, and insignificant for other marine mammals. Alternative 3 was rated conditional significant positive for Steller sea lions, conditionally significant negative for northern fur seals and harbor seals, and insignificant for other marine mammals. Alternatives 4 and 5 were rated conditionally significant negative for northern fur seals and harbor seals, and insignificant for other marine mammals. Disturbance effects were rated as insignificant under all alternatives except for northern fur seals which are unknown.

Although many of the effects were rated as insignificant, this does not mean that the management measures contained in the alternatives would not have some beneficial impacts on local marine mammal populations. However these beneficial impacts on local populations could be offset by displacing fishing activities into other areas, and at a meta-population level are not expected to have a significant effect on marine mammal population trajectories. Management measures included in the alternatives were not analyzed with respect to the development of an experimental design to evaluate the efficacy of Steller sea lion protection measures. Alternatives 3 and 4, to a greater extent than the other alternatives, do contain management measures which could be useful in the development of such an experimental design.

Effects on commercial fish species

For walleye pollock and Pacific cod, effects from all five alternatives are predicted to be insignificant because they meet the following significance criteria: (1) they would not be expected to jeopardize the capacity of the stock to produce maximum sustainable yield on a continuing basis; (2) they would not alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or

above the minimum stock size threshold; (3) they would not alter harvest levels such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (4) they would not alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold; and (5) they would not disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold.

For Atka mackerel, flatfish, rockfish, thornyheads, sablefish and other species analyzed, the effects from all alternatives are predicted to be either insignificant or unknown.

Effects on non-specified species

For Alternatives 1, 4, and 5 in the Bering Sea/Aleutian Islands, effects are predicted to be insignificant (less than 20% change) or unknown; for Alternatives 2 (low and slow) and 3 (restricted and closed areas) effects are predicted to induce conditionally significant positive effects (20 to 50% reduction) on jellyfish bycatch. In the Gulf of Alaska, jellyfish bycatch is predicted to result in a significant positive impact (greater than 50% reduction) from Alternative 2 and a conditionally significant positive impact from Alternative 3. Other non-specified fish, sessile invertebrates and mobile invertebrates are predicted to receive conditionally significant positive effects from Alternative 2.

Effects on forage fish

For all alternatives, effects are predicted to be insignificant (less than 20% change), except smelt bycatch is predicted to have conditionally significant positive effects (between 20% and 50% reduction) from Alternative 2 (low and slow) in both the Bering Sea/Aleutian Islands and the Gulf of Alaska, and significant positive effects (greater than 50% reduction) from Alternative 3 (restricted and closed areas) in the Gulf of Alaska.

Effects on prohibited species bycatch

In the Bering Sea, all alternatives are predicted to have insignificant effects (less than 50% reduction or no change in spatial/temporal concentration) for all species and issues, except for Alternative 2 (low and slow). Alternative 2 is predicted to induce conditionally significant positive effects (50% to 99 reduction) on Chinook salmon and other salmon bycatch, but would induce conditionally significant negative effects (50% to 99% increase) on the bycatch of herring and king crabs other than red king crab. In the Aleutian Islands, insignificant effects are predicted except for the following cases: (1) Chinook salmon are predicted to receive conditionally significant positive effects from all alternatives except Alternative 3 (restricted and closed areas), where conditionally significant negative effects are predicted; (2) herring are predicted to receive conditionally significant positive effects from Alternatives 2 and 3; and (3) other Tanner crab are predicted to have conditionally significant positive effects from Alternatives 2,3, and 4. For all alternatives in the Gulf of Alaska, and for all species and effects parameters, the effects are predicted to be insignificant.

Effects on Endangered Species Act listed Pacific salmon

All alternatives are predicted to have insignificant effects (less than 50% reduction in bycatch, no change in spatial/temporal concentration and no substantial difference in prey biomass removal), except for

Alternative 2 (low and slow). Alternative 2 is predicted to induce conditionally significant positive effects on Pacific salmon bycatch (50% to 99% reduction) in both the Bering Sea/Aleutian Islands and the Gulf of Alaska. These results are thought to be below a level at which Endangered Species Act consultation should be reinitiated.

Effects on seabirds

All alternatives are predicted to have unknown or insignificant effects (take number and/or rate is the same as 1993-1999 averages, prey availability is the same, impact to benthic habitat is the same, and availability of processing wastes is the same [all are qualitative estimates]) except for the following predictions: (1) a conditionally significant positive effect is predicted for the availability of processing wastes (wastes may be minimally increased) for the northern fulmar for all alternatives except Alternative 2 (low and slow), which is predicted to have an insignificant effect; and (2) all alternatives are predicted to induce a conditionally significant negative effect on incidental take for the short-tailed albatross (take number and/or rate may increase minimally).

Effects on marine habitat and other essential fish habitat

Alternative 1(no action) and 5 (critical habitat catch limits) are predicted to cause conditionally significant negative effects (moderate displacement in trawling effort) when evaluated for removal and damage to HAPC biota, except that all alternatives are predicted to have insignificant effects to non-living substrate by fixed gear. Alternative 2 (low and slow) is predicted to cause significant positive effects on removal of biota which forms living substrate by trawling (large increase in closed areas without displacement of effort elsewhere) and conditionally significant positive effects on removal of biota in habitat areas of concern by fixed gear (some increase in areas closed), modification to substrate by trawling (areas closed to trawling is greater) and changes to species diversity (area closed to trawl is greater). Alternative 3 (restricted and closed areas) is predicted to induce conditionally significant positive effects for the trawling questions (area closed to trawling is moderately greater), and conditionally significant positive effects on removal of biota in habitat areas of concern by fixed gear and for biodiversity change. Alternative 4 (area and fishery specific) is predicted to have conditionally significant negative effects on removal of biota (moderate displacement of trawling and longline effort), with insignificant impacts predicted for bottom substrate from fixed gear and for changes in biodiversity .

Effects on essential fish habitat (EFH) were evaluated for each alternative. All of the alternatives have the potential for regional adverse effects to EFH, or to a component of EFH such as certain biota known as habitat areas of particular concern (HAPC). Consultations on the effect of the preferred alternative on essential fish habitat were completed October 24, 2001, and no new mitigation measures were required.

Effects on the ecosystem

Predatory-prey relationships were assessed with four indicators: pelagic forage availability, spatial/temporal concentration of fishery on forage, removal of top predators, and introduction of nonnative species. All alternatives were predicted to induce significantly positive effects when considering pelagic forage availability (greater than 10% increase in pollock or other key forage abundance). While Alternative 1 (no action) is predicted to have conditionally significant negative effects on spatial/temporal concentrations of fishery on forage (probable increased temporal or spatial compression), all other alternatives would have

conditionally significant positive effects (probable decreased temporal or spatial compression). All alternatives are predicted to induce insignificant effects on removal of top predators (no change in trophic level of catch relative to trophic level of biomass). All alternatives are predicted to induce insignificant effects on the introduction of nonnative species (less than 10% change in total catch), except Alternative 1 where conditionally significant negative effects are predicted (greater than 10% increase in total catch).

Energy flow and balance is predicted to have insignificant effects from all five alternatives, as is functional diversity under biological diversity. Conditionally significant positive effects on species diversity is anticipated for Alternatives 2 through 5.

Effects on State of Alaska managed parallel fisheries

Assessing the effects of each alternative were analyzed for their impact on harvest levels during state waters parallel fisheries, and on levels of participation by vessel gear type and length. State waters parallel fisheries are those pollock, Pacific cod, and mackerel fisheries that occur within state waters during the open federal season.

For state parallel Pacific cod fisheries, Alternative 1 (no action) is predicted to induce insignificant effects (less than 20% change in catch) in all state waters examined. Alternative 2 (low and slow) is predicted to induce conditionally significant or significant adverse effects (greater than 50% decrease in harvest) in all areas (except Prince William Sound) and gear types (except jig). Alternative 3 (restricted and closed areas) is predicted to induce significant negative effects in all areas (except Prince William Sound) and gear types (some areas had insignificant effects for jig gear). Alternative 4 (area and fishery specific) is predicted to induce conditionally significant or significant adverse effects for all trawl fisheries, and a mix of effects in other gear types and areas. Alternative 5 (critical habitat catch limits) is predicted to have insignificant effects in Prince William Sound, but significant adverse effects for other areas and gear types (except jig gear).

For state waters parallel pollock fisheries, all alternatives are predicted to have insignificant effects in Prince William Sound and in the Aleutian Islands, but significant adverse effects for pollock fisheries in the Bering Sea and Gulf of Alaska. For state waters parallel Atka mackerel fisheries, all alternatives are predicted to have insignificant effects for jig and other gear types, but Alternatives 2, 3, and 4 are projected to have significant adverse effects for trawl catcher/processors.

Effects on management and enforcement

All alternatives are predicted to have significant negative effects on monitoring and enforcement (complex area boundaries are created and the number of directed fishing closures is increased), with Alternative 4 (area and fishery specific) being the most complex alternative. While Alternative 1 (no action) is predicted to induce insignificant effects on managing harvest within specified limits (no change in the number of quota categories or the size of quotas), all other alternatives are predicted to have significant negative effects on managing harvest within specified limits (an increase in the number of quota categories and a decrease in the amount of catch available in the quota categories), with Alternative 2 (low and slow) being the most complex alternative. The Regulatory Impact Review (Appendix C) states that NMFS Division of Enforcement estimates costs of approximately $552,000 per year associated with Alternatives 2 through 5

and NMFS Sustainable Fisheries Division estimates costs of $300,000 per year for Alternatives 2, 3, and 5 and $400,000 per year for Alternative 4.

Effects on the economic environment

The economic effects are grouped in the following categories: non-market impacts, industry costs and market impacts, and indirect impacts. Non-market impacts impacts are those elements of economic value in society that are not explicitly traded in the marketplace. Economic impacts that directly affect the commercial fishing industry are classified as industry costs and market impacts and include impacts to harvests and product prices, changes in operating costs, and effects on groundfish market values. Economic consequences that are attributable to the alternatives but not directly associated are considered indirect impacts and they include safety costs, impacts to related fisheries, costs to consumers, excess capacity, and prohibited species catch.

In the case of the Steller sea lion protective measures, non-market impacts include existence value, subsistence value, and benefits associated with eco-tourism. Existence value refers to the benefit that individuals in society gain just from knowing that Steller sea lion populations are stable and flourishing in their natural environments. Two specific impacts to subsistence harvests are that declining numbers of Steller sea lions will increase the costs of subsistence harvests, and fewer sea lions are likely to be harvested in total. Eco-tourism centered around Steller sea lions include impacts to tourists and those involved in providing services to those persons. For all three components of non-market impacts, each alternative is found to provide conditionally significant positive impacts. The exception is the no-action alternative (Alternative 1), which provides a conditionally significant negative impact.

Impacts to harvest levels, price effects, and gross revenues, address catch levels and total revenue changes that could be anticipated from the alternatives. Positive and negative changes in revenue are attributable to reductions in the level of catch and the accompanying impacts on prices and within the market for products processed from the harvested fish. An economic model was developed to address the "first wholesale" gross revenue changes to the several affected fishing sectors, and for each alternative. The total revenue associated with adoption of Alternative 2 represents the worst-case situation as measured against the 'no action' baseline case, and a significantly negative impact associated with Alternative 2. The model suggests a lesser, but also significantly negative, impact for Alternative 3. Alternative 4 has an insignificant impact, while Alternative 5 has a relatively small (conditionally significant) negative impact.

Operating cost impacts affect the fishing industry directly as increased costs per unit of harvest. They include items such as increased travel time to and from more distant fishing grounds, costs of learning new fishing grounds, reduced catch per unit of fishing effort due to less concentrated stocks, costs of stand downs and lay-ups, and costs to processing facilities built for higher rates of throughtput. In general, all alternatives will impose operational changes that will increase costs to fishing vessel operators.

Impacts on markets for pollock, Pacific cod, and Atka mackerel are measured as the changes in prices and product revenues associated with the alternatives. This includes product prices, quantities, volumes, product forms, market share, and balance of trade considerations. An analysis of the markets concluded that, although the impacts varied in quantity by harvested species and product form, the alternatives would have uniformly similar effects regardless of the species. In particular, Alternative 2 would result in rather significantly negative impacts to markets for pollock, Pacific cod, and Atka mackerel. Although prices for product forms would likely rise, the losses in sales volumes would not be sufficient to compensate the

industry. Alternative 4 (the only other alternative examined in detail in the market analysis) would have a relatively small effect on the markets of most of the product forms, and have an overall insignificant impact. By interpolation, these results are extended to Alternatives 3 and 5. Both are evaluated to also be significantly negatively impacted.

Safety costs or factors include fishing further offshore, during periods of extreme weather, and on more exposed or remote grounds, and considers the relationship between safety and reduced profitability. Several of the alternatives contain provisions which seek, either directly or indirectly, to accommodate the differential capacities and characteristics of the fleets operating in the regulated fisheries, such as explicitly exempting smaller vessel classes from an area restriction. A qualitative assessment suggests that governing the timing and fishing area restrictions, contained in Alternatives 2, 3, and 5, would force vessels to fish further offshore and/or during periods when operating conditions are potentially more extreme. Alternative 4 would, by comparison, reduce these likely effects. Because of the difficulty in measuring safety impacts, they are considered conditionally significant adverse for all the alternatives.

Impacts to related fisheries include those spillover effects such as increases in non-target catches of Pacific cod and pollock, effects of displacing capacity from SSL regulated fisheries, increased costs of gearing up associated with pre-season planning uncertainty; implications and opportunities for topping off behavior; and increased bait costs in crab fisheries. Each of the alternatives has been determined to have an unknown impact ranking because it was not possible to determine a net result of these complex, interrelated effects.

Costs to consumers, or impacts felt through product market channels through to the U.S. consumer level, were analyzed as a part of the market analysis. The market analysis determined that the impact varied by product form, and would be most noticed by consumers of pollock and Pacific cod fillets, and by the select market of surimi in the U.S. In these cases, prices to consumers in the U.S. will rise slightly if the quantity of pollock and Pacific cod is reduced by the respective alternatives. The remainder of products are almost entirely exported and would not affect U.S. consumers. The impact of Alternative 2 was ranked as having a conditionally significant adverse impact. Alternative 4 was ranked as having an insignificant impact. By interpolation, Alternative 3 ranks as having a conditionally significant negative impact (similar to Alternative 2) and Alternative 5 ranks as having an insignificant impact (similar to Alternative 4).

Excess capacity relates to the aggregate impact of a fixed amount of capital equipment among the fishing and processing sectors, but operating under a reduced harvest regime. There is no available quantification of net changes or shifts within these sectors that would likely occur, but changes imposed under at least Alternatives 2, 3 and 5 will result in excess capacity in the harvesting sector. Nevertheless, the alternatives would have an unknown impact.

Bycatch and associated avoidance measures have the potential to increase vessel operating costs. There is no quantitative method to relate the biological findings of prohibited species catch impacts, by alternative, to economic costs to fishing operations, nor is there a quantitative evaluation of the impacts that the different alternatives will have upon fish discards. The fishing restrictions imposed under each of the alternatives may result in fishermen having to fish in waters that have previously not been fished. The results of this change are not known, but it is reasonable to assume that at least some of the fishing activity in new areas will result in greater discards of non-target species. The extent of the effect leads to an unknown impact from the alternatives.

Effects on the social environment

The socioeconomic effects of implementing Steller sea lion protection measures were assessed for the federally managed commercial pollock, Pacific cod and Atka mackerel fisheries in terms of 21 socioeconomic indicators by region. Summary comparisons were made of Alternatives 2 and 4 with Alternative 1 for four of these indicators, vessel safety and the non-market values of Steller sea lions and other living marine resources. These alternatives were selected for the summary comparisons because Alternative 1 is the no action alternative and because compared to Alternative 1, Alternatives 2 and 4, respectively, are projected to have the largest and smallest effects on the four indicators.

The summary comparisons (shown in Table ES-3) are made for the high and low estimates for these four indicators and three alternatives. Both Alternatives 2 and 4 may cause disproportionate socioeconomic effects on some regions. For example, Alternative 2 is predicted to cause between 31% and 55% reductions in catcher vessel total harvests of pollock, Pacific cod and Atka mackerel across all regions, but is predicted to cause between 54% and 80% reductions in regionally owned catcher vessel harvests in the Alaska Peninsula/Aleutian Island region. The decreases in total harvesting and processing payments to labor and employment accruing to this region from the pollock, Pacific cod and Atka mackerel fisheries are also disproportionately large. For the Kodiak region, the predicted decrease is disproportionately large for each of the four indicators.

Alternative 4 is predicted to cause 5% to 9% reductions in catcher vessel harvest of pollock, Pacific cod and Atka mackerel across all regions, but is predicted to cause 7% to 17% and 9% to 15% reductions in regionally owned catcher vessel harvest in the Alaska Peninsula/Aleutian Island and Oregon Coast regions, respectively. Likewise, across all regions, Alternative 4 is predicted to cause reductions in total ex-vessel value of pollock, Pacific cod and Atka mackerel of between 1% and 6%, but the Kodiak region is predicted to lose between 3% and 12%.

Specific fisheries within specific regions may experience disproportionate impacts relative to the total fishery in that region. For example, under Alternative 4, a disproportionate impact can be seen in the Alaska Peninsula/Aleutian Island, where harvest reductions to regional owned catcher vessels are predicted to drop between 7% and 17%, but the Pacific cod harvest is predicted to drop between 17% and 26%. Other disproportionate fisheries specific impacts can be found by examining the data tables in Chapter 4, Section 12 of this SEIS.

Regarding safety at sea, Alternative 2 is predicted to have the largest operational changes (e.g., transit greater distances between port and open fishing grounds, fish farther offshore, and aggravate the race for fish). And therefore, Alternative 2 is expected to have a high potential to increase the risk of accidents and injury per unit of catch. However, this adverse effect will be offset, at least in part, by the substantial reductions in catch that would occur with this alternative. Alternative 4 reduces some requirements which force effort farther offshore (especially for the smaller vessels) and should, therefore, impose a relatively lower risk of accident and injury, to the extent that occurrence of accidents and injuries are highly correlated with fishing distance offshore, weather and sea conditions, and vessel size.

Given the lack of availability of precise information, it is not possible to distinguish degrees of positive subsistence impact among the alternatives, either to order them or to determine whether or not such theoretically positive impacts would rise to a level of significance. Logically, those which reduce

commercial groundfish harvest the most would have the most potential benefit for the subsistence use of Steller sea lions and other living marine resources. Therefore, Alternatives 2 and 4 would be expected to provide increased subsistence use values compared to Alternative 1.

Although the other non-market values of Steller sea lions and other living marine resources are thought to be substantial, the difference in these values among the alternatives is not known. That uncertainty is due, in part, to our limited ability to predict the degree to which the various alternatives affect the probability of either the recovery or extinction of Steller sea lions. However, as with subsistence value, the other non-market values would be expected to be higher for alternatives that decrease the probability of extinction or increase the probability of recovery.

Cumulative effects

The analysis of cumulative effects addressed the synergistic and incremental effects of past, present, and future external actions on the action alternatives Steller sea lions and groundfish fisheries. External actions evaluated can include those of the NMFS, other human controlled events, and natural events. Cumulative effects were examined for marine mammals (including the Steller sea lion and northern fur seal), target groundfish species (including the pollock, Pacific cod, and Atka mackerel) and other species, non-specified fish species, forage fish, prohibited species, ESA listed Pacific salmon, seabirds, benthic habitat and essential fish habitat, the ecosystem, social, and economic indicators. In order to compare and evaluate incremental and synergistic effects for each of these topics, the cumulative effects analysis uses the same categories and significance criteria used to analyze potential direct and indirect effects. Cumulative effects are summarized below:

For the Steller sea lion: Cumulative effects for incidental take or entanglement and disturbance were considered to be insignificant for all alternatives. Cumulative effects for prey availability were considered to be conditionally significant adverse for all five alternatives. Cumulative effects for spatial and temporal harvest of prey were identified as conditionally significant adverse for four of the five alternatives; only Alternative 2 was noted as insignificant.

For the northern fur seal: Cumulative effects for spatial and temporal harvest were considered to be conditionally significant adverse for all five alternatives due to potential redistribution of fishing effort into areas important to northern fur seals. Cumulative effects for prey were identified as conditionally significant adverse for Alternative 5 and insignificant for the other Alternatives 1 through 4.

For the three target groundfish species: Cumulative effects were identified for fishing mortality, habitat suitability, and prey availability for pollock and Pacific cod in the eastern Bering Sea and Aleutian Islands (BSAI), and the Gulf of Alaska (GOA), but were considered insignificant for all five alternatives. Cumulative effects were identified for habitat suitability and prey availability for Atka mackerel in BSAI, but were considered insignificant for all five alternatives. Cumulative effects were noted for fishing mortality, spatial and temporal concentration, habitat suitability, and prey availability for Atka mackerel in the GOA; however, the significance of each of these effects is unknown at this time.

For habitat effects: Cumulative effects were identified from removal and damage to HAPC by both mobile and fixed gear. Effects from mobile gear were considered conditionally significant beneficial for Alternative 2, insignificant for Alternative 3, and conditionally significant adverse for Alternatives 1, 4, and 5. Effects

from fixed gear were considered conditionally significant adverse for Alternatives 1, 4, and 5, and insignificant for alternatives 2 and 3. Cumulative effects were identified from modification of non-living substrate, damage to epifauna and infauna by mobile and fixed gear. Effects from mobile gear were considered conditionally significant adverse for Alternatives 1 and 5, and insignificant for Alternatives 2, 3, and 4. Effects from fixed gear were considered insignificant for all alternatives. Cumulative effects were identified for habitat subject to biodiversity reduction; these effects were considered conditionally significant adverse for Alternatives 1 and 5, and considered insignificant for Alternatives 2, 3, and 4.

For ecosystem effects: Cumulative effects were identified as conditionally significant adverse under Alternative 1 for predator-prey relationships, and considered insignificant for all other alternatives. Cumulative effects for energy flows and balance were considered insignificant for all alternatives. Cumulative effects for biological diversity included a mixture of conditionally beneficial, adverse and in significant effects, depending on specific species and areas affected.

For socioeconomic effects: Cumulative socioeconomic effects for the five alternatives were examined in relation to selected factors public resource value, fishing industry, and community characteristics. Regarding public resource values, cumulative effects were identified as conditionally significant adverse or unknown for Alternative 1. Given the external factors, however, improvements from protection measures in Alternatives 2 through 5 resulted in cumulative effects considered as insignificant.

Regarding cumulative effects on the fishing industry, cumulative effects on excess capacity were identified as conditionally significant adverse for all alternatives. Cumulative effects on operating costs are also considered conditionally significant adverse for all alternatives, with the exception of Alternative 1 which is insignificant. Shore-based harvesters and processors in the BSAI and GOA that are interdependent on other fisheries such as salmon and crab would experience greater impacts. Cumulative effects on vessel safety are identified as conditionally significant adverse for Alternatives 2, 3, and 5, which require additional travel by smaller catcher vessels to areas open for to fishing. Cumulative effects on vessel safety for Alternative 1 and 4 are insignificant overall. Cumulative effects on harvest value/fish price and on product quality/revenue impacts are identified as conditionally significant adverse for Alternatives 2, 3, and 5, but insignificant for Alternatives 1 and 4. Cumulative effects on management and enforcement costs are identified as conditionally significant adverse for Alternatives 2, 3, and 4, but insignificant for Alternatives 1 and 5.

Overall trends in other state and federal fisheries result in conditionally significant adverse effects for all alternatives, particularly for the Aleutian Island/Alaska Peninsula and Kodiak Island regions whose economies are highly dependent on the fishing industry. Conditionally significant adverse cumulative effects are of a greater magnitude for Alternatives 2, 3, and 5, due to change in patterns in temporal and spatial closures that impact smaller vessels with limited options for redistributing fishing effort and having a greater potential for revenue at risk.

Comparison of the Alternatives

No differences (trade-offs) were found among Alternatives 1 through 5 in effects on four marine mammals (unlisted cetaceans, northern fur seals, other pinnipeds, and sea otters), on all 11 target commercial fish species (pollock, Pacific cod, Atka mackerel, flatfish, other flatfish, Pacific Ocean perch, red rockfish and other rockfish, thornyheads, sablefish, and squid and other species), on one prohibited species bycatch (in

GOA), on five seabirds (short-tailed albatross, other albatrosses and shearwaters, piscivorous seabirds, eiders, and other seabird species), and one of three components of ecosystems (energy flow and balance).

Some differences are shown for the effects of Alternatives 1 through 5 on resources, species, species groups, or effect parameters that are not central issues in this specific decision process related to the RPA for the Steller sea lion. Further, the actual effects shown range from U to CS- to I to CS+. The issues in this category include Endangered Species Act (ESA) listed cetaceans, harbor seals, non-specified fish species, forage fish, prohibited species bycatch in the Bering Sea (pollock and Pacific cod), prohibited species bycatch in the Aleutian Islands (Atka mackerel), ESA listed Pacific salmon, Norther fulmar, and marine benthic habitat and other essential fish habitat.

Some differences are shown for the effects of Alternatives 1 through 5 on four resources, species, species groups, or effect parameters that are central issues in this decision process (Steller sea lions, predator-prey relationships, diversity, and economic indicators). It should be recognized that effects on pollock, Pacific cod, and Atka mackerel also influence Steller sea lions; however, as noted above, all five alternatives are depicted as having insignificant (I) effects on these target commercial fish species.

Alternatives 2 and 4 are further compared because they seemed to be of the most interest by testimony comments at Council meetings and written comments on the draft SEIS. Alternative 1was not considered a viable option due to its potential noncompliance with RPA requirements to adequately address "jeopardy and adverse modification" for Steller sea lions. Alternatives 3 and 5 can be set-aside in this final analysis due to lesser interest in these options by the Council and general public. Re-examination of the trade-offs between Alternatives 2 and 4 in relation to the four issues listed in above reveal that there are no trade-offs (differences between these two alternatives) for predator-prey relationships and diversity. Examination of the remaining effects parameters for Steller sea lions and economic indicators reveal that trade-offs are displayed for only four parameters (harvest of prey species and spatial/temporal concentration of fishery for the Steller sea lion; and the economic indicators listed as harvests and fish prices, and costs to consumers).

Under alternative 2, conditionally significant positive effects would occur on the harvest of prey species and the spatial/temporal concentration of the fisheries; as a result, it is presumed that a "no jeopardy and no adverse modification" opinion would be rendered by the NMFS for the Steller sea lions. The social and economic analysis of alternative 2 indicated that significant negative effects would occur on harvest and fish prices for target groundfish species and conditionally significant negative effects would occur in relation to costs to consumers. The four socio-economic comparisons shown in Table ES-3 depict overall losses of between 28 to 61 percent, further, the losses are not evenly distributed based on the analysis of six geographical regions (the losses range from 23 to 80 percent depending upon the comparison and region). Conditionally significant negative cumulative effects would occur for prey availability for the Steller sea lion; and likewise for harvests and fish prices, product quality and revenue impacts, operating cost impacts, safety impacts, costs to consumers, management and enforcement costs, and excess capacity.

Under Alternative 4, conditionally significant negative effects would occur on the harvest of prey species for the Steller sea lion, and insignificant effects would occur on the spatial/temporal concentration of the fisheries; a "no jeopardy and adverse modification" opinion has been obtained from the NMFS (see 2001 Biological Opinion and Incidental Take Statement in Appendix A), and four reasonable and prudent measures have been identified as monitoring requirements to document the effectiveness of Alternative 4 in this regard. Insignificant effects would occur on harvest and fish prices for target groundfish species, and

in relation to costs to consumers. The four socio-economic comparisons shown in Table ES-3 depict losses of between less than 1% to 6%, further, the losses are not evenly distributed based upon the analysis of six geographical regions (the losses range from zero to 17 percent depending upon the comparison and region). Conditionally significant negative cumulative effects would occur for prey availability for the Steller sea lion and the spatial and temporal harvest of prey; likewise, such negative effects would also occur for operating cost impacts, and excess capacity

Identification of the Preferred Alternative

In the Draft SEIS released in August 2001, NMFS identified Alternative 4 as its preliminary preferred alternative. As part of the NEPA process undertaken following the comprehensive biological opinion and Council rejection of the associated RPA, it was the expectation that if an alternative could be formulated that was found to be in compliance with ESA and other federal laws and Executive Orders, and not be as economically costly as the RPA in the NMFS 2000 Biological Opinion, it would be designated the preferred alternative. Alternative 4 appears to prove that it is possible, thus it is designated the preferred alternative for purposes of the draft environmental impact analysis. Further, NMFS reinitiated Endangered Species Act Section 7 consultation for these fishery management measures, resulting in a draft Biological Opinion and Incidental Take Statement on the measures contained in Alternative 4, and the draft Biological Opinion was included as Appendix A in the draft SEIS. The Draft Biological Opinion contained a finding of no jeopardy and no adverse modification of critical habitat for Alternative 4. NMFS also attached a "Dear Reviewer" letter to the Draft Biological Opinion that requested the RPA Committee and the Council to critically review, assess, and evaluate the need for critical habitat harvest limits and seasonal harvest rates.

The RPA Committee met on August 23-24, 2001 to review the Draft Biological Opinion and the Draft SEIS. Although the Draft Biological Opinion found no jeopardy, the Committee recommended that the measures be slightly modified to include additional spatial and temporal fishery restrictions as part of Alternative 4 in response to the NMFS concerns. For BSAI cod fisheries, additional area closures would apply to Bering Sea longline fisheries, and the Bering Sea cod trawl fishery would be spread out over 3 seasons with differing apportionments for catcher vessels and catcher-processors. The Bering Sea pollock fishery would be modified by adding a more restrictive catch limit in the SCA.

The Council reviewed the Draft SEIS, Draft Biological Opinion, and RPA Committee recommendations at its meeting on September 5-9, 2001, to ensure that it had adequate time to fully consider the proposed management measures and NMFS' analysis under Section 7. The Council adopted Alternative 4 (including the recommendations of the RPA Committee for additional Steller sea lion protection measures) as its preliminary preferred alternative.

At its October 2001 meeting, the Council undertook its final review of the Draft SEIS and Draft Biological Opinion. The Council adopted Alternative 4 with the additional measures to protect Stellar sea lions including: a reduction in the critical habitat catch limit for Atka mackerel, a total closure of the Aleutian Islands pollock fishery, and a vessel monitoring system requirement for all vessels (except vessels using jig gear) fishing for pollock, cod, or Atka mackerel. Option 2 of Alternative 4 was also adopted to allow a limited Pacific cod fishery by longline catcher vessels on the west side of Unalaska Island. In choosing it's preferred alternative, the Council noted that Alternative 4 was precautionary response to concerns about Steller sea lions and that these management measures would neither jeopardize the continued existence of the western stock of Steller sea lions nor modify their critical habitat. Further, the Council noted that

Alternative 4 better met the Magnuson-Stevens Fishery Conservation and Management Act mandates, especially with regards to safety at sea, minimizing bycatch, minimizing impacts to fishing communities, and attainment of optimum yield.

The final Biological Opinion, dated October 19, 2001, concludes this suite of management measures would not likely jeopardize the continued existence of the western or eastern populations of Steller sea lions, nor would it adversely modify the designated critical habitat of either population. It is important to point out that the October 2001 Biological Opinion does not ask if Alternative 4 helps the Steller sea lion population size recover to some specified level so that the species could be delisted, but rather asks if Alternative 4 will jeopardize the Steller sea lion's chances of survival or recovery in the wild. While the Biological Opinion has concluded that Alternative 4 does not jeopardize the continued survival and recovery of Steller sea lions, it none-the-less identified four reasonable and prudent measures to include with Alternative 4 as necessary and appropriate to minimize impacts of the fisheries to Steller sea lions. The measures are: (1) monitoring the take of Steller sea lions incidental to the BSAI and GOA groundfish fisheries; (2) monitoring all groundfish landings; (3) monitoring the location of all groundfish catch to record whether the catch was taken inside critical habitat; and (4) monitoring vessels fishing for groundfish inside areas closed to pollock, Pacific cod and Atka mackerel to see if they are illegally fishing for those species.

Areas of Controversy

The whole issue regarding the effects of fishing on Steller sea lion is controversial. Some environmental groups have argued that fisheries compete with Steller sea lions for prey, and that this competition reduces the survival of Steller sea lions resulting in continued decline. Members of the fishing community argue that the fishing industry is not responsible for the decline of Steller sea lions, but rather other factors (e.g., climate change, predation by killer whales) are to blame. The controversy is further fueled by the lack of evidence linking fisheries with effects on Steller sea lions, combined with the Endangered Species Act requirements relative to burden of proof.

Issues to be Resolved

All five alternatives analyzed herein, including the preferred alternative (Alternative 4), include 3 nm no-transit zones around principal rookeries for the Steller sea lion. Many such rookeries occur in State of Alaska waters. No-transit zones have the effect of closing some Alaska State waters to directed fishing for groundfish. Further, questions have arisen as to the use of federal fisheries permits, and the practice of returning them to NMFS to enable fishing in State waters, and then the re-applications for such permits, all possibly occurring several times in a given year. The legal and policy implications of such practices, and their effect on State-managed waters, must be more thoroughly addressed and understood in implementing the preferred alternative. Several options for implementation are being developed; further, the implications of the options are considered in relation to the "no jeopardy and adverse modification" opinion of NMFS in their Section 7 Consultation under the Endangered Species Act (Appendix A). NMFS has worked with the State of Alaska to satisfactorily resolve these implementation issues.

A second unresolved issue is related to experimental research programs and their design, and the conducting of broad-scale monitoring programs. An on-going experimental program which began in the late 1990s is testing the efficacy of no-trawl zones in relation to the possible effects of fishing on prey abundance and distribution relative to the Steller sea lion. A study at Sequam Island is addressing Atka mackerel issues, and

a second study at Chiniak Island near Kodiak Island is addressing pollock biology. Both studies are designed to determine whether fisheries result in localized depletion of the target fish, and if so, whether or not Steller sea lions may be compromised because of the depletion of prey.

Relative to experimental programs specifically associated with Alternative 4, the Council has contracted with a four-person international team of scientists to review the NMFS 2000 Biological Opinion regarding its underlying scientific information, assumptions, and hypotheses. One specific task is to recommend an appropriate experimental design to improve the current understanding of the interactions between fisheries and Steller sea lions, and the efficacy of imposed management measures to promote recovery of the Steller sea lion population. The report from the team was received in September, 2001. The team will continue to meet during the fall as an experimental design and related monitoring program is developed for the preferred alternative. The Council's Science and Statistical Committee (SSC) has indicated that an adequate experimental design can be developed within the context of the preferred alternative. The SSC noted that the design must follow solid scientific principles, including testable hypotheses and the evaluation of assumptions. Further, the design should include the power to detect differences in trends.

In addition to the experimental programs that NMFS is conducting, other agencies' and universities' research projects are being funded to examine various facets of Steller sea lion ecology and possible causes of the decline in populations. Numerous research programs are described in the 2001 Biological Opinion and Incidental Take Statement for Alternative 4. Over time, it is anticipated that these research findings will contribute to an increased understanding of Steller sea lion biology and the effectiveness of the management measures included in the preferred alternative.

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures. These terms and conditions are non-discretionary.

1. NMFS will monitor the take of Steller sea lions in the pollock, Pacific cod and Atka mackerel fisheries. NMFS-trained observers on vessels in these fisheries will be deployed under the existing program for observer coverage based on vessel size and sector. NMFS will use observer data to make minimum estimates of mean annual mortality for each fishery. NMFS will evaluate the observer coverage that results from existing regulatory requirements to determine if changes in coverage are warranted to better assess take of Steller sea lions.

2. NMFS will monitor vessel location and compliance with gear and directed fishing restrictions for the pollock, Pacific cod and Atka mackerel fisheries. NMFS will implement a Vessel Monitoring System for all vessels in the pollock, Pacific cod and Atka mackerel fisheries that are subject to restrictions on directed fishing in rookery, haulout, or foraging area zones. NMFS will require electronic vessel logbooks or other recordkeeping and reporting measures necessary to monitor directed fishing.

3. NMFS will monitor harvest of pollock, Pacific cod and Atka mackerel. Monitoring of harvest of these species will be sufficient to account for the amount of fish harvested and to determine appropriate fishery closures by sector, gear type or area.

4. NMFS will manage critical habitat harvest limits using conservative management strategies to minimize the likelihood of exceeding a critical habitat harvest limit. Conservative management strategies shall include:

   If any part of an observed haul or set, or an unobserved vessel trip, occurs inside critical habitat, the entire catch will be counted against the critical habitat harvest limit.

   If VMS data are missing for a vessel in a fishery subject to a critical habitat harvest limit, the catch will be counted against the critical habitat harvest limit.

   If critical habitat harvest limits are small relative to the amount of fishing effort, NMFS will calculate the fishery closure date based on estimates of maximum harvest capacity, and pre-announce the closure date.

Table ES-1 Comparison of management measures under the alternatives.

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
Control Rule	Amendment 56 Tiers	TAC set as a % of maximum ABC	NMFS 2000 Biological Opinion Global Control Rule	Modified Global Control Rule - no directed fishing if biomass < B20%.	Amendment 56 Tiers
No Transit Zones	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries
Area Closures	No trawling 10/20 nm from 37 rookeries	Prohibit all trawling in CH/RFRPA; AI closed to pollock fishing	All CH/RFRPA sites designated as restricted or closed to fishing for pollock, cod, and mackerel	Specified closures around rookeries & haulouts by fishery, area, and gear type; SBSRA closed to pollock fishing; area 4, area 9, and Seguam closed to directed fishing for pollock, cod, and mackerel. AI closed to pollock fishing in 2002.	No pollock fishing in AI area; no trawling 10/20 nm from 37 rookeries
Season Closures	No trawling 1/1 to 1/20	No trawling 1/1to 1/20; no trawling for pollock 11/1 to1/20	No trawling 1/1 to 1/20; no trawling for pollock, cod, or mackerel 11/1 to 1/20; no fishing for pollock, cod, or mackerel inside CH 11/1 to 1/20	No trawling 1/1to 1/20; closure period between GOA pollock seasons; no trawling for pollock or cod 11/1 to 12/31	No trawling 1/1 to 1/20; no trawling for pollock 11/1 to1/20

Table ES-1 Comparison of management measures under the alternatives (cont.).

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
Seasons and Apportionments pollock	BSAI - 1/20 (45%), 9/1 (55%); GOA - 1/20 to 4/1 (25%), 6/1 to 7/1 (35%), 9/1 to 12/31 (40%)	Four seasons evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	AI - 1/20 (100%); BS 1/20 (40%), 6/11 (60%); GOA - 1/20 to 2/25 (25%); 3/10 to 5/31 (25%), 9/25 to 9/15 (25%), 10/1 to 11/1 (25%)	BSAI - 1/20, 4/1 (40%), 6/10, 8/20 to 11/1 (60%); GOA - 1/20 to 3/1 (30%), 3/15 to 6/1 (15%); 8/20 to 9/15 (30%), 10/1 to 11/1 (25%)
Seasons and Apportionments cod	BSAI trawl - 1/20 BSAI fixed -1/1, 5/1, 9/1 GOA trawl -1/20 GOA fixed - 1/1	Four seasons evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	BSAI trawl - 1/20-3/31 (60%), 4/1-6/10 (20%), 6/10-10/31 (20%) BSAI longline- 1/1 (60%), 6/11 (40%) BSAI pot - 1/1 (60%), 9/1 (40%) GOA trawl - 1/20 (60%), 9/1 (40%) GOA fixed - 1/1 (60%), 9/1 (40%)	BS trawl + fixed - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%) AI trawl + fixed - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%) GOA trawl + fixed - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%)
Seasons and Apportionments mackerel	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)	Four season evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	AI - 1/20 to 4/15 (50%), 9/1to 10/31 (50%)	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)
Catch Limits Inside CH	Akta mackerel: incremental change to limit of 40% inside CH in 2002	Foraging area catch limits for fixed gear fishing for Pacific cod	Pollock, cod, and mackerel: 4 seasons (1/20, 4/1, 5/11 8/22) inside CH/RFRPA with catch limits based on season and area	A season pollock harvest in SCA limited to 28% of annual TAC prior to April 1	Mackerel: incremental change to 40% inside CH and 60% outside in 2002 BSAI Pollock: maximum

Table ES-1 Comparison of management measures under the alternatives (cont.).

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
			specific biomass estimates	Mackerel 60% inside 40% outside of each season apportionment GOA cod: option for AMCC zonal approach for GOA Pacific cod.	TAC % allowed inside CH/RFRPA sites = 20% in A+B season combined (15% for A + B singly), 4.5% in C season and 7.5% in D season BS cod: maximum TAC % allowed inside CH = 20% (A), 3.6% (B) AI cod: maximum TAC % allowed inside CH = 20% (A), 48.3% (B) GOA cod: maximum TAC % allowed inside CH = 20% (A), 31.8% (B season)
Other Catch Limits		Daily catch limits: BS pollock 5000 mt GOA pollock 1000 mt BSAI cod 600 mt GOA cod 400 mt BSAI mackerel 300 mt		Platoon management of the Atka mackerel fishery	
Experimental Design	Small scale: Kodiak and Seguam localized depletion testing	Small scale with well defined and manageable objectives	Large scale: 4 sets of restricted/closed areas for comparison	Small scale with well defined and manageable objectives	Small scale: Kodiak and Seguam localized depletion testing

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
Observer Coverage	No change to current observer coverage requirements	All non-trawl Pacific cod vessels fishing in CH required to have observer.	No change to current observer coverage requirements	No change to current observer coverage requirements	No change to current observer coverage requirements
VMS	Required in BSAI Atka mackerel fishery	VMS required on all vessels fishing for cod in CH		VMS required on all vessels (except those using jig gear) when fishing for pollock, cod, or mackerel.	Required in BSAI Atka mackerel fishery
Registration Requirements	None	Seasonal exclusive area registration	None	Preregistration required for Atka mackerel fishery	None

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

4.1-7 Steller Sea Lions	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Incidental take/entanglement in marine debris	I	I	I	I	I
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	CS-	CS+	CS+	I	I
Disturbance	I	I	I	I	I
4.1-9 ESA Listed Cetaceans					
Incidental take/entanglement in marine debris	I	I	I	I	I
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	I	I	I	I	I
Disturbance	I	I	I	I	I
4.1-10 Other Cetaceans besides ESA listed Cetaceans					
Incidental take/entanglement in marine debris	I (U for killer whales)	I (U for killer whales)	I (U for killer whales)	I (U for killer whales)	I (U for killer whales)
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	I	I	I	I	I
Disturbance	I	I	I	I	I
4.1-11 Northern Fur Seals					
Incidental take/entanglement in marine debris	I	I	I	I	I
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	CS-	CS-	CS-	CS-	CS-
Disturbance	U	U	U	U	U

4.1-12 Harbor Seals	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Incidental take/entanglement in marine debris	I	I	I	I	I
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	CS-	CS+	CS-	CS-	CS-
Disturbance	I	I	I	I	I
4.1-13 Other Pinnipeds					
Incidental take/entanglement in marine debris	I	I	I	I	I
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	I	I	I	I	I
Disturbance	I	I	I	I	I
4.1-14 Sea Otters					
Incidental take/entanglement in marine debris	I	I	I	I	I
Harvest of prey species	I	I	I	I	I
Spatial/temporal concentration of fishery	I	I	I	I	I
Disturbance	I	I	I	I	I
4.2-4 EBS Pollock					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I

S = Significant, **C** = Conditional, **I** = Insignificant, **U** = Unknown, **+** = positive, **-** = negative

Shaded cells indicate tradeoffs between alternatives identified in the analysis for that resource for that parameter

4.7-3 Other Seabird Species					
Incidental Take	I	I	I	I	I
Prey Availability	I	I	I	I	I
Benthic Habitat	I	I	I	I	I
Proc. Waste & Offal	I	I	I	I	I
4.8-6 Marine Benthic Habitat	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Removal/damage to HAPC biota by bottom trawl gear	CS-	S+	CS+	CS-	CS-
Removal and damage to HAPC biota by fixed gear	CS-	CS+	CS+	CS-	CS-
Modification of nonliving substrates, damage to epifauna and infauna by trawl gear	CS-	CS+	CS+	I	CS-
Modification of nonliving substrates,	I	I	I	I	I
Habitat subject to change in biodiversity	CS-	CS+	CS+	I	CS-
4.9-3 Predator-prey Relationships					
Pelagic Forage Availability	S+	S+	S+	S+	S+
Spatial and Temporal Concentration	CS-	CS+	CS+	CS+	CS+
Removal of Top Predators	I	I	I	I	I
Introduction of Nonnative Species	CS-	I	I	I	I
4.9-3 Energy Flow and Balance					
Energy Redirection (Discards)	I	I	I	I	I
Energy Removal (Catch)	I	I	I	I	I
4.9-3 Diversity					
Species Diversity	CS-	CS+	CS+	CS+	CS+
Functional (Trophic) Diversity	I	I	I	I	I

4.11-7 Management Complexity and Enforcement Issue					
Compliance with Area Closures	S-	S-	S-	S-	S-
Harvest within Catch Limits	I	S-	S-	S-	S-
Economic Indicators	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Existence Values	CS-	CS+	CS+	CS+	CS+
Non-market Subsistence	CS-	CS+	CS+	CS+	CS+
Non-consumptive Eco-tourism Use	CS-	CS+	CS+	CS+	CS+
Harvests & Fish Prices	CS+	S-	S-	I	CS-
Operating Cost Impacts	CS+	CS-	CS-	CS-	CS-
Groundfish Market Values	CS+	S-	CS-	I	CS-
Safety Impacts	CS-	CS-	CS-	CS-	CS-
Impacts on Related Fisheries	U	U	U	U	U
Costs to Consumers	CS+	CS-	CS-	I	I
Management and Enforcement	I	S-	S-	S-	S-
Excess Capacity	CS-	U	U	U	U
Prohibited Species Catch	I	U	U	U	U

S = Significant, **C** = Conditional, **I** = Insignificant, **U** = Unknown, **+** = positive, **-** = negative

Shaded cells indicate tradeoffs between alternatives identified in the analysis for that resource for that parameter

Table ES-3 Estimated losses under Alternatives 2 and 4 compared to baseline (Alternative 1) using four socioeconomic indicators.

Region/Indicator		Reduction between Alternative 1 and Alternative 2				Reduction between Alternative 1 and Alternative 4			
		CV Harvest (tons)[1]	Ex-Vessel Value ($)[2]	Payments to Labor ($)[3]	Employment (FTEs)[4]	CV Harvest (tons)[1]	Ex-Vessel Value ($)[2]	Payments to Labor ($)[3]	Employment (FTEs)[4]
All Regions Combined	loss	328 - 587k	87 - 147m	184 - 306m	2,922 - 4,724	2.6 - 49.1k	2.6 - 14.0m	1.7 - 25.4m	15 - 411
	% loss	31 - 55%	36 - 61%	28 - 47%	29 - 48%	0 - 5%	1 - 6%	0 - 4%	0 - 4%
Alaska Peninsula & Aleutian Is. Region	loss	9.8 - 14.3k	70 - 123m	54.5 - 96.8m	1,262 - 2,235	1.5 - 3.2k	1.7 - 10.1m	1.5 - 8.0m	34 - 189
	% loss	55 - 82%	34 - 60%	33 - 60%	33 - 60%	8 - 18%	1 - 5%	1 - 5%	1 - 5%
Kodiak Region	loss	25.4 - 40.9k	15.6 - 22.1m	14.9 - 21.6m	335 - 476	(-0.1)[5] - 4.9k	1.0 - 3.8m	0.5 - 3.3m	2 - 73
	% loss	41 - 67%	50 - 71%	45 - 67%	45 - 64%	0 - 8%	3 - 12%	2 - 10%	0 - 10%
Alaska Southcentral Region	loss	3.4 - 4.8k	1.3 - 1.6m	2.7 - 3.7m	44 - 60	(-0.3) - 0.7k	(-44) - 145k	(-0.2) - 0.4m	(-10) - 4
	% loss	38 - 55%	40 - 49%	30 - 42%	27 - 37%	(-4) - 8%	(-1) - 4%	(-2) - 5%	(-6) - 2%
Alaska Southeast Region	loss	2.9 - 3.6k	0.8 - 1.0m	1.9 - 2.5m	47 - 60	(-0.1) - 0.5k	4.1 - 4.5k	(-5) - 302k	(-2) - 8
	% loss	40 - 50%	38 - 44%	26 - 36%	29 - 38%	(-1) - 8%	0 - 0%	0 - 4	(-1) - 5%
Washington Inland Waters Region	loss	234 - 431k	N.A.[6]	101 - 168m	1,117 - 1,720	1.3 - 31.9k	N.A.	0.1 - 12.3m	32 - 126
	% loss	28 - 52%	N.A.	24 - 41%	23 - 37%	0 - 4%	N.A.	0 - 3%	(-1) - 3%
Oregon Coast Region	loss	33 - 59k	N.A.	4.4 - 7.4m	50 - 82	0.3 - 5.0k	N.A.	84 - 641k	0 - 9
	% loss	36 - 64%	N.A.	39 - 66%	40 - 66%	0 - 5%	N.A.	1 - 6%	0 - 7%

Notes: [1]Total regionally owned catcher vessel harvest (in tons); [2] Total ex-vessel value paid by shorebased processors in the region (in dollars); [3]Total harvesting and processing payments to labor accruing to the region (in dollars); [4]Total harvesting and processing employment accruing to the region (in full-time equivalents); [5](-) denotes a negative loss, that is, an increase in that indicator relative to Alternative 1; [6]N.A. (not applicable) is used because little or no pollock, Pacific cod or Atka mackerel caught off Alaska is delivered to shorebased processors in Washington or Oregon.

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INDEX OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	NMFS Alaska Fisheries Science Center
AP	Council's Advisory Panel
APA	Administrative Procedure Act
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands
CDQ	community development quota
CFEC	Commercial Fisheries Entry Commission
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH	critical habitat (as defined under ESA)
CPUE	catch per unit effort
CV	coefficient of variation
CVOA	catcher vessel operational area
CZMA	Coastal Zone Management Act
DAH	domestic annual harvest
DAP	domestic annual processing
DCPL	daily cumulative production logbook
DFL	daily fishing logbook
DSR	demersal shelf rockfish
EA	environmental assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	environmental impact statement
ENSO	El Niño/Southern Oscillation
E.O.	Executive Order
ESA	Endangered Species Act
ESU	evolutionarily significant units
FMPs	fishery management plan(s)
FO	frequency of occurrence
FONSI	finding of no significant impact
FR	Federal Register
GHL	guideline harvest level
GIS	geographic information system
GOA	Gulf of Alaska
GPS	Global Positioning System
HAPC	habitat area of particular concern
ICA	incidental catch allowance
IFQ	individual fishing quota
IFR	interim final rule
IPHC	International Pacific Halibut Commission
IRIU	improved retention and improved utilization
ITAC	interim total allowable catch
ITQ	individual transferable quota
LLP	License Limitation Program
LOA	length overall

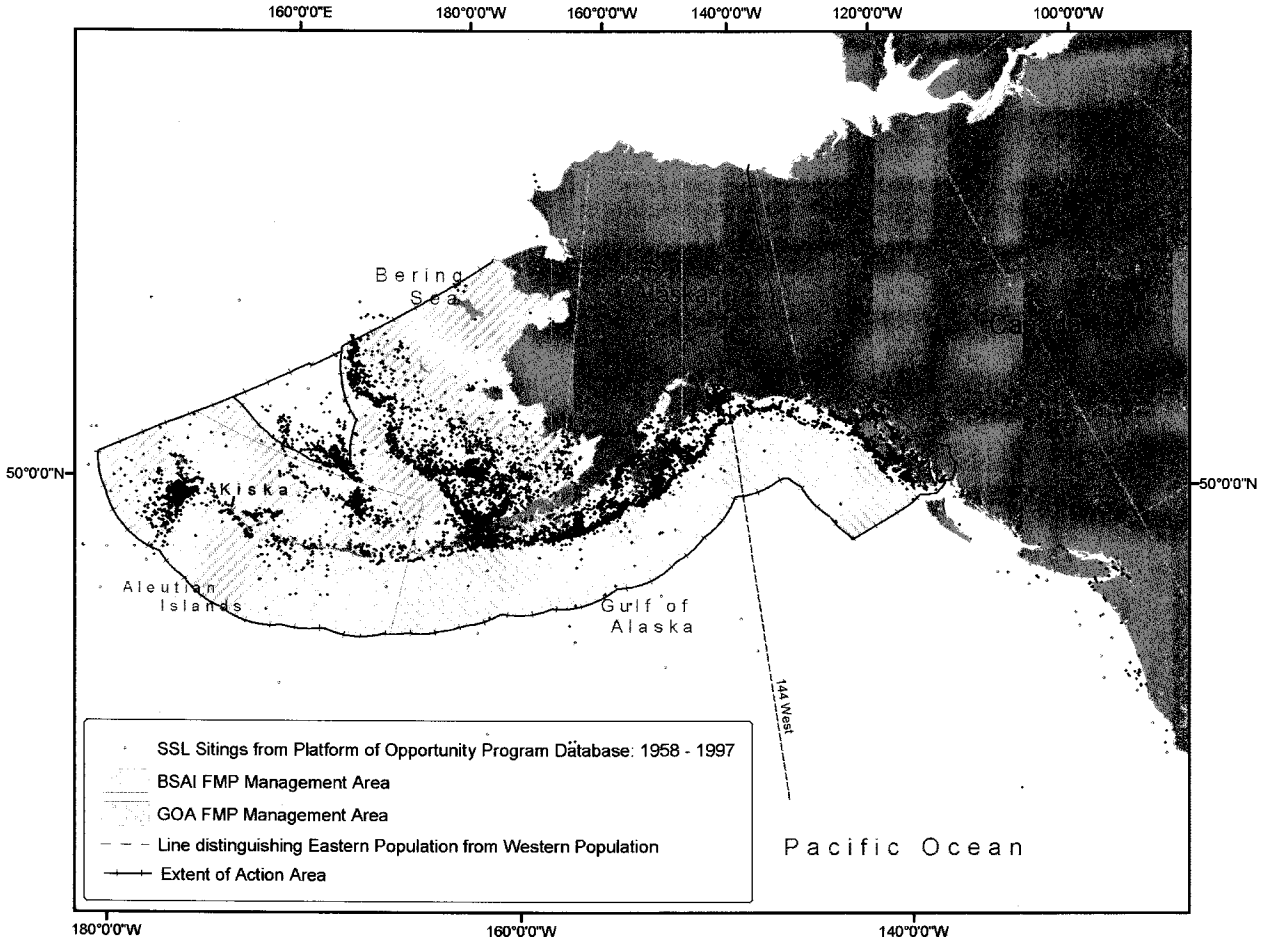
M	natural mortality rate
MSFCMA	Magnuson-Stevens Fishery Conservation Management Act
Magnuson-Stevens Act	same as above
MMPA	Marine Mammal Protection Act
MPA(s)	marine protected area(s)
MRB	maximum retainable bycatch
MSST	minimum stock size threshold
MSY	maximum sustainable yield
mt	metric ton
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NMML	NMFS AFSC National Marine Mammal Laboratory
NOA	notice of availability
NOAA	National Oceanic and Atmospheric Administration
NPFMC (Council)	North Pacific Fishery Management Council
NRC	National Research Council
OFL	overfishing level
OMB	Office of Management and Budget
OY	optimum yield
PBR	potential biological removal
Pub. L.	Public Law
PR	proposed rule
PSC	prohibited species catch
PSQ	prohibited species quota
RAM	Restricted Access Management
REFM	NMFS AFSC Resource Ecology and Fisheries Management Division
RFA	Regulatory Flexibility Act
RIR	regulatory impact review
RKCSA	Red King Crab Savings Area
RPA	reasonable and prudent alternatives
SAFE	Stock Assessment and Fishery Evaluation
SBREFA	Small Business Regulatory Enforcement Fairness Act
SCA	Steller sea lion conservation area
SEIS	supplemental environmental impact statement
SPR	spawning per recruit
SSC	Council's Scientific and Statistical Committee
TAC	total allowable catch
U.S.C.	United States Code
USCG	United States Coast Guard
USDOC	United States Department of Commerce
USFWS	United States Fish and Wildlife Service
USDOI	United States Department of the Interior
VIP	Vessel Incentive Program
VMP	Vessel Moratorium Program
VMS	Vessel Monitoring System
WHSA	Winter Herring savings area
WPR	weekly production report

Chapter 1 Purpose and Need for Action

1.1 Introduction

Management of the Federal groundfish fishery located off Alaska in the 3-200 nautical mile (nm) U.S. Exclusive Economic Zone (EEZ) is conducted under two Secretarial approved federal fishery management plans (FMPs), *The Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area* (BSAI) (NPFMC, 2000a) and *The Fishery Management Plan for the Groundfish of the Gulf of Alaska* (GOA) (NPFMC, 2000b) (Figure 1.1-1). These FMPs and their amendments are developed under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and other applicable Federal laws and executive orders (E.O.s). To briefly summarize, the purpose of the FMPs is to manage the groundfish fisheries for optimum yield (OY) and to allocate harvest among user groups while preventing overfishing and conserving marine resources. The FMPs, and any amendments to the FMPs, are North Pacific Fishery Management Council (Council) documents. The National Marine Fisheries Service (NMFS) develops Federal Fishing Regulations (50 CFR part 679) implementing the FMPs, their amendments, and regulatory actions necessary to conserve public trust resources.

Figure 1.1-1 Map of the groundfish fisheries management areas in the North Pacific Ocean and range of Steller sea lions.



All federal actions, including amendments to FMPs and changes to Federal Fishing Regulations, must comply with applicable Federal laws and E.O.s. The Federal laws most applicable to fisheries management actions include: the Magnuson-Stevens Act, the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA) and the Regulatory Flexibility Act (RFA). E.O.s important to this fishery management action include E.O. 12866 because of its relevance to regulatory planning and review; E.O. 12898 pertaining to environmental justice, E.O. 13084 requiring consultation and coordination with Indian tribal governments, E.O. 13186 relating to migratory birds, and EO 13132 on Federalism. The decision making process on this proposed action is informed by determining relative compliance of the various alternatives to federal laws and E.O.s.

The NMFS determined that an environmental impact statement (EIS) was the appropriate kind of NEPA analysis for the proposed federal action being considered. The determination was based both on the fact that significant impacts would result from implementation of the action and that the action was controversial. The analysis is designated as a supplemental EIS (SEIS) because EISs were prepared when the subject FMPs were first approved and implemented by the Secretary of Commerce, and for subsequent major amendments to these FMPs. Decisions informed by those prior FMPs are not being revisited through this analysis and the decisions being informed by this analysis are not tiering off previous decision documents. The scoping process used to identify analytical issues and alternatives to meet the identified purpose and need of this analysis is documented in Appendix B.

Consultation under section 7 of the ESA for alternative 4 proceeded in parallel with preparation of the NEPA analysis. A draft Biological Opinion was contained in the draft SEIS (Appendix A) and the final Biological Opinion is contained in the final SEIS (Appendix A). The draft Biological Opinion was released for public review with the Draft SEIS and all comments received on it are contained in the final analysis (Volume III).

1.2 Purpose and Need

The primary purpose of the proposed action is to modify the BSAI and GOA pollock, Pacific cod and Atka mackerel fisheries such that the reconfigured fisheries do not jeopardize the continued existence of Steller sea lions or adversely modify their critical habitat. If more than one alternative accomplishes the primary purpose of this action, a secondary objective is to modify the fisheries such that the reconfiguration minimizes the economic and social costs that will be imposed on the commercial fishing industry and associated coastal communities.

The need for this federal action stems from several sources. First, the Council and NMFS have a responsibility to insure that fishing activities authorized under the FMPs and implementing regulation do not jeopardize the continued existence of any listed species or adversely modify its critical habitat. Second, in order for the pollock, Pacific cod, and Atka mackerel fisheries to commence on January 1, 2002, NMFS must implement a suite of Steller sea lion protection measures, be it the RPA from the 2000 Biological Opinion or some other alternative, because the emergency rules governing BSAI pollock, Pacific cod, and Atka mackerel fishing expire on December 31, 2001. Without any action by NMFS, important Steller sea lion protection measures regulating the pollock, Pacific cod, and Atka mackerel fisheries will cease to exist. Finally, new information about Steller sea lion movements based on telemetry studies and new analysis of Steller sea lion scat samples have become available since the issuance of the 2000 Biological Opinion. An examination of that information as it relates to necessary protection measures is warranted.

This analysis evaluates alternatives to mitigate potential adverse effects as a result of competition for fish between Steller sea lions and the BSAI and GOA pollock, Pacific cod, and Atka mackerel fisheries under a no action alternative as well as four other alternatives that would substantially reconfigure these fisheries.

In 1990, the Steller sea lion was listed as threatened as defined by the ESA (62 FR 24345) throughout its range (55 FR 12645, 55 FR 13488, 55 FR 49204, 55 FR 50005). Justification was based on evidence of a major decline in their abundance throughout most of their range, but most acutely in the core region from the Kenai Peninsula to Kiska Island (Braham *et al.*, 1980; Merrick *et al.*, 1987). In this region, counts of adult and juvenile Steller sea lions had declined by about 80% since the population size was estimated in the late 1950s. On May 5, 1997, NMFS reclassified Steller sea lions into two distinct population segments under the ESA. The reclassification was based on biological information collected since the species was listed as threatened in 1990. The Steller sea lion population segment west of 144°W longitude (near Cape Suckling, Alaska) was reclassified and listed as endangered; the remainder of the U.S. Steller sea lion population remains listed as threatened.

On November 30, 2000, NMFS released a comprehensive Biological Opinion on the groundfish fisheries of the BSAI and GOA, pursuant to section 7 of the Endangered Species Act (NMFS, 2000a). The Biological Opinion 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. To mitigate this situation, the Biological Opinion included a set of sea lion protective measures (termed the Reasonable and Prudent Alternative, RPA), which included closure areas, limitations on the amount of pollock, Pacific cod, or Atka mackerel that could be harvested, establishment of seasonal harvest limitations, and a long-term experimental monitoring program. A one-year phase-in of these measures was imposed by Senator Ted Steven's rider to the fiscal year 2000 appropriations bill (Pub.L. 106-554).

The 2000 Biological Opinion is based on the following perspectives: "At present, the leading hypothesis to explain the continued decline of the western population of Steller sea lions is primarily the nutritional stress of juveniles and to a lesser extent adult females (Merrick *et al.*, 1987; Pitcher *et al.*, 1998; Rosen and Trites, 2000a; Alaska Sea Grant, 1993). Such nutritional stress indicates decreased foraging success, potentially as a consequence of environmentally-driven changes in prey availability, but also as a consequence of competition with the BSAI and GOA commercial groundfish fisheries." As alluded to above, "the groundfish fisheries reduce prey availability on several scales, resulting in range-wide, regional, and local depletion of prey. Fishing activity may also preclude some sea lions from certain important foraging areas simply by disturbance, or the presence of fishing vessels, gear, and activity. Since sea lions and the fisheries may well target the same aggregations of prey, such interference may reduce foraging success even when local prey are relatively abundant." (NMFS, 2000a).

The 2000 Biological Opinion concluded the following: "After analyzing the cumulative, direct and indirect effects of the Alaska groundfish fisheries on listed species, NMFS concludes that the fisheries do not jeopardize any listed species other than Steller sea lions. The 2000 Biological Opinion concludes that the fisheries do jeopardize Steller sea lions and adversely modify their critical habitat due to competition for prey and modification of their prey field. The three main prey species that Steller sea lions and these fisheries compete for are pollock, Pacific cod, and Atka mackerel. The biological opinion provides a reasonable and prudent alternative to modify the fisheries in a way that avoids jeopardy and adverse modification." (NMFS, 2000a).

The 2000 Biological Opinion included a RPA to avoid jeopardy and adverse modification of critical habitat in the above noted western region. The overall approach of the RPA involved the following strategy: 1) protect a substantial number of the rookeries and haulouts used by Steller sea lions and the marine environment immediately offshore of these areas from disturbance associated with commercial fishing for the three primary prey species (i.e., walleye pollock, Atka mackerel, and Pacific cod), 2) protect a substantial portion of critical habitat from the effects of commercial fishing on the three primary prey species, 3) ensure that adequate forage resources are available to sustain a population of Steller sea lions in excess of 34,600 animals, and 4) in areas where fishing is allowed, ensure that fishing does not create areas where Steller sea lions are not able to successfully forage (NMFS, 2000a).

Prior to implementation of the RPA from the NMFS 2000 Biological Opinion, the President signed Public Law 106-554. In essence, Pub. L. 106-554 at § 209(c)(2) legislated that while the 2001 BSAI and GOA groundfish fisheries would be managed in a manner consistent with the RPA contained in the 2000 Biological Opinion and as modified by other provisions of § 209, the provisions of the RPA would be phased in during the 2001 fishing year. It further legislated that the RPA contained in the 2000 Biological Opinion would become effective in its entirety on January 1, 2002, unless revised as necessary and appropriate based on independent scientific review or other new information. In accordance with Pub. L. 106-554, and starting on January 1, 2001, the 2001 BSAI and GOA groundfish fisheries were initially managed in accordance with the fishery management plans and federal regulations in effect for such fisheries prior to July 15, 2000. This initial management regime was subsequently replaced via an emergency rule issued by NMFS January 22, 2001, under the Magnuson-Stevens Act and effective on January 18, 2001 (66 FR 7276). The emergency rule contained a suite of management measures that phased-in certain provisions of the RPA. That emergency rule was extended and modified on July 17, 2001 (66 FR 37167).

1.3 Related NEPA Documents

The original EISs for the BSAI and GOA FMPs were completed in 1981 and 1979, respectively. An SEIS on the action of total allowable catch (TAC) setting was finalized in December, 1998 (NMFS,1998a); that document analyzed the impacts of groundfish fishing over a range of TAC levels (five alternatives) and affirmed the status quo alternative for TAC-setting.

In addition, a raft programmatic SEIS has been circulated for public review and comment (NMFS, 2001a). The analysis evaluates the BSAI and GOA groundfish FMPs in their entirety against policy level alternatives. When completed, the programmatic SEIS will provide insight as to what environmental effects would result from other management regimes within an analytical framework. Findings of that analysis could result in FMP amendments that could lead to formal rulemaking and implementation of changes to the current management policy governing the groundfish fisheries off Alaska. The public comment period on the draft programmatic SEIS was from January 25, 2001, through July 25, 2001. Finalization of that document is not expected until well after this Steller Sea Lion Protection Measures SEIS reaches completion.

In addition to these EIS analyses, several draft and final EAs have been prepared to describe the impacts of implementing similar suites of fishery management measures to mitigate Steller sea lion conservation concerns associated with the federal groundfish fisheries. These EAs include:

- EA for the first emergency interim rule in 1999 to implement Reasonable and Prudent Alternative from the first 1998 NMFS Biological Opinion (NMFS, 1999a);

- EA for an extension of the 1999 emergency interim rule to further implement Reasonable and Prudent Alternatives from the first 1998 NMFS Biological Opinion (NMFS, 1999b);

- EA for an emergency interim rule in 2000 to implement Revised Final Reasonable and Prudent Alternatives from the first 1998 NMFS Biological Opinion (NMFS, 2000b);

- EA/RIR for an extension and revisions of the Emergency Interim Rule for 2001 harvest specifications for the Alaska groundfish fisheries and for Steller sea lion protective fisheries management measures (NMFS, 2001b).

Each of the EAs expanded the analysis, incorporating new information and new alternatives as they became relevant. These documents initially served to inform the Council on the possible environmental and economic consequences of various alternatives allowable under the guidelines of a 1998 biological opinion (NMFS, 1998b).

1.4 Public Participation

This analysis was developed and alternatives presented with full anticipation of, and opportunity for, public participation in the development of the final management measures to mitigate competition between the pollock, Pacific cod, and Atka mackerel fisheries and the western population of Steller sea lions. The concept of developing an alternative suite of fishery management measures to substitute for the RPA in the 2000 Biological Opinion was first raised at the December, 2000, Council meeting in Anchorage, Alaska. The public and the Council's Advisory Panel provided recommendations for additional analyses that would help in further discussions. At the December 2000 Council meeting the Council notified the public that additional participation would be solicited through establishment of a Council RPA Committee. The Committee's objective was to develop a recommendation for the Council on a suite of alternative management measures that would meet the mandates of the ESA, Magnuson-Stevens Act, and other applicable laws. Nominations were submitted and the Council Chairman appointed 21 members on February 10, 2001. The RPA Committee included members of the fishing community, the conservation community, NMFS, the Council's Scientific and Statistical Committee, and State agencies. Notifications of the Council's RPA Committee meetings were published in the *Federal Register*, in the Council newsletter, and on the Council's web page. All of these meetings provided additional opportunity for public comment and recommendations as members of the public were offered an opportunity to present comments to the Committee at several times during each Committee meeting. Preparers of this analysis were staff to the Council's RPA Committee. All discussions at RPA Committee meetings were used to define the scope of analytical issues examined in this analysis.

1.5 Coordination with Others

The Council on Environmental Quality Regulations for implementing the procedural provisions of NEPA emphasize agency cooperation early in the NEPA process. Section 1501.6 states: "Upon request of the lead agency, any other Federal agency which has jurisdiction by law to be a cooperating agency. In addition, any other Federal agency which has special expertise with respect to any environmental issue, which should be addressed in the statement, may be a cooperating agency." (40 CFR 1501.6)

NMFS requested that United States Coast Guard (USCG), United States Department of the Interior Fish and Wildlife Service (USFWS) and State of Alaska Department of Fish and Game (ADF&G) be cooperating agencies in preparing this SEIS. Each agency agreed to participate in the development of this SEIS and

provided data, staff, and review for this analysis. In addition, the Council staff provided technical support. Along with staff preparers of the lead agency, individuals from cooperating agencies, Council staff, and consulting agencies' staff, that made contributions to this analysis are listed in section 5.0 List of Preparers.

1.5.1 Federal

Both the U.S. Department of the Interior's Fish and Wildlife Service (USFWS) and the U. S. 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 with this analysis. The USCG has expertise with enforcement, search and rescue, vessel accidents and incidents at sea, and human safety at sea. Expert USCG staff provided assistance with this analysis.

The Environmental Protection Agency (EPA) is a reviewing agency for all EISs.

1.5.2 State

Representatives from the states of Alaska, Washington, and Oregon have voting seats on the Council. Expert Alaska Department of Fish and Game staff provided assistance with this analysis.

1.6 Project Area

The subject groundfish fisheries occur in the North Pacific Ocean and Bering Sea in the EEZ from 50°N latitude to 65°N longitude. The subject waters are divided into two management areas; the BSAI area and the GOA area. The BSAI area is further divided into two sub-areas (eastern Bering Sea and Aleutian Islands) and nineteen reporting areas. The GOA area is further divided into three sub-areas (western, central, and eastern) and eight reporting areas. Figures showing the areas and sub-areas are in section 2.5.

The action area for the federally managed BSAI groundfish fisheries effectively covers all of the Bering Sea under U.S. jurisdiction, extending southward to include the waters south of the Aleutian Islands west of 170°W longitude, to the border of the U.S. EEZ. The federally managed GOA groundfish fisheries includes the U.S. EEZ of the North Pacific Ocean, exclusive of the Bering Sea, between the eastern Aleutian Islands at 170°W longitude and Dixon Entrance at 132°40'W longitude. These regions encompass those areas directly affected by fishing, and those that are likely affected indirectly by the removal of fish at nearby sites. The area affected by the fisheries necessarily include adjacent state waters and international waters. Some parallel fisheries take place in State of Alaska waters (inside 3nm) concurrent with a federal fishery opening. Fish that are harvested in State waters during a parallel fishery opening are credited against the federal total allowable catch (TAC). A review of areas fished by the groundfish fisheries (Fritz *et al.*, 1998) suggests that virtually the entire Bering Sea and GOA (from the continental slope shoreward) is utilized by one fishery or another.

Chapter 2 Alternatives Including the Proposed Action

2.1 NEPA Guidance for Alternatives

The Council on Environmental Quality regulations for implementing the procedural provisions of NEPA require consideration of several alternatives, or a range of alternatives, to be evaluated in addition to the proposed action and the environmental impacts of activities (in this instance, fish harvest) under each of these management alternatives to be evaluated. Five alternatives are presented for analytical purposes. These can be evaluated from information and analysis provided in Chapter 3 (Affected Environment), Chapter 4 (Environmental Consequences) and in the Regulatory Impact Review (Appendix C) and Regional profile appendices (Appendix D). Together this information presents the issues and impacts, thus providing the basis for choice among alternatives by the agency and the public.

2.2 Background and History of Protection for Steller Sea Lions in these Groundfish Fisheries

2.2.1 Steller Sea Lion ESA Listing and Critical Habitat Designation

The Steller sea lion species in the U. S. was listed as threatened in 1990. Justification was based on evidence of a major decline in their abundance throughout most of their range, but most acutely in the core region from the Kenai Peninsula to Kiska Island (Braham *et al.* 1980, Merrick *et al.* 1987). In this region, counts of adult and juvenile Steller sea lions had declined by about 80% since the late 1950s. On May 5, 1997, the Steller sea lion species was reclassified into two distinct population segments under the ESA (62 FR 24345). The reclassification was based on biological information collected since the species was listed as threatened in 1990. The Steller sea lion population segment west of 144°W (a line near Cape Suckling, AK) was reclassified as endangered; the listing for the remainder of the U.S. Steller sea lion population remained as threatened.

Steller sea lion critical habitat is listed in 50 CFR §226.202. All major Steller sea lion rookeries, haulouts, and foraging areas are identified on Figures 2.2-1 through 2.2-8 (map packet). NMFS recognizes that the locations of critical habitat listed in 50 CFR §226.202 are out of date. Advances in technology and repeated surveys to these areas have resulted in more precise and accurate location estimates. NMFS intends to update the locations as soon as practicable. Critical habitat includes the following areas:

- A terrestrial zone that extends 3000 feet (0.9 km) landward from the baseline or base point of each major rookery and major haulout.
- An air zone that extends 3,000 feet (0.9 km) above the terrestrial zone, measured vertically from sea level
- An aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major haulout in Alaska that is east of 144° W longitude.
- An aquatic zone that extends 20 nm (37 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska that is west of 144° W.

Critical habitat also includes three special aquatic foraging areas in Alaska; the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area.

- Shelikof Strait Foraging Area

  Critical habitat includes the Shelikof Strait area in the Gulf of Alaska which consists of the area between the Alaska Peninsula and Tugidak, Sitkinak, Aiaktilik, Kodiak, Raspberry, Afognak and Shuyak Islands (connected by the shortest lines): bounded on the west by a line connecting Cape Kumlik (56°38" /157°26′W) and the southwestern tip of Tugidak Island (56°24' /154°41'W) and bounded in the east by a line connecting Cape Douglas (58°37'N / 153°15'W) and the northernmost tip of Shuyak Island (58°37'N / 152°22'W).

- Bogoslof Foraging Area

  Critical habitat includes the Bogoslof area in the Bering Sea shelf which . . . consists of the area between 170°00′W and 164°00′W, south of straight lines connecting 55°00′N/170 00′W and 55°00′N/168°00′W; 55°30′N/168°00′W and 55°30′N/166°00′W; 56°00′N/166°00′W and 56°00′N/164°00′W and north of the Aleutian Islands and straight lines between the islands connecting the following coordinates in the order listed:

  52°49.2'N/169°40.4'W; 52°49.8'N/169°06.3'W; 53°23.8′N/167°50.1′W; 53°18.7′N/167°51.4′W; 53°59.0′N/166°17.2′W; 54°02.9′N/163°03.0′W; 54°07.7′N/165°40.6′W; 54°08.9′N/165°38.8′W; 54°11.9′N/165°23.3′W; 54°23.9'N/164°44.0'W

- Sequam Pass Foraging Area

  Critical habitat includes the Seguam Pass area which consists of the area between 52°00′N and 53°00′N and between 173°30′W and 172°30′W.

Since the designation of critical habitat in 1993, additional information on the habitat requirements of Steller sea lions has been collected. An additional 19 haulouts have been identified which have been observed to have substantial usage by Steller sea lions. For purposes of this analysis, the 19 additional haulouts and an area around the Bogoslof foraging area are included in Steller sea lion protection measures alternatives. Occasionally the term critical habitat is used inclusively to describe both the formally designated critical habitat and the more recently recognized, but not formally designated, haulouts.

As a result of the listing of Steller sea lions under the ESA, and in recognition of the continued declines, a series of management actions have been taken, and ESA section 7 consultations on the GOA and BSAI FMPs completed, since 1991 primarily focused on the endangered, western population and the potential impacts to Steller sea lions by the groundfish fisheries.

2.2.2 History of Steller Sea Lion Protection Measures

A brief review of fishery management measures that have been implemented to date to protect sea lions, as shown in Figure 2.2-1 and described in more detail below.

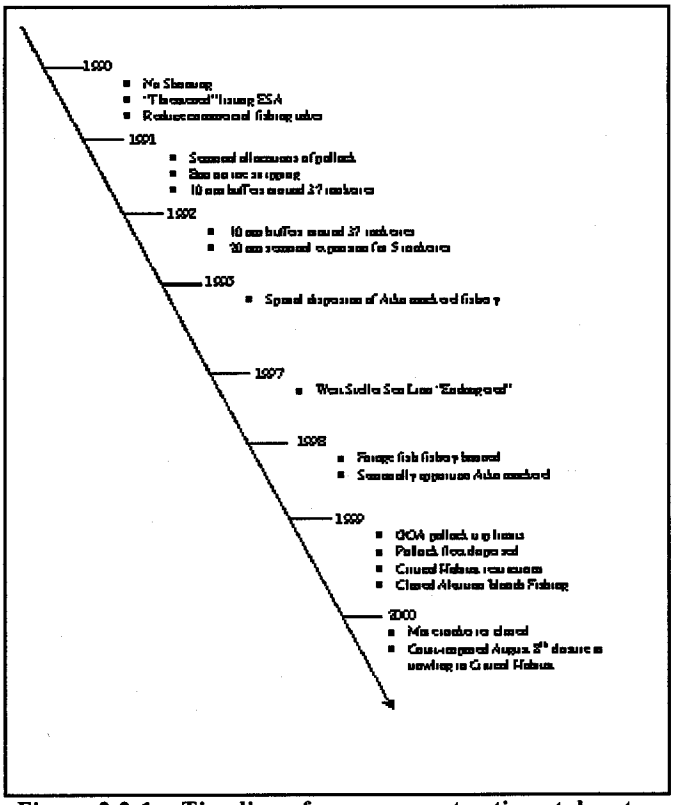


Figure 2.2-1 Timeline of management actions taken to reduce potential impacts of fishing on Steller sea lions.

No shooting: In 1990, a law was enacted prohibiting shooting at or within 100 yards of Steller sea lions. Before then large numbers of sea lions were thought to have been intentionally shot by fishermen and others.

Limits on incidental kills: When Steller sea lions were listed as threatened, the number of Steller sea lions that could be killed incidental to commercial fishing was reduced from 1,350 to 675 animals. In recent years, however; mortality of the western stock of Steller sea lions due to commercial fishing has averaged about 35 animals per year, of which 14 per year were taken in Alaska groundfish fisheries.

No entry buffer zones: Three mile no-entry zones were also established at the time of listing in 1990. No vessels are allowed to operate within 3 miles of principal rookeries east of 144° W longitude. Limits on approach by land (½ mile around the rookeries) were also instituted to minimize disturbance and reduce opportunities for individuals to intentionally shoot the animals.

No-trawl zones: In 1991, 27 trawl closure areas were implemented. These zones were established to reduce disturbance of feeding Steller sea lions around rookeries. Trawling is prohibited year-round within 10 nautical miles of the rookeries, and some extend to 20 miles during the pollock A- season.

No-pollock fishing zones: In 1999, trawling for pollock was prohibited within 10 or 20 nautical miles around most major haulout areas for Steller sea lions. All pollock fishing has been prohibited in the Aleutian Islands since 1998.

Seasonal dispersion of fisheries: Fisheries have been seasonally allocated to reduce potential impacts of localized depletion of prey. In 1991, pollock roe stripping was banned, and the Bering Sea pollock fishery was split into a winter fishery (A-season) and a late summer fishery (B-season). In June 1998, the Council adopted a regulatory amendment to seasonally apportion Atka mackerel in the Aleutian Islands. In 1999, the Council adopted regulations to further split the pollock fishery in the Gulf of Alaska and Bering Sea into four separate seasons, with limits on the amount that can be taken in each of those seasons. A limit on how much pollock a vessel can catch per trip was established for vessels in the Gulf of Alaska to reduce localized depletion of pollock.

Spatial dispersion of fisheries: Beginning in 1994, the Atka mackerel harvest limit was apportioned among smaller subareas of the Aleutian Islands area to prevent localized depletion. In June 1998, the Council adopted a regulation to reduce fishing for Atka mackerel near rookeries to further reduce potential for localized depletion of Atka mackerel within critical habitat areas. In 1999, regulations were adopted to disperse the pollock fishery outside of Steller sea lion critical habitat in the Gulf of Alaska and Bering Sea. In the Bering Sea, for example, major adjustments by the pollock fleet have been made to keep total removals of pollock from critical habitat areas to less than 50% of the quota.

Precautionary harvest limits on Steller sea lion prey: Catch specifications for some groundfish stocks have incorporated safeguards for Steller sea lions. Concerns for sea lions have resulted in explicit conservative harvest rates for pollock, Atka mackerel, and other known prey species. For example, the maximum acceptable biological catch for Bering Sea pollock in 2001 was 2,125,000 mt, but the total allowable catch limit was set at only 1,400,000 mt. While all groundfish stocks off Alaska are considered to be healthy, the concern for sea lions and a greater focus on multi-species, ecosystem oriented management has reinforced the Council's already conservative approach to the quota setting process.

Prohibition on directed fishing on forage fish: In 1997, the Council adopted FMP amendments that prohibit directed fishing for forage fish, which are prey for groundfish, seabirds, and marine mammals. Under this amendment, protection is provided for forage fish species such as capelin, sand lance, myctophids, and a host of other forage species.

2.2.3 Development of Alternatives for this Analysis

On November 30, 2000, NMFS released a comprehensive Biological Opinion (2000 Biological Opinion) on the groundfish fisheries of the BSAI and GOA, pursuant to section 7 of the Endangered Species Act. The 2000 Biological Opinion concluded that fisheries for pollock, Pacific cod, and Atka mackerel jeopardize the recovery of Steller Sea lions and adversely modify their critical habitat due to competition for prey and modification of their prey field. To mitigate this situation, the 2000 Biological Opinion included a set of sea lion protective measures (termed the Reasonable and Prudent Alternative, RPA), which included closure areas and a long-term experimental monitoring program.

On December 9, 2000, the Council moved to not adopt the conclusions of the 2000 Biological Opinion, or the RPAs as contained therein. When the Council was informed that the 2000 Biological Opinion's RPA would be implemented though emergency rule for 2001, and would require a plan amendment for 2002 fisheries, the Council decided that additional alternatives should be considered.

On December 18, 2000, The Consolidated Appropriations Act 2001 was passed Public Law (Pub. L.) 106-554. A one-year phase-in of the RPA regulations was required. Included in this phase-in was the global control rule and existing fishery closure zones.

On January 22, 2001, an emergency rule was issued to implement changes to the 2001 Alaska groundfish fisheries effective January 18, 2001, to be consistent with the requirements of the MSFCMA, the ESA, and additional requirements imposed by Congress in Pub. L. 106-554, the Consolidated Appropriations Act 2001. The rule implements new protection measures, and extends regulations establishing Steller sea lion protection measures for the BSAI pollock and Atka mackerel fisheries and the GOA pollock fishery. At its February 5-12, 2001, meeting, the Council sent a letter to the Secretary of Commerce requesting that he use his executive authority to ensure adequate harvest levels are made available for small boats and inshore processors for 2001 fisheries per the mandates of Pub. L. 106-554.

On January 12, 2001, the Council convened a one day meeting in Seattle to discuss the one-year phase in of sea lion protection measures for 2001. The Council recommended that an RPA Committee be established to make recommendations for the second half of 2001 and develop an alternative RPA for the 2002 plan amendment analysis. The Council set forth an initial set of alternatives based on the previous recommendations, as well as management measures from the September 2000 draft EA/RIR for the Pacific cod fisheries (NMFS 2000c).

At its February 5-12, 2001, meeting, the Council received the Scientific and Statistical Committee (SSC) review of the 2000 Biological Opinion and several reports on Steller sea lion research, and discussed the workplan for the 2002 amendment package. The SSC concluded that the 2000 Biological Opinion was scientifically deficient. The Council discussed issues to be examined by an independent scientific review team and the National Academy of Sciences. The Council reviewed a 'roadmap' for amendment development, and reviewed an initial set of alternatives for analysis. The Council chairman appointed RPA Committee members that included 21 members from the fishing community, the conservation community, NMFS, the SSC, and State agencies. The RPA Committee met numerous times to review SSL science, the 2000 Biological Opinion RPA, and new fishery and survey information. Meetings were held on February 10, February 20, March 6-7, March 26-29, April 9, May 9-11, and May 21-24, and August 23, 24, 2001. Public testimony was received at all meetings.

At its April 11-16, 2001, meeting, the Council adopted emergency rule measures for the second half of 2001, based on recommendations from the RPA Committee, Advisory Panel, and public. The Council's recommended emergency rule included a series of closure areas and season changes that increased protection for Steller sea lions and reduce impacts to fisheries and coastal communities.

The RPA Committee developed a set of alternative fishery management measures to assist the Council in forwarding to NMFS a complete alternative to the 2000 Biological Opinion RPA. It was presented to the Council at its June 6-11, 2001 meeting and was refined by the Advisory Council, Scientific and Statistical Committee and Council during that meeting. By the close of the June 2001 meeting, the Council had agreed to a set of five alternatives for analytical purposes. Each alternative incorporated a wide variety of changes to existing fisheries management regulations. A brief list of the chosen alternatives is provided below, with more thorough descriptions in section 2.3.

Alternative 1 No action. Regulatory measures implemented by emergency rule, and designed to protect Steller sea lions, would expire. *Note this alternative is presumed to violate the Endangered Species Act.*

Alternative 2 The low and slow approach. This alternative is derived from the Draft Programmatic SEIS for the Alaska groundfish fisheries (NMFS 2001a). Essentially, the approach is to establish lower total allowable catch levels (TACs) for pollock, Pacific cod, and Atka mackerel, prohibit trawling in critical habitat, and implement measures to spread out catches through the year.

Alternative 3 The restricted and closed area approach. This alternative is the RPA detailed in the November 30, 2000, Biological Opinion. Essential elements of this approach are to establish large areas of critical habitat where fishing for pollock, Pacific cod, and Atka mackerel is prohibited, and to restrict catch levels in remaining critical habitat areas.

Alternative 4 **(Preferred Alternative)** The area and fishery specific approach. This alternative was developed by the Council's RPA Committee. This approach allows for different types of management measures in the three areas (AI, BS, and GOA). Essential measures include fishery specific closed areas around rookeries and haulouts, together with seasons and catch apportionments (Table 2.3-1). Three options for closure areas are examined for this alternative.

Option 1: Chignik small boat exemption.
Option 2: Unalaska small boat exemption (**Preferred**).
Option 3: Gear specific zones for GOA Pacific cod fisheries.

Alternative 5 The critical habitat catch limit approach. This alternative is derived from the suite of RPA measures that were in place for the 2000 pollock and Atka mackerel fisheries, and measures considered for the Pacific cod fishery that include seasonal apportionments and harvest limits within critical habitat. Essentially, this alternative limits the amount of catch within critical habitat to be in proportion to estimated fish biomass.

At its September 2001 meeting, the Council reviewed the draft of this SEIS together with the draft biological opinion. In the draft, Alternative 4 had been identified by NMFS as the preferred alternative. The draft biological opinion concluded that the proposed actions in Alternative 4 would not be likely to cause jeopardy or adverse modification to Steller sea lions. The draft documents were widely distributed and were available on the Alaska region website.

Also in September, the Council affirmed Alternative 4 (with additional clarifications and details) to be its preliminary preferred alternative. The additional details for Alternative 4, along with revisions and additional information to be included in the final analysis, were those recommended by the Council's Advisory Panel. The Council's Scientific and Statistical Committee also suggested numerous revisions and clarifications for the final SEIS and final Biological Opinion.

At the October 2001 Council meeting, the Council took final action to implement a suite of measures for GOA and BSAI groundfish fisheries designed to protect Steller sea lions. The Council recommended that these measures be implemented by emergency rule for the 2002 fisheries beginning on January 1. The actions of the Council are detailed below:

The Council adopted Alternative 4 as its final preferred alternative, with only minor modifications and clarifications. These modifications include a decrease in the Atka mackerel TAC apportioned to critical habitat from 70% to 60%, establishment of a limited fishing zone in the Dutch Harbor area (Area 9) for jig and hook-and-line catcher vessels less than 60 ft, and closure of the Aleutian Islands to directed pollock fishing in 2002 (pollock fishing would open in the Aleutian Islands outside of critical habitat in 2003 with a seasonal TAC split of 40/60).

In addition, the Council recommended that a vessel monitoring system (VMS) be required to monitor and manage Steller sea lion protection measures. With the exception of vessels using jig gear, all vessels participating in a directed fishery for pollock, Pacific cod, or Atka mackerel must have onboard an operable VMS unit during the time period that the respective directed fishery is open in federal waters. Specific VMS provisions should be included in the emergency rule implementing the 2002 Steller sea lion protection measures and would be effective on June 10, 2002. The Council further encouraged development of

standards and protocols for integrating a software backup system that uses existing vessel electronics in the vessel monitoring and data reporting program for groundfish fisheries.

The Council requested NMFS to explore federal funding options for purchasing, installing, and implementing vessel monitoring systems on vessels. Should federal funding for VMS become available, NMFS should prioritize funding to vessels fishing for Pacific cod with disproportionate costs, possibly based on earnings estimates. NMFS should provide notice to fishermen of possible federal funding 90 days prior to June 10, 2002. Further, the Council requested that NMFS provide a discussion paper by February 2002 on procedures NMFS would use when a vessel's VMS unit breaks down.

Preferred Alternative

As part of NEPA and ESA processes undertaken following the NMFS 2000 Biological Opinion and Council rejection of the associated RPA, it was the expectation that if an alternative could be formulated that was found to be in compliance with ESA and other federal laws and E.O.s, and not be as economically costly as the RPA in NMFS 2000 Biological Opinion, it would be designated the preferred alternative of the SEIS. Alternative 4 apparently proved that it was possible, thus it was designated the preferred alternative.

ESA Section 7 consultation was reinitiated for the fisheries management measures embodied in Alternative 4, resulting in the 2001 Biological Opinion and Incidental Take Statement (Appendix A). The 2001 Biological Opinion concludes this suite of management measures would not likely jeopardize the continued existence of the western or eastern populations of Steller sea lions, nor would it adversely modify the designated critical habitat of either population. It is important to point out that the 2001 Biological Opinion does not ask if Alternative 4 is beneficial for the Steller sea lion (i.e. helps the Steller sea lion population size recover to some specified level so that the species could be delisted), but rather asks if Alternative 4 will jeopardize the Steller sea lions chances of survival or recovery in the wild. While the Biological Opinion has concluded that no, Alternative 4 does not jeopardize the continued survival and recovery of the Steller sea lion, it none-the-less suggested four reasonable and prudent measures to include as necessary and appropriate to minimize impacts of the fisheries to Steller sea lions. The measures are: (1) monitor the take of Steller sea lions in the pollock, Pacific cod and Atka mackerel groundfish fisheries; (2) monitor vessel location and compliance with gear and directed fishing restrictions for the pollock, Pacific cod and Atka mackerel fisheries; (3) monitor harvest of pollock, Pacific cod and Atka mackerel; and (4) manage critical habitat harvest limits using conservative management strategies to minimize the likelihood of exceeding a critical habitat harvest limit.

2.3 Detailed Description of Alternatives

A framework approach to avoiding jeopardy and adverse modification of Steller sea lion critical habitat was established in the 1998 and 1999 biological opinions on the pollock fisheries. The purpose was to seek ideas and recommendations for management measures to 1) protect waters around rookeries and haulouts to prevent localized depletion of prey and the potential for competition, 2) temporally disperse the fisheries to reduce the probability of localized depletions by pulse or derby fishing, and 3) spatially disperse the fisheries to reduce the probability of localized depletions from concentration of catch in local areas. Three principles were used as the foundation for the RPA framework to avoid jeopardy and adverse modification. The intent was to avoid competition in the winter and around rookeries and important haulouts, and to disperse the fisheries outside of those time periods and areas to ensure that local harvest rates were consistent with the overall harvest rate. The alternatives considered in this analysis (except Alternative 1, the no action alternative) were developed with this framework approach.

The alternatives range from no action, Alternative 1, which may allow the potential for competition with fisheries and Steller sea lions for prey resources, to Alternative 2 which, if adopted, would separate most of the fisheries from Steller sea lions. Alternatives 3, 4, and 5 take slightly different approaches in providing protection for Steller sea lions. The main difference between each of the alternatives is the types of fisheries allowed inside critical habitat, and where within critical habitat the fisheries would be allowed. More details of each alternative are provided in this section. Table 2.3-2 summarizes the management measures proposed under each alternative. Figures 2.3-1 through 2.3-8 (map packet) show the closure areas under each alternative.

Sections 2.3.1 through 2.3.5 provide a more detailed explanation of each alternative, including examples of what the 2001 total allowable catch (TAC) would have been for pollock, Pacific cod, and Atka mackerel under each of the alternatives. The following sector and gear allocations apply to the process for estimating TACs under each alternative.

- The final 2001 harvest specifications for the groundfish fisheries of the Bering Sea and Aleutian Islands management area (BSAI) and the Gulf of Alaska (GOA) are used as a basis for the TAC estimates (66 FR 7276; January 22, 2001) and the 2000 SAFE document is used as a basis for the maximum Acceptable Biological Catch (ABC) figures assumed under Alternative 2. (NPFMC, 2000c,d).

- BSAI pollock allocations under the American Fisheries Act (AFA) apply equally under all alternatives. Once an overall pollock TAC is established, 10% is allocated to the Community Development Quota (CDQ) Program. NMFS then estimates an appropriate amount of pollock to reserve for the incidental catch of pollock in non-pollock directed fisheries and puts it aside. In 2001, 4% of the pollock TAC was reserved as an incidental catch allowance (ICA). Finally, after the CDQ allocation and ICA are subtracted, the remaining pollock TAC is divided among the sectors as follows: 50% to the inshore sector, 40% to catcher/processors, and 10% to motherships.

- CDQ reserves of 7.5% of the TAC for Pacific cod and Atka mackerel in the BSAI.

- Atka mackerel in the BSAI is allocated 2% to vessels using jig gear and 98% to vessels using other gear. No gear allocations for Atka mackerel exist in the Central or Western Aleutian Islands areas.

- Pacific cod in the BSAI is allocated 2% to vessels using jig gear, 51% to vessels using hook-and-line gear or pot gear, and 47% to vessels using trawl gear. The trawl gear allocation is further allocated 50% to catcher vessels and 50% to catcher/processors. The hook-and-line and pot gear allocation of Pacific cod is further allocated 80% to catcher/processors using hook-and-line gear, 0.3% to catcher vessels using hook-and-line gear, 18.3% to vessels using pot gear, and 1.4% to catcher vessels less than 60 feet length overall that use either hook-and-line or pot gear.

- Pacific cod in the Gulf of Alaska is allocated 90% to the inshore sector and 10% to the offshore sector.

2.3.1 Alternative 1: No Action

Under this alternative, the regulatory measures implemented by emergency rule in 2001 to protect Steller sea lions would expire. The measures that would stay in place include regulations in effect to protect Steller sea

lions in 1999 and regulations implemented in 1999 and 2000 for the BSAI Atka mackerel fisheries. The mapable features of this alternative are illustrated in Figure 2.3-1 (map packet). The Steller sea lion protection measures that would continue to exist under Alternative 1 are:

Applicable to all fisheries:

- No transit zones within 3 nm of 37 rookeries.
- Closure within 10 nm of 37 rookeries to all trawling year-round, some extending to 20 nm on a seasonal basis.

Applicable to the Atka mackerel fisheries:

- Two seasons with TAC apportionments would be established: January 20 to April 15 (50%); September 1 to November 1 (50%).
- Harvest limits would be established in critical habitat: (40% inside critical habitat in 2002 and thereafter)
- A Vessel Monitoring System (VMS) unit is required on all vessels participating in the Atka mackerel fisheries in the Aleutian Islands area (541, 542, or 543).

The following examples illustrate how the 2001 TACs would be specified under Alternative 1.

Bering Sea Pollock

Prior to the implementation of the emergency interim rules for Steller sea lion protection measures, the Bering Sea pollock TAC was apportioned between an A season (45%) and a B season (55%). Applying the seasonal and sector allocations to the 2001 Bering Sea pollock TACs would result in the following apportionments (values in metric tons).

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	45%	55%	
CDQ (10%)	63,000	77,000	140,000
AFA Total (non-CDQ)	544,320	665,280	1,209,600
ICA	na	na	50,400
Total	607,320	742,280	1,400,000

Aleutian Islands Pollock

If the emergency interim rules expired, the Aleutian Islands pollock TAC would be the full 2001 ABC of 23,800 mt. Although two seasons existed for the Aleutian Islands pollock TAC in 1999, 100% of the TAC was allocated to the A season (January 20 to April 15) with any pollock quota remaining after the A season allowed to be harvested in the B season (September 1 to November 1). For this example, assume that all of the Aleutian Islands pollock TAC would be harvested during the A season because pollock is more valuable during the roe season. For the Aleutian Islands, assume an ICA of 2,000 mt because that amount has been

reserved as an incidental catch allowance in recent years when a directed fishery for pollock has been prohibited in the Aleutian Islands as a Steller sea lion protection measure. The Aleutian Islands pollock TAC would be distributed as follows under Alternative 1 (values in metric tons).

Season	A
Season Dates	1/20 to 4/15
Season Apportionment	100%
CDQ (10%)	2,380
AFA Total (non-CDQ)	19,420
ICA	2,000
Total	23,800

Bering Sea and Aleutian Islands Pacific Cod

Under Alternative 1, the 2001 BSAI Pacific cod TAC of 188,000 mt would be allocated among the CDQ and non-CDQ fisheries. Pacific cod is available for trawl gear between January 20 and December 31 and available to fixed gear between January 1 and December 31. No specific incidental catch allowance is applied to the Pacific cod TAC, although consideration of the expected incidental catch of cod is made when determining directed fishing allowances for the non-CDQ fisheries. The distribution of the BSAI Pacific cod take under Alternative 1 would be as follows (values in metric tons):

CDQ (7.5%)	14,100
Total non-CDQ	173,900
Trawl (47%)	81,733
Fixed gear (51%)	88,689
Jig (2%)	3,478
Total Pacific cod TAC	188,000

Bering Sea and Aleutian Islands Atka Mackerel

The Atka mackerel TAC in the Bering Sea and Aleutian Islands is divided among three areas: (1) Bering Sea and Eastern Aleutian Islands (BS/EAI), (2) Central Aleutian Islands (management area 542), and (3) Western Aleutian Islands (management area 543). Under Alternative 1, seasonal allocations apply to the non-CDQ fisheries, but do not apply to the CDQ fisheries. Critical habitat area catch limits exist for the CAI and WAI areas, but not for the BS/EAI area. For this example, assume the critical habitat area catch limits that will apply in 2002 and thereafter under the current regulations (50% of the TAC in each area and season). The Atka mackerel TAC under Alternative 1 would be apportioned among areas and allocated among users as follows (values in metric tons):

Bering Sea/Eastern Aleutian Islands

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	50%	50%	
CDQ (7.5%) - no seasons			585
Jig gear (2%) - no seasons			144
Other gear (trawl)	3,536	3,535	7,071
Total			7,800

Central Aleutian Islands

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	50%	50%	
CDQ (7.5%) - no seasons			2,520
Non-CDQ	15,540	15,540	31,080
Total			33,600
Critical Habitat Area Catch Limit	40%	40%	
CDQ - no seasons			1,008
Non-CDQ	6,216	6,216	12,432

Western Aleutian Islands

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	50%	50%	
CDQ (7.5%) - no seasons			2,093
Non-CDQ	12,904	12,903	25,807
Total			27,900
Critical Habitat Area Catch Limit	40%	40%	
CDQ - no seasons			837
Non-CDQ	5,162	5,161	10,323

Gulf of Alaska Pollock

Alternative 1 would revert to the ABC and TAC management measures for GOA pollock that were in place through 1998. These measures included apportioning the annual pollock ABC among management areas based on the most recent (in this example estimates for 2001) estimate of average distribution of biomass. Within the management areas of the Western and Central GOA fishing season dates and seasonal apportionments are unchanged from 1998, while in the Eastern GOA no seasonal apportionments were made in 1998. The 2001 GOA pollock TACs under Alternative 1 would be apportioned as follows (values in metric tons):

Season	A	B	C	Total
Season Dates (trawl gear)	1/20 to 4/1	6/1 to 7/1	9/1 to 12/31	
Season Apportionment	25%	35%	40%	
Area				
Shumagin (610)	8,618	12,066	13,790	34,474
Chirikof (620)	10,606	14,848	16,969	42,423
Kodiak (630)	4,992	6,989	7,988	19,969
Subtotal (Western/Central)	24,216	33,903	38,747	96,866
West Yakutat (640)				2,484
Total				99,350

* No seasonal apportionment of pollock in Area 640.

Gulf of Alaska Pacific Cod

Alternative 1 would implement ABC and TAC management measures for GOA Pacific cod that were in place through 1998. These measures included apportioning the annual Pacific cod ABC among management areas based on the most recent (in this example estimates for 2001) estimate of distribution of biomass. The 2001 GOA Pacific cod TACs under Alternative 1 would be apportioned as follows (values in metric tons):

Season	Annual
Season Dates	1/1 to 12/31 fixed gear 1/20 to 12/31 trawl gear
Seasonal Apportionment	100%
Area	
Western GOA	18,300
Central GOA	26,988
Eastern GOA	3,560
Total	48,848

Note: Does not include allocation between inshore (90%) and offshore (10%) components.

2.3.2 Alternative 2: Low and Slow Approach

This alternative is derived from the Draft Programmatic SEIS for the Alaska groundfish fisheries (NMFS, 2001a). Essentially, the approach is to establish lower total allowable catch levels (for pollock, cod, and mackerel), prohibit trawling in critical habitat, and implement measures to spread out catches through the year. The mapable features of this alternative are illustrated in Figure 2.3-2 (map packet). Details are as follows:

Applicable to all fisheries:

- No transit zones within 3 nm of 37 rookeries.
- No groundfish fishing within 3 nm of haulouts.
- No trawling for any groundfish species within Steller sea lion critical habitat.

Applicable to pollock, Pacific cod, and Atka mackerel fisheries:

- Four seasons would be established for pollock, cod, and mackerel fisheries with equal seasonal TAC apportionment: January 20 to March 15 (25%), April 1 to June 1 (25%), June 15 to August 15 (25%), September 1 to Dec 31 (25%). Two week stand-downs would be established between seasons with no rollover of TAC allowed

- "Seasonal exclusive area registration would be required, such that vessels must register for one fishing area at a time for each pollock, cod, or mackerel season." For purposes of this analysis, this proposal is assumed to mean that a vessel owner must register with NMFS each season before they participate in directed fisheries for pollock, Pacific cod, or Atka mackerel. They may register for only one area per species per season. They would be prohibited from participating in a directed fishery for a species in more than one area in a season.

Applicable to pollock fisheries

- The Aleutian Islands would be closed to directed pollock fishing.

- Maximum TACs would be established as a percentage of the maximum ABC as follows:
  Bering Sea pollock TAC: 74.5% of maximum permissible ABC.
  GOA pollock TAC: 44.8% of maximum permissible ABC.

- Separate TACs would be established for Bering Sea pollock east and west of 170° West longitude, and GOA pollock TACs would be established by management area (e.g., 610, 620, 630) and for the Shelikof Strait.

- Maximum daily catch limits would be established for the fleet of vessels fishing in the pollock fisheries as follows:
  Bering Sea pollock: 5,000 mt.
  GOA pollock: 1,000 mt.

Applicable to the Pacific cod fisheries

- The Pacific cod TAC would be split from a combined BSAI TAC to separate TACs for the Eastern Bering Sea and the Aleutian Islands based on the biomass distribution of the stock.

- Maximum TACs would be established as a percent of the maximum ABC as follows:
  Bering Sea cod TAC: 71.8%.
  Aleutian Islands cod TAC: 71.8%.
  GOA cod TAC: 55.0%.

- Separate TACs would be established for Bering Sea cod east and west of 170° West longitude, separate AI cod TACs would be established by management area (e.g., 541, 542, 543); and GOA cod TACS would be established by management area (e.g., 610, 620, 630) and for the Shelikof Strait. (Note in below examples that biomass distribution information is inadequate to estimate a separate Shelikof Strait Pacific cod TAC.)

- Maximum daily catch limits would be established for the fleet of vessels fishing in the cod fisheries as follows:

  Bering Sea cod: 600 mt.
  Aleutian Islands cod: 600 mt.
  GOA cod: 400 mt.

- Foraging area (Seguam, SCA, Shelikof) catch limits would be established at 10% of survey biomass estimate. (Note in below examples that biomass distribution information is inadequate to estimate a Pacific cod foraging area catch limit for Seguam Pass or Shelikof Strait.)

- VMS would be required on vessels directed fishing for cod within critical habitat.

- All non-trawl vessels fishing in critical habitat would be required to have an observer.

- A zonal approach would be implemented for BSAI and GOA Pacific cod fisheries, with buffer zones that apply to distance from rookeries and haulouts as follows.

0-3 nm	3-10 nm	10-20 nm	Outside 20 nm
no fishing	pot vessels with 60 pot limit, all jig vessels, and hook-and-line vessels < 60'	all pot vessels, all jig vessels, all hook-and-line vessels < 60', and catcher hook-and-line >60'	all vessels and gears

Applicable to Atka mackerel fisheries:

- Maximum Atka mackerel TAC would be established at 33% of the maximum ABC.

- Separate TACs would be established for AI management areas (e.g., 541. 542, 543).

- A maximum daily catch limit of 300 mt would be established for vessels directed fishing for Atka mackerel.

The following examples show how the 2001 TACs would be specified under Alternative 2

Bering Sea Pollock

- The Bering Sea pollock TAC would be 74.5% of the maximum permissible ABC (1,842,000 mt x .745 = 1,372,290 mt).

- The total Bering Sea pollock TAC of 1,372,290 mt would be distributed equally among four seasons as follows (values in metric tons):

Season	A	B	C	D	Total
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Season Apportionment	25%	25%	25%	25%	
Total	343,073	343,072	343,073	343,072	1,372,290

- The seasonal apportionment of the BS pollock TAC would be divided between areas east of 170° W longitude and west of 170° W longitude based on the seasonal distribution of the pollock biomass as follows:

Season	A	B	C	D
East of 170° W	52%	45%	39%	39%
West of 170° W	48%	55%	61%	61%
Total	100%	100%	100%	100%

- The following summarizes how the 2001 BS pollock TAC would be allocated by area, season, and sector under Alternative 2 (values in metric tons):

East of 170° W					
Season	**A**	**B**	**C**	**D**	**Total**
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Total TAC by Season	178,398	154,383	133,798	133,798	600,377
CDQ Reserve	17,840	15,438	13,380	13,380	60,038
Remaining TAC	160,558	138,944	120,418	120,418	540,338
- 4% ICA	6,422	5,558	4,817	4,817	21,614
AFA Total (non-CDQ minus ICA)	154,136	133,387	115,602	115,602	518,727
Inshore (50%)	77,068	66,693	57,801	57,801	259,363
Catcher/proc. (40%)	61,654	53,355	46,241	46,241	778,088
Motherships (10%)	15,414	13,339	11,560	11,560	51,873
Total AFA by Season	154,136	133,387	115,602	115,602	518,726
West of 170° W					
Season	**A**	**B**	**C**	**D**	**Total**
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Total TAC by Season	164,675	188,690	209,274	209,274	771,913
CDQ Reserve	16,467	18,869	20,927	20,927	77,191
Remaining TAC	148,207	169,821	188,347	188,347	694,722
- 4% ICA	5,928	6,793	7,534	7,534	27,789
AFA Total (non-CDQ minus ICA)	142,279	163,028	180,813	180,813	666,933
Inshore (50%)	71,140	81,514	90,406	90,406	333,466
Catcher/proc. (40%)	56,912	65,211	72,325	72,325	1,000,399
Motherships (10%)	14,228	16,303	18,081	18,081	66,693
Total AFA by Season	142,279	163,028	180,813	180,813	666,933

Daily catch limit: In addition, there would be a maximum daily catch limit of 5,000 mt for all vessels fishing in the BS pollock fisheries.

Aleutian Islands Pollock: Directed fishing for pollock would be prohibited under Alternative 2. The 2001 TAC of 2,000 mt would be specified for the incidental catch of pollock in non-pollock fisheries.

Bering Sea and Aleutian Islands Pacific Cod

In 2001, one Pacific cod TAC was specified for the entire BSAI. Alternative 2 would require separate Pacific cod TACs for east of 170° W long., west of 170° W long., Eastern Aleutian Islands (541), Central Aleutian Islands (542), and the Western Aleutian Islands (543). The following procedure is used to estimate the Bering Sea portion of the Pacific cod TAC under Alternative 2.

- Alternative 2 would require that the TAC would be 71.8% of the maximum permissible ABC. The maximum permissible ABC for BSAI Pacific cod was 214,000 mt in 2001. This ABC is divided between the Bering Sea and Aleutian Islands based on the distribution of Pacific cod biomass in those areas, which is estimated to be 88% in the Bering Sea and 12% in the Aleutian Islands (NMFS 2000a).

  BS portion of Pacific cod maximum ABC = 214,000 * .88 = 188,320 mt
  AI portion of the Pacific cod maximum ABC = 214,000 * .12 = 25,680 mt

- The maximum ABC is multiplied by .718 to determine the BS and AI Pacific cod TACs under Alternative 2:

  BS 188,320 mt * .718 = 135,214 mt
  AI 25,680 mt *.718 = 18,438 mt

- The BS Pacific cod TAC of 135,214 mt is distributed equally among four seasons as follows (values in metric tons):

Season	A	B	C	D	Total
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Season Apportionment	25%	25%	25%	25%	
Bering Sea	33,804	33,803	33,804	33,803	135,214

- The seasonal apportionment of the BS Pacific cod TAC would be divided between areas east of 170° W longitude and west of 170° W longitude based on the seasonal distribution of the Pacific cod biomass as follows:

Season	A	B	C	D
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31
East of 170° W	82%	51%	51%	63%
West of 170° W	18%	49%	49%	37%
Total	100%	100%	100%	100%

- The Aleutian Islands Pacific cod TAC of 18,438 is allocated among the three management areas based on the following biomass distribution:

  Eastern Aleutian Islands 37%
  Central Aleutian Islands 29%
  Western Aleutian Islands 34%

- The 2001 BSAI Pacific cod TAC would be allocated by area, season, and sector under Alternative 2 as follows (values in metric tons):

Season	A	B	C	D	Total
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
BS East of 170° W					
Total TAC by Season	27,719	17,240	17,240	21,296	83,495
CDQ Reserve	2,079	1,293	1,293	1,597	6,262
Non-CDQ Fisheries	25,640	15,947	15,947	19,699	77,233
BS West of 170° W					
Total TAC by Season	6,085	16,563	16,564	12,507	51,719
CDQ Reserve	456	1,242	1,242	938	3,878
Non-CDQ Fisheries	5,629	15,321	15,322	11,569	47,841
Eastern AI					
Total TAC by Season	1,705	1,706	1,705	1,706	6,822
CDQ Reserve	128	128	128	128	512
Non-CDQ Fisheries	1,577	1,578	1,577	1,578	6,310
Central AI					
Total TAC by Season	1,337	1,337	1,337	1,336	5,347
CDQ Reserve	100	100	100	100	400
Non-CDQ Fisheries	1,237	1,237	1,237	1,236	4,947
Western AI					
Total TAC by Season	1,568	1,567	1,568	1,566	6,269
CDQ Reserve	118	117	118	117	470
Non-CDQ Fisheries	1,450	1,450	1,450	1,449	5,800
Total Bering Sea TAC					135,214
Total Aleutian Is. TAC					18,438
Total BSAI TAC					153,652

Daily catch limit: In addition, there would be a maximum daily catch limit of 600 mt of Pacific cod for all vessels fishing in the Bering Sea and a separate 600 mt daily catch limit for vessels fishing in the Aleutian Islands.

Foraging Area Catch Limit: Alternative 2 would require a catch limit for Pacific cod inside the foraging areas of Seguam, the Sea Lion Conservation Area (SCA), and Shelikof Strait established at 10% of the survey biomass for Pacific cod. Information about the distribution of Pacific cod within the Seguam or Shelikof Strait foraging areas is unavailable, so no foraging area catch limit could be estimated for those areas. However, a foraging area catch limit inside the SCA established as 10% of the exploitable biomass inside the SCA by season would be as follows (values in metric tons):

Season	A	B	C	D
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31
Foraging Area Catch Limit	61	20	17	46

Bering Sea and Aleutian Islands Atka Mackerel

The procedure for specifying BSAI Atka mackerel TACs under Alternative 2 would be as follows:

- Alternative 2 requires that the TAC would be 33% of the maximum permissible ABC. The maximum permissible ABC for BSAI Atka mackerel was 127,900 mt in 2001. Therefore, the maximum Atka mackerel ABC would be 42,207 mt (127,900 mt * .33).

- This maximum permissible ABC is divided among the three Atka mackerel management areas in the same proportion as the 2001 Atka mackerel ABC (values in metric tons).

Area	2001 ABC	% by Area	Distribution of Max. ABC (127,900 mt)	Alt. 2 TAC (33% max ABC)
BS/EAI	7,800	11.26%	14,402	4,753
CAI	33,600	48.48%	62,005	20,462
WAI	27,900	40.26%	51,493	16,992
Total	69,300	100.00%	127,900	42,207

- The Atka mackerel TAC of 42,207 mt would be distributed among the areas, seasons, and sectors under Alternative 2, as follows:

Seasonal Apportionment (seasons apply to CDQ and non-CDQ fisheries)					
Season	**A**	**B**	**C**	**D**	**Total**
Season Dates	1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Season Apportionment	25%	25%	25%	25%	100%
Bering Sea/Eastern Aleutian Islands (BS/541)					
CDQ Reserve	89	89	89	89	356
Jig Allocation	22	22	22	22	88
Non-CDQ, Other Gears	1,077	1,077	1,077	1,077	4,309
Total BS/EAI	1,189	1,189	1,189	1,189	4,753
Central Aleutian Islands (542)					
CDQ Reserve	384	384	384	383	1,535
Non-CDQ	4,732	4,732	4,732	4,712	18,927
Total CAI	5,116	5,116	5,116	5,114	20,462
Western Aleutian Islands (543)					
CDQ Reserve	319	318	319	318	1,274
Non-CDQ	3,930	3,930	3,930	3,929	15,719
Total WAI	4,248	4,248	4,248	4,249	16,993

Daily catch limit: In addition, there would be a maximum daily catch limit of 300 mt for vessels fishing in the Atka mackerel fishery. This would mean that 300 mt would be the maximum for all Atka mackerel fishing in the BS and Aleutian Islands (BS/541, 542, and 543 together).

Gulf of Alaska Pollock

Management measures for ABC and TAC levels for GOA pollock under Alternative 2 include: 1) setting a modified ABC at a level equal to 44.8% of the maximum ABC (in this example the 2001 ABC is the maximum permissible); 2) apportioning the annual pollock ABC among management areas based the most

recent seasonal (an A/B or winter/spring and a C/D or summer/fall) distribution of pollock biomass; and 3) establishing four equal seasonal apportionments of pollock TAC among five management areas (including the Shelikof Strait) in the A and B seasons and among four management areas in the C and D seasons. The 2001 GOA pollock TACs under Alternative 2 would be apportioned as follows (values in metric tons):

Season		A	B	C	D	
Season Dates (trawl gear)		1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Season Apportionment		25%	25%	25%	25%	Total
Area	Shumagin (610)	3,154	3,154	4,565	4,565	15,438
	Chirikof (620)	2,131	2,131	2,712	2,712	9,686
	Kodiak (630)	287	287	3,575	3,575	7,724
	Shelikof Strait	5,281	5,281	0	0	10,562
	West Yakutat (640)	275	275	275	275	1,100
Total		11,128	11,128	11,127	11,127	44,510

Daily catch limit: In addition, there would be a maximum daily catch limit of 1,000 mt of pollock for all vessels fishing in the Gulf of Alaska.

Gulf of Alaska Pacific Cod

Management measures for ABC and TAC levels under Alternative 2 include: 1) set a modified ABC at a level equal to 55% of the maximum ABC (in this example the maximum permissible ABC for 2001 was calculated as 76,700 mt); 2) apportion the annual Pacific cod ABC among four management areas based the most recent estimate of distribution of pollock biomass (biomass estimates for the Shelikof Strait are not available, however the distribution of Pacific cod biomass in areas 620 and 630 is estimated at 30.2% and 26.8% of the total gulf biomass respectively); and 3) establish four equal seasonal apportionments of Pacific cod TAC among four management areas. The 2001 GOA Pacific cod TACs under Alternative 2 would be apportioned as follows (values in metric tons):

Season		A	B	C	D	
Season Dates		1/20 to 3/15	4/1 to 6/1	6/15 to 8/15	9/1 to 12/31	
Season Apportionment		25%	25%	25%	25%	Total
Area	Shumagin (610)	2,848	2,847	2,848	2,847	11,390
	Chirikof (620)	2,389	2,389	2,389	2,388	9,555
	Kodiak (630)	2,120	2,120	2,120	2,019	8,479
	West Yakutat (640)	554	554	554	553	2,215
Total		7,911	7,910	7,911	7,907	31,639

Note: Does not include allocation between inshore (90%) and offshore (10%) components.

Daily catch limit: In addition, there would be a maximum daily catch limit of 400 mt of Pacific cod for all vessels fishing in the Gulf of Alaska.

2.3.3 Alternative 3: Restricted and Closed Area Approach

This alternative is the RPA detailed in the November 30, 2000, Biological Opinion (NMFS, 2000a). Essential elements of this approach are to establish large areas of critical habitat where fishing for pollock, cod, and

mackerel is prohibited, and to restrict catch levels in remaining critical habitat areas. The mapable features of this alternative are illustrated in Figure 2.3-3 (map packet). Details are as follows:

Applicable to all fisheries:

- No transit zones within 3 nm of 37 rookeries.
- No groundfish fishing within 3 nm of haulouts.

Applicable to all pollock, Pacific cod and Atka mackerel fisheries:

The NMFS 2000 Biological Opinion global control rule would be applied, whereby the ABC for pollock, Pacific cod, and Atka mackerel in the BSAI and GOA would be reduced when the spawning biomass is estimated to be less than 40% of the projected unfished biomass, such that the reduction would result in no directed fishing for a species when the spawning biomass is estimated to be less than 20% of the projected unfished biomass.

- Closure areas to directed fishing for pollock, Pacific cod, and Atka mackerel inside specified sites (designated in the NMFS 2000 Biological Opinion as Areas 2,4,6,8, 9,10,11,13) would be established.

- Fishing for pollock, Pacific cod and Atka mackerel with trawl gear would be prohibited from November 1 through January 20.

- Fishing for pollock, Pacific cod and Atka mackerel using any gear type would be prohibited from November 1 through January 20 inside critical habitat.

- Outside of critical habitat, establish two evenly spaced seasons for pollock, Pacific cod, and Atka mackerel fisheries in the EBS, GOA, and AI. Apportion an amount of the annual TAC to each season based on the approach used in the 1998 Biological Opinion so that 40% of the annual TAC is available in the winter season (A/B seasons) and 60% is available in the fall season (C/D seasons). Inside critical habitat, establish four seasons for the open CH-RFRPA zones. This measure will evenly subdivide the combined winter allocation of 40% to the A and B seasons (20% each to the A and B season inside CH), and the combined fall allocation of 60% to the C and D seasons (30% each to the C and D season inside CH).

- Catch limits for pollock, Pacific cod, and Atka mackerel inside critical habitat would be established based on the proportion of biomass estimated to be in critical habitat open to fishing to the total biomass in the overall management area.

Applicable to pollock fisheries:

- A portion of the Aleutian Islands would be open to pollock fishing (Area 12).

Applicable to the Pacific cod fisheries:

- The Pacific cod TAC would be split from a combined BSAI TAC to separate TACs for the EBS and the AI based on the biomass distribution of the stock.

TACs under Alternative 3 would be established following the procedures described in Section 9 of the November 30, 2000 Biological Opinion and would be as follows (values in metric tons):

Bering Sea and Aleutian Islands Pollock

Season and Dates	A 1/20 to 4/1	B 4/1 to 6/10	C 6/10 to 8/21	D 8/21 to 11/1	Total
Seasonal Apportionment	A + B (40% annual TAC)		C + D (60% annual TAC)		
Bering Sea Pollock					
CDQ		56,000		84,000	140,000
AFA		483,840		725,760	1,209,600
Total, Directed Fisheries		539,840		809,760	1,349,600
ICA					50,400
Total					1,400,000
Limit Inside Area 7 [1]	7.3%	4.6%	0.9%	1.4%	
CDQ	10,220	6,440	1,260	1,960	19,880
AFA	88,301	55,642	10,886	16,934	171,763
Total Catch Limit	98,521	62,082	12,146	18,894	191,643
Aleutian Islands Pollock					
CDQ		952		1,428	2,380
AFA		7,768		11,652	19,420
Total, Directed Fisheries		8,720		13,080	21,800
ICA					2,000
Total					23,800
Limit Inside CH-RFRPA [1]	0.9%	1.0%	1.8%	1.7%	
CDQ	21	24	43	0	128
AFA	175	194	350	330	1,049
Total catch limit	196	218	393	370	1,177

Bering Sea and Aleutian Islands Pacific Cod

Season and Dates [2]	A 1/20 to 4/1	B 4/1to 6/10	C 6/10 to 8/21	D 8/21 to 11/1	Total
Seasonal Apportionment	A + B (40% annual TAC)		C + D (60% annual TAC)		
Bering Sea Pacific Cod					
CDQ		4,963		7,445	12,408
Non-CDQ		61,213		91,819	153,032
Total		66,176		99,264	165,440
Limit Inside CH-RFRPA [1]	6.9%	1.3%	2.5%	6.0%	
CDQ	856	161	310	744	2,072
Non-CDQ	10,559	1,989	3,826	9,182	25,556
Total Catch Limit	11,415	2,151	4,136	9,926	27,628
Aleutian Islands Pacific Cod					
CDQ		677		1,015	1,692
Non-CDQ		8,347		12,521	20,868
Total		9,024		13,536	22,560
Limit Inside CH-RFRPA [1]	13.7%	7.4%	4.4%	9.7%	
CDQ	232	125	74	164	595
Non-CDQ	2,859	1,544	918	2,024	7,345
Total Catch Limit	3,091	1,669	993	2,188	7,940

[1] Catch limits are established as a maximum % of the annual TAC for the area per NMFS 2000 Biological Opinion.
[2] Vessels using other than trawl gear may fish for Pacific cod outside of critical habitat areas starting on January 1.

Bering Sea and Aleutian Islands Atka Mackerel

Season	A	B	C	D	Total
Season Dates	1/20 to 4/1	4/1 to 6/10	6/10 to 8/21	8/21 to 11/1	
Seasonal Apportionment	A + B (40% annual TAC)		C + D (60% annual TAC)		
Bering Sea/Eastern Aleutian Islands Atka Mackerel					
CDQ		234		351	585
Non-CDQ		2,886		4,329	7,215
Total		3,120		4,680	7,800
Limit Inside CH-RFRPA [1/]	1.7%	1.7%	2.5%	2.5%	
CDQ	88	88	130	130	436
Non-CDQ	1,090	1,090	1,603	1,603	5,386
Total Catch Limit	1,178	1,178	1,733	1,733	5,822
Central Aleutian Islands Atka Mackerel					
CDQ		1,008		1,512	2,520
Non-CDQ		12,432		18,648	31,080
Total		13,440		20,160	33,600
No fishing allowed inside CH-RFRPA					
Western Aleutian Islands Atka Mackerel					
CDQ		837		1,256	2,093
Non-CDQ		10,323		15,485	25,808
Total		11,160		16,741	27,900
No fishing allowed inside CH-RFRPA					

[1/] CH-RFRPA = Critical Habitat-Revised Final Reasonable and Prudent Alternative from the first NMFS 1998 Biological Opinion (NMFS, 1998b). Catch limits are established as a maximum % of the annual Atka mackerel TAC for all areas per the NMFS 2000 Biological Opinion.

Gulf of Alaska Pollock

Management measures for ABC and TAC levels for GOA pollock under Alternative 3 include: 1) adoption of the NMFS 2000 Biological Opinion global control rule in establishing an ABC (in this example, based on the 2001 GOA pollock stock assessment, the global control rule would apply); 2) apportioning the annual pollock ABC among management areas based the most recent seasonal (and A/B or winter/spring and a C/D or summer/fall) distribution of pollock biomass; 3) two seasonal apportionments of pollock TAC among 4 management areas in the A/B season and in the C/D seasons; and 4) four seasonal catch limits of pollock TAC within critical habitat areas among four management areas in the A, B, C and D seasons. The 2001 GOA pollock TACs under Alternative 3 would be apportioned as follows (values in metric tons):

Season	A/B		C/D		Total
Season Dates (trawl gear)	1/20 to 6/11		6/11 to 11/1		
Season Apportionment	40		60		100
Area					
Shumagin (610)	9,282		20,158		29,440
Chirikof (620)	19,976		11,973		31,949
Kodiak (630)	2,686		15,785		18,471
West Yakutat (640)	809		1,213		2,022
Total	32,753		49,129		81,882
Critical Habitat Catch Limit					
Season	**A**	**B**	**C**	**D**	**Total**
Season Dates (trawl gear)	1/20 to 4/1	4/1 to 6/11	6/11 to 8/22	8/22 to 11/1	
Season Apportionment	20	20	30	30	
Area					
Shumagin (610)	3,930	3,930	1,720	1,720	11,300
Chirikof (620)	8,761	8,761	3,767	3,767	25,056
Kodiak (630)	82	82	1,801	1,801	3,766
West Yakutat (640)	164	164	246	246	820
Total	12,937	12,937	7,534	7,534	40,942

Gulf of Alaska Pacific Cod

Management measures for ABC and TAC levels for GOA Pacific cod under Alternative 3 include: 1) adoption of the NMFS 2000 Biological Opinion global control rule in establishing an ABC (in this example, based on the 2001 GOA Pacific cod stock assessment, the global control rule would not be applicable); 2) apportioning the annual Pacific cod ABC among management areas based the most recent estimate of distribution of Pacific cod biomass; 3) two seasonal apportionments of Pacific cod TAC among 4 management areas in the A/B season and in the C/D seasons; and 4) four seasonal catch limits of Pacific cod TAC within SSL CH among 4 management areas in the A, B, C and D seasons. The TAC values listed reflect a reduction of the total ABC by 25% in consideration of fully utilized State water fisheries, however the values listed for catch limits within critical habitat in the individual seasons have not been reduced to reflect the State water fisheries. The 2001 GOA Pacific cod TACs under Alternative 3 would be apportioned as follows (values in metric tons):

Season	A/B		C/D		Total
Season Dates (trawl gear)[1/]	1/20 to 6/11		6/11 to 11/1		
Season Apportionment;	40		60		100
Area					
Western	7,320		10,980		18,300
Central	11,595		17,393		28,988
Eastern	1,424		2,136		3,560
Total	20,339		30,509		50,848
Critical Habitat Catch Limit					
Season	**A**	**B**	**C**	**D**	**Total**
Season Dates	1/20 to 4/1	4/1 to 6/11	6/11 to 8/22	8/22 to 11/1	
Area					
Western	1,153	68	68	68	1,357
Central	5,424	1,492	2,509	2,576	12,001
Eastern	271	136	136	203	746
Total	6,848	1,696	2,713	2,847	14,104

Note: Does not include allocation between inshore (90%) and offshore (10%) components.

[1/] Season dates outside critical habitat for fixed gear are from 1/1 to 6/11 for the A/B season and from 6/11 to 12/31 for the C/D season.

2.3.4 Alternative 4: Area and Fishery Specific Approach (Preferred Alternative)

This alternative was developed by the Council's RPA committee and adjusted by the Council at its September and October 2001 meetings. This approach allows for different types of management measures in the three areas (AI, BS, and GOA). Essential measures include fishery specific closed areas around rookeries and haulouts, together with seasons and catch apportionments. The mapable features of this alternative are illustrated in Figure 2.3-4 through 2.3-6 (map packet). Table 2.3-1 shows the site closures for each directed fishery. Details are as follows:

Applicable to all fisheries:

- No transit zones around 37 rookeries and no groundfish fishing within 3 nm of 39 rookeries.

Applicable to all pollock, cod, and mackerel fisheries:

- A modified harvest control rule would be applied. If the spawning biomass of pollock, Pacific cod, or Atka mackerel in the BSAI or GOA is estimated to be less than 20% of the projected unfished biomass, directed fishing for that species would be prohibited. The TAC would be limited to amounts needed for bycatch in other fisheries. Essentially, the ABC control rule would remain unchanged, but the regulations would specify that should biomass fall below B20% for one of these species, then directed fishing for that species in the relevant management area would be prohibited.

- The Seguam Pass foraging area, Area 9 (Bogoslof) and Area 4 (Chignik), would be closed to all gear types fishing for pollock, Pacific cod, and Atka mackerel. The Area 4 (Chignik) restriction does not apply to vessels using jig gear.

- No pollock, Pacific cod, or Atka mackerel fishing within 0-20 nm of the 5 northern haulouts in the Bering Sea, except jig gear. These include the Round (Walrus Islands), Cape Newenham, Hall Island, St Lawrence SW Cape, and St. Lawerence Island, South Punuk Island haulouts.

- The 19 additional "RPA" haulouts would be treated consistently with CH haulouts for the purpose of these regulatory changes affecting the pollock, Pacific cod, and Atka mackerel fisheries.

Applicable to AI pollock fisheries:

- Closure of the Aleutian Islands to directed pollock fishing West of 170 West Longitude in 2002. Directed pollock fishing would open in the Aleutian Islands in 2003 (and thereafter) outside of CH with seasons and TAC apportionments: January 20 to June 10 (40%), June 10 to November 1 (60%).

Applicable to BSAI cod fisheries:

- Establish seasons and TAC apportionments by gear type:

trawl:	January 20 to March 31 (60%), April 1 to June 10 (20%), June 10 through October 31 (20%)
trawl CV	January 20 to March 31 (70%), April 1 to June 10 (10%), June 10 through October 31 (20%)
trawl CP	January 20 to March 31 (50%), April 1 to June 10 (30%), June 10 through October 31 (20%)
hook-and-line, jig:	January 1 to June 10 (60%), June 10 through December 31 (40%)
pot:	January 1 to June 10 (60%), September 1 through December 31 (40%)
pot CDQ	January 1 through December 31
pot or H&L < 60 ft LOA	January 1 to December 31

[*Note: the harvest of cod by the <60' pot and hook-and-line vessels accounts towards the 1.4% quota when the season for vessels >=60' using pot or hook-and-line gear is closed. At other times it counts to the 18.3% or 0.3% quotas as appropriate.*]

- Pacific cod rollover in the BSAI: Unharvested cod TAC can be rolled over from one season to the next, consistent with bycatch consideration objectives of optimizing catch by gear groups and sectors.

- Roll over the seasonal apportionments of TAC so as to maximize the opportunities for Pacific cod harvests by the trawl sector. Cod rollovers within the trawl sector would occur within a season prior to allocating to other gear types. Such rollovers would continue into subsequent seasons, but may be reallocated if one sector is unable to reach its TAC.

- Establish area restrictions based on gear type:

  In the Aleutian Islands

  Hook-and-line and Pot: No fishing in critical habitat east of 173° West to western boundary of Area 9, 0-10 nm closures at Buldir, 0-20 nm closure at Agligadak.

  Trawl: East of 178° West longitude: 0-10 nm closures around rookeries, except 0-20 nm at Agligadak; 0-3 nm closures around haulouts.

Trawl	West of 178° West longitude: 0-20 nm closures around haulouts and rookeries until the Atka mackerel fishery inside CH A or B season, respectively, is completed, at which time trawling for cod can occur outside 3 nm of haulouts and 10 nm of rookeries.

In the Bering Sea:

0-3 nm closures around all rookeries and haulouts (except with jig gear around haulouts).

0-10 nm closures around all rookeries and haulouts for trawl gear (except the Pribilof haulouts that would be closed 0-3 nm).

0-7 nm closure around Amak rookeries for hook-and-line and pot gear.

0-10 nm closure around Bishop Point and Reef Lava haulouts in Area 8 for vessels greater than or equat to 60 ft length overall using hook-and-line gear.

Applicable to BSAI Atka mackerel fisheries:

- Establish two seasons and TAC apportionments: January 20 - April 15(50%), September 1 - November 1 (50%). For the CDQ fisheries, CDQ Atka mackerel fishing would occur during a single season per the 2001 provisions.

- TAC would be further apportioned inside and outside of critical habitat, with 60% inside and 40% outside.

- During each season, fishing would begin first in Area 541. Fishing would begin in Areas 542 and 543 48 hours following the closure of Area 541.

- A system of platoon management would be implemented for Areas 542 and 543 in each season. Platoons will only affect fishing inside critical habitat.

  Vessels wishing to fish in critical habitat would register with NMFS to fish in Area 542, in Area 543, or in both Areas 542 and 543. The vessels registering to fish in an area would be assigned to the "group" for that area. There would be an Area 542 group and an Area 543 group. Vessels registering for both areas would be placed in both groups.

  Two directed fisheries would be defined for each area. Directed fisheries in an area would take place in sequence with defined start and stop dates; directed fisheries could last no longer than 14 days.

  Half of the vessels in each group would be assigned (at random) to a "platoon" to participate in each of the directed fisheries (although one platoon would have one more vessel than the other if there were an odd number of vessels in the group). A vessel wishing to fish in critical habitat in Area 542 and Area 543 would be first assigned to an Area 542 platoon at random. That vessel would then be automatically assigned to a platoon in Area 543 that participated in a directed fishery taking place at a different time. Thus a vessel in the 542 and 543 groups that was assigned, at random, to the platoon for the first directed fishery in

Area 542 would automatically be in the platoon for the second directed fishery in Area 543. If the vessel had been randomly assigned to the platoon for the second directed fishery in Area 542, it would be in the platoon for the first directed fishery in Area 543.

Once registered for a critical habitat area directed fishery in a season, vessels would be prohibited from fishing in any other fishery until the assigned critical habitat fishery is closed. If they have registered for both areas, this applies only to the first directed fishery to which they are assigned.

The CH limit (60% of the annual TAC) for the area is divided between the platoons in proportion to the number of vessels in the platoon compared to the number of vessels in the area group. Directed fisheries close when the TAC limit to the fishery has been reached or the closure date is reached.

The platoon system does not extend to waters outside of critical habitat. These waters remain open to the operations of vessels in either platoon or vessels that are not in either platoon.

- No directed fishing for Atka mackerel in critical habitat east of 178° West longitude (including critical habitat in the Bering Sea management area).
- 0-10 nm closures around rookeries west of 178° West longitude, and 0-15 nm at Buldir.
- 0-3 nm closures around haulouts (except with jig gear).
- Two observers are required for each vessel fishing in critical habitat.

Applicable to Bering Sea pollock fisheries:

- Establish seasons and TAC apportionments: January 20 to June 10 (40%), June 10 to November 1 (60%).
- No fishing for pollock during the A season within an area north of Alaska peninsula and Aleutian Islands chain approximately 10 nm from shore, based on a series of straight lines that are tangent to haulouts in the area. (Bering Sea Pollock Restriction Area (BSPRA))
- 0-10 nm closures around all rookeries and haulouts (except the Pribilof haulouts that would be closed 0-3nm).
- The 'Catcher Vessel Operational Area' would be closed to trawl catcher/processors during the B season (June 10 to November 1).
- A limit on the amount of pollock taken within the SCA would be established at no more than 28% of the annual TAC prior to April 1 each year. The remaining portion of TAC available prior to June 10, or 12% of the annual TAC, may be harvested outside of the SCA before April 1 or inside SCA after April 1. If the 28% was not taken in the SCA prior to April 1, the remainder can be rolled over to be taken inside after April 1. The SCA harvest limits would be allocated to sectors

proportionately, so that each sector can harvest no more than 28% of its allocation prior to April 1 in the SCA.

- Set aside such A season pollock quota in the SCA as needed for vessels < 99 feet LOA to harvest their full A season pollock quota in the SCA during the period from January 20th through March 31.

- Catcher vessel exclusive fishing seasons for Bering Sea and GOA pollock would continue so that: Catcher vessels are prohibited from participating in directed fishing for pollock under the following conditions. Vessels less than 125 ft (38.1 m) LOA are exempt from this restriction when fishing east of 157°00' W. long.

If you own or operate a catcher vessel and engage in directed fishing for pollock in the	During the...	Then you are prohibited from subsequently engaging in directed fishing for pollock in the...
Bering Sea subarea	A season (1/ 20 - 6/ 10)	GOA until the following C season (8/25)
	B season (6/10 - 11/1)	GOA until the A season of the next year (1/20)
GOA	A season (1/20 - 2/25)	BS until the following B season (6/10)
	B season (3/10 - 5/31)	BS until the following B season (6/10)
	C season (8/25 - 9/15)	BS until the A season of the following year (1/20)
	D season (10/1 - 11/1)	BS until the A season of the following year (1/20)

Applicable to Gulf of Alaska pollock fisheries:

- Establish seasons and TAC apportionments:
  A season = January 20 to February 25 (25%)
  B season = March 10 to May 31 (25%)
  C season = August 25 to September 15 (25%)
  D season = October 1 to November 1 (25%)
  [Note: Rollovers of TAC apportionment are allowed, provided that no rollover is more than 30% of annual TAC for an individual management area.]

- Catcher vessels would continue to be prohibited from retaining on board, at any time, more than 300,000 pounds (136 mt) of unprocessed pollock. Tender vessels would continue to be prohibited from (i) operating as a tender vessel east of 157° W. longitude and (ii) operating as a tender vessel west of 157° W longitude while retaining on board at any time more than 600,000 pounds (272 mt) of unprocessed pollock.

- Catcher vessel exclusive fishing seasons for BS and GOA pollock would continue (see Bering Sea pollock fisheries).

- No directed pollock fishing in the areas listed:

  Area 1: 0-20 nm from all rookeries and haulouts, except 0-10 nm around Middleton Island

  Area 2: 0-10 nm from all haulouts. 0-20 nm closures at Pye Island and Sugarloaf rookeries. 0-15 nm closures at Marmot Island in the first half of the year, and 0-20 nm in the second half of the year.

  Area 3: 0-10 nm from all rookeries and haulouts except 0-3 nm at Cape Barnabus and Cape Ikolik. 0-10 nm closures at Gull Point and Ugak Island during the first half of the year and 0-3 nm during the second half of the year.

  Area 4: 0-20 nm from all haulouts and rookeries.

  Area 5: 0-20 nm from all rookeries and haulouts, except 0-3 nm at Mitrofania, Spitz, Whaleback, Sea Lion Rocks, Mountain Point, and Castle Rock..

  Area 6: 0-10 nm from all rookeries and haulouts, except 0-3 nm at Caton and the Pinnacles.

  Areas 10 and 11: 0-20 nm from all rookeries and haulouts

Applicable to Gulf of Alaska cod fisheries:

- Establish seasons and TAC apportionments:
  A-season = 60% of TAC: January 1 hook-and-line, pot, or jig, January 20 trawl, until June 10, at which time directed fishing for Pacific cod by all gear would be prohibited until September 1.
  B-season = 40% of TAC: September 1 all gear types to November 1 for trawl gear and December 31 for non-trawl gear. Pacific cod bycatch taken between June 10 and August 31 will be subtracted from the B season apportionment.

- No trawling for cod in the areas listed:

  Area 1: 0-20 nm from all rookeries and haulouts, except 0-10 nm around Middleton Island.

  Area 2: 0-10 nm from all haulouts. 0-20 nm closures at Pye Island and Sugarloaf rookeries. 0-15 nm closures at Marmot Island in the first half of the year, and 0-20 nm in the second half of the year.

  Area 3: 0-10 nm from all rookeries and haulouts except 0-3 nm at Cape Barnabus and Cape Ikolik. 0-10 nm closures at Gull Point and Ugak Island during the first half of the year and 0-3 nm during the second half of the year.

  Area 4: 0-20 nm from all haulouts and rookeries.

  Area 5: 0-20 nm from all rookeries and haulouts, except 0-3 nm at Mitrofania, Spitz, Whaleback, Sea Lion Rocks, Mountain Point, and Castle Rock.

Area 6: 0-10 nm from all rookeries and haulouts, except 0-3 nm at Caton and the Pinnacles.

Areas 10 and 11: 0-20 nm from all rookeries and haulouts.

- No jig gear fishing from 0-3 nm of all rookeries.
- No directed fishing for cod with pot or hook-and-line gear in the areas listed.

Area 1: 0-3 nm from all rookeries.

Area 2: 0-10 nm closures at Pye Island, Sugarloaf, and Marmot.

Area 3: 0-3 nm around Cape Barnabus and Cape Ikolik haulouts.

Area 4: 0-20 nm from all haulouts and rookeries.

Area 5: 0-3 nm from all rookeries and Mitrofania, Spitz, Whaleback, Sea Lion Rocks, Mountain Point, and Castle Rock haulouts.

Area 6: 0-3 nm at Caton and the Pinnacles.

Areas 10 and 11: 0-20 nm from all rookeries and haulouts for pot gear; 0-10 nm from all rookeries and haulouts for hook-and-line gear.

- Three options for closure areas applicable to the GOA Pacific cod fisheries under this alternative were considered (see Figure 2.3-7 (map packet)). These alternatives were:

Option 1: Chignik small boat exemption. This option would establish a fishing zone in the Chignik area (area 4) for non-trawl gear out to ten (10) miles from Castle Cape to Foggy Cape for vessels under 60 ft.

Option 2: Unalaska small boat exemption (**Preferred**). This option would establish a fishing zone for Pacific cod in the Dutch Harbor area (area 9)for jig, and hook-and-line catcher vessels less than 60 ft. This fishing zone would encompass all waters of the Bering Sea south of the line connecting the point 3 nm north of Bishop Point to Cape Tanak. This option would include a 10 nm radius closure around the Bishop Pt haulout in Area 9. This area would fish under a 250,000 lbs. Pacific cod harvest cap.

Option 3: Gear specific zones for GOA Pacific cod fisheries. This option would establish zones (0-3 nm, 3-12, nm, 12-20 nm, and >= 20 nm), as measured from land, from which vessels of certain sizes, and using certain listed gear types could participate.

0-3 nm	3-12 nm	12-20 nm	Outside 20 nm
pot vessels with 60 pot limit, and jig vessels with a 5 machine limit	pot vessels with 60 pot limit, jig vessels with a 5 machine limit, and hook-and-line vessels < 60'	all pot vessels, all jig vessels, and all hook-and-line vessels	all vessels and gears

The following provide examples of how the 2001 TACs would have been determined under Alternative 4 (values in metric tons).

Bering Sea Pollock

Season	A	B	Total
Season Dates	1/20 to 6/10	6/10 to 11/1	
Season Apportionment	40%	60%	
CDQ	56,000	84,000	140,000
AFA	483,840	725,760	1,209,600
ICA			50,400
Total			1,400,000
Catch Limit Inside the SCA			
Season Dates	**Before 4/1**		
Catch Limit	28% of annual TAC		
CDQ	39,200		
AFA	338,688		
Total	377,888		

Aleutian Islands Pollock

One season opening on January 20, with no directed fishing for pollock inside critical habitat. The following TAC would be available.

Total pollock TAC:	23,800 mt
CDQ Reserve	2,380 mt
AFA	19,420 mt
ICA	2,000 mt

Bering Sea and Aleutian Islands Pacific Cod

	A		B	Total
CDQ Reserve				
Season Dates	1/1 to 6/10		6/10 to 12/31	
% Allocation	60%		40%	
Seasonal Allocation	8,460		5,640	14,100
Trawl Gear	**A**	**B**	**C**	
Season Dates	1/20-3/31	4/1-6/10	6/10-11/1	
% Allocation	60%	20%	20%	
Seasonal Allocation	49,039	16,347	16,347	81,733
CV %	70%	10%	20%	
CV allocation	28,606	4,088	8,173	40,867
CP %	50%	30%	20%	
CP allocation	20,433	12,259	8,174	40,866
Non-trawl Gear	**A**		**B**	
Season Dates				
Hook-and-line, jig	1/1-6/10		6/10-12/31	
Pot	1/1-6/10		9/1 to 12/31	
% Allocation	60%		40%	
Seasonal Allocation	53,213		35,475	92,167
Total BSAI Pacific Cod TAC				188,000

Bering Sea and Aleutian Islands Atka Mackerel

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1-11/1	
Season Allocation (%)	50%	50%	
Bering Sea/Eastern Aleutian Islands			
CDQ Reserve	293	293	
Non-CDQ, jig	72	72	
Non-CDQ, other gears	3,535	3,535	
Total	3,900	3,900	7,800
Central Aleutian Islands			
Total TAC for Area			
CDQ Reserve	1,260	1,260	
Non-CDQ	15,540	15,540	
Total	16,800	16,800	33,600
Limit Inside Critical Habitat	60%	60%	
CDQ Reserve	756	756	
Non-CDQ	9,324	9,324	
Total	10,080	10,080	20,160
Western Aleutian Islands			
Total TAC for Area			
CDQ Reserve	1,046	1,046	
Non-CDQ	12,904	12,904	
Total	13,950	13,950	27,900
Limit Inside Critical Habitat	60%	60%	
CDQ Reserve	628	628	
Non-CDQ	7,742	7,742	
Total	8,370	8,370	16,740

Gulf of Alaska Pollock (Western and Central Regulatory Areas)

Management measures for ABC and TAC levels under Alternative 4 include: 1) modifying the NMFS 2000 Biological Opinion global control rule to be used in establishing an ABC (in this example using the 2001 GOA pollock stock assessment the global control rule would not result in an adjustment of GOA pollock ABC); 2) apportioning the annual pollock ABC among management areas based the most recent seasonal (and A/B or winter/spring and a C/D or summer/fall) distribution of pollock biomass; and 3) establishing four equal seasonal apportionments of pollock TAC among four management areas in the A, B, C and D seasons. The 2001 GOA pollock TACs under Alternative 4 would be apportioned as follows (values in metric tons):

Season	A	B	C	D	Total
Season Dates (trawl gear)	1/20 to 2/25	3/10 to 5/31	8/25 to 9/15	10/1 to 11/1	
Season Apportionment	25	25	25	25	
Area					
Shumagin (610)	7,039	7,039	10,191	10,191	34,460
Chirikof (620)	15,148	15,148	6,054	6,054	42,404
Kodiak (630)	2,037	2,037	7,980	7,980	20,034
Total	24,224	24,224	24,224	24,224	96,896

Gulf of Alaska Pacific Cod

Management measures for ABC and TAC levels for GOA Pacific cod under Alternative 4 include: 1) modifying the NMFS 2000 Biological Opinion global control rule to be used in establishing an ABC (in this example using the 2001 GOA Pacific cod stock assessment a harvest control rule would not result in an adjustment of GOA Pacific cod ABC); 2) apportioning the annual Pacific cod ABC among management areas based the most recent estimates of distribution of Pacific cod; and 3) establishing two seasonal apportionments of Pacific cod TAC among three management areas. The 2001 GOA Pacific cod TACs under Alternative 4 would be apportioned as follows (values in metric tons):

Season	A	B	Total
Season Dates	1/1 to 6/10 non-trawl gear 1/20 to 6/10 trawl gear	9/1 to 12/31 non-trawl gear 9/1 to 11/1 trawl gear	
Seasonal Apportionment	60%	40%	
Area			
Western GOA	10,980	7,320	18,300
Central GOA	17,393	11,595	28,988
Eastern GOA	2,136	1,424	3,560
Total	30,509	20,339	50,848

Note: Does not include allocation between inshore (90%) and offshore (10%) components.

Table 2.3-1 Alternative 4 Steller sea lion rookery and haulout closures by fishery

Rookery or Haulout site name	Management Region	Site Type	No transit 3nm	Groundfish Closure 3nm	Pollock Closure	Atka Mackerel Closure	P. Cod Trawl Closure[11]	P. Cod Jig Gear[7]	P. Cod Hook-and-line Gear	P. Cod Pot Gear	Area Numbers
St. Lawrence I./S Punuk I.	BS	H			20	20	20		20	20	8
St. Lawrence I./SW Cape	BS	H			20	20	20		20	20	8
Hall I.	BS	H			20	20	20		20	20	8
St Paul I./Sea Lion Rock	BS	H			3	20	3		3	3	8
St Paul I./NE Pt.	BS	H			3	20	3		3	3	8
Walrus I. (Pribilofs)	BS	R	Y	3	10	20	10	3	3	3	8
St. George I./Dalnoi Pt.	BS	H			3	20	3		3	3	8
St. George I./S Rookery	BS	H			3	20	3		3	3	8
Cape Newenham	BS	H			20	20	20		20	20	8
Round (Walrus Islands)	BS	H			20	20	20		20	20	8
Attu I./Cape Wrangell	AI	R	Y	3	20	10	20, 10	3	3	3	13
Agattu I./Gillon Pt	AI	R	Y	3	20	10	20, 10	3	3	3	13
Attu I./Chirikof Pt.	AI	H			20	3	20, 3				13
Agattu I./Cape Sabak	AI	R	Y	3	20	10	20, 10	3	3	3	13
Alaid I.	AI	H			20	3	20,3				13
Shemya I.	AI	H			20	3	20,3				13
Buldir I.	AI	R	Y	3	20	15	20, 10	3	10	10	13
Kiska I./Cape St. Stephen	AI	R	Y	3	20	10	20, 10	3	3	3	13
Kiska I./Sobaka & Vega	AI	H			20	3	20, 3				13
Kiska I./Lief Cove	AI	R	Y	3	20	10	20, 10	3	3	3	13
Kiska I./Sirius Pt.	AI	H			20	3	20, 3				13
Tanadak I. (Kiska)	AI	H			20	3	20, 3				13
Segula I.	AI	H			20	3	20, 3				13
Ayugadak Point	AI	R	Y	3	20	10	20, 10	3	3	3	13
Rat I./Krysi Pt.	AI	H			20	3	20, 3				13
Little Sitkin I.	AI	H			20	3	20, 3				13
Amchitka I./Column Rocks	AI	R	Y	3	20	10	20, 10	3	3	3	13
Amchitka I./East Cape	AI	R	Y	3	20	10	20, 10	3	3	3	13
Amchitka I./Cape Ivakin	AI	H			20	3	20, 3				13
Semisopochnoi/Petrel Pt.	AI	R	Y	3	20	10	20, 10	3	3	3	13
Semisopochnoi I./Pochnoi Pt.	AI	R	Y	3	20	10	20, 10	3	3	3	13
Amatignak I./Nitrof Pt.	AI	H			20	3	20, 3				13

Table 2.3-1 Alternative 4 Steller sea lion rookery and haulout closures by fishery continued

Rookery or Haulout site name	Management Region	Site Type	No transit 3nm	Groundfish Closure 3nm	Pollock Closure	Atka Mackerel Closure	P. Cod Trawl Closure[11]	P. Cod Jig Gear[7]	P. Cod Hook-and-line Gear	P. Cod Pot Gear	Area Numbers
Unalga & Dinkum Rocks	AI	H			20	3	20, 3				13
Ulak I./Hasgox Pt.	AI	R	Y	3	20	10	20, 10	3	3	3	13
Kavalga I.	AI	H			20	3	20, 3				13
Tag I.	AI	R	Y	3	20	10	20, 10	3	3	3	13
Ugidak I.	AI	H			20	3	20, 3				13
Gramp Rock	AI	R	Y	3	20	10	20, 10	3	3	3	13
Tanaga I./Bumpy Pt.[12]	AI	H			20	20	3				13
Bobrof I.	AI	H			20	20	3				13
Kanaga I./Ship Rock	AI	H			20	20	3				13
Kanaga I./North Cape	AI	H			20	20	3				13
Adak I.	AI	R	Y	3	20	20	10	3	3	3	12
Little Tanaga Strait	AI	H			20	20	3				12
Great Sitkin I.	AI	H			20	20	3				12
Anagaksik I.	AI	H			20	20	3				12
Kasatochi I.	AI	R	Y	3	20	20	10	3	3	3	12
Atka I./N. Cape	AI	H			20	20	3				12
Amlia I./Sviech. Harbor[3]	AI	H			20	20	3	SFA	SFA	SFA	12
Sagigik I.[3]	AI	H			20	20	3	SFA	SFA	SFA	12
Amlia I./East[3]	AI	H			20	20	SFA	SFA	20	20	12
Tanadak I. (Amlia)[3]	AI	H			20	20	3	SFA	20	20	12
Agligadak I.[3]	AI	R	Y	3	20	20	20	SFA	20	20	12
Seguam I./Saddleridge Pt.[3]	AI	R	Y	3	20	20	10	SFA	20	20	12
Seguam I./Finch Pt.	AI	H			20	20	3		20	20	12
Seguam I./South Side	AI	H			20	20	3		20	20	12
Amukta I. & Rocks	AI	H			20	20	3		20	20	12
Chagulak I.	AI	H			20	20	3		20	20	12
Yunaska I.	AI	R	Y	3	20	20	10	3	20	20	12
Uliaga[5, 13]	BS	H			20	20	10	BFA	BFA	BFA	9
Chuginadak	GOA	H			20	NDF	20		10	20	11
Kagamil[5, 13]	BS	H			20	20	10	BFA	BFA	BFA	9
Samalga	GOA	H			20	NDF	20		10	20	11
Adugak I.[5]	BS	R	Y	3	10	20	10	BFA	BFA	BFA	9

Table 2.3-1 Alternative 4 Steller sea lion rookery and haulout closures by fishery continued

Rookery or Haulout site name	Management Region	Site Type	No transit 3nm	Groundfish Closure 3nm	Pollock Closure	Atka Mackerel Closure	P. Cod Trawl Closure[11]	P. Cod Jig Gear[7]	P. Cod Hook-and-line Gear	P. Cod Pot Gear	Area Numbers
Umnak I./Cape Aslik[5]	BS	H			BFA	BFA	BFA	BFA	BFA	BFA	9
Ogchul I.	GOA	R	Y	3	20	NDF	20		10	20	11
Bogoslof I./Fire Island[5]	BS	R	Y	3	BFA	BFA	BFA	BFA	BFA	BFA	9
Polivnoi Rock[4]	GOA	H			20	NDF	20		10	20	11
Emerald I[4]	GOA	H			20	NDF	20		10	20	11
Unalaska/Cape Izigan[4]	GOA	H			20	NDF	20		10	20	11
Unalaska/Bishop Pt[6, 10]	BS	H			10	20	10		10	3	8
Akutan I./Reef-lava[6, 10]	BS	H			10	20	10		10	3	8
Unalaska I./Cape Sedanka[4]	GOA	H			20	NDF	20		10	20	10
Old Man Rocks[4]	GOA	H			20	NDF	20		10	20	10
Akutan I./Cape Morgan[4]	GOA	R	Y	3	20	NDF	20	3	10	20	10
Akun I./Billings Head[6]	BS	R	Y	3	10	20	10	3	3	3	8
Rootok[4]	GOA	H			20	NDF	20		10	20	10
Tanginak I.	GOA	H			20	NDF	20		10	20	10
Tigalda/Rocks NE[4]	GOA	H			20	NDF	20		10	20	10
Unimak/Cape Sarichef[6]	BS	H			10	20	10		3	3	8
Aiktak[4]	GOA	H			20	NDF	20		10	20	10
Ugamak I.[4]	GOA	R	Y	3	20	NDF	20		10	20	10
Round (GOA)[4]	GOA	H			20	NDF	20		10	20	10
Sea Lion Rock (Amak)[6]	BS	R	Y	3	10	20	10		7	7	7
Amak I. and rocks[6]	BS	H			10	20	10		3	3	7
Bird I.	GOA	H			10	NDF	10				6
Caton I.	GOA	H			3	NDF	3		3	3	6
South Rocks	GOA	H			10	NDF	10				6
Clubbing Rocks (S)	GOA	R	Y	3	10	NDF	10	3	3	3	6
Clubbing Rocks (N)	GOA	R	Y	3	10	NDF	10	3	3	3	6
Pinnacle Rock	GOA	R	Y	3	3	NDF	3	3	3	3	6
Sushilnoi Rocks	GOA	H			10	NDF	10				6
Olga Rocks	GOA	H			10	NDF	10				6

Table 2.3-1 Alternative 4 Steller sea lion rookery and haulout closures by fishery continued

Rookery or Haulout site name	Management Region	Site Type	No transit 3nm	Groundfish Closure 3nm	Pollock Closure	Atka Mackerel Closure	P. Cod Trawl Closure[11]	P. Cod Jig Gear[7]	P. Cod Hook-and-line Gear	P. Cod Pot Gear	Area Numbers
Jude I.	GOA	H			20	NDF	20				5
Sea Lion Rocks (Shumagins)	GOA	H			3	NDF	3		3	3	5
Nagai I./Mountain Pt.	GOA	H			3	NDF	3		3	3	5
The Whaleback	GOA	H			3	NDF	3		3	3	5
Chernabura I.	GOA	R	Y	3	20	NDF	20	3	3	3	5
Castle Rock	GOA	H			3	NDF	3		3	3	5
Atkins I.	GOA	R	Y	3	20	NDF	20	3	3	3	5
Spitz I.	GOA	H			3	NDF	3		3	3	5
Mitrofania	GOA	H			3	NDF	3		3	3	5
Kak	GOA	H			20	NDF	20		20	20	4
Lighthouse Rocks	GOA	H			20	NDF	20		20	20	4
Sutwik I.	GOA	H			20	NDF	20		20	20	4
Chowiet I.	GOA	R	Y	3	20	NDF	20	3	20	20	4
Nagai Rocks	GOA	H			20	NDF	20		20	20	4
Chirikof I.	GOA	R	Y	3	20	NDF	20	3	20	20	4
Puale Bay	GOA	H			10	NDF	10				3
Kodiak/Cape Ikolik	GOA	H			3	NDF	3		3	3	3
Takli I.	GOA	H			10	NDF	10				3
Cape Kuliak	GOA	H			10	NDF	10				3
Cape Gull	GOA	H			10	NDF	10				3
Kodiak/Cape Ugat	GOA	H			10	NDF	10				2
Sitkinak/Cape Sitkinak	GOA	H			10	NDF	10				3
Shakun Rock	GOA	H			10	NDF	10				2
Twoheaded I.	GOA	H			10	NDF	10				3
Cape Douglas (Shaw I.)	GOA	H			10	NDF	10				2
Kodiak/Cape Barnabas	GOA	H			3	NDF	3		3	3	3
Kodiak/Gull Point[1]	GOA	H			10,3	NDF	10, 3				3
Latax Rocks	GOA	H			10	NDF	10				2
Ushagat I./SW	GOA	H			10	NDF	10				2
Ugak I.[1]	GOA	H			10,3	NDF	10, 3				3
Sea Otter I.	GOA	H			10	NDF	10				2

Table 2.3-1 Alternative 4 Steller sea lion rookery and haulout closures by fishery continued

Rookery or Haulout site name	Management Region	Site Type	No transit 3nm	Groundfish Closure 3nm	Pollock Closure	Atka Mackerel Closure	P. Cod Trawl Closure[11]	P. Cod Jig Gear[7]	P. Cod Hook-and-line Gear	P. Cod Pot Gear	Area Numbers
Long I.	GOA	H			10	NDF	10				2
Sud I.	GOA	H			10	NDF	10				2
Kodiak/Cape Chiniak	GOA	H			10	NDF	10				2
Sugarloaf I.	GOA	R	Y	3	20	NDF	20	3	10	10	2
Sea Lion Rocks (Marmot)	GOA	H			10	NDF	10				2
Marmot I.[2]	GOA	R	Y	3	15,20	NDF	15, 20	3	10	10	2
Nagahut Rocks	GOA	H			10	NDF	10				2
Perl	GOA	H			10	NDF	10				2
Gore Point	GOA	H			10	NDF	10				2
Outer (Pye) I.	GOA	R	Y	3	20	NDF	20	3	10	10	2
Steep Point	GOA	H			10	NDF	10				2
Seal Rocks (Kenai)	GOA	H			10	NDF	10				2
Chiswell Islands	GOA	H			10	NDF	10				2
Rugged Island	GOA	H			10	NDF	10				2
Point Elrington [8,9]	GOA	H			20	NDF	20				1
Perry I.[8]	GOA	H									1
The Needle[8]	GOA	H									1
Point Eleanor[8]	GOA	H									1
Wooded I. (Fish I.)	GOA	R		3	20	NDF	20	3	3	3	1
Glacier Island[8]	GOA	H									1
Seal Rocks (Cordova)[9]	GOA	R		3	20	NDF	20	3	3	3	1
Cape Hinchinbrook[9]	GOA	H			20	NDF	20				1
Middleton I.	GOA	H			10	NDF	10				1
Hook Point[9]	GOA	H			20	NDF	20				1
Cape St. Elias	GOA	H			20	NDF	20				1

BS = Bering Sea, AI = Aleutian Islands, GOA = Gulf of Alaska, H = haulout, R = rookery, NDF = No directed fishery for Atka Mackerel in the Gulf of Alaska Area

Fishery closures are an area around a site from between 0 nm to the number of nm shown in the column for each site.

[1]The trawl closure between 0-10 nm is effective from Jan. 20 through May 31 for pollock and from Jan. 20 through June 10 for Pacific cod. Trawl closure between 0-3 nm is effective from August 25 through November 1 for pollock and from September 1 through November1 for Pacific cod.

[2] Trawl closure between 0-15 nm is effective from Jan. 20 through May 31 for pollock and from Jan. 20 through June 10 for Pacific cod. Trawl closure between 0-20 nm is effective from August 25 to November 1 for pollock and from September 1 through November 1 for Pacific cod.

[3] Some or all of the restricted area is located in the Seguam Foraging Area (SFA) which is closed to all gears types.

[4] Restriction area includes only waters of the Gulf of Alaska area.[5] This site lies within the Bogoslof Foraging area (BFA) which is closed to all gear types.

[6] This site is located in the Bering Sea Pollock Restriction Area, closed to pollock trawling during the A season.

[7] Jig gear fishing is exempt from haulout closures and from 3-10 nm or 20 nm rookery closures, except in Area 9 of the Bering Sea and in the Seguam Foraging Area.

[8] Contact the Alaska Department of Fish and Game for fishery restrictions at these sites.

[9] The 20 nm closure around this site is effective in waters outside of the state waters of Prince William Sound.

[10] Hook-and-line no fishing zones apply only to vessels greater than or equal to 60 feet LOA in waters around Bishop Point and Reef-Lava, east of 167 degrees W.long. For Bishop Point, the 10 nm closure west of 167 degrees W. long. applies to all hook-and-line vessels.

[11] When two numbers are given it means Pacific cod trawling is prohibited 0-20 nm of rookeries and haulouts until the critical habitat Atka mackerel fishery in the A or B seasons are completed. After closure of the Atka mackerel critical habitat fishery, trawling is prohibited between 0-10 nm of rookeries and between 0-3 nm of haulouts.

[12] The 20 nm Atka mackerel fishery closure around the Tanaga I./Bumpy Pt. Rookery is established only for that portion of the area east of 178 degrees W. long.

[13] The pollock and Atka mackerel closures around these sites applies to 20 nm critical habitat areas specified at 50 CFR 226.202. Pacific cod trawl closures around these sites are effective for the waters inside the BFA only.

2.3.5 Alternative 5: Critical Habitat Catch Limit Approach

This alternative is derived from the suite of RPA measures that were in place for the 2000 pollock and Atka mackerel fisheries, and measures considered for the Pacific cod fishery that include seasonal apportionments and harvest limits within critical habitat. Essentially, this alternative limits the amount of catch within critical habitat to be in proportion to estimated fish biomass. The mapable features of this alternative are illustrated in Figure 2.3-8 (map packet). Details are as follows:

Applicable to all fisheries:

- No transit zones within 3 nm of 37 rookeries.
- Closure within 10 or 20 nm of 37 rookeries to all trawling year-round.

Applicable to pollock fisheries:

- Closure to pollock fishing within 10 or 20 nm of 75 haulouts, seasonally or year-round based on use by sea lions.
- In the Bering Sea pollock fishery: four seasons with harvest limits within sea lion critical habitat foraging areas; and two seasons (40:60% allocation) outside critical habitat.
- In the Gulf of Alaska pollock fishery: fishery distributed over 4 seasons (30%, 15%, 30%, 25%).
- The Aleutian Islands area would be closed to directed fishing for pollock.

Applicable to the Atka mackerel fisheries:

- Two seasons with TAC apportionments would be established: January 20 to April 15 (50%); September 1 to November 1 (50%).
- Harvest limits would be established in critical habitat: (40% inside critical habitat, and 60% outside).
- VMS coverage would be required on all vessels fishing for Atka mackerel.

Applicable to the Pacific cod fisheries:

- In the BSAI cod fishery: separate TACs would be established for the Bering Sea and Aleutian Islands, two seasons (A season Jan 20-April 30 at 40% of TAC; B season May 1-November 1 at 60% of TAC) with catch limits within critical habitat based on best estimates of biomass. Using these estimates, the Bering Sea catch limits within critical habitat are 20% in the A season and 3.6% in the B season. In the Aleutian Islands, the catch limits within critical habitat are 20% in the A season and 48.3% in the B season.
- In the GOA cod fishery: two seasons (A season Jan 20-April 30 at 40% of TAC; B season May 1-November 1 at 60% of TAC) would be established with catch limits within critical habitat based on best estimates of biomass. Based on these estimates, the catch limits within critical habitat are 20% in the A season and 31.8% in the B season.

The following summarize what the 2001 TACs would have been under Alternative 5.

Bering Sea Pollock

Season	A + B		C + D	
Season Dates	1/20 to 6/10		6/10 to 11/1	
Season Apportionment	40%		60%	
CDQ	56,000		84,000	
AFA	483,840		725,760	
Catch Limit Inside SCA				
Season	**A**	**B**	**C**	**D**
Season dates	1/20 to 4/1	4/1 to 6/10	6/10 to 8/20	8/20 to 11/1
% limit in SCA [1/]				
CDQ	62.00%	20.50%	14.00%	23.00%
AFA Inshore 50%)	42.00%	14.00%	13.50%	22.50%
AFA c/ps (40%)	24.75%	8.25%	0.00%	0.00%
AFA motherships (10%)	37.50%	12.5%	0.00%	0.00%
Amount of limit in SCA				
CDQ	34,720	11,480	11,760	19,320
AFA inshore 50%)	101,606	33,869	48,989	81,648
AFA c/ps (40%)	47,900	15,967	0	0
AFA motherships (10%)	18,144	6,048	0	0

[1/] Limit inside critical habitat calculated as a percent of each sector's seasonal allocation following the procedure described in the 2000 annual groundfish specifications (65 FR 8282; February 18, 2000).

Aleutian Islands Pollock

No directed fishing for pollock in the Aleutian Islands, so the TAC would be set at 2,000 mt to provide for incidental catch of pollock in other groundfish fisheries.

Bering Sea and Aleutian Islands Pacific Cod

Bering Sea Pacific Cod (88% of BSAI TAC)			
Season	**A**	**B**	**Total**
Season Dates	1/20 to 5/1	5/1 to 11/1	
Season Apportionment	40%	60%	
CDQ	4,963	7,445	
Non-CDQ, by gear	61,213	91,819	
Total TAC	66,176	99,264	165,440
Inside CH-RFRPA			
Season	**A**	**B**	**Total**
Season Apportionment	20%	3.6%	
CDQ	2,482	447	
Non-CDQ, by gear	30,606	5,509	
Total inside CH	33,088	5,956	39,044
Aleutian Islands Pacific Cod (12% of BSAI TAC)			
Season	**A**	**B**	**Total**
Season Dates	1/20 to 5/1	5/1 to 11/1	
Season Apportionment	40%	60%	
CDQ	677	1,015	
Non-CDQ, by gear	8,347	12,521	
Total TAC	9,024	13,536	22,560
Inside CH-RFRPA			
Season	**A**	**B**	**Total**
Season Dates	1/20-5/1	5/1 to 11/1	
Season Apportionment	20%	48.3%	
CDQ	338	817	
Non-CDQ, by gear	4,174	10,079	
Total inside CH	4,512	10,896	15,408
Total BS+AI Pacific Cod TAC			188,000

Bering Sea and Aleutian Islands Atka Mackerel

Bering Sea/Eastern Aleutian Islands

Season	**A**	**B**	**Total**
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	50%	50%	
CDQ (7.5%) - no seasons			585
Jig Gear (2%) - no seasons			144
Other Gear (trawl)	3,536	3,535	7,071
Total			7,800

Central Aleutian Islands

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	50%	50%	
CDQ (7.5%) - no seasons			2,520
Non-CDQ	15,540	15,540	31,080
Total			33,600
Critical Habitat Area Catch Limit	40%	40%	
CDQ - no seasons			1,008
Non-CDQ	6,216	6,216	12,432

Western Aleutian Islands

Season	A	B	Total
Season Dates	1/20 to 4/15	9/1 to 11/1	
Season Apportionment	50%	50%	
CDQ (7.5%) - no seasons			2,093
Non-CDQ	12,904	12,903	25,807
Total			27,900
Critical Habitat Area Catch Limit	40%	40%	
CDQ - no seasons			837
Non-CDQ	5,162	5,161	10,323

Gulf of Alaska Pollock

Management measures for ABC and TAC levels for GOA pollock under Alternative 5 include four seasonal apportionments of pollock TAC, based on the average distribution of biomass, among four management areas in the A, B, C, and D seasons. The 2001 GOA pollock TACs under Alternative 5 would be apportioned as follows (values in metric tons):

Season	A	B	C	D	Total
Season Dates (trawl gear)	1/20 to 3/15	3/15 to 6/1	8/20 to 9/15	10/1 to 11/1	
Season Apportionment	30	15	30	25	
Area					
Shumagin (610)	10,342	5,171	10,342	8,619	34,474
Chirikof (620)	12,727	6,364	12,727	10,606	42,422
Kodiak (630)	5,991	2,995	5,991	4,992	19,969
West Yakutat (640)	745	373	745	621	2,484
Total	29,805	14,903	29,805	24,838	99,350

Gulf of Alaska Pacific Cod

Management measures for GOA Pacific cod ABC and TAC levels in this alternative include: 1) apportioning the annual Pacific cod ABC among three management areas based the most recent estimates of distribution of Pacific cod; 2) establishing two seasonal apportionments of Pacific cod TAC among three management areas; and 3) establishing catch limits inside critical habitat. The 2001 GOA Pacific cod TACs under Alternative 5 would be apportioned as follows (values in metric tons):

Season	A	B	Total
Season Dates	1/1 to 5/1 fixed gear 1/20 to 5/1 trawl gear	5/1 to 11/1 fixed gear 5/1 to 11/1 trawl gear	
Season Apportionment	40%	60%	
Area			
Western	7,320	10,980	18,300
Central	11,595	17,393	28,988
Eastern	2,136	1,424	3,560
Total	21,051	29,797	50,848
Critical Habitat Catch Limits			
Season Apportionment	20%	31.80%	
Area			
Western	3,660	5,819	9,479
Central	5,798	9,218	15,016
Eastern	712	1,132	1,844
Total	10,170	16,169	26,339

Note: Does not include allocation between inshore (90%) and offshore (10%) components.

Table 2.3-2 Comparison of management measures under the alternatives.

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
Control Rule	Amendment 56 Tiers	TAC set as a % of maximum ABC	NMFS 2000 Biological Opinion Global Control Rule	Modified Global Control Rule - no directed fishing if biomass < B20%.	Amendment 56 Tiers
No Transit Zones	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries
Area Closures	No trawling 10/20 nm from 37 rookeries	Prohibit all trawling in CH/RFRPA; AI closed to pollock fishing	All CH/RFRPA sites designated as restricted or closed to fishing for pollock, cod, and mackerel	Specified closures around around rookeries & haulouts by fishery, area, and gear type; SBSRA closed to pollock fishing; area 4, area 9, and Seguam closed to directed fishing for pollock, cod, and mackerel. AI closed to pollock fishing in 2002.	No pollock fishing in AI area; no trawling 10/20 nm from 37 rookeries
Season Closures	No trawling 1/1 to 1/20	No trawling 1/1to 1/20; no trawling for pollock 11/1 to1/20	No trawling 1/1 to 1/20; no trawling for pollock, cod, or mackerel 11/1 to 1/20; no fishing for pollock, cod, or mackerel inside CH 11/1 to 1/20	No trawling 1/1to 1/20; closure period between GOA pollock seasons; no trawling for pollock or cod 11/1 to 12/31	No trawling 1/1 to 1/20; no trawling for pollock 11/1 to1/20
Seasons and Apportionments pollock	BSAI - 1/20 (45%), 9/1 (55%); GOA - 1/20 to 4/1 (25%), 6/1 to 7/1 (35%), 9/1 to 12/31 (40%)	Four seasons evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	AI - 1/20 (100%); BS 1/20 (40%), 6/11 (60%); GOA - 1/20 to 2/25 (25%); 3/10 to 5/31 (25%), 9/25 to 9/15 (25%), 10/1 to 11/1 (25%)	BSAI - 1/20, 4/1 (40%), 6/10, 8/20 to 11/1 (60%); GOA - 1/20 to 3/1 (30%), 3/15 to 6/1 (15%); 8/20 to 9/15 (30%), 10/1 to 11/1 (25%)

Table 2.3-2 Comparison of management measures under the alternatives (cont.).

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
Seasons and Apportionments cod	BSAI trawl - 1/20 BSAI fixed -1/1, 5/1, 9/1 GOA trawl -1/20 GOA fixed - 1/1	Four seasons evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	BSAI trawl - 1/20-3/31 (60%), 4/1-6/10 (20%), 6/10-10/31 (20%) BSAI longline- 1/1 (60%), 6/11 (40%) BSAI pot - 1/1 (60%), 9/1 (40%) GOA trawl - 1/20 (60%), 9/1 (40%) GOA fixed - 1/1 (60%), 9/1 (40%)	BS trawl + fixed - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%) AI trawl + fixed - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%) GOA trawl + fixed - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%)
Seasons and Apportionments mackerel	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)	Four season evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	AI - 1/20 to 4/15 (50%), 9/1to 10/31 (50%)	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)
Catch Limits Inside CH	Akta mackerel: incremental change to limit of 40% inside CH in 2002	Foraging area catch limits for fixed gear fishing for Pacific cod	Pollock, cod, and mackerel: 4 seasons (1/20, 4/1, 5/11 8/22) inside CH/RFRPA with catch limits based on season and area specific biomass estimates	A season pollock harvest in SCA limited to 28% of annual TAC prior to April 1 Mackerel 60% inside 40% outside of each season apportionment GOA cod: option for AMCC zonal approach for GOA Pacific cod.	Mackerel: incremental change to 40% inside CH and 60% outside in 2002 BSAI Pollock: maximum TAC % allowed inside CH/RFRPA sites = 20% in A+B season combined (15% for A + B singly), 4.5% in C season and 7.5% in D season BS cod: maximum TAC % allowed inside CH = 20%

Management Measures	Alternative 1 No Action	Alternative 2 Low and Slow Approach	Alternative 3 Restricted and Closed Areas	Alternative 4 Area and Fishery Specific Approach	Alternative 5 CH Catch Limit Approach
					(A), 3.6% (B) AI cod: maximum TAC % allowed inside CH = 20% (A), 48.3% (B) GOA cod: maximum TAC % allowed inside CH = 20% (A), 31.8% (B season)
Other Catch Limits		Daily catch limits: BS pollock 5000 mt GOA pollock 1000 mt BSAI cod 600 mt GOA cod 400 mt BSAI mackerel 300 mt		Platoon management of the Atka mackerel fishery	
Experimental Design	Small scale: Kodiak and Seguam localized depletion testing	Small scale with well defined and manageable objectives	Large scale: 4 sets of restricted/closed areas for comparison	Small scale with well defined and manageable objectives	Small scale: Kodiak and Seguam localized depletion testing
Observer Coverage	No change to current observer coverage requirements	All non-trawl Pacific cod vessels fishing in CH required to have observer.	No change to current observer coverage requirements	No change to current observer coverage requirements	No change to current observer coverage requirements
VMS	Required in BSAI Atka mackerel fishery	VMS required on all vessels fishing for cod in CH		VMS required on all vessels (except those using jig gear) when fishing for pollock, cod, or mackerel.	Required in BSAI Atka mackerel fishery
Registration Requirements	None	Seasonal exclusive area registration	None	Preregistration required for Atka mackerel fishery	None

2.4 Alternatives Considered and Eliminated from Detailed Study

During the development of the alternatives for this plan amendment analysis, several proposals were briefly considered, but eliminated from further study. A summary of these alternatives, and brief rationale as to why they were not included in the analysis, is provided below:

Considered Alternative A: This alternative was a combination of Alternative 5 (the critical habitat catch limit approach) and the court injunction that prohibited all trawling within critical habitat. This alternative was proposed by the Council at its meeting in February 2001, but was not recommended for analysis when the Council developed its final set of alternatives in June 2001. The Council's rationale was that the major component of this alternative, the trawling prohibition in critical habitat, was already included in Alternative 2 (the low and slow approach), and the remainder of the alternative would be analyzed as Alternative 5. Hence, addition of this alternative would not have widened the range of alternatives.

Considered Alternative B: This alternative was developed as a strawman proposal for the RPA Committee. Elements of this approach included: 1) a prohibition on all groundfish fishing within 3 nm of all rookeries and haulouts; 2) a prohibition on fishing for pollock, cod, and mackerel within 10 nm of all rookeries and haulouts; 3) prohibition on all groundfish fishing within Seguam and Bogoslof; and 4) other features to spread out fishing effort over time. This alternative was not included in the final set of alternatives because most of the elements were included in Alternative 4; elements that were not included were considered but rejected as unworkable, unneeded (e.g., a prohibition on octopus retention), or failed to take into account needs of fishing communities. Therefore, inclusion of this alternative would not have widened the range of alternatives.

Considered Alternative C: This alternative, previously termed the 'no fishing policy' or setting total allowable catch at zero, would end all commercial groundfish fishing in the EEZ off Alaska. This alternative has been considered previously (i.e., NPFMC 1981, NMFS 1998a, NMFS 2001a), but not adopted because it would be inconsistent with the objectives for the FMPs and the Magnuson-Stevens Act. While this alternative may have positive benefits to Steller sea lions by eliminating groundfish fisheries, a potential source of competition for fish, this alternative would have major adverse biological, social, and economic consequences (NMFS 2001a). A goal is to provide sound conservation of living marine resources, while also providing socially and economically sustainable fisheries. Because this alternative would run counter to this goal, it was not considered to be a reasonable alternative, and dropped from further consideration.

2.5 Description of the Current Fisheries

An overview of the federal management of the GOA and BSAI groundfish fisheries is presented in section 2 of the 2000 Biological Opinion (NMFS 2000a) and in section 2.7 of the Draft Programmatic SEIS prepared on the Alaska groundfish fishery management plans (NMFS 2001a). A discussion of the historical development of the Alaska groundfish fisheries that focuses on the BSAI pollock fishery is presented in section 3 of the Draft EIS prepared on the management provisions implementing the American Fisheries Act (AFA) (NMFS 2001c). This information is further summarized here along with an overview of management tools used to monitor these fisheries and a historical perspective on safety issues associated with the Alaska groundfish fisheries.

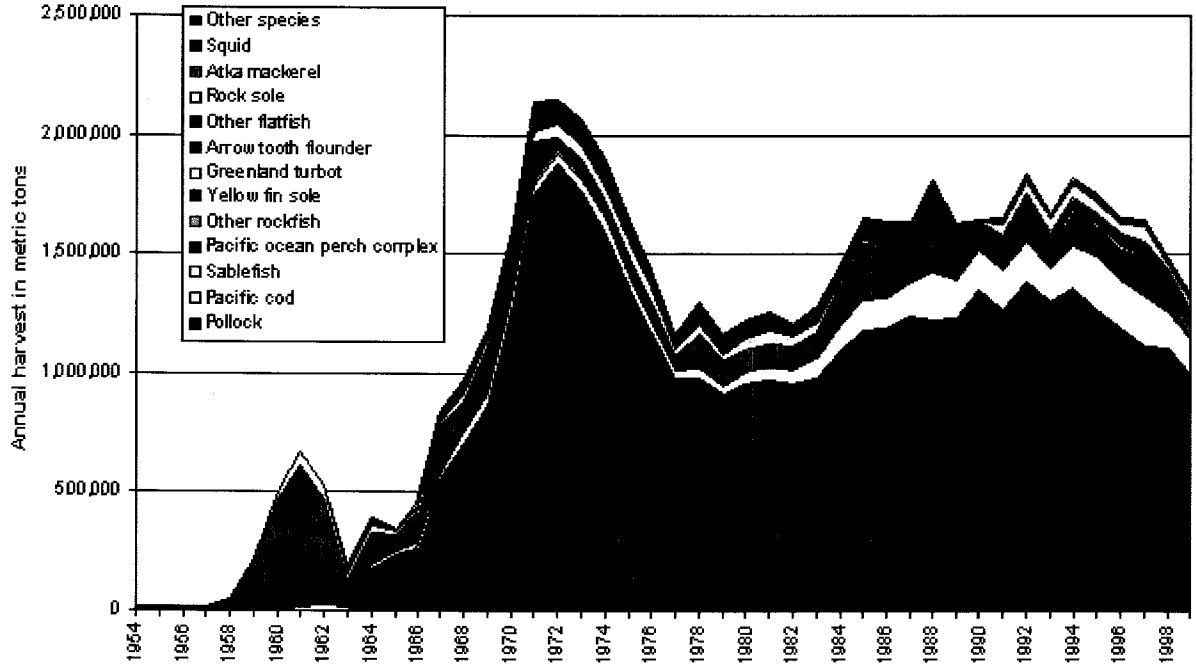
A general historical perspective of the catches of groundfish and squid taken in the Bering Sea, Aleutian Islands, and Gulf of Alaska are displayed in Figures 2.5-1 through 2.5-3, respectively. These figures reveal the growth and magnitude of the foreign groundfish harvest off Alaska during the late-1950s 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.

Prior to 1980, Alaska groundfish was harvested primarily by foreign vessels. 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 led 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 (Figure 2.5-4).

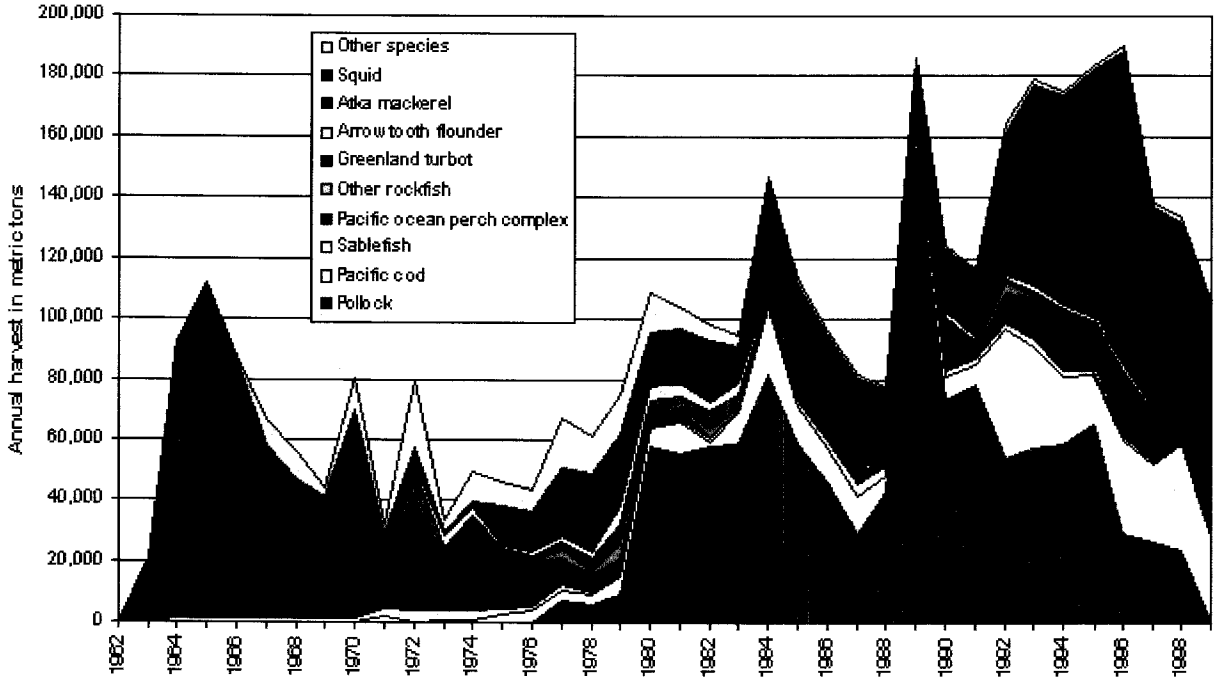
As a result of these policies, the groundfish resource off Alaska was harvested and processed entirely by U.S.-flagged vessels and processors by 1991, although the explosive growth of the domestic fishery was financed, in large part, by a flood of foreign capital into new vessels and processors. The 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.

Figure 2.5-1 Groundfish harvests in the Bering Sea subarea by species, 1952-1999



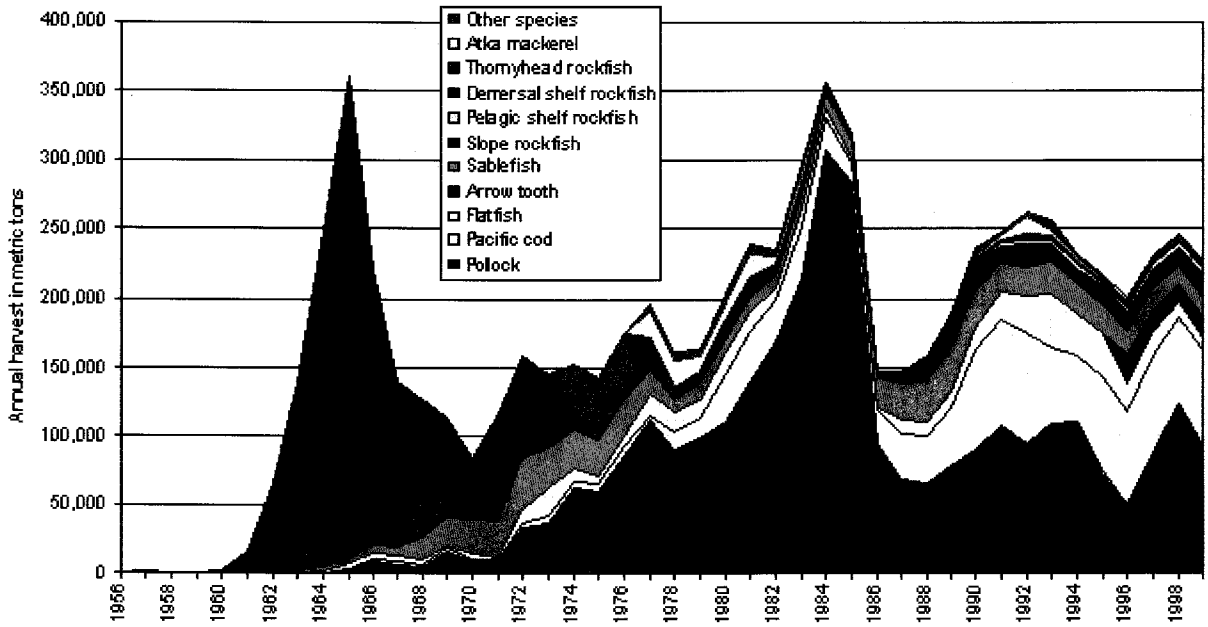
Source: NMFS catch statistics

Figure 2.5-2 Groundfish harvests in the Aleutian Islands subarea by species, 1962-1999



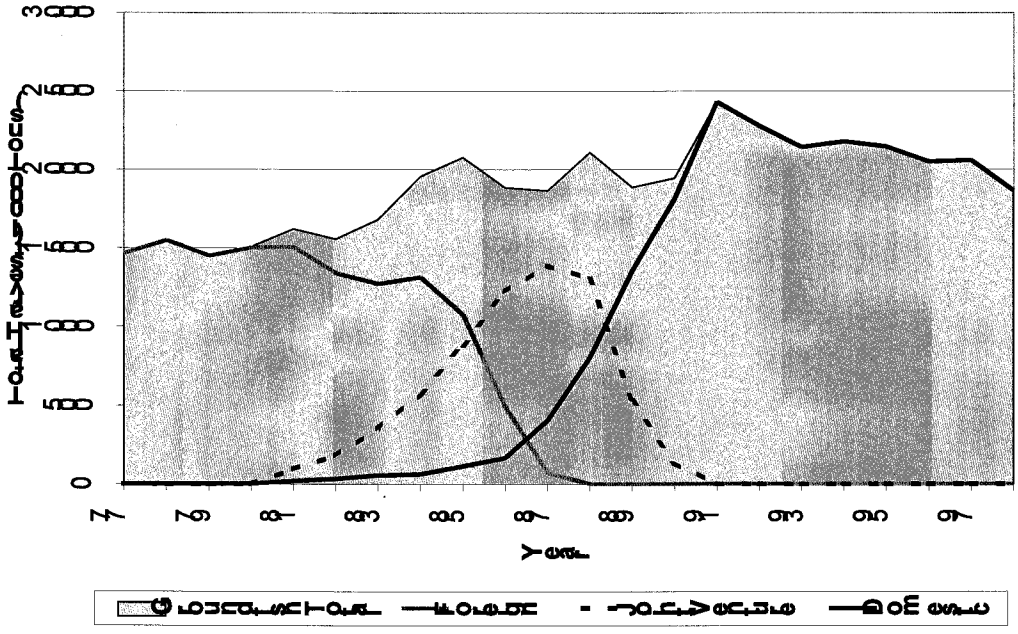
Source: NMFS catch statistics

Figure 2.5-3 Groundfish harvests in the Gulf of Alaska by species, 1958-1999



Source: NMFS catch statistics

Figure 2.5-4 Foreign, joint-venture, and domestic groundfish fishing and processing, 1977-1998



Source: NMFS catch statistics

2.5.1 Overview of the Pollock, Pacific cod, and Atka mackerel Fisheries

The 2001 BSAI and GOA groundfish total allowable catch (TACs) amounts are apportioned by area, season, gear, and sector. In total, 133 separate TAC allocations and apportionments must be monitored and managed. An additional 53 separate gear, fishery, and seasonal allocations and apportionments of established prohibited species catch (PSC) limits must be similarly monitored and enforced. Authorized catch amounts are specified annually based on the best available scientific information on status of stocks and regulatory provisions for allocation and apportionment of TACs and PSC limits. The 2001 harvest specifications were implemented by an emergency interim rule to accommodate new protection measures for Steller sea lions and were published in the Federal Register on January 22, 2001 and July 17, 2001 (66 FR 7276 and 66 FR 37167, respectively).

Gear types authorized by the FMPs are trawl, hook-and-line, pot, jig, and other gear as defined in regulations. Gear types and sector allocations for specific BSAI fisheries in 2001 are listed in Table 2.5-1. In the BSAI, pollock is allocated among four sectors, with 10% of the TAC allocated to the CDQ Program, 4% held in reserve for incidental catch, and the remainder split among the inshore, mothership, and catcher/processor sectors in the ratio of 50:10:40, respectively. During 2000 and the first half of 2001, the pollock TAC was further allocated among four seasons inside the Steller sea lion conservation area (SCA) and between two seasons outside of the SCA. For 2001, the SCA harvest limits were removed for the second half of the year with the extension of the 2001 emergency interim rule for the harvest specifications and Steller sea lion protection measures (66 FR 37167, July 17, 2001).

The BSAI Pacific cod TAC also was seasonally allocated to two seasons with a 60/40 % split. For all other BSAI fisheries (except sablefish), 7.5% of the TAC is held as reserve for the Western Alaska Community Development Quota Program (CDQ). After removal of the CDQ reserve for Pacific cod, the remainder is allocated to vessels using jig (2%), hook-and-line and pot (51%) and trawl (47%) gear, with the trawl portion split evenly between catcher vessels and catcher/processors. The hook-and-line and pot gear allocation is further allocated among 4 specified sectors as shown in Table 2.5-1. For sablefish in the Bering Sea, hook-and-line and pot together are allocated 50% and trawl is allocated 50%. For Atka mackerel, 2% of the allocation goes to jig gear. 15% of each target species or species group, except for fixed gear sablefish, is placed in a non-specified reserve category that is reapportioned to target fishery categories as fishery management needs require.

Table 2.5-1 Regulatory allocations of 2001 TAC specifications for pollock, Pacific cod, and Atka Mackerel in the BSAI.

Species[1]	Gear		Season		Other Allocations and Reserves	
Pollock[2]	None		Season dates (inside SCA)[3]	%TAC	CDQ	10%
			A season: 1/20 to 4/1	30		
			B season: 4/1 to 6/10	10	Incidental bycatch	5%
			C season: 6/10 to 8/20	30	Of the remaining TAC:	
			D season: 8/20 to Nov 1	30	Inshore	50%
					Mothership	10%
					Catcher/proc.	40%
Pacific cod	Jig	2%	A season	60	Trawl allocation is split:	
	Hook-&-line/pot	51%	B season	40	Catcher vessels	50%
	- H&L C/P 80.0%		**Trawl**		Catcher/processors	50%
	- pot 18.3%		A season 1/20 to 6/10			
	- < 60 ft 1.4%		B season 6/10-11/1			
	- H&L CV 0.3%		**H&L over 60 Ft. LOA**		7.5% of TAC to CDQ reserve	
			A season 1/20-6/10			
	Trawl	47%	B season 8/15-12/31			
			Pot over 60 ft LOA			
			A season 1/20-6/10			
			B season 9/1-12/31			

Notes: 1. Except for pollock and sablefish, 25% of each initial TAC (TAC minus reserves) is made available January 1 under interim specifications. The remainder is made available when the final specifications supercede the interim specifications, generally in February or March.

2. AFA Allocations.
A. Pollock CDQ - 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 CDQ program .
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% to catcher vessels for processing by the inshore component;
(2) 40% to catcher/processors and catcher vessels for processing by catcher/processors in the offshore component; and
(3) 10% to catcher vessels for processing by motherships in the offshore component.

3. During the second half of 2001, no SCA harvest limit were implemented during the C/D season

In the GOA (Table 2.5-2), 20% of pollock, cod, flatfish and "other" species may be held for initial reserve to provide management the flexibility needed to prevent the catch from exceeding the TAC. The pollock directed fishing allowance is allocated 100% to the inshore sector. For Pacific cod, the allocation is split 90% to the inshore sector and 10% to the offshore sector. Sector allocations are not established for flatfish, rockfish, or other species in the GOA.

Table 2.5-2 Regulatory allocations of 2001 TAC specifications for pollock and Pacific cod in the GOA.

Species	Gear	Season		Other Allocations and Reserves
Pollock	None	Western and central GOA:		Inshore component 100%
		1/20 to 3/1–1st allowance	30%	Offshore (bycatch)
		3/15 to 5/31--2nd allowance	15%	
		8/20 to 9/15--3rd allowance...		
		10/1 to 11/1--4th allowance..	30%	
		Eastern GOA:	25%	
		1/1 to 12/31		
			100%	20% of TAC to initial reserve

2.5.1.1 The Directed Fishery for Pollock

A description of the BSAI and GOA pollock fisheries and their management is presented in section 2.7.7 of the Draft Programmatic SEIS (NMFS 2001a). The most recent status of stock information on the BSAI and GOA groundfish resources is contained in the 2000 Stock Assessment and Fishery Evaluation (SAFE) reports prepared for the 2001 fisheries (NPFMC 2000c, NPFMC 2000d).

Pollock (*Theragra chalcogramma*) is the most abundant species within the eastern Bering Sea (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 *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 area 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 1991). 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 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 (Wespestad *et al.* 1997). 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).

Pollock supports the largest fishery in Alaskan waters. In the BSAI, pollock comprise 75-80 percent of the groundfish catch. In the GOA, pollock constitute 25-50 percent of the groundfish catch. In the BSAI, pollock can only be targeted with pelagic trawl gear to minimize the potential interaction with Pacific halibut, crab, and other groundfish species and to reduce the magnitude of bottom disturbance. Pollock are also caught with bottom-trawl gear as bycatch from other fisheries.

In the BSAI, annual TAC amounts are allocated by season, sector, and to some extent, inside and outside Steller sea lion critical habitat (CH). The fishing season has traditionally been separated into two parts, a roe season during early winter, and a surimi/filet season during the second half of the year. Currently, to

minimize the potential indirect interaction with Steller sea lions (*Eumetopias jubatus*), the seasons have been managed to occur over broader areas and over seasons that are less contracted in time. Sector allocations between inshore and offshore processing components were implemented under a series of fishery management plan amendments starting in 1992. Inshore/offshore amendments still direct the allocation of pollock in the GOA (100 percent of the directed fishing allowance is allocated to the inshore sector). The sector allocations of BSAI pollock currently are governed by the American fisheries Act, which was signed into law in October 1998. A detailed discussion of the history and allocation measures implemented for the pollock fisheries is presented in section 3 of the Draft EIS prepared on AFA provisions (NMFS 2001c).

Section 2.7.7.2 of the Draft Programmatic SEIS (NMFS 2001a) summarizes specific AFA provisions as they relate to the allocation of the annual TAC of Bering Sea subarea pollock. The Draft Programmatic SEIS also presents in Table 2.7-33 a hypothetical example of a 1 million mt pollock TAC for the Bering Sea subarea and percentage of TAC allocated to different sectors as directed fishing allowances under the AFA.

Since 1999, directed fishing for pollock in the Aleutian Island subarea has been prohibited as a result of reasonable and prudent alternatives developed for the pollock fishery under section 7 consultations conducted under the ESA. Section 2.7.7.2 of the Draft Programmatic SEIS also describes management measures that were implemented by emergency interim rules in 2000 to spatially and temporally distribute the Bering sea pollock fishery (NMFS 2001a). Under 2001 Steller sea lion protection measures, the Bering Sea pollock fishery is distributed spatially and temporally and pollock trawl exclusion zones are expanded around important sea lion rookeries and haulouts. These measures and protection zones were implemented under emergency interim rulemaking (66 FR 7276, January 22, 2001; 66 FR 37167, July 17, 2001).

The Draft Programmatic SEIS (NMFS 2001a) notes the difficulty in separating out the effects on fishing patterns that resulted from measures to protect Steller sea lions from the AFA. It is clear, however, that whatever the cause, weekly localized catch rates of pollock decreased with the establishment of pollock co-ops authorized under the AFA. Furthermore, increased potential exists for pollock bycatch reduction under this scenario, because of the removal of derby-like fishing conditions. Removing the race for the fish (increased length of fishing season and lower daily catch rates) allows fishermen to spend time searching for the size fish they desire and, therefore, affects fishing behavior and patterns.

Sections 5 and 6 of the 2000 Biological Opinion (NMFS 2000a) assessed the effects of the AFA on the BSAI groundfish fisheries as being largely related to ownership restrictions and restrictions on the number of vessels in the fishing fleet, allocation of pollock among the four sectors in Bering Sea, improving observer coverage and assessment of tons caught, restrictions in other fisheries (including fisheries in the GOA) of vessels benefitting from the AFA, and requirements for formation of cooperatives within sectors. These allocations have altered the nature of the pollock fishery by eliminating the race for fish, and allowing for better temporal dispersion of catch. The formation of cooperatives may also facilitate spatial dispersion of the catch to the extent that vessels can be more deliberative about where and when they fish to maximize profit. The 2000 Biological Opinion (Page 214) concludes:

> It seems clear that cooperatives following the implementation of the AFA (see discussion in section 5[of the 2000 Biological Opinion]) resulted in a decrease in adverse impacts on the western population of Steller sea lions. The pollock fishery was not only slower in the BSAI in 1999 and 2000 due to AFA, it also employed fewer boats and had less discards. Methods that encourage fishermen to work together to solve these problems on a voluntary basis have promise and are often superior in situations where enforcement is difficult.

Steller sea lion protection measures include the spatial and temporal dispersion of fishing effort for pollock. The pollock harvest is over 2 seasons outside of the Steller sea lion conservation area (SCA) and for 4 seasons within the SCA. Table 2.5-3 provides the 2001 allocations for the eastern Bering Sea pollock harvest. Open and closed areas are established around rookeries and haulout sites. No pollock fishing is allowed in the closed areas (Tables 21 and 22 of 50 CFR part 679 as modified by the amended 2001 emergency rule implementing Steller sea lion protection measures for the second half of 2001 (66 FR 37167, July 17, 2001)). To date, catches inside and outside the SCA in 2001 have been maintained under seasonal harvest limits. For the second half of 2001, the SCA harvest limit was eliminated and the C and D seasons are combined for the entire eastern Bering Sea.

Table 2.5-3 2001 Eastern Bering Sea Pollock Seasonal Allocations based on 1.4 million mt TAC.

Season	A	B	C/D
Season dates	Jan 20 - Mar 31	Apr 1 - Jun 10	Jun 11 - November 1
Outside SCA	A + B (40 % annual TAC) **560,000 mt**		C + D (60 % annual TAC) **840,000 mt**
Inside SCA	**166,751 mt**	**55,497 mt**	

2.5.1.2 The Directed Fishery for Pacific cod

A description of the BSAI and GOA Pacific cod fisheries and their management is presented in section 2.7.7 of the Draft Programmatic SEIS (NMFS 2001a). The most recent status of stock information on the BSAI and GOA groundfish resources is contained in the 2000 Stock Assessment and Fishery Evaluation (SAFE) reports prepared for the 2001 fisheries (NPFMC 2000c, NPFMC 2000d). The federal Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in Alaska State waters. Since the beginning of a separately managed Pacific cod fishery by the State of Alaska in 1998, the federally managed TACs have been adjusted downward from ABC levels by the amount of guideline harvest levels (GHLs) established by the State. The combined State waters Pacific cod GHLs in the GOA were 16,465 mt in 1999 (64 FR 12094, March 11, 1999) and are 16,400 mt in 2001 (66 FR 7276, January 22, 2001).

Pacific cod 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 (OCSEAP 1987). GOA, Bering Sea, and Aleutian Islands 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 Pacific cod fishery is the second largest Alaskan groundfish fishery. In 1999, Pacific cod constituted 12 percent of the groundfish catch in the BSAI and 30 percent of the groundfish catch in the GOA. The fishery for Pacific cod is conducted with bottom trawl, hook-and-line, pot, and jig gear. Of these, the fishery conducted with jig gear is by far the smallest. More than 100 vessels participate in each of the three larger fisheries. The age at 50 percent recruitment varies between regions. For trawl, hook-and-line, and pot gear, the age at 50 percent recruitment in the EBS is approximately 4, 4, and 5 years, respectively (Thompson and Dorn 1999). For all three gears, the age at 50 percent recruitment in the GOA is approximately 6 years (Thompson *et al.* 1999). The trawl fishery is typically concentrated during the first few months of the year, whereas fixed-gear fisheries may sometimes run essentially year-round. Bycatch of crab and halibut often causes the Pacific cod fisheries to close prior to reaching the TAC. In the Bering Sea, trawl fishing is concentrated immediately north of Unimak Island, whereas the hook-and-line fishery is distributed along the shelf edge to the north and west of the Pribilof Islands. In the GOA, the trawl fishery has centers of activity around the Shumagin Islands and south of Kodiak Island, while the hook-and-line fishery is located primarily in the vicinity of the Shumagins. The most common Pacific cod products for at -sea processors are headed and gutted fish and fillets. The most common products for shoreside processors are salted cod, fillets, and fish meal..

As shown in Table 2.5-1, the BSAI Pacific cod TAC is allocated among different gear groups and sectors. In fall of 2000, NMFS issued regulations implementing Amendment 64 to the BSAI groundfish fishery management plan. Amendment 64 established the following apportionment of the hook-and-line and pot gear allocation after deducting incidental catch of Pacific cod in other groundfish fixed-gear fisheries:

80 percent to hook-and-line catcher/processors
0.3 percent to hook-and-line catcher vessels
18.3 percent to pot vessels
1.4 percent to hook-and-line or pot vessels less than 60 ft

In April 2000, the Council adopted proposed FMP Amendment 67 that would build upon the existing license limitation program (LLP) by implementing participation and landings requirements and establishing species and gear endorsements for the hook-and-line and pot gear BSAI Pacific cod fisheries. As proposed, this amendment would further limit the number of vessels allowed to fish for Pacific cod with fixed gear in the BSAI.

2001 management measures

In accordance with Pub. L. 106-544, management measures contained in the 2000 Biological Opinion RPA were phased in by emergency interim rule (66 FR 7276, January 22, 2001; 66 FR 37167, July 17, 2001) to protect the western population of Steller sea lions. For BSAI Pacific cod this included a seasonal apportionment of TAC (less the CDQ reserve) of 60 percent of the annual TAC (104,340 mt) from January 1 to June 10 and 40 percent of the annual TAC (69,560 mt) from June 10 to December 31, 2001. In the GOA, seasonal apportionments of Pacific cod TAC also were specified in the Central and Western Regulatory Areas at 60 percent of the annual TAC from January 1 to June 10 and 40 percent of the annual TAC from June 10 to December 31, 2001. With the extension and amendments to the emergency interim regulations in July, the B season was delayed to September 1. The trawl fisheries for BSAI and GOA Pacific cod are prohibited after October 31.

All hook-and-line Pacific cod fishing in the GOA was put on bycatch status by February 26 because of halibut bycatch. Pot and jig gear Pacific cod fishing in the western and inshore Central areas were put on

bycatch status by April 26 because the seasonal TAC was reached. Western, Central, and Eastern GOA Pacific cod trawl fisheries were put on bycatch status by late April because of halibut bycatch. On March 29, 2001, an amendment to the January 22, 2001, emergency rule was published exempting jig vessels and vessels < 60 feet (18.3m) in the BSAI hook-and-line and pot gear fishery from the 3 nm no fishing zone around haulouts (66 FR 17083). This amendment also removed the seasonal Pacific cod BSAI allocation for these vessels. After June 10, 2001 and until July 17, 2001, critical habitat areas were either opened or closed to fishing for groundfish, including Pacific cod, around rookeries and haulout. On June 10, 2001, an amendment to the January 18, 2001, emergency interim rule (66 FR 7276, January 22, 2001) was implemented to prohibit fishing for BSAI Pacific cod by vessels equal to or greater than 60 feet LOA using pot or hook-and-line gear and for all vessels in the Western and Central GOA regulatory areas (66 FR 31845). This action was necessary to implement the Council's recommendation to delay the second GOA Pacific cod season to September 1 and to delay the BSAI Pacific cod season for vessels equal to or greater than 60 feet LOA using pot or hook-and-line gear to September 1 and August 15, respectively. This action was necessary to avoid the "race for the fish" before the emergency rule extension and amendments were in place and to reduce salmon and halibut bycatch. These new season dates are part of the amendment to the emergency rule that became effective July 18, 2001, and that established new open and closed areas for the Pacific cod fisheries and established a new starting dates for the second Pacific cod season in 2001 (66 FR 37167, July 17, 2001).

2.5.1.3 The Directed Fishery for Atka mackerel

A description of the BSAI Atka mackerel fishery and its management is presented in section 2.7.7 of the Draft Programmatic SEIS (NMFS 2001a). The most recent status of stock information on the BSAI and GOA groundfish resources is contained in the 2000 Stock Assessment and Fishery Evaluation (SAFE) reports prepared for the 2001 fisheries (NPFMC 2000c, NPFMC 2000d).

Atka mackerel 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 *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, 1999). 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).

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 1999). Although Atka mackerel comprise a separate TAC category in the GOA, abundance and TAC amounts are inadequate to support a directed fishery given that the full TAC amount is needed for bycatch in other fisheries. As such, Atka mackerel in the GOA are currently managed as a bycatch fishery.

The directed fishery for Atka mackerel is prosecuted by catcher-processor bottom trawlers. The patterns of the fishery generally reflect the behavior of the species in that the fishery is highly localized, occurring in the same few locations each year, generally occurs at depths between 100 and 200 m (Lowe and Fritz 1999). Important Atka mackerel fishery locations include Seguam Bank, Tanaga Pass, north of the Delarof Islands, Petrel Bank, south of Amchitka Island, east and west of Kiska Island, and on the seamounts and reefs near Buldir Island.

Steller sea lion protection measures include the spatial and temporal dispersion of fishing effort for Atka mackerel. The Atka mackerel harvest is over 2 seasons with critical habitat limits for the Western and

Central AI areas. Table 2.5.4 provides the 2001 allocations for the AI Atka mackerel harvest. Inside critical habitat was closed to trawling February 2 and February 13 in areas 542 and 543, respectively, as the CH limits were reached for these areas.

Table 2.5-4 Atka mackerel - Aleutians Islands area 2001 seasonal allocations based on 69,300 mt TAC.

Area	A Jan 1 - April 15		B September 1-November 1	
	Total	CH limit	Total	CH limit
Western AI District (543)	12,904 mt	6,194 mt	12,904 mt	6,194 mt
Central AI District (542)	15,540 mt	7,148 mt	15,540 mt	7,148 mt
Eastern AI/BS subarea*	3,572 mt	na	3,572 mt	na

*Does not include the 1% jig allocation (72 mt) which is not seasonally apportioned.
na = not available

To address the possibility that the fishery creates localized depletions of Atka mackerel and adversely modifies Steller sea lion critical habitat by disproportionately removing prey, the Council, in June 1998, passed a fishery management regulatory amendment which proposed a four-year timetable to temporally and spatially disperse and reduce the level of Atka mackerel fishing within Steller sea lion critical habitat in the BSAI. The temporal dispersion is accomplished by dividing the BSAI Atka mackerel TAC into two equal seasonal allowances. The first allowance is made available for directed fishing from January 1 to April 15 (A season), and the second seasonal allowance is made available from September 1 to November 1 (B season). The spatial dispersion is accomplished through maximum catch percentages of each seasonal allowance that can be caught within Steller sea lion critical habitat (CH) as specified for the central and western Aleutian Islands. No critical habitat closures are established for the eastern Aleutian Islands district, but 20 nm trawl exclusion zones around the Seguam and Agligadak are in effect year-round. The regulations implementing these management changes became effective January 22, 1999. The four-year timetable for spatial dispersion of the Atka mackerel fishery outside of critical habitat is:

Aleutian Island District

	Area 541		Area 542		Area 543	
Year(s)	Inside CH	Outside CH	Inside CH	Outside CH	Inside CH	Outside CH
1999			80%	20%	65%	35%
2000			67%	33%	57%	43%
2001			54%	46%	49%	51%
2002			40%	60%	40%	60%

2.5.1.4 The CDQ Fishery

The Western Alaska Community Development Quota (CDQ) Program was created by the North Pacific Fishery Management Council (Council) in 1992 as part of the inshore/offshore allocation of pollock in the Bering Sea and Aleutian Islands. The Council established the CDQ Program to provide fishermen who resided in western Alaska an opportunity to participate in the Bering Sea and Aleutian Islands fisheries that had been foreclosed to them because of the high capital investment needed to enter the fishery. The purpose

of the CDQ Program was to help western Alaska communities to diversify their local economies and to provide new opportunities for stable, long-term employment.

Currently, 65 communities are eligible to participate in the CDQ Program. The CDQ communities are located within 50 nautical miles of the Bering Sea coast or on an island in the Bering Sea. Approximately 27,000 people live in the CDQ communities, which are small communities populated predominantly by Alaska Native people. These 65 communities have formed the following six non profit corporations called "CDQ groups" to manage and administer their CDQ allocations, investments, and economic development projects:

Aleutian Pribilof Island Community Development Association (APICDA)
Bristol Bay Economic Development Corporation (BBEDC)
Central Bering Sea Fishermen's Association (CBSFA)
Coastal Villages Region Fund (CVRF)
Norton Sound Economic Development Corporation (NSEDC)
Yukon Delta Fisheries Development Association (YDFDA)

Table 2.5-5 lists the communities that are members of each CDQ group. Table 2.5-6 lists the allocation of the 2001 CDQ reserve among the 6 CDQ groups authorized to receive allocations.

Through the CDQ Program, a portion of the Bering Sea and Aleutian Islands area (BSAI) catch limits for crab, halibut, groundfish, and prohibited species are allocated to eligible western Alaska communities. The percentage of each catch limit allocated to the CDQ Program is determined by the AFA for pollock (10%), the Magnuson-Stevens Act for crab (7.5%), the Fishery Management Plan for the Groundfish Fisheries of the Bering Sea and Aleutian Islands area (FMP) for all other groundfish and prohibited species (7.5%, except 20% for fixed gear sablefish), and 50 CFR 679 for halibut (20% to 100%). These allocations to the CDQ Program are called "CDQ reserves."

With the addition of the remainder of the groundfish species and the prohibited species allocations in 1998, regulations were implemented combining the two separate CDQ fisheries (pollock and fixed gear halibut and sablefish) with the new groundfish and prohibited species into the multispecies groundfish and halibut CDQ fisheries. Under these regulations, all catch of all groundfish and prohibited species by vessels fishing for CDQ groups accrue against the CDQ groups' allocations and none of the groundfish or prohibited species caught in the groundfish CDQ fisheries accrues against the non-CDQ fisheries TACs or prohibited species catch limits. The CDQ groups are required to manage their catch to stay within all of their CDQ allocations. This system of strict quota accountability was implemented because all bycatch in all of the CDQ fisheries accrues against the CDQ allocations. None of this catch should be subtracted from the portion of the quotas available to the non-CDQ fisheries.

In 2000, approximately 180,000 metric tons of groundfish, 3 million pounds of halibut, and 3 million pounds of crab were allocated to the CDQ Program. The six CDQ groups had total revenues in 2000 of approximately $63 million, most of this from pollock CDQ royalties. Since 1992, the CDQ groups have accumulated assets worth approximately $187 million, including ownership of small local processing plants, catcher vessels, and catcher/processors that participate in the groundfish, crab, salmon, and halibut fisheries. The CDQ groups have used their CDQ allocations to develop local fisheries, invest in a wide range of fishing businesses outside the communities, and provide residents with education, training, and job opportunities in the fishing industry.

Table 2.5-5 Eligible Western Alaska Communities and the CDQ Groups.

Aleutian Pribilof Island Community Development Association (APICDA)

Akutan
Atka
False Pass
Nelson Lagoon
Nikolski
Saint George

Bristol Bay Economic Development Corporation (BBEDC)

Aleknagik
Clark's Point
Dillingham
Egegik
Ekuk
Ekwok
Levelock
Manokotak
Naknek
Pilot Point
Port Heiden
Portage Creek
South Naknek
Sovonoski/King Salmon
Togiak
Twin Hills
Ugashik

Central Bering Sea Fishermen's Association (CBSFA)

Saint Paul

Coastal Villages Region Fund (CVRF)

Chefornak
Chevak
Eek

CVRF (cont.)

Goodnews Bay
Hooper Bay
Kipnuk
Kongiganak
Kwigillingok
Mekoryuk
Napakiak
Napaskiak
Newtok
Nightmute
Oscarville
Platinum
Quinhagak
Scammon Bay
Toksook Bay
Tuntutuliak
Tununak

Norton Sound Economic Development Corporation (NSEDC)

Brevig Mission
Diomede
Elim
Gambell
Golovin
Koyuk
Nome
Saint Michael
Savoonga
Shaktoolik
Stebbins
Teller
Unalakleet
Wales
White Mountain

Yukon Delta Fisheries Development Association (YDFDA)

Alakanuk
Emmonak
Grayling
Kotlik
Mountain Village
Nunam Iqua (Sheldon Point)

Table 2.5-6 Multispecies CDQ Program Allocations in 2001.

Groundfish CDQ Species	2001 TAC	2001 CDQ Reserve	CDQ Group Amounts (metric tons)						
			APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA	TOTAL
BS FG Sablefish	780	156	23	34	28	0	31	39	156
AI FG Sablefish	1,875	375	56	75	0	113	75	56	375
BS Sablefish	780	59	10	12	6	10	11	11	59
AI Sablefish	625	47	11	11	4	5	5	11	47
BS Pollock - total	1,400,000	140,000	19,600	29,400	5,600	33,600	32,200	19,600	140,000
AI Pollock	2,000	200	28	42	8	48	46	28	200
Bogoslof Pollock	1,000	100	14	21	4	24	23	14	100
Pacific Cod	188,000	14,100	2,256	2,820	1,410	2,397	2,538	2,679	14,100
WAI Atka Mackerel	27,900	2,093	628	314	167	314	293	377	2,093
CAI Atka Mackerel	33,600	2,520	756	378	202	378	353	454	2,520
EAI/BS Atka Mackerel	7,800	585	176	88	47	88	82	105	585
Yellowfin Sole	113,000	8,475	2,373	2,034	678	509	593	2,288	8,475
Rock Sole	75,000	5,625	1,350	1,294	450	619	619	1,294	5,625
BS Greenland Turbot	5,628	422	84	93	30	63	63	89	422
AI Greenland Turbot	2,772	208	33	42	10	44	42	37	208
Arrowtooth Flounder	22,011	1,651	396	363	149	182	165	396	1,651
Flathead Sole	40,000	3,000	600	600	300	450	450	600	3,000
Other Flatfish	28,000	2,100	525	483	189	210	210	483	2,100
BS Pacific Ocean Perch	1,730	130	23	27	9	23	23	23	130
WAI Pacific Ocean Perch	4,740	356	107	53	28	53	50	64	356
CAI Pacific Ocean Perch	2,560	192	58	29	15	29	27	35	192
EAI Pacific Ocean Perch	2,900	218	65	33	17	33	31	39	218
BS Other Red Rockfish	135	10	2	2	1	2	2	2	10
AI Sharpchin/Northern	6,745	506	152	76	40	76	71	91	506
AI Shortraker/Rougheye	912	68	15	12	5	12	12	12	68
BS Other Rockfish	361	27	7	6	2	3	4	6	27
AI Other Rockfish	676	51	12	9	4	9	9	9	51
Other Species	26,500	1,988	358	398	199	318	318	398	1,988

Table 2.5-6 (cont.) Multispecies CDQ Program Allocations in 2001 (metric tons).

Prohibited Species	2001 TAC	2001 CDQ Reserve	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA	TOTAL
Zone 1 Red King Crab	97,000	7,275	2,110	1,673	582	509	509	1,892	7,275
Zone 1 Bairdi Tanners	730,000	54,750	14,235	13,140	4,380	4,380	4,380	14,235	54,750
Zone 2 Bairdi Tanners	2,070,000	155,250	35,708	34,155	13,973	18,630	17,078	35,708	155,252
Opilio Tanner Crab	4,350,000	326,250	78,300	71,775	29,363	35,888	32,625	78,300	326,251
Pacific Halibut	4,575	343	75.460	75.460	30.870	41.160	41.160	78.890	343.000
Chinook Salmon	41,000	3,075	461	646	123	707	707	431	3,075
Non-Chinook Salmon	42,000	3,150	473	662	158	725	693	441	3,152

Values are in metric tons.

2.5.1.5 Incidental Catch of Pollock, Pacific cod and Atka mackerel in Other Directed Fisheries for Groundfish

While fishery participants may target a certain species, they are not 100% effective in limiting their catch to that specific target. Other fishes and marine life are also caught to varying degrees depending on target species, gear type and fishing method, area fished and habitat type, season, depth, and other physical and biological factors. These other fishes and marine life are referred to as "incidental catch" or "bycatch."[1] Whether a species or stock is caught as a target by a fishing vessel, or incidentally by a vessel fishing for another target species, the catch is credited against the overall total allowed for a species or stock. That is, TACs are intended to represent the sum of all catch including targeted catch and incidental catch.

The fishery for a target species may be categorized as open to directed fishing, closed to directed fishing, or prohibited. When a fishery for a species is open to directed fishing, vessels are allowed to target and retain it with no restrictions on the amount harvested. If the catch is expected to reach the TAC and some amount of TAC must be held in reserve for incidental catch in other fisheries, then a portion of the TAC may be established as a "directed fishing allowance," meaning that directed fishing is allowed only on that portion of the TAC. For example, for the BSAI pollock fishery, 4% of the TAC is established as an "incidental catch allowance" and the directed fishery is based on the remaining 96% of the TAC. For fisheries other than BSAI pollock, the amount for a "directed fishing allowance" is determined as the season progresses, and is established by an in-season action. Once the directed fishing allowance for a species is taken, the fishery is closed to directed fishing. When a species is closed to directed fishing, vessels are allowed to retain up to a maximum retainable amount specified in regulations at 50 CFR 679.20 (e) and (f) at any time during the fishing trip. This provision does allow targeting for the species on a haul-by-haul basis, as long as the maximum retainable amount for the trip is not exceeded at any time. If the catch reaches the TAC, then the status changes to "prohibited," and retention is prohibited for the rest of the year. If NMFS determines that harvest of a species will reach the overfishing level (OFL), then the Regional Administrator has the authority to close the fisheries in which the species is taken to prevent overfishing. Since 1998, discarding of pollock and Pacific cod is prohibited under the regulations at 50 CFR 679.27, except in fisheries where these species are on "bycatch only" status. That case, vessel operators are required to keep amounts of incidentally caught pollock and Pacific cod up to the maximum retainable bycatch percentage, and then discard the rest.

Appendix E1 contains data summarizing the 1999 catch of pollock, Pacific cod, and Atka mackerel in the BSAI and GOA groundfish fisheries by gear, federal reporting area, and processing mode. Tables 2.5-7 through 2.5-9 summarize this information to show where most of the catch is occurring. The year 1999 was chosen as a representative baseline for catch by gear given that the catch and distribution of groundfish harvest in 2000 was impacted by a court ordered injunction that prohibited commercial trawling for groundfish in designated Steller sea lion critical habitat as of August 2000, for the remainder of the year. Catch information for 2001 is available only for the first half of the year. Thus 1999 is considered the most recent full year for which representative catch data are available and is used in this SEIS as the most representative year from which to characterize the current groundfish fisheries.

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[1] The terms "incidental catch" and "bycatch" are often used to mean catch of species or marine life not targeted. In regulations, the terms are given specific meanings. "Incidental catch" applies to the unintended catch of species that may be targeted or the unintended catch of species other than prohibited species. "Bycatch" is used in the regulations to refer to the incidental catch of prohibited species.

BSAI pollock are caught as bycatch in other directed fisheries, but because pollock occur primarily in well defined aggregations that can be avoided, the impact of this bycatch is typically minimal relative to overall TAC. Discard rates through the early 1990s (discards/retained catch) of pollock in the directed fishery have been about 7-8 percent but in 1998 dropped to 1.5 percent (Ianelli *et al.* 1999). This is due to the fact that in 1998, discarding of pollock was prohibited except in the fisheries where pollock are in bycatch-only status. Incidental catches of pollock are highest in the BSAI Pacific cod, rock sole, and yellowfin sole fisheries trawl fisheries, and the GOA trawl and hook-and-line gear fisheries for Pacific cod (Table 2.5-7).

Incidental catch amounts of BSAI Pacific cod are taken primarily in the trawl fisheries for rock sole, yellowfin sole, flathead sole, and the Atka mackerel fishery in the Aleutian Islands. In the GOA, Pacific cod is taken as bycatch primarily in the trawl fisheries for rockfish, pollock, and flatfish (Table 2.5-8).

Atka mackerel are not commonly caught as bycatch in other directed fisheries. The largest amounts of discards of Atka mackerel, which are likely undersize fish, occur in the directed Atka mackerel trawl fisheries. Recent discard rates (discards/retained catch) of Atka mackerel in the directed fishery have been below 10 percent (Lowe and Fritz 1999a). Atka mackerel are also caught as bycatch in the Aleutian Islands area trawl fisheries for rockfish and Pacific cod (Table 2.5-9). It is difficult to discern the level of natural bycatch of Atka mackerel in the rockfish fisheries, as vessels may actually be targeting Atka mackerel in particular hauls, but overall they are designated as targeting rockfish on a particular trip.

Table 2.5-7 **1999 catch of non CDQ pollock by area, fishery, and gear in descending order based on catch.**

Management Area	TARGET	GEAR	ZONE	DESIG	PLCK (mt)	%PLCK
BSAI	P Pollock - midwater	TRW	517	S	306,736	0.31
	P	TRW	521	P	165,872	0.17
	P	TRW	517	P	114,897	0.12
	P	TRW	509	S	94,186	0.10
	P	TRW	509	P	59,785	0.06
	P	TRW	513	P	59,024	0.06
	P	TRW	521	M	36,952	0.04
	P	TRW	513	S	31,068	0.03
	P	TRW	509	M	29,410	0.03
	P	TRW	517	M	29,266	0.03
	P	TRW	513	M	9,600	0.01
	C Pacific cod	TRW	509	S	7,518	0.01
	C	TRW	509	P	6,058	0.01
	R rock sole	TRW	509	P	4,070	0.00
	Y yellowfin sole	TRW	513	P	3,201	0.00
	B pollock-bottom	TRW	509	M	2,466	0.00
	B	TRW	509	P	2,304	0.00
	Y	TRW	509	P	2,302	0.00
	L Flathead sole	TRW	513	P	2,134	0.00
	B	TRW	517	P	1,616	0.00
	Y	TRW	517	P	1,550	0.00
	Y	TRW	514	P	1,549	0.00
	P	TRW	519	S	1,399	0.00
	C	TRW	517	S	1,332	0.00
	C	TRW	517	P	1,282	0.00
	C	HAL	521	P	1,239	0.00
	L	TRW	517	P	1,198	0.00
	R	TRW	516	P	1,027	0.00
	C	HAL	517	P	845	0.00
	C	HAL	513	P	830	0.00
	C	HAL	509	P	769	0.00
	B	TRW	513	P	720	0.00
	P	TRW	521	S	658	0.00
	L	TRW	521	P	633	0.00
	B	TRW	517	M	511	0.00

NOTE: Total catch of pollock in the BSAI and GOA from which percentage amounts are calculated equal 989,777 mt and 95,637 mt, respectively. ZONE refers to Federal reporting area; DESIG refers to shoreside processor (S), catcher/processor (P), or mothership (M) processing mode. Target fisheries which accounted for less than 500 mt of BSAI pollock and 100 mt of GOA pollock are not listed, but are presented in Appendix E1. Data source: NMFS 1999 Blend Database.

Table 2.5-7 (cont.) 1999 catch of non CDQ pollock by area, fishery, and gear in descending order based on catch.

Management Area	TARGET	GEAR	ZONE	DESIG	PLCK (mt)	% PLCK
GOA	P pollock midwater	TRW	620	S	35,826	0.37
	P	TRW	630	S	28,460	0.30
	P	TRW	610	S	22,855	0.24
	P	TRW	649	S	2,209	0.02
	B Pollock-bottom	TRW	620	S	2,096	0.02
	P	TRW	640	S	1,740	0.02
	B	TRW	630	S	695	0.01
	C Pacific cod	TRW	630	S	476	0.00
	C	TRW	610	S	239	0.00
	C	TRW	620	S	149	0.00
	C	HAL	630	S	127	0.00

NOTE: Total catch of pollock in the BSAI and GOA from which percentage amounts are calculated equal 989,777 mt and 95,637 mt, respectively. ZONE refers to Federal reporting area; DESIG refers to shoreside processor (S), catcher/processor (P), or mothership (M) processing mode. Target fisheries which accounted for less than 500 mt of BSAI pollock and 100 mt of GOA pollock are not listed, but are presented in Appendix E1. Data source: NMFS 1999 Blend Database.

Table 2.5-8 1999 catch of non CDQ Pacific cod by area, fishery, and gear in descending order based on catch.

Management Area	TARGET	GEAR	ZONE	DESIG	PCOD (mt)	%PCOD
BSAI	C	HAL	521	P	32,400	0.19
	C	TRW	517	S	20,651	0.12
	C	HAL	509	P	15,183	0.09
	C	HAL	517	P	13,364	0.08
	C	HAL	513	P	13,038	0.07
	C	POT	519	S	7,219	0.04
	C	TRW	509	P	6,670	0.04
	C	TRW	541	P	6,141	0.04
	C	TRW	541	M	5,617	0.03
	C	TRW	509	S	5,428	0.03
	C	HAL	541	P	4,096	0.02
	C	HAL	542	P	3,217	0.02
	C	HAL	523	P	2,513	0.01
	R	TRW	509	P	2,082	0.01
	C	HAL	516	P	1,824	0.01
	Y	TRW	509	P	1,752	0.01
	C	POT	541	S	1,691	0.01
	L	TRW	513	P	1,572	0.01
	C	TRW	517	P	1,522	0.01
	C	POT	509	S	1,470	0.01
	C	TRW	541	S	1,452	0.01
	C	HAL	518	P	1,397	0.01

Management Area	TARGET	GEAR	ZONE	DESIG	PCOD (mt)	%PCOD
	C	TRW	521	P	1,236	0.01
	R	TRW	516	P	1,179	0.01
	C	POT	517	S	1,091	0.01
	Y	TRW	513	P	960	0.01
	Y	TRW	517	P	946	0.01
	A	TRW	541	P	943	0.01
	L	TRW	521	P	826	0.00
	C	POT	509	P	776	0.00
	L	TRW	517	P	755	0.00
	A	TRW	543	P	755	0.00
	A	TRW	542	P	717	0.00
	P	TRW	517	S	711	0.00
	Y	TRW	514	P	702	0.00
	C	HAL	524	P	698	0.00
	C	TRW	521	M	646	0.00
	C	POT	543	M	574	0.00
	C	POT	524	P	551	0.00
BSAI	C Pacific cod	POT	543	P	541	0.00
	C	POT	518	S	539	0.00
	P pollock -midwater	TRW	521	P	494	0.00
	C	HAL	519	P	459	0.00
	P	TRW	517	P	418	0.00
	C	TRW	542	P	397	0.00
	C	HAL	543	P	389	0.00
	P	TRW	509	P	380	0.00
	P	TRW	509	S	363	0.00
	C	POT	521	P	357	0.00
	C	POT	542	P	320	0.00
	C	POT	541	P	301	0.00
	C	POT	542	M	289	0.00
	C	TRW	513	P	279	0.00
	C	HAL	512	P	271	0.00
	C	POT	513	P	254	0.00
	C	TRW	542	M	244	0.00
	P	TRW	513	P	239	0.00
	P	TRW	517	M	202	0.00

Management Area	TARGET	GEAR	ZONE	DESIG	PCOD (mt)	%PCOD
GOA	C	TRW	630	S	15,308	0.22
	C	TRW	610	S	14,348	0.21
	C	POT	630	S	7,555	0.11
	C	HAL	630	S	6,014	0.09
	C	POT	620	S	5,410	0.08
	C	HAL	610	P	5,139	0.07
	C	POT	620	P	2,932	0.04
	C	TRW	620	S	2,411	0.04
	C	POT	610	P	1,424	0.02
	C	POT	610	S	1,161	0.02
	K rockfish	TRW	630	S	880	0.01
	C	TRW	630	P	618	0.01
	C	TRW	610	P	428	0.01
	C	POT	649	S	297	0.00
	B pollock-bottom	TRW	630	S	263	0.00
	H shallow water flats	TRW	630	S	259	0.00
	D Deepwater flats	TRW	630	S	249	0.00
	X rex sole	TRW	630	P	239	0.00
	X	TRW	620	P	228	0.00
	K	TRW	630	P	215	0.00
	C	HAL	649	S	205	0.00
	P	TRW	620	S	204	0.00

NOTE: Total catch of Pacific cod in the BSAI and GOA from which percentage amounts are calculated equal 173,978 mt and 68,613 mt, respectively. ZONE refers to Federal reporting area; DESIG refers to shoreside processor (S), catcher/processor (P), or mothership (M) processing mode. Target fisheries which accounted for less than 200 mt of BSAI Pacific cod are not listed, but are presented in Appendix E1.
Data source: NMFS 1999 Blend Database.

Table 2.5-9 1999 catch of non CDQ Atka mackerel by area, fishery, and gear in descending order based on catch.

Management Area	TARGET	GEAR	ZONE	DESIG	AMCK (mt)	% AMCK
BSAI	A Atka mackerel	TRW	542	P	21,520	0.38
	A	TRW	543	P	16,207	0.29
	A	TRW	541	P	14,565	0.26
	A	TRW	519	P	1,741	0.03
	K rockfish	TRW	542	P	734	0.01
	C Pacific cod	TRW	541	P	372	0.01
	K	TRW	541	P	172	0.00
	K	TRW	543	P	158	0.00
	B pollock - bottom	TRW	517	S	136	0.00
	C	TRW	542	P	98	0.00
	A	TRW	517	P	82	0.00
	T Greenland Turbot	TRW	519	P	73	0.00
	C	HAL	542	P	62	0.00
	T	TRW	517	P	60	0.00
	F Other flatfish	TRW	517	P	44	0.00
	C	TRW	517	P	35	0.00
	C	TRW	541	M	28	0.00
	Y Yellowfin sole	TRW	517	P	25	0.00
	C	TRW	519	P	21	0.00
	L Flathead sole	TRW	517	P	14	0.00
	A	TRW	518	P	12	0.00
GOA	K	TRW	610	P	140	0.498177
	P pollock-midwater	TRW	610	S	118	0.416819

NOTE: Total catch of Atka mackerel in the BSAI and GOA from which percentage amounts are calculated equal 56,231mt and 262mt, respectively.
ZONE refers to Federal reporting area; DESIG refers to shoreside processor (S), catcher/processor (P), or mothership (M) processing mode.
Data source: NMFS 1999 Blend Database.

2.5.2 Spatial and Temporal Fishing Patterns

Appendix E2 contains a series of tables and figures that summarize 1999 distribution of the pollock, Pacific cod, and Atka mackerel harvests in the directed fishery for each species inside and outside of Steller sea lion critical habitat (haulouts and rookeries) by week, area, and vessel type, sector, and size category. Harvest is presented by federal reporting area, as well as percentage of catch within different zones of Steller sea lion critical habitat. A description of the data used in Appendix E2 follows.

Catch data was compiled to represent catch by all groundfish vessels in the Bering Sea and Gulf of Alaska in 1999. In the database, shoreside deliveries are represented by Alaska Department of Fish and Game fish tickets; deliveries to offshore motherships, and deliveries to or catch by catcher processors ≥ 125 ft are represented by observer data; and deliveries to catcher processors < 125 ft are represented by federal weekly production reports.

In compiling the tables, catch was reported as catch of the target species (pollock, Pacific cod, or Atka mackerel) taken in landings that were in those targets. Vessels were categorized as small (S, < 60 ft), medium (M, ≥ 60 and ≤ 124 ft), and large (L, ≥ 125 ft). Reporting areas were Bering Sea or Aleutian Islands, in the BSAI area; Federal areas 610, 620, 630 and the Eastern Gulf for GOA pollock fisheries; and Eastern, Central and Western Gulf for GOA Pacific cod fisheries. The gear categories used were trawl, hook-and-line, pot, and jig, and the processing categories were catcher vessels and catcher processors.

All data were classified at the ADF&G state statistical area level. The state statistical area is reported on each ADF fish ticket. Observer data were assigned a state statistical area depending on the retrieval location of the haul. Weekly production report (WPR) data are reported by week and federal reporting area. WPR catch within a federal reporting area and week was assigned to state statistical areas according to either the observed catch by state statistical area for that vessel and week, or according to the observed catch by state statistical area for similar vessels operating in the same federal reporting area and week. The WPR catch was allocated to state statistical areas in proportion to the observed catch in each area.

State statistical areas were over-laid by 3, 10 and 20 nm buffers around Steller sea lion rookeries, haulouts and RPA sites (haulouts not previously included in closures) in a GIS. The area within each resulting state statistical area segment was calculated, as was the percent each segment represented of a total state statistical area. The catch from a reported state statistical area was then multiplied by the percent of the statistical area that was within the desired buffer (e.g. 3 nm or 20 nm). For instance, a state statistical area with 5% within 3 miles of a rookery or haulout would have the catch reported from that state statistical area multiplied by 0.05 to estimate the amount of catch from the statistical area that occurred within 3 nm of a rookery or haulout.

In keeping with Alaska Department of Fish and Game confidentiality standards, any cell in the tables provided that represented catch by less than 4 vessels was censored and represented in the tables by an "X." The total catch, including catch that was screened in the weekly tables, is summarized in Table 2.5-10.

Table 2.5-10 generally shows a trend of smaller vessels and vessels fishing for Pacific cod with pot gear using fishing grounds closer to shore in critical habitat compared to larger vessels and vessels fishing with hook-and-line or trawl gear. Trawl and hook-and-line vessels fishing for Pacific cod in the Gulf of Alaska were more dependent on near-shore fishing grounds than trawl and hook-and-line vessels fishing in the Bering Sea. However, vessels fishing for Pacific cod in the Aleutian Islands subarea relied heavily on fishing grounds within 20 nm of haulouts and rookeries. The BSAI catcher processors vessels fishing for Pacific

cod with hook-and-line gear were least dependent on near shore waters and harvested only 9% of their annual 1999 catch from fishing grounds within 20 nm of Steller sea lion critical habitat.

The GOA trawl pollock fishery harvested about 60% of their 1999 catch within 20 nm of Steller sea lion rookeries and haulouts, with smaller vessels being more reliant on these near shore fishing grounds than larger vessels. The Bering Sea pollock fishery is least dependent overall on near shore fishing grounds within 20 nm of the shore, with less than 5 percent of the overall 1999 harvest coming from these areas. In assessing these data for the pollock fisheries, we need to keep in mind that in 1999, an emergency rule was implemented that prohibited directed fishing for pollock within 10 or 20 nm of rookeries and important haulouts in the BSAI and GOA (64 FR 3437, January 22, 1999). Thus, the 1999 data presented in Table 2.5-10 likely reflects minimal fishing around these areas for that reason.

The Atka mackerel fleet in the Aleutian Islands subarea harvested over 40% of its catch from waters within 20 nm of haulouts and rookeries.

In summary, the data listed in Table 2.5-10 is a useful modeling effort to estimate how dependent fishing vessels are on fishing grounds within 3 nm of haulouts. Several points, however need to be highlighted. First, the overall amounts harvested (noted as "weekly report table") includes catch from both the parallel and state-managed fisheries (only pertinent for GOA pollock and cod). Second, the relative percentages within 3 nm should NOT be used as a proxy for total harvest in State waters, which could be significantly greater (Table 2.5-11). The percentages only reflect estimates within a particular distance of haulouts. Third, the percentages within 3 nm reflect an area proration of catch based on reported harvest in State statistical areas and an assumption of homogeneity of catch within an area.

The overall importance of fishing grounds in Alaska State waters within 3 nm from the shore, not just within circles around haulouts, can be assessed from the data presented in Table 2.5-11. This data also is based on the information used to generate the tables in Appendix E-2, however, catch data is grouped to summarize State water harvest of pollock, Pacific cod, and Atka mackerel in the respective directed fisheries for those species in both the parallel and State managed groundfish fisheries. A general trend similar to that described for fishing activity within critical habitat exists in that small vessels and vessels fishing with pot or jig gear are more reliant on state water fishing grounds comparted to other vessels. Also note that significantly greater percentages of directed catch is attributed to State water fishing grounds compared to State waters only around haulouts.

Appendix E-3 provides a series of GIS maps that show the intensity of seasonal and spatial distribution of the pollock, Pacific cod and Atka mackerel fleets using the 1999 catch data used to derive the tables presented in Appendix E-2. The maps in Appendix E-3 show the ADF&G statistical areas that overlap critical habitat and from which catch was prorated inside and outside critical habitat as explained above.

Table 2.5-10 **Pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target.**

Gulf of Alaska

		Vessel Class									
		Large (125 ft or greater)				Large Total	Medium (60 ft - 124 ft)				Medium Total
		EGOA	610	620	630		EGOA	610	620	630	
CV trawl pollock	Weekly report table	x	1,348	1,628	x	2,976	1,625	9,688	31,443	27,381	70,137
	% In 3 miles	0.0%	3.3%	0.0%	0.0%	1.5%	0.0%	5.1%	0.3%	1.2%	1.3%
	% In 20 miles	0.0%	23.0%	9.6%	0.0%	15.7%	100.0%	80.9%	34.0%	78.9%	59.5%
	Summary - all data	x	3,790	2,947	x	6,737	3,028	10,500	32,624	27,596	73,748

		Small (less than 60 ft)				Small Total	All vessel Total	All data total
		EGOA	610	620	630			
CV trawl pollock	Weekly report table	x	8,835	1,279	34	10,149	83,262	
	% In 3 miles	0.0%	2.7%	7.8%	0.0%	3.3%	1.5%	
	% In 20 miles	0.0%	76.0%	79.8%	38.2%	76.4%	60.0%	
	Summary - all data	x	9,418	2,074	682	12,173	92,659	94,426

Data in metric tons. Percentages reflect estimated 1999 catch within specified distances of haulouts or rookeries relative to total catch amounts derived from Appendix E-2.

Table 2.5-10 (cont'd)

		Vessel Class							
		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CV H&L Pacific cod	Weekly report table	x	-	x	x	131	x	x	131
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% In 20 miles	0.0%	0.0%	0.0%	0.0%	86.9%	0.0%	0.0%	86.9%
	Summary - all data	x	0	x	0	487	x	x	487

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CV H&L Pacific cod	Weekly report table	5,607	551	x	6,159	6,290	
	% In 3 miles	5.8%	1.5%	0.0%	5.4%	5.3%	
	% In 20 miles	82.8%	46.5%	0.0%	79.6%	79.7%	
	Summary - all data	5,702	592	x	6,294	6,781	6,966

Data in metric tons. Percentages reflect estimated 1999 catch within specified distances of haulouts or rookeries relative to total catch amounts derived from Appendix E-2.

Table 2.5-10 (Cont'd)

		Vessel Class							
		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CP H&L Pacific cod	Weekly report table	-	-	663	663	-	-	1,685	1,685
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% In 20 miles	0.0%	0.0%	33.6%	33.6%	0.0%	0.0%	51.6%	51.6%
	Summary - all data	0	0	1,068	1,068	0	0	1,962	1,962

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CP H&L Pacific cod	Weekly report table	-	-	-	-	2,348	
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	
	% In 20 miles	0.0%	0.0%	0.0%	0.0%	46.5%	
	Summary - all data	0	0	0	0	3,030	3,030

Table 2.5-10 (cont'd)

		Vessel Class							
		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CV jig Pacific cod	Weekly report table	x	-	-	x	x	-	-	x
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% In 20 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Summary - all data	x	0	0	0	x	0	0	0

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CV jig Pacific cod	Weekly report table	1,024	x	251	1,275	1,275	
	% In 3 miles	22.3%	0.0%	9.9%	19.8%	19.8%	
	% In 20 miles	93.5%	0.0%	97.3%	94.2%	94.2%	
	Summary - all data	1,087	x	351	1,439	1,439	1,477

Data in metric tons. Percentages reflect estimated 1999 catch within specified distances of haulouts or rookeries relative to total catch amounts derived from Appendix E-2.

Table 2.5-10 (cont'd)

		Large (125 ft or greater)		Large Total	Medium (60 ft - 124 ft)		Medium Total	Small (less than 60 ft)		Small Total	All vessel Total
		AI	BS		AI	BS		AI	BS		
CV trawl pollock	Weekly report table	-	256,843	256,843	x	250,734	250,734	-	x	x	507,577
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% In 20 miles	0.0%	6.0%	6.0%	0.0%	4.6%	4.6%	0.0%	0.0%	0.0%	5.3%
	Summary - all data	0	269,261	269,261	x	256,788	256,788	0	x	0	526,049
CP trawl pollock	Weekly report table	x	328,693	328,693	-	x	x	-	-	-	328,693
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% In 20 miles	0.0%	3.2%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%
	Summary - all data	x	342,401	342,401	0	x	0	0	0	0	342,401
CV trawl Pacific cod	Weekly report table	1,176	3,406	4,582	4,223	21,817	26,040	-	x	x	30,622
	% In 3 miles	0.0%	0.0%	0.0%	1.4%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%
	% In 20 miles	90.5%	15.6%	34.9%	89.4%	29.2%	39.0%	0.0%	0.0%	0.0%	38.4%
	Summary - all data	2,215	4,693	6,908	5,024	22,567	27,590	0	x	0	34,498
CP trawl Pacific cod	Weekly report table	3,693	2,883	6,576	x	777	777	-	-	-	7,353
	% In 3 miles	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
	% In 20 miles	83.8%	6.9%	50.1%	0.0%	2.8%	2.8%	0.0%	0.0%	0.0%	45.1%
	Summary - all data	6,261	5,499	11,760	x	2,718	2,718	0	0	0	14,478
CV pot Pacific cod	Weekly report table	99	2,024	2,123	913	5,219	6,132	x	x	x	8,255
	% In 3 miles	0.0%	0.3%	0.3%	5.9%	0.5%	1.3%	0.0%	0.0%	0.0%	1.0%
	% In 20 miles	100.0%	98.2%	98.3%	94.9%	77.7%	80.3%	0.0%	0.0%	0.0%	84.9%
	Summary - all data	715	2,959	3,674	1,193	5,924	7,117	x	x	0	10,791
CP H&L Pacific cod	Weekly report table	2,113	42,344	44,456	318	3,922	4,240	-	-	-	48,696
	% In 3 miles	1.9%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
	% In 20 miles	72.1%	6.6%	9.7%	62.1%	0.3%	4.9%	0.0%	0.0%	0.0%	9.3%
	Summary - all data	5,571	54,464	60,035	1,658	9,539	11,197	0	0	0	71,232
CV jig Pacific cod	Weekly report table	-	-	-	x	-	x	x	37	37	37
	% In 3 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	1.5%	1.5%
	% In 20 miles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	85.1%	85.1%	85.1%
	Summary - all data	0	0	0	x	0	0	x	100	100	100
CP trawl Atka mack	Weekly report table	36,473	x	36,473	-	x	x	-	-	-	36,473
	% In 3 miles	0.3%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
	% In 20 miles	41.0%	0.0%	41.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	41.0%
	Summary - all data	50,026	x	50,026	0	x	0	0	0	0	50,026

Table 2.5-11 Metric tons of pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target. [Percentages reflect estimated 1999 catch within Alaska State waters (i.e., within 3 nm of the shore) relative to total catch amounts derived from Appendix E-2.]

Gulf of Alaska

		Vessel Class									
		Large (125 ft or greater)				Large Total	Medium (60 ft - 124 ft)				Medium Total
		EGOA	610	620	630		EGOA	610	620	630	
CV trawl pollock	Weekly report table	x	1,348	1,628	x	2,976	1,625	9,688	31,443	27,381	70,137
	% In State waters	0.0%	45.9%	24.9%	53.6%	33.5%	0.0%	42.7%	22.2%	30.1%	28.0%
	Summary - all data	x	3,790	2,947	x	6,737	3,028	10,500	32,624	27,596	73,748

		Small (less than 60 ft)				Small Total	All vessel Total	All data total
		EGOA	610	620	630			
CV trawl pollock	Weekly report table	x	8,835	1,279	34	10,149	83,262	
	% In State waters	0.0%	68.0%	65.1%	44.2%	66.2%	33.6%	
	Summary - all data	x	9,418	2,074	682	12,173	92,659	94,426

Table 2.5-11 (cont'd) Metric tons of pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target. Percentages reflect estimated 1999 catch within Alaska State waters (i.e., within 3 nm of the shore) relative to total catch amounts derived from Appendix E-2.

		Vessel Class							
		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CV trawl Pacific cod	Weekly report table	x	-	x	x	15,912	-	3,465	19,377
	% In State waters	0.0%	0.0%	0.0%	0.0%	1.5%	0.0%	23.4%	5.7%
	Summary - all data	x	0	x	0	16,229	0	3,857	20,087

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CV trawl Pacific cod	Weekly report table	1,304	-	10,439	11,743	31,120	
	% In State waters	8.2%	0.0%	13.3%	12.6%	8.2%	
	Summary - all data	1,716	0	10,492	12,208	32,294	32,878

Table 2.5-11 Metric tons of pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target. Percentages reflect estimated 1999 catch within Alaska State waters (i.e., within 3 nm of the shore) relative to total catch amounts derived from Appendix E-2.

		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CV pot Pacific cod	Weekly report table	-	-	x	x	6,093	x	981	7,074
	% In State waters	0.0%	0.0%	0.0%	0.0%	38.4%	0.0%	33.2%	37.4%
	Summary - all data	0	0	x	0	8,128	x	1,753	9,882

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CV pot Pacific cod	Weekly report table	10,203	-	6,434	16,637	23,711	
	% In State waters	71.1%	0.0%	97.2%	81.6%	66.0%	
	Summary - all data	10,922	0	6,596	17,518	27,400	27,934

Table 2.5-11 (cont'd) Metric tons of pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target. Percentages reflect estimated 1999 catch within Alaska State waters (i.e., within 3 nm of the shore) relative to total catch amounts derived from Appendix E-2.

Gulf of Alaska

		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CV H&L Pacific cod	Weekly report table	x	-	x	x	131	x	x	131
	% In State waters	0.0%	0.0%	0.0%	0.0%	56.0%	0.0%	0.0%	56.0%
	Summary - all data	x	0	x	0	487	x	x	487

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CV H&L Pacific cod	Weekly report table	5,607	551	x	6,159	6,290	
	% In State waters	32.8%	96.4%	0.0%	36.2%	37.1%	
	Summary - all data	5,702	592	x	6,294	6,781	6,966

Table 2.5-11 (cont'd) Metric tons of pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target. Percentages reflect estimated 1999 catch within Alaska State waters (i.e., within 3 nm of the shore) relative to total catch amounts derived from Appendix E-2.

		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CP H&L Pacific cod	Weekly report table	-	-	663	663	-	-	1,685	1,685
	% In State waters	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Summary - all data	0	0	1,068	1,068	0	0	1,962	1,962

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CP H&L Pacific cod	Weekly report table	-	-	-	-	2,348	
	% In State waters	0.0%	0.0%	0.0%	0.0%	0.0%	
	Summary - all data	0	0	0	0	3,030	3,030

Table 2.5-11 (cont'd) Metric tons of pollock taken in fisheries where pollock was the target, Pacific cod where Pacific cod was the target, and Atka mackerel where Atka mackerel was the target. Percentages reflect estimated 1999 catch within Alaska State waters (i.e., within 3 nm of the shore) relative to total catch amounts derived from Appendix E-2.

		Large (125 ft or greater)			Large Total	Medium (60 ft - 124 ft)			Medium Total
		CGOA	EGOA	WGOA		CGOA	EGOA	WGOA	
CV jig Pacific cod	Weekly report table	x	-	-	x	x	-	-	x
	% In State waters	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Summary - all data	x	0	0	0	x	0	0	0

		Small (less than 60 ft)			Small Total	All vessel Total	All data total
		CGOA	EGOA	WGOA			
CV jig Pacific cod	Weekly report table	1,024	x	251	1,275	1,275	
	% In State waters	98.4%	0.0%	99.6%	98.7%	98.7%	
	Summary - all data	1,087	x	351	1,439	1,439	1,477

the VMS data indicates that the vessel fished at any time inside critical habitat, all catch delivered from that trip would be counted against the inside critical habitat catch limit. For unobserved vessels without VMS fishing in a management area with a critical habitat area catch limit that had not yet been reached, NMFS would accrue all catch from that vessel against the inside CH catch limit.

2.5.4 Vessel Mishap History

Groundfish fishing is dangerous. Lincoln and Conway of the National Institute of Occupational Safety and Health (NIOSH) estimate that, from 1991 to 1998, groundfish fatality rates were about 46/100,000, or about ten times the national average (Lincoln and Conway, 1999)[3,4]. The danger inherent in commercial groundfish fishing was underscored by two accidents in March and April of 2001. In March, two men were lost when the 110 foot cod trawler Amber Dawn sank in a storm near Atka Island. In April, 15 men were lost when the 103 foot trawler-processor Arctic Rose sank about 200 miles to the northwest of St. Paul Island in the Bering Sea, while fishing for flathead sole.

However, during most of the 1990s commercial fishing appeared to become safer. While annual vessel accident rates remained relatively stable, annual fatality per incident rates (case fatality rates) dropped. The result was an apparent decline in the annual occupational fatality rate.[5] From 1991 to 1994, the case fatality rate averaged 17.5% a year; from 1995 to 1998 the rate averaged 7.25% a year. Lincoln and Conway report that "The reduction of deaths related to fishing since 1991 has been associated primarily with events that involve a vessel operating in any type of fishery other than crab." (Lincoln and Conway, 1999) Lincoln and Conway described their view of the source of the improvement in the following quotation.

The impressive progress made during the 1990s in reducing mortality from incidents related to fishing in Alaska has occurred largely by reducing deaths after an event has occurred, primarily by keeping fishermen who have evacuated capsized (sic.)or sinking vessels afloat and warm (using immersion suits and life rafts), and by being able to locate them readily, through electronic position indicating radio beacons (Lincoln and Conway, 1999).

There could be many causes for this improvement. Lincoln and Conway point to improvements in gear and training, flowing from provisions of the Commercial Fishing Industry Vessel Safety Act of 1988, that were implemented in the early 1990s. Other causes may be improvements in technology and in fisheries management. Technological improvements may include advances in EPIRB technology. Fishery

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[3] The NIOSH study does not cover 1999-2001. Results updated through 1999 should be published in the summer of 2001; however, results are not available at this writing. The rates are based on an estimate of 17,400 full time employees active in the fisheries. This estimate of the employment base was assumed constant over the time period. Various factors may, however, have affected this base, including reductions in the size of the halibut and sablefish fleets due to the introduction of individual fishing quotas. These estimates must therefore be treated as rough guides. The updated results due in the summer of 2001 should include an updated estimate of the number of full time equivalent employees as well.

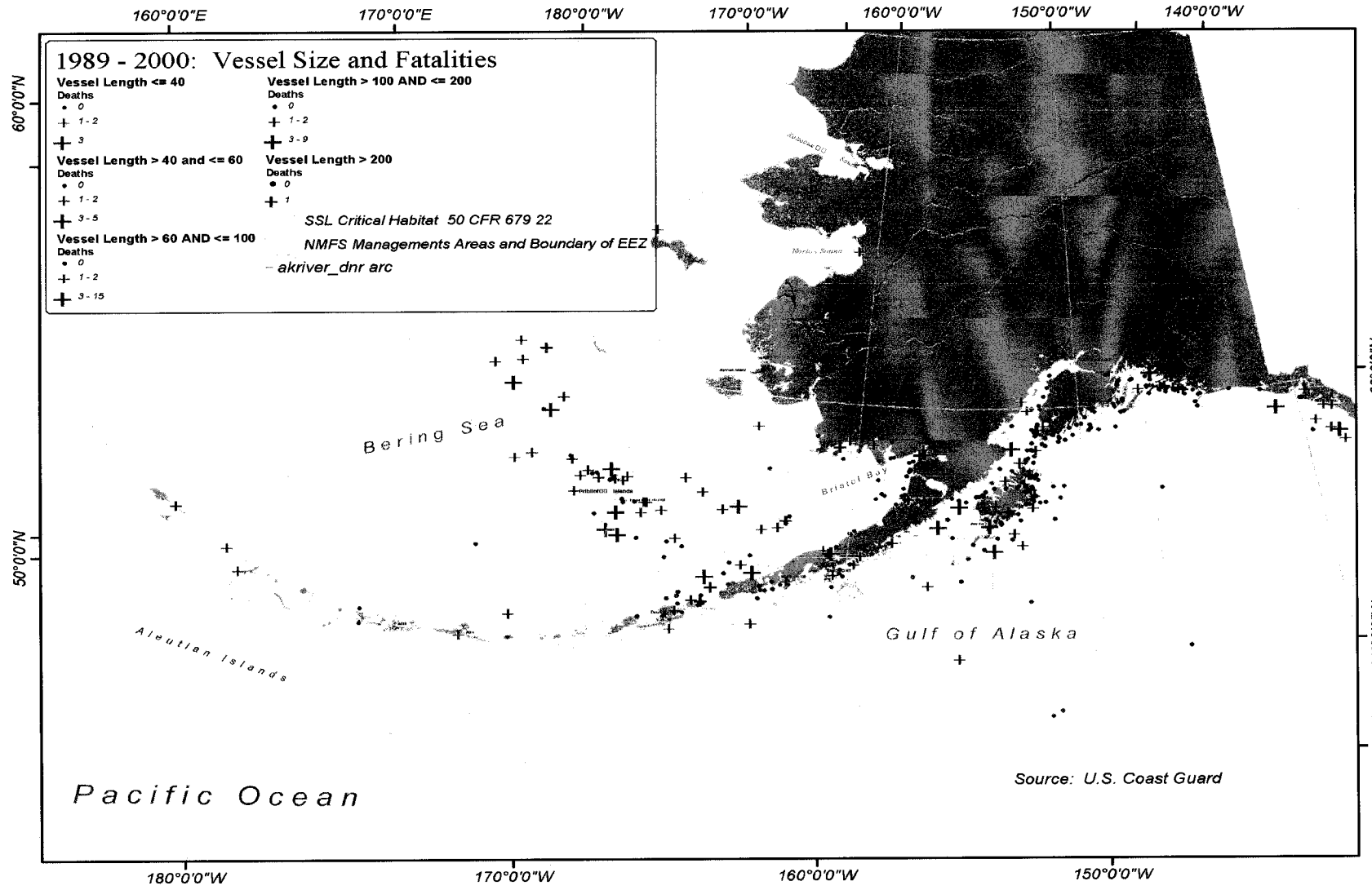
[4] Personal Communication, Jennifer M. Lincoln, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 4230 University Drive, Grace Hall, Suite 310, Anchorage, AK 99508.

[5] This result is based on an examination of the years from 1991-1998. It does not reflect the losses in the winter of 2001.

management improvements may include the introduction of individual quotas in the halibut and sablefish fisheries. The introduction of co-ops in the pollock fisheries in 1999 and 2000 would not be reflected in these statistics, but by rationalizing fishing, they may lead to safety improvements.

Figure 2.5-5 shows the distribution of U.S. Coast Guard vessel incident data for 1989-2000 by number of fatalities per vessel size class. These data reflects all significant incidents and includes accidents other than those experienced by vessels fishing for groundfish. Nonetheless, Figure 2.5-5 generally shows that vessel accidents tend to be clustered in areas where the greatest fishing activity occurs (see Appendix E3 for distribution of fishing for pollock, Pacific cod and Atka mackerel). Further, accidents involving vessels less than 60 ft LOA tended to occur in waters closer to shore (within 20 nm) where these relatively smaller vessels concentrate their fishing effort for safety and logistic reasons. Similarly, accidents involving vessels greater than 60 and less than 201 ft LOA tended to occur in more offshore areas, again reflecting the fishing grounds these vessels typically use when fishing for groundfish or crab. The largest vessel size category (vessels larger than 200 ft LOA) show a distribution of incidences near or onshore, indicating that these accidents likely involved processor vessels receiving catch from catcher vessels in protected bays or inlets.

Figure 2.5-5 U.S. Coast Guard Vessel Safety Data: Significant events from 1989-2000 by vessel size and number of fatalities.



Chapter 3 Affected Environment

Section 1502.15 of the CEQ NEPA regulations (40 CFR parts 1500-1508) direct that "an environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort and attention on important issues. Verbose descriptions of the affected environment are themselves no measure of the adequacy of an environmental impact statement."

This affected environment section contains succinct descriptions of the resources and issues identified as important to predicting the direct, indirect, and cumulative impacts that will accrue from the proposed action. The topics in this section are arranged in the same order they are treated in the environmental consequences section that follows: marine mammals, target fish species, non-specified fish species, forage fish, prohibited species, ESA listed Pacific salmon, seabirds, marine benthic habitat, ecosystem, State managed fisheries, management complexity and enforcement issues, and socio-economic issues.

References to original literature are made throughout the section to identify scientific sources and guide readers to further information. All references called out throughout chapters 1, 2, 3, and 4 of this document are listed in chapter 7 of this document. Each reference contains information necessary to find the respective paper, report, journal article, or book, following standard library citation format. Any reader desiring to access one of the references given should be able to read or borrow a copy from a public library. Resource libraries located in Alaska and the Northwest such as the NMFS Alaska Fisheries Science Center Library in Seattle, Washington, or the Auke Bay Fisheries Laboratory near Auke Bay, Alaska, the State Library in Juneau, Alaska, and the libraries at the University of Alaska and the University of Washington, will be more likely to have these particular references on their shelves. Other libraries are able to get these references through interlibrary loan systems.

3.1 Marine Mammals

Because of combinations of bathymetric and oceanographic features, the Bering Sea and Aleutian Island (BSAI) and Gulf of Alaska (GOA) are among the world's most productive ecosystems, and supports a rich assemblage of marine mammals (Loughlin, *et al.,* 1999). Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry *et al.*, 1982). In the areas fished by commercial groundfish fleets, twenty-six species of marine mammals are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises) (Lowry and Frost 1985). Most species are resident throughout the year, while others seasonally migrate into or out of the management areas. Following are descriptions of their distribution, population status, abundance, habitat, diet, and known sources of anthropogenic mortality.

3.1.1 Steller Sea Lion

The Steller sea lion (*Eumetopias jubatus*), also found in the literature as Steller's sea lion and northern sea lion, probably evolved in the North Pacific at least 3-4 million years ago (Repenning, 1976). Steller sea lions are members of order the Pinnipedia, family Otariidae (composed of fur seals and sea lions), subfamily Otariinae, a group of five sea lion species (California (*Zalophus californianus*), Steller, southern (*Otaria*

bryonia), Australian (*Neophoca cinerea*), and New Zealand (*Phocartos hookeri*)) mostly distributed in temperate and subpolar waters.

3.1.1.1 Distribution

The Steller sea lion 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 (Figure 3.1-1). 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, the northern most of all sea lion rookeries (Kenyon and Rice, 1961).

In general sea lions seem to have a high degree of site fidelity, returning to breed at or near their natal rookeries (Loughlin, 1997; Raum-Suryan *et al.*, submitted). Tagged and branded individuals have been seen at distances up to 1784 km from their natal rookeries, but once they approach adulthood they generally remain within 500 km of their natal rookery (Raum-Suryan *et al.*, submitted).

3.1.1.2 Population Status and Trends

In November 1990, the NMFS listed Steller sea lions as "threatened" range-wide under the U.S. Endangered Species Act (55 *Federal Register* 49204, November 26, 1990) in response to a population decrease of 50% - 60% during the previous 10 - 15-year period. Several years later, two population stocks were identified, based largely on differences in genetic identity, but also on regional differences in morphology and population trends (Bickham *et al.*, 1996; Loughlin, 1997). The western stock, which occurs from 144° W long. (approximately at Cape Suckling, just east of Prince William Sound, Alaska) westward to Russia and Japan, was listed as "endangered" in June 1997 (62 *Federal Register* 24345, May 5, 1997). The eastern stock, which occurs from southeast Alaska southward to California, remains classified as threatened.

3.1.1.2.1 Western Stock

Population assessment for Steller sea lions has been achieved primarily by aerial surveys and on-land pup counts. Historically, this included surveys of limited geographical scope in various portions of the species' range, in many cases conducted using different techniques, and occasionally during different times of year. Consequently, reconstructing population trends for Steller sea lions from the 1970s and earlier, and over a large geographical area, such as the Western Stock in Alaska, includes a patchwork of regional surveys conducted over many years.

Aerial surveys conducted from 1953 through 1960 resulted in combined counts of 170,000 to 180,000 Steller sea lions in what we now define as the Western Stock in Alaska (Mathisen, 1959; Kenyon and Rice, 1961). Surveys during 1974-1980 suggested an equivocal increase to about 185,000, based on maximal counts at sites over the same area, as summarized by Loughlin *et al.* (1984). It was concurrent with the advent of more systematic aerial surveys that population declines were first observed. Braham *et al.* (1980) documented declines of at least 50% from 1957 to 1977 in the eastern Aleutian Islands, the heart of what now is the Western Stock. Merrick *et al.* (1987) estimated a population decline of about 50% from the late 1950s to 1985 over a much larger geographical area, the central Gulf of Alaska through the central Aleutian Islands, although this still included a patchwork of regional counts and surveys (Figures 3.1-1, 3.1-2). The population in the Gulf of Alaska and Aleutian Islands declined by about 50% again from 1985 to 1989, or an overall decline of about 70% from 1960 to 1989 (Loughlin *et al.*, 1992).

Much of the population trend analyses during recent years has focused on "trend sites" as espoused by the Steller Sea Lion Recovery Team (NMFS 1992b, NMFS 1995a). Trend sites are those rookeries and haul-out sites surveyed consistently from the mid 1980s to the present, thus allowing analysis of population trends on a decadal scale. Trend sites include about 75% of animals observed in recent surveys (Strick *et al.*, 1997; Sease *et al.*, 1999; Sease and Loughlin, 1999; Sease *et al.*, 2001). At 82 rookery and haul-out trend sites in the western stock, the June 2000 count represented declines of 10.3% from 1998, 17.5% from 1996, and 40.0% from 1990 (Figure 3.1-1) (Sease *et al.*, 2001). The average annual rate of decline has been consistently around 5% during the 1990s (Strick *et al.*, 1997; Sease *et al.*, 1999; Sease and Loughlin, 1999; Sease *et al.*, 2001).

The population decline for the Western Stock in Alaska has been apparent in all regions, although not at the same rate. The decline was first observed in the eastern Aleutian Islands (Braham *et al.*, 1980). During subsequent years the decline spread into adjacent regions in the Aleutian Islands and Gulf of Alaska (Merrick *et al.*, 1987). In the eastern Aleutian Islands, the rate of decline lessened and by 1989 or 1990 the population there appeared to stabilize, but at very low levels (Figure 3.1-2). Since 1975 there has been a steady rate of decline of 6% a year or greater, with an additional drop of about 8.7% per year during the late 1980s when the population from the Kenai Peninsula to Kiska Island in the central Aleutian Islands declined at about 15.6% per year (York *et al.*, 1996). Other regions have demonstrated short periods of stability within a general declining trend. With the exception of the differentiation between the eastern and western stocks, however, these regional boundaries are not based on ecological or other biological parameters, and differences in regional trends should be interpreted with caution.

In most years, pups within the Western Stock in Alaska have been counted only at selected rookeries, and on an alternating schedule to minimize potential cumulative effects of disturbance. Range-wide survey efforts included pup counts at virtually all Western Stock rookeries in Alaska in 1998, and all except the Near Islands in the western Aleutian Islands in 1994 (Strick *et al.*, 1997; Sease and Loughlin, 1999). Pup counts in the western stock in Alaska (excluding the western Aleutian Islands) declined by 19.0% from 1994 to 1998. In the western Aleutian Islands, pup numbers declined 18% from 1997 to 1998, the only years for which comprehensive comparison is possible (Figure 3.1-3). Recent pup counts in 2000 and 2001 from Seguam Island to Prince William Sound were similar in magnitude to those conducted in 1998 (NMFS NMML data, unpublished).

3.1.1.2.2 Eastern Stock

Loughlin *et al.* (1992) described southeast Alaska as the only region of Alaska in which the Steller sea lion population appeared to be stable in 1989, even though numbers of non-pup sea lions (adults and juveniles combined) in southeast Alaska increased by about 16% from 1985 to 1989, or by an average of 3.5% to 4.0% per year. Calkins *et al.* (1999) estimated that the Steller sea lion population in southeast Alaska increased by an average of 5.9% per year from 1979 to 1997, based on counts of pups at the three rookeries in the region. From 1989 to 1997, however, pup numbers increased by only 1.7% and counts of non-pups at 12 index sites were stable (average change of +0.5% per year). The Steller Sea Lion Recovery Team employed a different set of index, or "trend," sites for monitoring population status (NMFS, 1992b; NMFS, 1995a). Counts of non-pup sea lions at the three rookeries and ten haul-outs sites showed an overall increase of 29.3% from 1990 to 2000, or an average annual increase of 1.9% (Sease *et al.*, 2001). Despite differences in individual index sites or model type (e.g., based on counts of pups versus non-pups), the conclusion is that numbers of Steller sea lions in southeast Alaska are stable or increasing slightly (Figure 3.1-4).

Steller sea lions in southeast Alaska are not an isolated stock, as demonstrated by genetic data and by the movement of branded and tagged animals from southeast Alaska to British Columbia and Washington (Raum-Suryan *et al.*, submitted). The number of non-pup sea lions in British Columbia is similar to the number in southeast Alaska, and increasing by about 2.5% per year during the last decade (Figure 3.1-5). Numbers of pups in British Columbia have increased by about 1.5% per year during the same time (personal communication from P. Olesiuk, Pacific Biological Laboratory, Nanaimo, British Columbia, V9R 5K6). Counts of Steller sea lions in Oregon and northern California have been stable during recent decades at about a third as many animals as in either British Columbia or southeast Alaska. Numbers in central and southern California have been small, but decreasing at about 4.5% - 5.0% per year since 1982 or as much as 10% per year since 1990 (NMFS, 1995; Calkins *et al.*, 1999; Ferrero *et al.*, 2000, Angliss *et al.*, 2001). Despite the observed declines in southern and central California, the Eastern Stock as a whole is stable or increasing slowly.

3.1.1.3 Reproduction and Growth

Steller sea lions have a polygynous reproductive system in which a single male may mate with multiple females. Males establish territories in May in anticipation of female arrival (Pitcher and Calkins, 1981). Mating occurs on land (or in the surf or intertidal zones), thus males are able to defend territories and thereby exert at least partial control over access to adult females and mating privileges. The pupping and mating season is relatively short and synchronous, probably due to the strong seasonality of the environment and the need to balance aggregation for reproductive purposes with dispersion to take advantage of distant food resources (Bartholomew, 1970). In late May and early June, adult females arrive at the rookeries, where pregnant females give birth to a single pup (twinning is rare). Viable births begin in late May and continue through early July. The sex ratio of pups at birth is approximately 1:1, though biased toward slightly greater production of males (e.g., Pike and Maxwell, 1958; Lowry *et al.*, 1982; NMFS, 1992b). Pupping is highly synchronous throughout the sea lion range between the Aleutian Islands and California, with a median pupping date of 12-13 June (Bigg 1985, Merrick 1987). There is evidence that pupping dates have become later at Sugarloaf and Fish Island rookeries (Pitcher *et al.*, 1996). Because timing of pupping depends upon maternal condition, this change may reflect changing environmental conditions, or changing maternal age structure.

Merrick *et al.* (1995) compared pup sizes at different sites where Steller sea lion populations were either decreasing or increasing, to determine if pup size or growth may be compromised in decreasing populations. Their results were not consistent with that hypothesis; rather, they found that pups about two to four weeks of age weighed more at sites in the Aleutian Islands and GOA than in southeast Alaska or Oregon. Fadely and Loughlin (2001) also found that these pups did not weigh greater than expected based on body length, such that they were larger overall. These size differences may arise through different growth rates, as no significant differences have been found among neonatal mass among rookeries (Brandon and Davis, 1999; Adams, 2000). Brandon and Davis (1999) and Adams (2000) found that pups at rookeries in areas of decline grew faster than pups from southeast Alaska. As there were no differences in milk or energy intake among pups at these rookeries, differences in growth rates may be attributable to differences in pup activity (Adams, 2000), time spent fasting between suckling bouts, or other physiological costs. These observed differences indicate that at least this phase of reproduction may not be affected; that is, if females are able to complete their pregnancy and give birth, then the size of those pups does not appear to be compromised. Possible alternative explanations for the observed size differences are that pups were measured at different ages (i.e., pups in the GOA and Aleutian Islands may have been born earlier and therefore were older when weighed), or that over time, harsher environmental conditions in the Aleutian Islands of the GOA have selected for

larger pup size. Pup condition, measured as the ratio of observed body mass to that expected based on length, seems to be a reasonable index of condition related to survival (Trites and Jonker, 2000). For the pups aged between 2 and 4 weeks, there was no general relationship between pup condition and pup numbers or magnitude of decline at rookeries, though the poorest average pup conditions during the late 1990s were associated with areas of greatest decline (Fadely and Loughlin, 2001). There also was evidence that pup condition was poorest during weak depressions of the Aleutian Low, and better when the Aleutian Low was stronger.

Mothers nurse pups during the day, staying with a pup for the first week, then go to sea on foraging trips. Maternal attendance patterns seem to vary over the range, with the average length of foraging trips during lactation being about 24 hours to two days at the southernmost rookery at Año Nuevo Island, California (Higgins *et al.*, 1988; Hood and Ono, 1997), about 25 hours at Lowrie Island, 19 hours at Fish Island, 11 hours for Chirikof Island, and 7 hours in the Aleutian Islands (Brandon and Davis, 1999). 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. The ramifications of nursing a pup beyond a year on pupping frequency, or survival of a second pup, are unknown.

The length of the nursing period may be an important indicator of the female's condition and ability to support her pup, and the pup's condition at weaning (and hence, the likelihood that the pup will survive the post weaning period). Steller sea lion weaning takes place away from the rookeries, over a period of time, and thus has not been directly observed in Alaska. Thorsteinson and Lensink (1962) suggested that nursing of yearlings was common at Marmot Island in 1959. Pitcher and Calkins (1981) suggested that it is more common for pups to be weaned before the end of their first year, but they also observed nursing juveniles (aged 1 - 3). Porter (1997) distinguished metabolic weaning (i.e., the end of nutritional dependence of the pup or juvenile on the mother) from behavioral weaning (i.e., the point at which the pup or juvenile no longer maintains a behavioral attachment to the mother). He also suggested that metabolic weaning is more likely a gradual process occurring over time and more likely to occur in March-April, preceding the next reproductive season. In many otariids, the length of the lactation period varies among individuals and 'weaning' occurs over a period of time, rather than at a single point of time as with phocids (Lee *et al.*, 1991). Using an allometric relationship between weaning mass and maternal mass for otariids (Kovacs and Lavigne, 1992), and assuming a maternal mass of 530 lbs. (240 kg) (midpoint of range of maternal masses, 386.8 - 663 lbs (175 - 300 kg) (Calkins and Pitcher 1982), Steller sea lions could be expected to wean when achieving a body mass of 159 - 183 lbs (72 - 83 kg). According to growth data of Calkins and Pitcher (1982), this is achieved at an age of 11 months, and assuming a median pupping date of June 12, is an age reached in mid-May. A weaning age of 11 months was also used in analyses of comparative mammalian weaning by Lee *et al.* (1991). The transition to nutritional independence may, therefore, occur over a period of months as the pup begins to develop essential foraging skills, and depends less and less on the adult female. The length of the nursing period may also vary as a function of the condition of the adult female. The nature and timing of weaning is important because it determines the resources available to the pup during the more demanding winter season and, conversely, the demands placed on the mother during the same period. A bioenergetic model suggested that a 10 year old female nursing a pup in the spring had to consume twice as much energy as a same age female without a pup (Winship, 2000). The maintenance of the mother-offspring bond may also limit their distribution or the area used for foraging (see Section 3.1.6).

Relatively little is known about the life history of sea lions during the juvenile years between weaning and maturity. Female growth is asymptotic, and reaches 87% of the asymptote during their third year (Winship *et al.*, 2001), a size typically associated with puberty in female pinnipeds (Laws, 1956). Pitcher and Calkins (1981) found that females reach sexual maturity between 2-8 years of age, with an average age of first

pregnancy at 4.9 ±1.2 years, and may breed into their early twenties. The available literature indicates an overall reproductive (birth) rate on the order of 55% - 70% or greater (Pike and Maxwell, 1958; Gentry, 1970; Pitcher and Calkins, 1981; Pitcher *et al.*, in press). York (1994) derived age-specific fecundity rates based on data from Calkins and Pitcher (1982). Those rates illustrate a number of important points and assumptions. First, the probability of pupping is rare (about 10%) for animals 4 years of age or younger. Second, maturation of 100% of a cohort of females occurs over a prolonged period which may be as long as 4 years (starting at age 3 or 4). Third, the reported constancy of fecundity extending from age 6 to 30 indicates that either senescence has no effect on fecundity, or our information on fecundity rates is not sufficiently detailed to allow confident estimation of age-specific rates for animals older than age 6. Given the small size of the sample taken, the latter is a more likely explanation for such constancy.

For mature females, the reproductive cycle includes mating, gestation, parturition, and nursing or post-natal care. Mating occurs about one to 2 weeks after giving birth (Gentry 1970). Copulation may occur in the water, but mostly occurs on land (Pitcher and Calkins, 1998; Gentry, 1970; Gisiner, 1985). The gestation period is probably about 50 to 51 weeks, but implantation of the blastocyst is delayed until late September or early October (Pitcher and Calkins, 1981). Due to delayed implantation, the metabolic demands of a developing fetus are not imposed on the female until well into fall and early winter. After parturition (birth), females nurse their pups over a period of months to several years. The reproductive success of an adult female is determined by a number of factors within a cycle and over time through multiple cycles. The adult female's ability to complete this cycle successfully is largely dependent on the resources available to her. While much of the effort to explain the Steller sea lion decline has focused on juvenile survival rates, considerable evidence suggests that decreased reproductive success may also have contributed to the decline.

- Young females collected in the 1970s were larger than females of the same age collected in the 1980s (Calkins *et al.*, 1998). As size, as well as age, may influence the onset of maturity, females in the 1980s would also be more likely to mature and begin to contribute to population productivity at a later age.

- Pitcher *et al.* (1998) provide data from the 1970s and 1980s that suggest a high pregnancy rate after the mating season (97%; both periods), which declined to 67% for females collected in the 1970s and 55% for females collected in the 1980s. These changes in pregnancy rate suggest a high rate of fetal mortality that could be a common feature of the Steller sea lion reproductive strategy (i.e., may occur even when conditions are favorable and population growth is occurring), but is more likely an indication of stress (possibly nutritional) experienced by individual females.

- The observed differences in late pregnancy rates (67% in the 1970s and 55% in the 1980s) were not statistically significant. However, the direction of the difference is consistent with the hypothesis that reproductive effort in the 1980s was compromised.

- Pitcher *et al.* (1998) did observe a statistical difference in the late season pregnancy rates of lactating females in the 1970s (63%) versus lactating females in the 1980s (30%). This difference indicates that in contrast to lactating females in the 1970s, lactating females in the 1980s were less able to support a fetus and successfully complete consecutive pregnancies.

Male growth is also asymptotic, but constant until about year 6 and thus males grow at a greater rate for a longer period than do females (Winship *et al.*, 2001). Males also reach sexual maturity at about 3 - 8 years old, but do not have the physical size or skill to obtain and keep a breeding territory until they are nine years of age or older (Pitcher and Calkins, 1981). A sample of 185 territorial males from Marmot, Atkins,

Ugamak, Jude, and Chowiet Islands in 1959 included animals 6 - 17 years of age, with 90% from 9 - 13 years old (Thorsteinson and Lensink, 1962). Males may return to the same territory for up to 7 years, but most return for no more than 3 years (Gisiner, 1985). During the breeding season, males may not eat for 1 to 2 months. The rigors of fighting to obtain and hold a territory and the physiological stress of the mating season reduces their life expectancy. Males rarely live beyond their mid-teens, while females may live as long as 30 years.

3.1.1.4 Survival

Much of the recent effort to understand the decline of Steller sea lions has been focused on juvenile survival, or has assumed that the most likely proximate explanation is a decrease in juvenile survival rates. This contention is consistent with direct observations and a modeling study, and is consistent with the notion that juvenile animals are less adept at avoiding predators and obtaining sufficient prey for growth and survival.

The direct observations consist of low resighting rates at Marmot Island of 800 pups tagged and branded at that site in 1987 and 1988 (Chumbley *et al.*, 1997) and observations of relatively few juveniles at Ugamak Island (Merrick *et al.*, 1988). The low resighting rates do not themselves confirm that the problem was a corresponding drop in juvenile survival, but only that many of the marked animals were lost to the Marmot Island population. Migration to other sites where they were not observed is a possibility, but unlikely given the observations of relatively high site fidelity of animals returning to breed at their natal site. If the "loss" of these animals is viewed in the context of the overall sea lion decline in the central GOA (from 1976 to 1994 the number of non-pups counted at Marmot Island declined by 88.9% and by 76.9% at the 14 other trend sites in the Gulf; Chumbley *et al.*, 1997), then a significant increase in juvenile mortality is a much more plausible conclusion.

Modeling by York (1994) suggests that the observed decline in sea lion abundance in the GOA may have been due to an increase in juvenile mortality. York used the estimated rate of decline between the 1970s and the 1980s, and the observed shift in the mean age of adult females (3 years of age) to explore the effects of changes in adult reproduction, adult survival, and juvenile survival. While she pointed out that the observed decline did not rule out all other possible explanations, she concluded that the observed decline is most consistent with a decrease in juvenile survival on the order of 10% - 20% annually.

However, juvenile survival is not assumed to be the only factor influencing the decline of the western population of Steller sea lions. Evidence indicating a decline in reproduction was presented in the previous section. In addition, changes in adult survival may also have contributed to the decline. At present, survival rates for adult animals can not be determined with sufficient resolution to determine if those rates have changed over time or are somehow compromised to the extent that population growth and recovery are compromised.

3.1.1.5 Age distribution

Two life tables have been published with age-specific rates. The first was from Calkins and Pitcher (1982) and was based on sea lions killed in the mid to late 1970s. York (1994) created a second life table using a Weibull model from the same data from Calkins and Pitcher (1982). A comparison of data collected between the 1970s and the 1980s (Calkins and Goodwin 1988) showed a 1.55 year increase in the mean age of reproductive females.

Both samples of sea lions were from the same area but collected over different time periods. Independent of the samples were observations of the rate of decline of the population. These three pieces of information were combined (York 1994) to suggest that increased juvenile mortality may have been an important proximate factor in the decline of Steller sea lions. That is, such a shift in mean age would occur as the adult population aged without expected replacement by recruitment of young females.

3.1.1.6 Prey and Foraging Behavior

3.1.1.6.1 Methodology and potential biases

Historically, diet studies on marine mammals were based on the remains of prey in the stomach contents of the predator. Currently, the primary method of identifying prey species consumed by pinnipeds is through analysis of bony remains in fecal (scat) collections. The interpretation of predator diet through the use of scat was first developed for terrestrial studies and has been adapted for use in marine mammal trophic studies over the past two decades. Scat is a reliable tool for monitoring seasonal and temporal trends in predator diets without the need to euthanize the animal.

Typically, the rank importance of any given prey species in marine mammal diet studies is based on some combination of two factors: the number of individuals of a particular species represented across all samples (prey number); and the number of samples containing that species across all samples containing prey remains (frequency of occurrence). All methods of diet evaluation (stomachs, lavage, regurgitations, scat, enema, fatty acids, and stable isotopes analyses) in marine mammals have their own set of biases that variably affect estimates of prey volume, weight, number, rank and frequency of occurrence (Fitch and Brownell, 1968; Perrin *et al.*, 1973; Jobling and Breiby, 1986). For instance, stomach contents from an individual animal may represent an accumulation of a number of meals over an extended period of time since certain prey parts such as squid beaks or large fish bones get trapped in stomach folds where they digest very slowly, or accumulate until regurgitated. An accumulation of prey parts predictably overestimate the importance of some prey types over others. Regurgitations (spewings) represent a very small portion of the overall diet and primarily that of the largest prey items consumed. Scat remains by comparison typically represent meals eaten 12 - 72 hours prior and tend to underestimate the size of prey consumed since small items pass through the digestive tract more readily (and with less erosion) than large items (Sinclair *et al.*, in prep.). Accordingly, diet studies should be interpreted with consideration of the method used to collect prey samples.

Steller sea lions eat a broad range of prey that vary in adult body size from approximately 10-80 cm in body length. The most recent diet study of the western stock (Sinclair and Zeppelin, submitted) indicates that prey remains in scat are primarily from late stage juvenile to adult size fish. However, these estimates are qualitatively based on visual comparison with museum reference specimens. To date, estimates of prey size have remained qualitative due to the limited number of intact otoliths (fish earbones) recovered from Steller scats. Otoliths recovered from pinniped stomachs and scats are typically used to estimate size of fish prey using otolith to body length regressions. However, relatively few otoliths are recovered in Steller sea lion scats and those that are found are usually highly degraded due to erosion in the stomach. Other skeletal remains are found in Steller sea lion scat in greater abundance and in better condition than otoliths, but until recently (Zeppelin *et al.*, in prep), no technique existed to quantify bone size to fish length.

Zeppelin *et al.* (in prep) developed regressions to estimate fish length using six diagnostic bones (other than otoliths) from Pacific cod (*Gadus macrocephalus*), walleye pollock (*Theragra chalcogramma*), and Atka mackerel (*Pleurogrammus monopterygius*). For all species and all elements, regressions showed a high

degree of correlation between the size of the element and the fork length of prey ($r^2 \geq 0.85$). Fork length of prey consumed by Steller sea lions was predicted by applying these regression models to skeletal structures recovered from scats collected during 1998 and 1999 across the range of the western stock, confirming qualitative estimates that Steller sea lions largely consume adult fish (Sinclair and Zeppelin, submitted). These regressions will eventually allow quantitative comparisons between the size of prey consumed by Steller sea lions and the commercial fish catch in Bering Sea and Gulf of Alaska.

3.1.1.6.2 Foraging Distribution and Depths

At least three types of telemetry are (or have been) used to study sea lion foraging. Very high frequency (VHF) telemetry can be used to determine presence or absence of an animal and, to some extent, animal location and whether it is on land or in the water. The use of VHF telemetry to determine the presence or absence of an animal can be used to infer the occurrence and length of foraging trips (e.g., Brandon, 2000; Merrick and Loughlin, 1997), and movement patterns between sites that can be monitored manually, remotely, or automatically by VHF receivers.

Satellite-linked telemetry is being used to determine animal location and, when coupled with time-depth recorders, diving patterns (e.g., Merrick *et al.*, 1994). Satellite-linked telemetry provides an opportunity to collect information on animal location without having to recapture the animal to collect stored data. At present, satellite-linked telemetry is the most cost-effective means of assessing the distribution of foraging animals and thereby determining those regions that are critical for Steller sea lions.

Stomach telemetry is being developed and offers an opportunity to determine when an animal has consumed prey, rather than requiring the investigator to infer feeding from diving behavior. Stomach telemetry, in combination with satellite-linked telemetry, may provide greater understanding of foraging behavior and discrimination of at-sea activities that may or may not be related to foraging (Andrews, 1998).

Steller sea lion foraging distribution is based on sightings at sea or observations of foraging behavior (or presumed foraging behavior) in areas such as the southeastern Bering Sea (Fiscus and Baines, 1966; Kajimura and Loughlin, 1988; NMFS unpublished data[1] from the Platform-of-Opportunity Program [POP]), records of incidental take in fisheries (Perez and Loughlin, 1991), and satellite telemetry studies (e.g., Merrick *et al.*, 1994; Merrick and Loughlin, 1997). Observations and incidental take of sea lions (Loughlin and Nelson, 1986; Perez and Loughlin, 1991) in the vicinity of Seguam Pass, the southeastern Bering Sea, and Shelikof Strait provided a basis for establishment of those areas as critical habitat.

The POP database provides our best overall view of the foraging range or distribution of Steller sea lions in the Bering Sea and the western/central Gulf of Alaska (Figure 3.1-6). This database and the locations of sea lions taken incidentally in groundfish fisheries (1973 - 1988, Perez and Loughlin, 1991), indicate that sea lions disperse widely to forage throughout much of the Bering Sea and the GOA, at least as far out as the continental shelf break. Such broad dispersal may be essential to sea lion populations to take advantage of distant food resources and, as a consequence, limit intra-specific competition near rookeries and haulout sites. However, this database should be viewed with some caution. The sightings in the POP database were collected over a period of 4 decades and do not reflect any natural changes that may have occurred in sea lion foraging patterns during that period. Similarly, foraging range, as indicated by such sightings, would be expected to change over time due to the severe decline of the species in the last two decades. In addition,

[1]D. DeMaster, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115

the database is biased as a reflection of overall foraging dispersion by the location of sighting effort. That is, a sighting at a particular location indicates sea lion presence at that site, but the lack of sightings at a site could mean that the site is not important for foraging or it could mean that there was insufficient sighting effort in that area. Also, it is not clear that each sighting represents a different animal, and it is possible that some sightings were of the same animal. Furthermore, the area may be important to sea lions during times of the year not covered intensively by sightings. Finally, the sighting database does not include information on the age and sex of the sighted animal.

Telemetry studies suggest that foraging distributions vary by individual, size or age, season, site, and reproductive status (Merrick and Loughlin, 1997). The foraging patterns of adult females differed during summer months when females were with pups versus winter periods when considerable individual variation was observed, but may be attributable to the lactation condition of the females. Trip duration for females (n = 14) in summer was approximately 18 - 25 hours. For five of those females that could be tracked, trip length averaged 10.5 miles (17 km) and they dove approximately 4.7 hours per day. For five females tracked in winter months, mean trip duration was 204 hours, mean trip length was 82.5 miles (133 km), and they dove 5.3 hours per day. The patterns exhibited by females in winter varied considerably, from which the investigators inferred that two of them may still have been supporting a pup. Those two females continued to make relatively shorter trips (mean of 32.9 miles [53 km] over 18 hours) and dove 8.1 hours per day, whereas the other three ranged further, dove 3.5 hours per day, and spent up to 24 days at sea. Five winter young-of-the-year exhibited foraging patterns intermediate between summer and winter females in trip distance (mean of 18.6 miles [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 (mean ± 1 SE) were 197 ± 38.4 miles^2 (319 ± 61.9 km$^{2)}$ for adult females in summer, 29,499 ± 16,556.4 miles^2 (47,579 ± 26,704 km^2) for adult females in winter, and 5,701.5 ± 4,215.4 miles^2 (9,196 ± 6,799 km^2) for winter young-of-the-year. The sea lions used in Merrick and Loughlin's (1997) study were from the GOA (Sugarloaf Island, Latax Rocks, Marmot Island, Long Island, Chirikof Island, Atkins Island, and Pinnacle Rock), and the BSAI region (Ugamak Island and Akun Island). This information is, therefore, directly pertinent to the action areas for both the GOA and BSAI fisheries, although it is perhaps most relevant to the GOA action area.

Overall, the available data suggest two types of foraging patterns: 1) foraging around rookeries and haulout sites that is crucial for adult females with pups, pups, and juveniles, and 2) foraging that may occur over much larger areas where these and other animals may range to find the optimal foraging conditions once they are no longer tied to rookeries and haulout sites for reproductive or survival purposes.

The sea lions in the Merrick and Loughlin (1997) study tended to make relatively shallow dives, with few dives recorded at greater than 820 feet (250 m) (Figure 3.1-7). Maximum depth recorded for each of the five summer adult females was in the range from 328 to 820 feet (100 to 250 m), and maximum depth for the five winter adult females was greater than 820 feet. The maximum depth measured for winter young-of-the-year was 236.2 feet (72 m). These results suggest that sea lions are generally shallow divers, but are capable of deeper dives (i.e., greater than 820 feet). The winter young-of-the-year sea lions were instrumented from November to March, when they were about 5 - 9 nine months old and may have still been nursing. At this age, they are just beginning to develop foraging skills, which may take years to learn. The diving depths and patterns exhibited by these young-of-the-year are not indicators of the foraging patterns of older juveniles (1 - 3-year-olds). For example, Swain and Calkins (1997) report dives of a 2-year-old male sea lion to 826.6 feet (252 m), and regular dives of this animal and a yearling female to 492 - 820 feet (150 m - 250 m). Clearly, if young-of-the-year are limited to relatively shallow depths, and older animals are capable of diving to much greater depths, then those younger animals are just beginning to develop the diving and foraging skills necessary to survive. The rate at which they develop those skills and begin to dive to greater depths

or take prey at greater depths is unknown, but probably occurs rapidly after weaning to take advantage of otherwise unavailable prey resources. The ADF&G is currently studying the ontogeny of dive behavior in young Steller sea lions.

A recent study analyzed data from 13 pup and 12 yearling Steller sea lions equipped with satellite dive recorders in the Gulf of Alaska/Aleutian Islands (n = 18), and Washington (n = 7) from 1994-2000 (Loughlin *et al.*, unpublished). A total of 1413 days of transmission ($\bar{x}$ = 56.5 days, range 14.5-104.1 days) were received. They recorded 222,073 dives, which had a mean depth of 60.4 feet (18.4 m) (range of means 19.0 - 222.7 feet [5.8-67.9 m]). Alaskan pups dove briefer and shallower (mean depth $\bar{x}$ = 25.3 feet [7.7 m], mean duration $\bar{x}$ = 0.8 min, mean maximum depth $\bar{x}$ = 84.3 feet [25.7 m], and maximum depth $\bar{X}$ = 826.6 feet [252 m]) than Alaskan yearlings ($\bar{x}$ = 54.4 feet [16.6 m], $\bar{x}$ = 1.1 minutes, $\bar{x}$ = 63.4 m, 944.6 feet [288 m], respectively), with Washington yearlings diving the longest and deepest ($\bar{x}$ = 129.2 feet [39.4 m], $\bar{x}$ = 1.8 minutes, $\bar{x}$ = 474.0 feet [144.5 m], and 1,075.8 feet [328 m], respectively).

Loughlin *et al.*, unpublished) described three types of movements for these young sea lions, long-range trips (greater than 8 miles and greater than 20 hours), short-range trips (less than 8 miles and less than 20 hours), and transits to other sites. Transits began as early as 7 months of age, occurred more often after 9 months of age and ranged between 3.5 - 245 miles. Long-range trips started around 9 months of age and occurred most frequently at around the time of weaning while short-range trips happened almost daily (.9 trips/day, n = 426 trips).

3.1.1.6.3 Prey Species and Size

Steller Sea Lion Diet, Western Stock - Current [2]

The most recent analysis of Steller sea lion diet compares trends in prey species consumption between summer and winter, when juveniles are first learning to forage on their own. (Sinclair and Zeppelin, submitted). Steller sea lion scats were collected (1990-1998) from 31 rookeries (May-September) and 31 haulout sites (December-April) across the U.S. range of the western stock resulting in a sample of 3,762 scats with identifiable prey remains. As is typical in marine mammal diet studies prey remains were identified to the lowest possible taxon using museum reference specimens. The relative importance of each prey species was based on their frequency of occurrence (FO).

Frequency of occurrence values combined across years, seasons, and sites depicted walleye pollock (*Theragra chalcogramma*) and Atka mackerel (*Pleurogrammus monopterygius*) as the two dominant prey species, followed by Pacific salmon (Salmonidae) and Pacific cod (*Gadus macrocephalus*). Other primary prey species consistently occurring at frequencies of 5% or greater included arrowtooth flounder (*Atheresthes stomias*), Pacific herring (*Clupea pallasi*), Pacific sandlance (*Ammodytes hexapterus*), Irish lord (*Hemilepidotus sp.*), and cephalopods (squid and octopus). Species that occurred among the top three prey items on certain islands included: snailfish (Liparididae), rock greenling (*Hexagrammos lagocephalus*), kelp greenling (*Hexagrammos decagrammus*), sandfish (*Trichodon trichodon*), rock sole (*Lepidopsetta bilineata*), northern smoothtongue (*Leuroglossus schmidti*), skate (Rajidae), and smelt (Osmeridae) (Figure 3.1-8).

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[2] *Discussion of current diet trends in the western stock of Steller sea lions is based on a recently submitted draft publication (Sinclair and Zeppelin, submitted) and should not be cited without permission from the authors.*

Sites where the FO were most similar were identified using Principal Components and Agglomerative Hierarchical Cluster Analysis (Ward, 1963; Ramsey and Schafer, 1996) resulting in regions of diet similarity. These newly defined diet regions were used to compare regional and seasonal differences in prey. The diet divisions closely paralleled those defined as metapopulations based on patterns in population decline by York *et al.* (1996) suggesting that diet and decline are linked (Figure 3.1-9).

Chi-square analysis demonstrated significantly ($P = 0.01$) strong seasonal patterns in diet within each of the defined diet regions (island groupings as defined by cluster analysis). Pacific cod FO was significantly larger in winter in every region. Salmon FO was significantly lower during winter in the western Gulf of Alaska through the eastern Aleutian Islands, and higher in winter throughout the central and western Aleutian Islands. In the western Gulf, where arrowtooth flounder is most abundant in scats and well represented year-round, its FO was significantly lower in winter. Atka mackerel was significantly lower in the winter in the central and western Aleutians where it is the dominant prey species year-round. Forage fishes (herring and Pacific sand lance) are significantly different between seasons, however, there is no general trend among the regions. Walleye pollock is an important prey year-round in all regions up to the central Aleutian Islands where it is replaced by Atka mackerel. Likewise, cephalopod FO was not significantly different between seasons in any Region. Irish lord FO was generally higher in winter than in summer and though rarely occurring during summer and not included in Chi-square analysis, sandfish and snailfish have relatively high occurrences during the winter across all regions.

Diet diversity, calculated using Shannon's index of diversity (Ludwig and Reynolds, 1988), indicated that the Unimak Pass area as well as Sea Lion Rock (Amak Island) on the continental shelf just eastward of the pass encompassed the regions of highest prey diversity in this study. In the midst of precipitous population declines range wide among the western stock (Loughlin *et al.*, 1992), Amak Island was among 5 other rookeries identified by York *et al.* (1996) that demonstrated persistently stable or increasing population counts: Amak, Akun, Akutan, Chernabura, Clubbing, Ugamak. The York *et al.* (1996) temporal model for extinction of the western stock predicted that in the face of extinction of all other sites, these six would remain viable. All of these sites fall within Regions 2 and 3 as defined in this study, regions of highest diversity and greatest overlap in prey matrices between regions in this study (Figure 3.1-9). Implications of the importance of diversity in otariid diet (Merrick *et al.*, 1997; Sinclair *et al.*, 1994), though difficult to measure, should be further addressed, with special attention given to the dynamics of physical and bottom-up processes that influence nearshore habitat of rookery regions and ultimately, the population stability of Steller sea lions.

Based on the patterns in prey consumption presented in this (Sinclair and Zeppelin, submitted) and earlier studies (Fiscus and Baines, 1966; Pitcher, 1981; Calkins, 1998) Steller sea lions specialize feeding throughout the water column in the epipelagic (herring), demersal (arrowtooth flounder), and semi-demersal (pollock, Atka mackerel) zones. While the size of prey consumed undoubtedly varies with the age and sex of sea lion sampled, the remains of primary prey represented in this study are largely from adult fish (Zeppelin *et al.*, in prep). The seasonal and regional patterns in prey consumption by Steller sea lions presented in this study, along with known distributions of their primary prey, indicate that Steller sea lions target prey when they are densely schooled in spawning aggregation nearshore (over or near the continental shelf) or along oceanographic boundary zones. This is true in summer when collected scats are primarily from adult females, and in winter when scats are presumably from some increased proportion of juveniles and adult males as well as females.

The close parallel of these data (Sinclair and Zeppelin, submitted) with those of metapopulation patterns of decline (York *et al.*, 1996) suggests that diet and decline of Steller sea lions is linked; that diet diversity is

highest where population trends are most positive; and that regional diet patterns generally reflect regional foraging strategies learned at or near the natal rookery site on seasonally dense prey patches characteristic of that area. These data do not reflect Steller sea lion diet outside the range of the U.S. western stock. Goto and Shimazaki (1998) examined stomachs from 67 Steller sea lions killed by hunters off the coast of Hokkaido, Japan during 1994-1996. The most common prey was walleye pollock, but other common prey included Pacific cod, saffron cod, cephalopods, and flatfishes (Pleuronectidae).

Steller sea lion diet, western stock - historical

Prior to the 1990s, diet studies on Steller sea lions were based on the prey remains from stomachs of animals collected at sea or on rookery and haulout sites. Typically, sample sizes were small and singular publications reported on diet findings from various parts of the range of Steller sea lions, including the diet of animals collected (unknowingly) from both the eastern and western stock. The review of historical diet literature provided here regards only those findings from animals that were likely from the western stock - animals collected eastward of 144°. In otherwards, if authors reported results of their analyses of animals collected both in southeast Alaska and the western Aleutians, only the latter were reviewed here. Direct comparisons between historical and current studies must be viewed with some degree of caution due to these differences in methodologies. Nonetheless, indications of a shift in Steller diet since the mid-1970s are similar to those reported for other apex predators as well as findings of fisheries research surveys in the northern North Pacific Ocean and Bering Sea. That is, pollock have always been present in the system and in the diet of apex predators for which diet trend data is available (northern fur seals, murres, Steller sea lions), often among the top four prey items present. Whereas now, they are consistently the dominant, year-round, prey staple for these same predators.

In terms of the species of fish eaten by Steller sea lions, recent diet work (Sinclair and Zeppelin, submitted) compares most closely with studies conducted since the mid-1970s. In studies conducted along the range of the western stock between 1958 and 1969, pollock were completely absent from Steller diet (Mathisen *et al.*, 1962; Thorsteinson and Lensink, 1962; Tikhomirov, 1964; Fiscus and Baines, 1966). The high occurrence of pollock in Sinclair and Zeppelin (submitted) this study is most comparable to diet studies conducted since 1975 (Calkins, 1998; Frost and Lowry, 1986; Merrick *et al.*, 1997[3]; Pitcher, 1981) and possibly prior to the 1950s when Imler and Sarber (1947) reported pollock in 2 stomachs collected near Kodiak Island in 1945-1946. Sinclair and Zeppelin (submitted) also highlight the importance of Pacific cod in Steller diet during the winter months. Prior to this work, relatively few papers have focused on winter diet, so it is difficult to assess whether consumption of Pacific cod by Steller sea lions is a recent trend. Pacific cod was a top prey item in Calkins (1998) Bering Sea winter collections, and in stomachs that may have been collected in winter in the Gulf of Alaska 1973-1975 (Pitcher 1981). Overall, the most common prey items in studies prior to the mid-1970s included: capelin (*Mallotus villosus*), sand lance, cephalopods, herring, greenlings (Hexagrammidae), rockfishes, and smelts. Capelin, which were important in Steller diet through the 1970s (Fiscus and Baines, 1966; Pitcher, 1981) do not have an occurrence greater than 5% in recent studies. Salmon were present in early studies, but, not at the frequencies found across the western range during the summer. The occurrence of flatfish, especially Arrowtooth flounder, in the Gulf of Alaska is substantially higher now than any previous studies. Cephalopods were among the top prey items found in

[3]Merrick *et al.* 1997 was based on portions of the 1990-1993 dataset incorporated into Sinclair and Zeppelin (submitted).

Steller sea lion stomachs in many early studies (Mathisen *et al.*, 1962; Pitcher, 1981; Thorsteinson and Lensink, 1962), sometimes ranking as the most frequently occurring prey item (Fiscus and Baines, 1966). Cephalopod occurrence in Sinclair and Zeppelin (submitted) was primarily limited to the central and western Aleutian Islands and highest during the summer months, but never reached the high frequencies of the 1960s. The difference in cephalopod values between recent scat and historical stomach based diet studies may be due to differences in representation of cephalopod beaks in scats versus stomachs.

3.1.1.6.4 Prey Quality

An important consideration in evaluating effects of changing diets or prey abundance on Steller sea lions is the quality of the prey. Lipid content, and therefore energy density, varies greatly among Steller sea lion prey species, and within prey species depending upon life history stage, location and time of year (Stansby, 1976; Van Pelt *et al.*, 1997; Payne *et al.*, 1999; Anthony *et al.*, 2000). Atka mackerel and gadids are generally lower energy dense prey species (ranging within about 3 kJ/g - 6 kJ/g, though few data exist for Atka mackerel), while forage fish such as eulachon, herring, or capelin have generally higher energy contents (up to about 11 kJ/g). Because energy densities are seasonally variable, this is not an absolute relationship. For example, capelin and sandlance declined in lipid content, and therefore energy density, throughout the summer, from 6.7 kJ/g to 3.7 kg/g and 6.5 kJ/g to 4.8 kJ/g respectively (Anthony *et al.*, 2000).

In addition to considerations of prey energy content, vitamins and other metabolites are essential for adequate nutrition. There is evidence from captivity that marine mammal diets entirely or largely comprised of clupeid (herring) and osmerid (smelt) induces thiamin deficiencies (Geraci 1981). This has not been diagnosed with certainty in otariids, though it was thought to be observed in California sea lions. The potential for fish-induced anemia in marine mammals was also highlighted by Geraci (1981) based on symptoms expressed in terrestrial mammals fed primarily gadid fish. This condition was found in mink fed thawed raw gadoid fish, but not fresh raw fish, and has not been directly observed in marine mammals. However, Thompson *et al.* (1997) and Fadely (1997) referenced this mechanism when circumstantially associating similar hematologic findings in free-ranging harbor seals with evidence for switching between clupeid and gadoid diets.

The ultimate net energy gain imparted to an animal from ingesting a particular prey item not only depends upon the energy content of the prey, but also on the costs associated with traveling to, finding, capturing, handling, and digesting the prey. It thus also depends on the prey item's individual size, total biomass, availability, behavior, degree of aggregation, temporal and spatial distribution, and so on. That is, the value of any particular prey type depends on the net gain to a sea lion from foraging on that prey, and net gain is a function of multiple factors of which lipid content is an important, but not the only, determinant.

3.1.1.6.5 Foraging - Integration and Synthesis

Foraging patterns of Steller sea lions are still far from being completely described. However, the available information suggests that:

- Steller sea lions are land-based predators but their attachment to land and foraging patterns/distribution varies considerably as a function of age, sex, site, season, and reproductive status, and as a function of prey availability and environmental conditions.

- Steller sea lions tend to be relatively shallow divers but are capable of (and apparently do) exploit deeper waters (e.g., to beyond the shelf break).

- Foraging sites relatively close to rookeries may be particularly important during the reproductive season when lactating females are limited by the nutritional requirements of their pups.

- Pups dependent upon mothers for nutrition tend not to disperse greatly and remain relatively nearshore conducting shallow dives.

- Yearlings that have reached nutritional independence greatly increase their foraging area, and begin deeper diving.

- Food availability may be extremely important during April - June, when pups are likely to be making a transition to nutritional independence, and the energy requirements of pregnant females are about double that of nonpregnant females.

- Dominant prey items vary with region and season, but pollock, Atka mackerel, Pacific cod and salmon are generally the most common or dominant prey.

- Steller sea lions consume a variety of demersal, semi-demersal, and pelagic prey, indicating a potentially broad spectrum of foraging styles.

- Diet diversity may influence status and growth of Steller sea lion populations.

- The life history and spatial/temporal distribution of important prey species are likely important determinants of sea lion foraging success

- The broad distribution of sea lions sighted in the POP database indicates that sea lions also forage at sites distant from rookeries and haulout sites.

- The availability of prey at these sites may be crucial in that they allow sea lions to take advantage of distant food sources, thereby mitigating the potential for intraspecific competition for prey in the vicinity of rookeries and haulout sites.

- The question of whether competition exists between the Steller sea lion and BSAI or GOA groundfish fisheries is a question of sea lion foraging success. For a foraging sea lion, the net gain in energy and nutrients is determined, in part, by the availability of prey or prey patches it encounters within its foraging distribution. Competition occurs if the fisheries reduce the availability of prey to the extent that sea lion condition, growth, reproduction, or survival are diminished, and population recovery is impeded.

3.1.1.7 Physiology and Nutrition

Fundamental to an evaluation of the effects of commercial fisheries on Steller sea lions is an understanding of the physiological adaptations and nutritional requirements that underlie the sea lion's role in the Bering Sea and Gulf of Alaska ecosystems. Steller sea lions spend time on land at rookeries and haulout sites for reproduction, lactation, molting and resting, and undertake foraging trips to sea. The relative time spent at

sea depends upon age and size, season, reproductive status, and the availability of forage (Boyd, 1995; Boyd, 1996). Trips to sea may be made for a variety of reasons, for foraging but also for seasonal or age-specific movements along the coast. While foraging, swimming and diving behavior are controlled by a compromise between the necessity to breathe at the surface and to submerge to seek and consume prey. In addition to the abundance and distribution of prey, the time a sea lion spends submerged will depend upon physiological adaptations for maximizing time underwater. This will be a result of the how fast oxygen stores are utilized (that is, metabolic rate), and how much oxygen is stored in the body, and the conflicting demands of diving and exercise (Castellini, 1991; Boyd, 1997). Pinnipeds exhibit many physiological strategies to increase dive duration (Boyd and Croxall, 1996; Boyd, 1997).

During a dive, approximately 47% of a sea lions oxygen stores are in blood, with 35% in muscle and the remainder in the lungs (Kooyman, 1985). There is a considerable developmental component until the oxygen storage ability of an otariid is fully matured (Horning and Trillmich, 1997), because of increases in blood volume, muscle myoglobin and body mass. Likewise, juveniles operate at metabolically higher rates than adults (Lavigne *et al.*, 1986; Costa, 1993). Thus, younger sea lions do not have the same capacity to stay submerged (and hence dive to as great of depths) as adults, which consequently affects their ability to acquire prey and thus choice of foraging strategies.

Sea lions have a streamlined shape that minimizes the cost of transport while swimming (Feldkamp, 1987; Stelle *et al.*, 2000). Laboratory measurements of swim speed and drag in 3 year old Steller sea lions showed that they preferred to swim at a mean velocity of 3.41 m s^{-1} (2.9-3.4 m s^{-1}), equivalent to 1.46 body lengths per second (Stelle *et al.*, 2000), a speed found to be the minimum cost of transport for California sea lions (Feldkamp, 1987). Williams *et al.* (1991) found that the average ventilation time did not change with swim speed in California sea lions. That is, time spent submerged did not change as swim speeds increased to 4.37 yd s^{-1} (4 m s^{-1}). Because of anatomical adaptations, sea lions appear to require shorter times for lung tidal volume exchange than do seals (Williams *et al.*, 1991). Skeletal muscles of pinnipeds (and sea lions) are adapted for aerobic metabolism of lipids during hypoxic conditions of diving and exercise (Kanatous *et al.*, 1999). Lipid stores in swimming muscle were sufficient to meet the resting muscle metabolism for 17 hours in Steller sea lions (Kanatous *et al.*, 1999).

Food Intake Requirements

Kastelein *et al.* (1990) measured the daily food intake rate of 10 captive Steller sea lions for a 15 year period. The sea lions were fed 3 - 6 times per day on a mixture that averaged 22% mackerel, 40% herring, 10% sprat, 14% whiting (a gadid), and 14% squid based on weight. They found large seasonal variation in daily intake rates, with a particularly strong depression of consumption during summer months in males between 8-15 years old. Seasonality of intake was presumably related to hormonal influences, changes in energy requirements due to reproduction, and seasonal temperature changes. Much of these effects could be influenced or transduced by changes in sea lion body mass or composition, which they could not measure.

To estimate the amount of food required by Steller sea lions in the wild, more detailed measurements of metabolic rates and food intake requirements have been measured in captivity. The amount of energy derived from food can be described by following the bioenergetic scheme which details the efficiencies and costs of metabolizing food at various steps in the digestive process (Lavigne *et al.*, 1982). Proportions of proteins, lipids, or undigestible matter in a prey item affect its ability to be absorbed and digested in the body. Energy available in the prey is lost throughout the digestive process before it becomes available for activity, growth or reproduction by the sea lion, and varies depending upon the relative amounts of protein and lipid or energy

density in the diet item (Rosen and Trites, 2000a; Rosen and Trites, 2000b). Laboratory measurements of nutritional requirements seek to control multiple sources of variation that affect the amount of energy derived from prey. Then, if the costs of various activities are also determined, it is possible to model the nutritional requirements of sea lions in the wild. This provides a basis to determine the effects of consuming prey items with varying energy content.

Assimilation (dry-matter) efficiencies of northern fur seals, California sea lions, and Steller sea lions fed herring range from 86.9% to 93% (Miller, 1978; Fadely *et al.*, 1990; Fadely *et al.*, 1994; Rosen *et al.*, 2000; Rosen and Trites, 2000a), and for pollock between 81.3% - 90% (Miller, 1978; Fadely *et al.*, 1994; Rosen and Trites, 2000a). In terrestrial mammals, larger meal sizes or increased feeding frequency may decrease assimilation efficiencies (Golley *et al.*, 1965), but while these effects may have been observed in ringed seals (Parsons, 1977), harp seals (Keiver *et al.*, 1984) and northern fur seals (Fadely *et al.*, 1990), it was not observed in Steller sea lions (Rosen *et al.*, 2000) or in other studies of harp, ringed or grey seals (Ronald *et al.*, 1984; Lawson *et al.*, 1997a; Lawson *et al.*, 1997b). Because fish have relatively small indigestible fractions, there is a linear relationship between digestive efficiency and assimilation efficiency, and digestive efficiencies are likewise high (Rosen *et al.*, 2000) but not equivalent because of prey composition. When compared to other pinnipeds, assimilative and digestive efficiencies of Steller sea lions are comparable (Rosen and Trites, 2000a).

However, the cost of consuming low-energy prey items may be greater than expected purely based on differences in prey energy content. Captive feeding trials using six Steller sea lions ranging in age between 0.9 and 4.5 years old were fed herring or pollock diets over periods of 7 - 24 days to measure differences in metabolism and digestive efficiency (Rosen and Trites, 1997; Rosen and Trites, 1999; Rosen and Trites, 2000a; Rosen and Trites, 2000b; Rosen *et al.*, 2000). Based on the gross energy content differences between the two diets, the captive sea lions were expected to consume about 35% - 65% more pollock than herring. However, results suggested that because of additional costs of digesting pollock and a slightly lower digestive efficiency relative to a herring diet, the sea lions would have had to consume about 35% - 80% more pollock than herring (Rosen and Trites, 2000b). The sea lions in that study were unable or unwilling to consume the additional amounts of pollock, and hence lost body mass in spite of also reducing resting metabolic rates (Rosen and Trites, 1999).

A Steller Sea Lion Recovery Team review of captive feeding studies performed to date suggested that these studies may not be generally representative of field situations (Didier 1999), a point that has also been highlighted by researchers conducting the studies (Fadely *et al.*, 1994; Rosen and Trites, 2000b). They cited the short duration, often less than two weeks, which may have been inadequate to trigger cues utilized by sea lions to adjust intake in response to dietary changes. Likewise, these studies did not directly measure changes in activity or body condition, which also affect food intake rates. As a goal of the captive feeding studies was specifically to detect differences in metabolism related to prey composition, sea lions were fed single-species diets to maximize potential treatment effects, and as such, these studies present important data regarding metabolic adjustments that can be made in response to diets of differing quality. However, the diet of free-ranging sea lions does not consist exclusively of single prey items, prey vary in energy density throughout the year, and it is also unknown how availability of prey may affect total intake (Rosen and Trites, 2000b).

A subsequent set of captive feeding studies are being conducted to address many of these concerns by performing feeding trials throughout the year, and by using mixed diets based on known diet compositions of free-ranging sea lions (Castellini, 2001). Using mixed diets based on pre-decline, decline, and southeast Alaska prey frequencies of occurrence in sea lion diets, preliminary results indicate that in some seasons,

body mass is defended regardless of diet, and sea lions adjust volume consumed; two sea lions showed relatively stable body composition regardless of diet, a third changed composition; and, all sea lions had maintained excellent health and condition regardless of diet. Thus, while a monospecific diet of low-fat prey may be nutritionally limiting to sea lions under certain conditions, results from feeding trials performed over longer periods with diet mixtures reflective of wild sea lions have the potential to refine our understanding of free-ranging dietary needs of sea lions. And though captive feeding studies can describe the metabolism of prey once ingested, they do not include components of foraging efficiency, or the cost to the sea lion of acquiring a certain prey type.

With estimates of food intake requirements, population size and age structure, and of activity, it is possible to generate estimates of food intake requirements for the entire population of Steller sea lions. Perez and McAllister (1993) estimated annual food consumption by the Steller sea lion population in the eastern Bering Sea as 18.5×10^4 mt, of which 14.1×10^4 mt (76 percent) was fish. Of the total annual fish consumption, commercial groundfish comprised 69 percent. Winship (2000) built a Steller sea lion bioenergetic model incorporating variability in estimates of sea lion growth, metabolism, activity, and diet to produce more robust estimates of population food intake requirements. Estimates of annual prey biomass consumption varied seasonally, and by up to 12% among regions of Alaska due to differences in population size and diet composition (Winship, 2000). The southeast Alaska population consumed the greatest biomass annually, while the central Aleutian Islands population consumed the least. Similar amounts of gadids were consumed annually by the Gulf of Alaska (7.64×10^4 mt) and southeast Alaska populations (7.29×10^4 mt). The second largest single species consumption was of Atka mackerel by the central Aleutian Islands population (4.87×10^4 mt). Winship (2000) estimated that the total annual consumption of pollock by all sea lions was 6% of the total estimated pollock biomass attributed to natural mortality, and 19% of the total biomass removed by commercial fisheries. Steller sea lion predation accounted for a greater proportion (83%) of the estimated biomass of Atka mackerel annual natural mortality. However, this type of analysis does not consider spatial, temporal or local availability of prey to sea lions, particularly on scales relevant to foraging sea lions (Winship, 2000).

Physiology and Foraging - Integration

Field measurements of metabolic rate or energy consumption show that otariids generally operate at 3-6 times their basal metabolic rate while traveling and foraging (Costa *et al.*, 1989; Arnould *et al.*, 1996; and see Winship, 2000). This is higher than measurements for phocids, and reflects a high energy strategy for foraging. In general, otariids have adopted an "energy maximizer" type foraging strategy, which is characterized by high energy turnover. That is, sea lions expend comparatively (to phocids) high levels of energy to acquire relatively high levels of energy. This strategy is advantageous in highly productive ecosystems with concentrated and predictable prey (Costa, 1993).

Otariids can make adjustments to foraging strategies on many behavioral and metabolic scales. Changes in foraging trip duration and in time at a prey patch have been observed in response to prey availability (Boyd, 1996; Boyd, 1999; Andrews, 2001). Responses by sea lions will vary depending upon life history status, for example, whether an adult female is lactating or not, or whether a mother-pup pair is at a rookery (central place foraging), or foraging from multiple haulout sites (multiple central place foraging). This change in strategy is likely related to costs of lactation, when at some point it becomes more advantageous energetically for the female to move away from the rookery with the pup, though it is not yet weaned, to allow exploitation of prey with a higher rate of energy return (Boyd, 1998), either because of prey proximity, quality, or abundance at sites other than near the rookery.

Individual foraging strategies will vary depending upon prey location and quality. If prey are not shallow, travel costs increase to access the prey patch. At some combination of prey size, quality, number, catchibility and depth, it will become suboptimal for a sea lion to forage on a given prey type (Boyd, 1997). This type of foraging decision was recently directly observed by Thomas and Thorne (2001), where sea lions in Prince William Sound were observed feeding on surface schooling herring, rather than diving to a deeper, though more concentrated, school of pollock.

3.1.1.8 Anthropogenic Sources of Mortality

Anthropogenic, or human-caused, sources of mortality can occur incidental to other actions, or through directed taking. Examples are mortalities that occur incidental to commercial fishing, through entanglement in derelict fishing gear or other debris, directly through subsistence harvests, or directly by illegal shooting or other action.

A primary source of data for the rate of mortalities that occur incidental to commercial groundfish fishing is from the North Pacific Groundfish Observer Program database. Based on recent observer data, minimum estimates of mean annual mortality for the BSAI groundfish trawl fishery are 7.0 (CV = 0.21) sea lions per year for the past 5 years, 1.2 (CV = 0.6) sea lions annually for the GOA groundfish trawl fisheries, and 0.8 (CV = 1.0) for the GOA groundfish longline fishery (Angliss *et al.*, 2001). Resultant ranges of observer coverage relative to fishing effort was 53% - 74% for BSAI groundfish trawl, 33% - 55% for GOA groundfish trawl, and 8% - 21% for GOA groundfish longline fisheries (Angliss *et al.*, 2001). There appears to have been a slight decline in estimated incidental take rates throughout the 1990s. A closer examination shows no apparent 'hot spots' of incidental catch (Figure 3.1-10), nor an apparent relationship between mortality and magnitude of catch. Because of the size class requirements for observer coverage, if vessels with limited or no coverage operate in ways different than the larger vessels, either in technique or area, then these mortality estimates could potentially be biased.

Steller sea lions are incidentally taken by commercial fisheries other than groundfish fisheries, including some nearshore salmon drift or set gillnet fisheries and halibut longline fisheries. An estimated minimum mean annual mortality rate from the past five years of data for all commercial fisheries taking Steller sea lions from the western stock is 28.3 (CV = 0.64) sea lions per year (Angliss *et al.*, 2001). However, many fisheries known to interact with Steller sea lions have not been observed, and thus this should be considered a minimum estimate.

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. From a sample of rookeries and haulout sites in the Aleutian Islands, of 15,957 adults observed, Loughlin *et al.* (1986) found only 11 (0.07%) entangled in marine debris, some of which was derelict fishing gear. Observations of sea lions at Marmot Island for several months during the same year observed 2 of 2,200 adults (0.09%) entangled in marine debris. During 1993-97, only one fishery-related stranding was reported from the range of the western stock, a sea lion observed in August 1997 with troll gear in its mouth and down its throat (Angliss *et al.*, 2001). Entanglement of sea lions in derelict fishing gear or other marine debris does not appear to represent a significant threat to the population.

Steller sea lions are primarily utilized for subsistence purposes in communities within the range of the western stock. Pinniped harvests in southeast Alaska tend to be dominated by harbor seal rather than Steller sea lions, and essentially all of the harvest is from the western stock. Of these, most are harvested in the

Pribilof Islands. Estimates of the total number of sea lions taken (harvested plus struck and lost) declined over the six year period of 1992 - 1998 from 549 to 171 per year (Angliss *et al.*, 2001), with an overall mean annual take of 329 sea lions for the entire period.

Harvest levels typically have been lowest during June - August, peaking during September - November and declining through May, but this seasonality has been less pronounced since 1996 with declining harvest rates (Wolfe and Mishler, 1997). The proportion of the harvest comprised of female sea lions has been relatively low. For 1996 - 1998, adult females comprised 14.2%, 9.2%, and 6.9% of the total harvest, while juvenile females accounted for 5.8%, 6.9% and 3.0% (Wolfe and Mishler, 1997; Wolfe and Hutchinson-Scarbrough, 1999). Takahashi and Wada (1998) used a modified Leslie matrix model to assess the possible effect of hunting Steller sea lions in Japanese waters and concluded that hunting near Hokkaido to reduce damage to local fisheries likely depleted the sea lion population in the Kuril Islands.

Illegal shooting occurs, but the frequency of occurrence is difficult to estimate. NMFS successfully prosecuted two cases of illegal shooting of sea lions in the Kodiak area in 1998, and two cases in southeast Alaska between 1995 - 1999 (Angliss *et al.*, 2001).

Based on a published life table and the current rate of decline, Loughlin and York (2001) estimate the total number of mortalities of non-pup Steller sea lions in 2000 was about 6,425 animals; of those, 4,710 (73%) were mortalities that would have occurred if the population were stable, and 1,715 (27%) were additional mortalities that fueled the decline. They tabulated the levels of reported anthropogenic sources of mortality (subsistence, incidental take in fisheries, and research), guessed at another (illegal shooting), then approximated levels of predation (killer whales and sharks). They attempted to partition the various sources of "additional" mortalities as anthropogenic and as additional mortality including some predation. Loughlin and York (2001) classified 438 anthropogenic mortalities and 779 anthropogenic plus some predation mortalities as "mortality above replacement;" this accounted for 25% and 45% of the estimated total level of "mortality above replacement." The remaining mortality (75% and 55%, respectively) was not attributed to a specific cause and may be the result of nutritional stress.

3.1.1.9 Natural Predators

A brief review of predation on Steller sea lions by killer whales and sharks was presented in the 2000 BSAI/GOA groundfish BIOP (NMFS, 2000). Based on surveys of researchers, fishers, tour boat operators and others, more lethal interactions may occur in the Aleutian Islands compared to other parts of Alaska (Barrett-Lennard *et al.*, 1995). In a study dedicated to tracking killer whales in Prince William Sound during 1984 - 1996, 31documented marine mammal kills by transient killer whales none were of Steller sea lions (Saulitas *et al.*, 2000). However, nearly 33 (14/43) observed harassments of Steller sea lions by PWS or GOA transient killer whales were observed. Observations were conducted during summer months, and the availability of juvenile sea lions to killer whales may be higher in this area during spring months, when sea lions arrive seeking herring. Based in part on these observations, and on stomach contents of six stranded killer whales, sea lions were estimated to comprise 5% - 20% of killer whale diet (Matkin *et al.*, 2001). Expanding this to account for daily killer whale metabolic needs, average size and caloric content of sea lions consumed, and a population estimate of killer whales, a range of the percent of sea lion mortalities attributable to killer whales was estimated to be 6% - 77%, with a best estimate of 27% (Matkin *et al.*, 2001). The results of this exercise highlighted the need for improved data on killer whale population size and proportion of sea lions in their diet, and suggests that killer whale predation may be a factor in current decline and lack of recovery of sea lions. (Estes *et al.*, 1998; Matkin *et al.*, 2001).

Attacks by great white sharks have been documented on sea lions at the southern end of their range in California (Ainley *et al.*, 1985). Though Alaska waters lie mostly north of the theorized normal range of white sharks, sleeper sharks (*Somniosus pacificus*) range throughout the Gulf of Alaska and Bering Sea, and small marine mammals have been documented in stomach contents (Yang and Page, 1999). One such occurrence was the discovery of harbor seal remains from one shark taken in Alaska (Bright, 1959), though whether this seal was predated or scavenged is unclear. There have also been recent reports of sleeper sharks collected in Alaska containing cetacean and harbor seal remains (Hulbert *et al.*, 2001). No remains of Steller sea lions were found in 13 sleeper shark stomachs collected in the Gulf of Alaska between June and August 1996 in areas near active sea lion rookeries and haulout sites (Yang and Page, 1999). Though this is a small sample size, the stomach contents indicated primarily benthic feeding, despite the proximity and local abundance of sea lion pups (Yang and Page, 1999). Pinniped residues were found in the stomach of 1 sleeper shark among 148 sampled from the Bering Sea in 1997 (Orlov, 1999).

3.1.1.10 Disease and Contaminants

As with any wild mammal population, a multitude of infectious (viral, bacterial, parasitic, or mycotic) or toxicological (heavy metal, organochlorine) diseases may afflict Steller sea lions. Many anatomical and clinical studies have been performed to determine disease prevalence, with an ultimate goal of determining incidence, interactions with environment, and what role disease may play in the population decline or as an impediment to recovery.

Infectious

Many diseases common to otariids in general and sea lions specifically can cause reproductive failure or death, and have thus been considered relative to their role in the population decline (NMFS, 1995). Among those potentially pathogenic that have tested positive for exposure in some sea lions are calicivirus (San Miguel sea lion virus; Barlough *et al.*, 1987), *Listeria* sp. (Spraker and Bradley, 1996), *Edwardsiella tarda* (Spraker and Bradley, 1996), *Bordatella bronchiseptica* (Spraker and Bradley, 1996), canine distemper virus, phocine distemper virus, phocid herpesvirus 1, *Salmonella* sp. (Spraker and Bradley, 1996), *Toxoplasma gondii*, and chlamidia (Sheffield and Zarnke, 1997). Prevalence or isolation of pathogens occurs throughout the range, with no immediate temporal/spatial pattern detectable due largely to small or infrequent sampling (Sheffield and Zarnke, 1997; NMFS, 1995). No exposure to influenza A or *Brucella* spp. was detected (Sheffield and Zarnke, 1997).

Parasitic

Calkins *et al.* (1994) reported finding numerous lesions in adult and juvenile sea lions necropsied during the *Exxon Valdez* oil spill. Gross lesions caused by parasites were found in the nasal cavity, stomach, and intestine, and were unrelated to hydrocarbon exposure (Calkins *et al.*, 1994).

Nasal mites infect sea lions in Alaska (Fay and Furman, 1982) and Russia (Konishi and Shimazaki, 1998) by at least two years of age, though nasal mites and sea lions have apparently evolved into a relatively neutral, or benign, relationship (Konishi and Shimazaki, 1998).

Contaminants

Organic and inorganic chemicals from pesticides and industrial applications that accumulate in food webs and are hazardous to wildlife include persistent organic pollutants (such as DDT, PCBs, chlordane, hexachlorocyclohexane, dioxin), heavy metals (lead, cadmium, mercury), radioactive elements or compounds, and petroleum hydrocarbons. Contaminants can be transported to Alaska via atmospheric or oceanic currents, or can be found in localized point sources such as abandoned military installations, industrial complexes, mining sites, land or sea dumps, and from discharges or spills (AMAP, 1997). Contamination of wildlife can result from inhalation, absorption through skin, direct ingestion, or by consumption of contaminated prey (Marine Mammal Commission, 1999). Changes in diets or ecosystem trophic webs can thus affect the contaminant burden of top predators (Marine Mammal Commission, 1999). Toxic effects of contaminants in wildlife and marine mammals have been associated with reproductive failures (Helle *et al.*, 1976; Reijnders, 1986), population declines (Martineau, 1987), carcinomas (Gulland *et al.*, 1997), and immune suppression (deSwart *et al.*, 1995; Ross *et al.*, 1996).

Few analyses have been published on heavy metal contamination in Steller sea lions. Evidence of transitory metals accumulation in southeast Alaska sea lions was found by Castellini and Cherian (1999). They found that circulating zinc (Zn) and metallothionein (a chelating compound) were increased in southeast Alaska sea lion pups during the early 1990s, and returned to values comparable to Aleutian Island pups by 1997. Zinc, copper, and metallothionein levels were comparable between pups sampled from the western stock and Forrester (Lowrie) Island (eastern stock), and lower than captive sea lions (Castellini and Cherian, 1999). Hepatic metal concentrations in Steller sea lions have generally been much lower than found in northern fur seals (Noda *et al.*, 1995). Vanadium concentrations in Steller sea lion livers ranged between 0.023-0.43 µg/g of wet weight, and positively correlated with levels of selenium, silver, and mercury (Saeki *et al.*, 1999).

No toxicological studies have been performed on otariids to determine clinical ramifications of increasing contaminant burdens. However, Organochlorines have been associated with levels of health concern in other animals. Mink kit survival was compromised at approximately 8,000 ng/g lipid weight (AMAP, 1997), immunosuppression in harbor seals was detected at average concentrations of 16,488 ±1023 ng/g lipid weight, ,and premature parturition in California sea lions was observed at burdens of 134,000 ng/g lipid weight (DeLong *et al.*, 1973).

Lee *et al.* (1996) examined Steller sea lion blubber and liver samples from the Bering Sea and Gulf of Alaska and found that blubber PCBs ranged 5,700-41,000 ng/g lipid in males, and 570-16,000 ng/g lipid in females. PCB concentration in males was orders of magnitude higher than other Arctic and Alaskan pinnipeds. DDTs in levels in males ranged from 2.8 to 17 ng/g lipid and in females from 0.19 to 6.5 ng/g lipid. For males and females aged 6 and 8 years of age, DDE levels were 5.4 and 1.8 ug/g lipid wt, respectively. Females were found to decrease the contaminant burden throughout life, relative to adult males, by dumping contaminants through lactation. Varanasi *et al.* (1992) obtained sea lions samples from the Bering Sea, Barren Islands, Prince William Sound, and St. George Island (Pribilof Islands) and found organochlorine levels in the blubber at 23000 +/-37000 ng/g, wet weight. There was large variance because of the large range of 1,800-110,000 ng/g. The high level at 110,000 ng/g was from a 1-2 year old male from the Bering Sea.[4] Finally, the NMFS Northwest Center examined blubber samples from 24 Steller sea lions from southeast Alaska and report PCB levels of 630-9900 ng/g wet weight and DDT levels of 400-8200 ng/g wet weight, respectively

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(NMFS, unpublished)[5]. These studies indicate burdens are present in Steller sea lions that could be sufficient to produce health effects.

Concerns exist that the toxicity of contaminants may increase within an individual in negative energy balance, or nutritional limitation, as lipophilic contaminants such as PCBs are released as blubber stores are metabolized. While levels of circulating organochlorines did increase in the blood of harbor seals with high body burdens of organochlorines fasting for 15 days, immunological responses remained within normal ranges suggesting short-term fasting did not add an additional threat (De Swart *et al.*, 1995). Based on endocrine responses, however, seals with high levels of contaminants were likely to be less likely to adequately respond to stressful situations (De Swart *et al.*, 1995).

Sea lions exposed to oil spills may become contaminated with polycyclic aromatic hydrocarbons (PAHs) through inhalation, dermal contact and absorption, direct ingestion, or by ingestion of contaminated prey (reviewed in Albers and Loughlin, in press)). After the *Exxon Valdez* oil spill in March 1989, Calkins *et al.* (1994) recovered 12 sea lion carcasses from the beaches of Prince William Sound, and collected an additional 16 sea lions from haulout sites in the vicinity of PWS and the Kenai coast. The highest levels of PAHs were in sea lions found dead following the oil spill. Sea lions collected seven months after *Exxon Valdez* oil spill of 1989 in Prince William Sound had levels of PAH metabolites in the bile consistent with exposure and metabolism of PAH compounds (Calkins *et al.*, 1994). However, since lesions associated with hydrocarbon contamination were not found in histological exams of any sea lion, there was no evidence of oil toxicity damage (Calkins *et al.*, 1994).

Disease has not been considered to have played a significant role in the overall decline of the western stock of Steller sea lions (NMFS, 1995), but it is inconclusive to what extent it played as a contributory factor, and to what extent disease may be operating as a limitation to recovery. In declining populations, decreased genetic diversity and synergistic effects from chemical contaminant toxicity can act to compound factors that lead to reduced fitness (Bickham *et al.*, 2000).

Field Studies of Health and Condition

Several field studies have been conducted to assess health and condition of Steller sea lions utilizing hematological and morphometric indices of condition (see Donnelly and Trites, 2000 for a review). In general, health assessments based on blood profiles represent physiological responses to relatively recent effects, and thus are most useful for addressing questions about current health status. A limitation of assessing individual health based on a single sample is that without additional observations or sample gathering, it is difficult to generate a definitive diagnosis of a disease state should the indices indicate an abnormality. However, when multiple individuals are combined it may be possible to generate a picture of health status at a population level, a method commonly applied in domestic and wildlife medicine (Seal *et al.*, 1978; Franzmann, 1985), and has been applied to Steller sea lions (Bishop and Morado, 1995; Castellini *et al.*, 1993; Rea *et al.*, 1998). However, the utility of this type of analysis is highly dependent upon the type and scope of factors operating on the population, and on the sensitivity of the measured variables to those factors.

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A key to blood chemistry profiling is that metabolites present in the blood can be directly related to nutritional status as well as many other disease states, and can thus present a snapshot of health for animals sampled from a haulout or rookery. Blood chemistry profiles have in general not detected significant health issues for newborn to 1 month old Steller sea lion pups throughout their range in Alaska during the 1990s (Castellini *et al.*, 1993; Bishop and Morado, 1995; Rea *et al.*, 1998). Rea *et al.* (1998) did find metabolites in pups from southeast Alaska indicative of longer fasting periods than pups from the Aleutian Islands or Gulf of Alaska. This was consistent with longer periods between suckling associated with longer maternal foraging trips (Brandon *et al.*, 1996). However, levels of plasma haptoglobin, an acute phase reaction protein that increases in response to infection, inflammation, trauma and environmental stress, were found to be significantly elevated in pups and adults during 1992-1994 from the Aleutian Islands and Gulf of Alaska compared to those in southeast Alaska (Zenteno-Savin *et al.* 1997). This could indicate that some stressors were operating on populations in the areas of decline differently than on the area of stability.

Comparisons of growth measurements, such as mass or length at age, are more reflective of longer term conditions experienced by an animal. Steller sea lions sampled in the 1980s weighed less and were shorter for age than sea lions sampled during the 1970s (Calkins *et al.*, 1998), and were less massive than expected based on length-girth relationships (Castellini and Calkins, 1993). These differences were most notable among animals less than 10 years old (Calkins and Goodwin, 1988), and may have been declining since the 1960s (Calkins *et al.*, 1998). These changes are consistent with nutritional limitation. Recent comparisons of body size across regions of decline and stability do not recapitulate the long-term trend, however. There is evidence for larger pup sizes in areas of decline (Rea, 1995; Merrick *et al.*, 1995; Adams, 2000; Fadely and Loughlin, 2001), arising from differential growth rates (Brandon and Davis, 1999). Adult females with pups were not different in size between the regions of stability and decline (Davis *et al.*, 1996), though this sample of unknown age females may not be representative of the populations as a whole.

3.1.1.11 Natural Competitors

Steller sea lions forage on a variety of marine prey that are also consumed by other marine mammals (e.g., northern fur seals, harbor seals, humpback whales), marine birds (e.g., murres and kittiwakes), and marine fishes (e.g., pollock, arrowtooth flounder). To some extent, these potential competitors may partition the prey resource so that little direct competition occurs. For example, harbor seals and northern fur seals may consume smaller pollock than Steller sea lions (Fritz *et al.* 1995). Competition may still occur if the consumption of smaller pollock limits the eventual biomass of larger pollock for sea lions, but the connection would be difficult to demonstrate. Such competition may occur only seasonally if, for example, fur seals migrate out of the area of competition in the winter and spring months. Similarly, competition may occur only locally if prey availability or prey selection varies geographically for either potential competitor. Finally, competition between sea lions and other predators may be restricted to certain age classes, because diet may change with age or size.

3.1.1.12 Influence of environmental and climatic change on Steller sea lions

From 1940-1941 an intense Aleutian Low was observed over the BSAI, and GOA, this was followed from December 1976 to May 1977 with an even more intense Aleutian Low. During this latter period, most of the North Pacific Ocean was dominated by this low pressure system which signaled a change in the climatic regime of the BSAI, and GOA (NRC, 1996). The system shifted from a "cold" regime to a "warm" regime that persisted for several years. Since 1983, the GOA and Bering Sea have undergone different temperature changes. 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. Recent evidence now indicates that another regime shift occurred in the North Pacific in 1989 (NRC, 1996).

Most scientists agree that the 1976/77 regime shift dramatically changed environmental conditions in the BSAI and GOA (Benson and Trites, 2000). However, there is considerable disagreement on how and to what degree these environmental factors may have affected both fish and marine mammal populations. Productivity of the Bering Sea was high from 1947 to 1976, reached a peak in 1966, and declined from 1966 to 1997. Some authors suggest that the regime shift changed the composition of the fish community and reduced the overall biomass of fish by about 50 percent (Merrick *et al.,* 1995; Piatt and Anderson, 1996). Other authors suggest that the regime shift favored some species over others, in part because of a few years of very large recruitment and overall increased biomass (Beamish, 1993; Hollowed and Wooster, 1995; Wyllie-Echeverria and Wooster, 1998).

It is reasonable to conclude that the regime shift created environmental conditions that produced very large year classes of gadids (i.e. pollock and Pacific cod). However, because of the historically high catches of gadids before the regime shift occurred, it is not likely that the regime shift favored gadids in a way which would allow them to out compete other fish species and dominate the ecosystem, although the absolute level of biomass is not well known.

Many competing factors have contributed to the ecosystem in which Steller sea lions now depend Pauly *et al.*, 1998). However, the important question is whether the diet of Steller sea lions was adversely affected by the regime shift. Specifically, the question has been raised as to whether the increase in pollock abundance is now contributing to the decline of Steller sea lions. From the information available, it seems reasonable to conclude that gadids (i.e., pollock and Pacific cod) were abundant before the regime shift, and that sea lions relied upon them for food before the decline. Therefore, it is unlikely that a change in the structure of the ecosystem, resulting in a dominance of gadids is the sole cause of the current decline.

Shima *et. al.* (2000), looked at the GOA and three other ecosystems which contained pinniped populations, similar commercial harvest histories, environmental oscillations, and commercial fishing activity. Of the four ecosystems only the GOA pinniped population (Steller sea lions) were decreasing in abundance. They hypothesized that the larger size and restricted foraging habitat of Steller sea lions, especially for juveniles that forage mostly in the upper water column close to land, may make them more vulnerable than other pinnipeds to changes in prey availability. They further reasoned that because of the behavior of juveniles and nursing females, the entire biomass of fish in the GOA might not be available to them. This would make them much more susceptible to spatial and temporal changes in prey, especially during the critical winter time period (Shima *et. al.*, 2000).

Figure 3.1-1 Steller Sea Lion western stock population trends, 1976-2000.

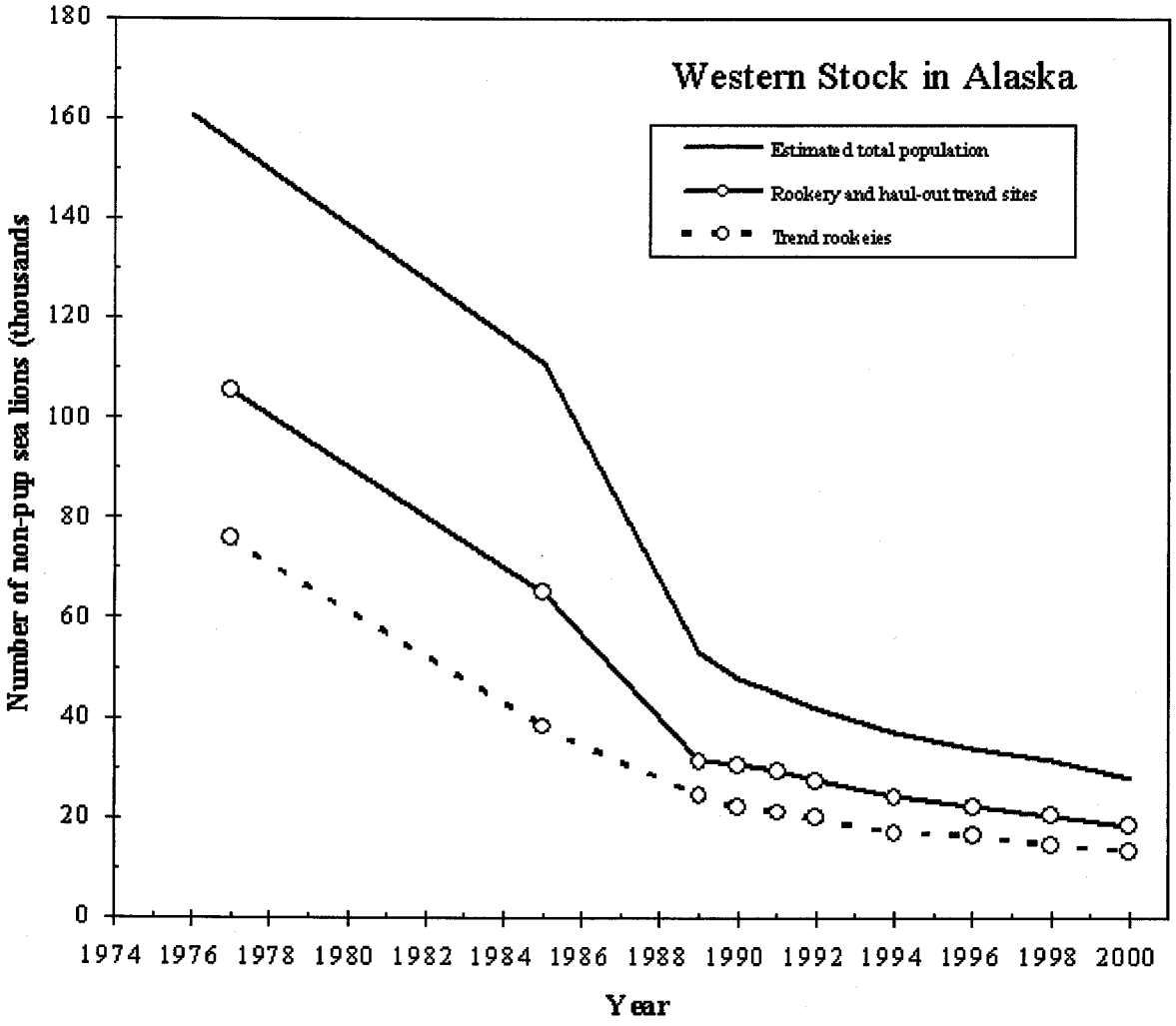


Figure 3.1-2 Regional Steller sea lion population trends, 1976-2000.

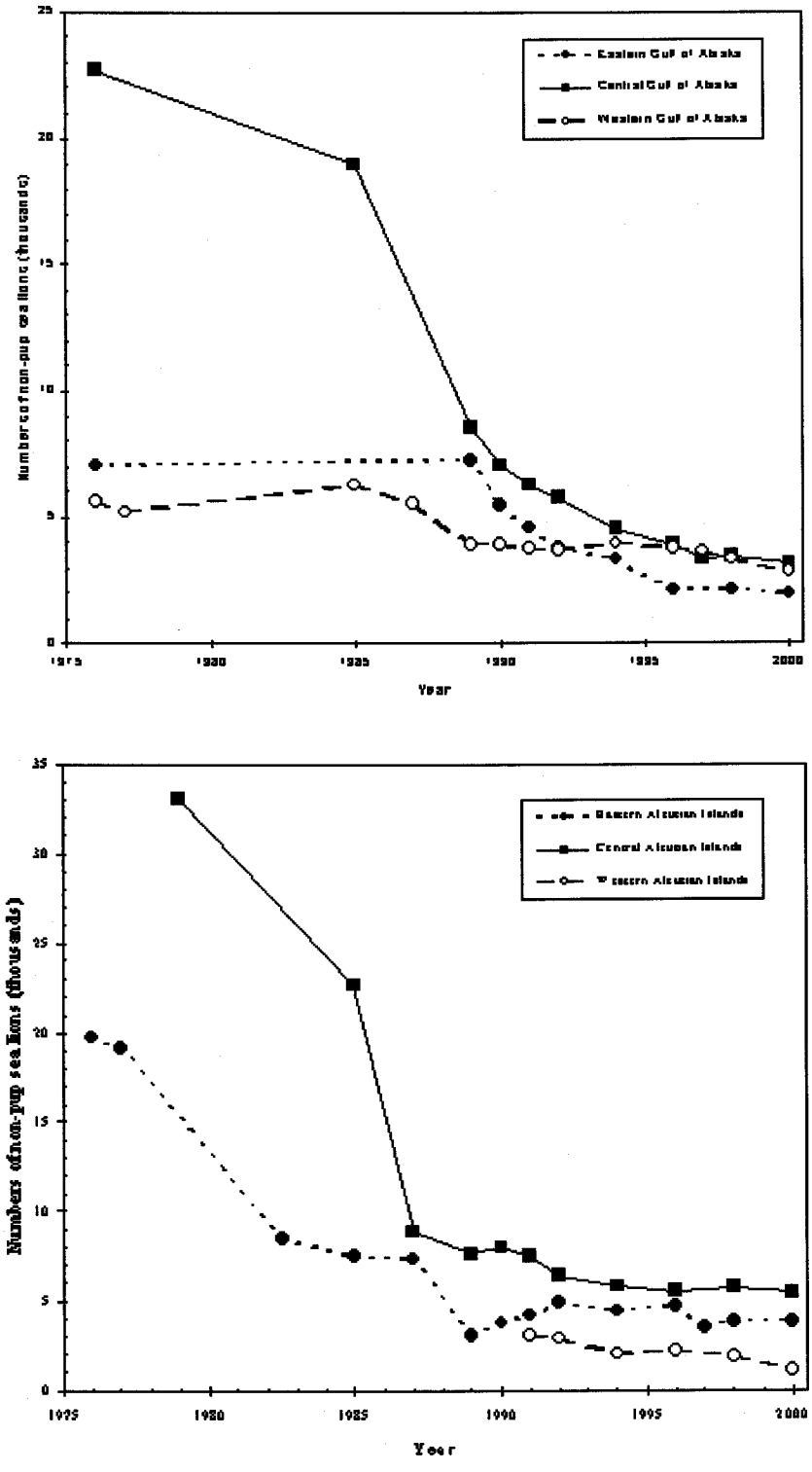


Figure 3.1-3 Counts of Steller sea lion pups in Alaska (Sease and Loughlin, 1999).

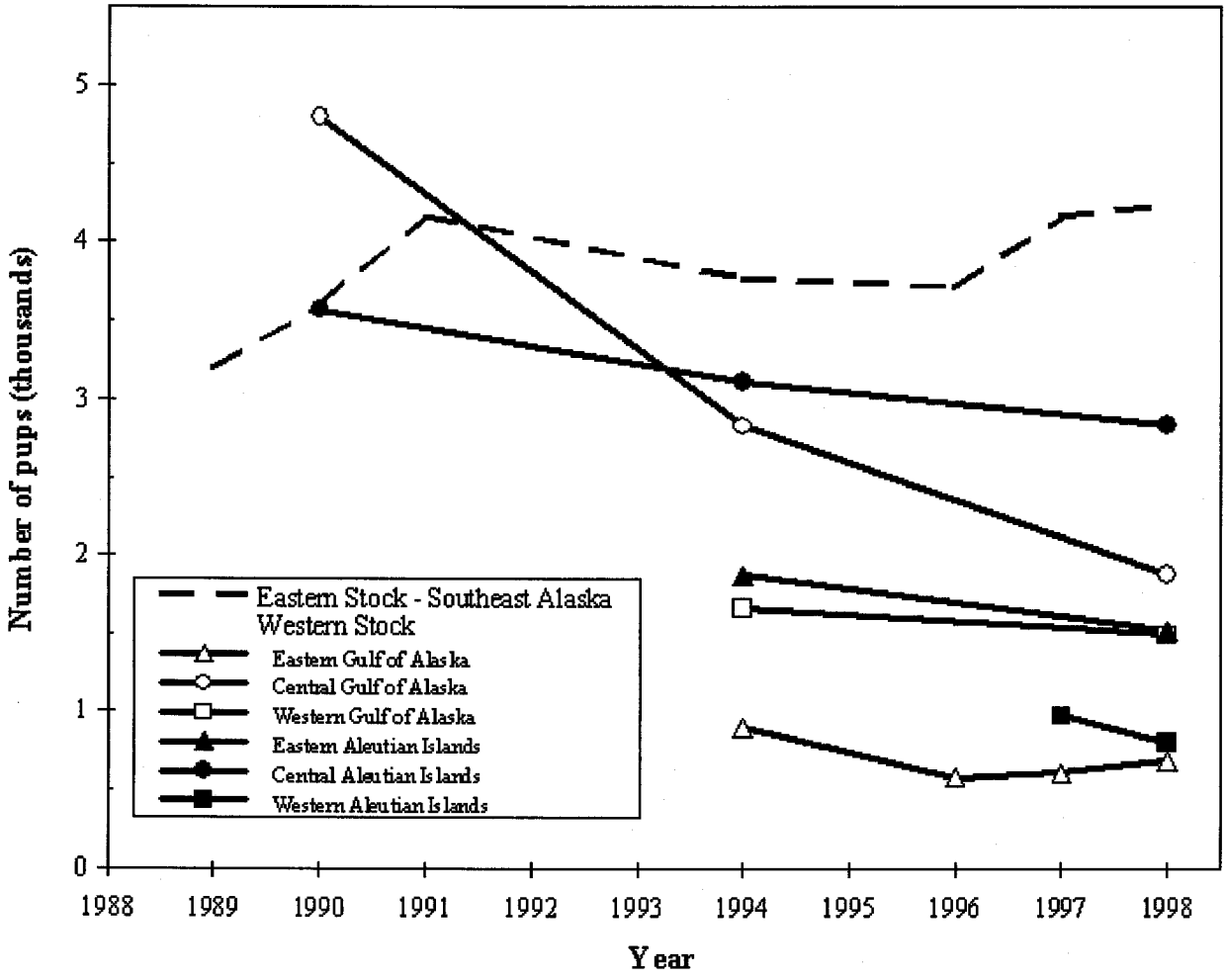


Figure 3.1-4 Population trends of Steller sea lion eastern stock in southeast Alaska, 1975-2000.

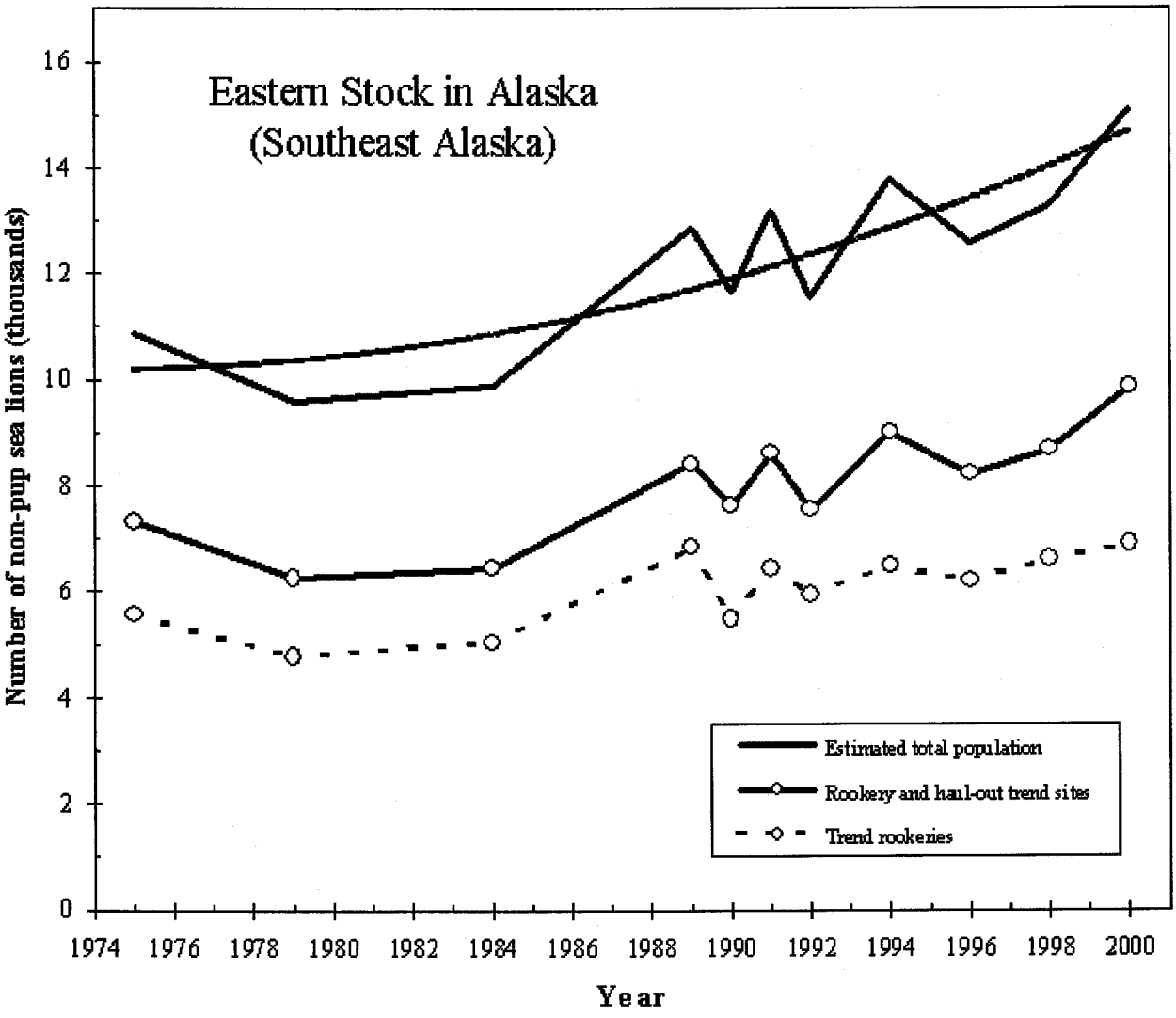


Figure 3.1-5 **Counts of Steller sea lions in the eastern stock, 1982-1998 (adapted from Angliss *et al.*, 2001).**

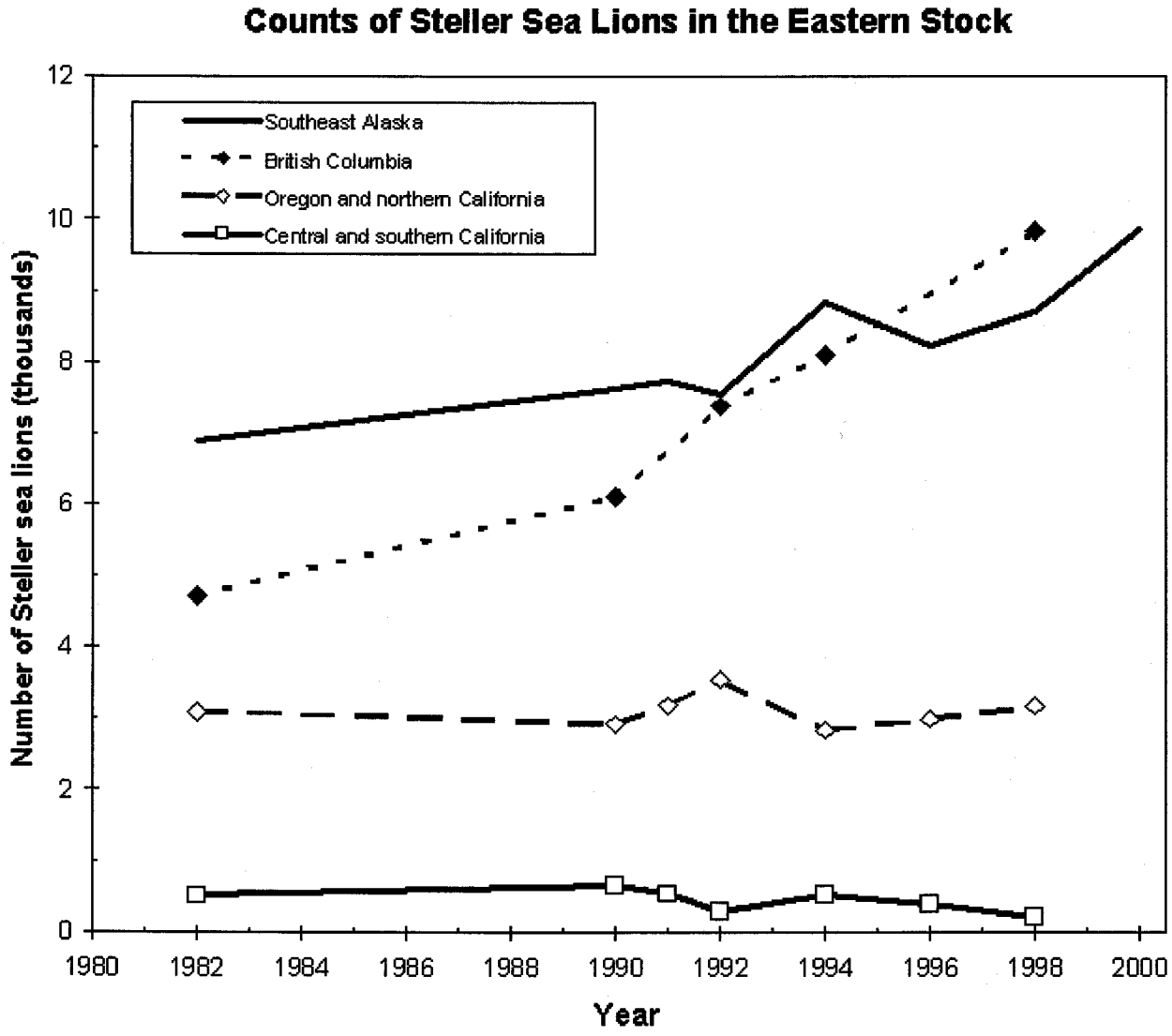


Figure 3.1-6 Distribution of Steller sea lions in the Bering Sea and Western/Central Gulf of Alaska from the Platform of Opportunity (POP) Database (NMFS Data).

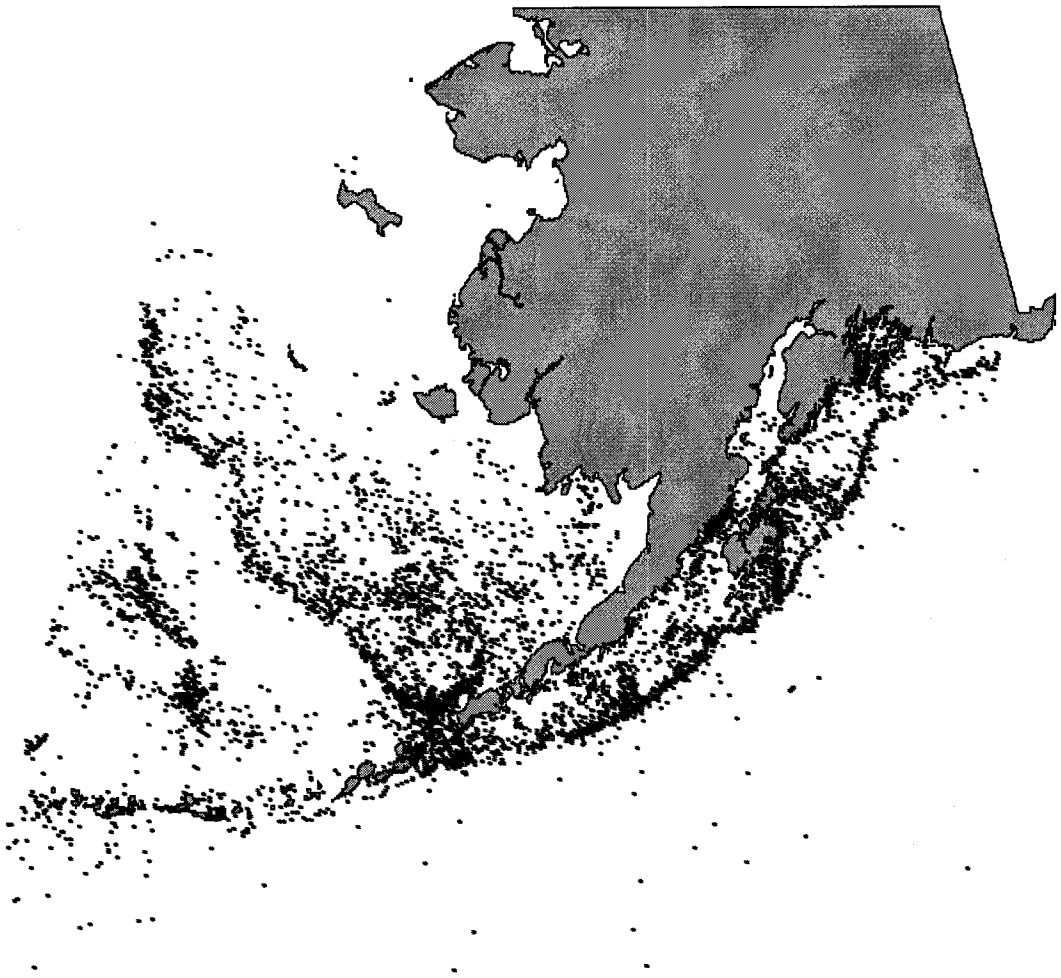


Figure 3.1-7 Proportion of dives by depth range for young-of-the-year (WYOY) and adult female Steller sea lions in summer (SAF) and winter (WAF) tracked during 1990-1993 (Merrick and Loughlin, 1997).

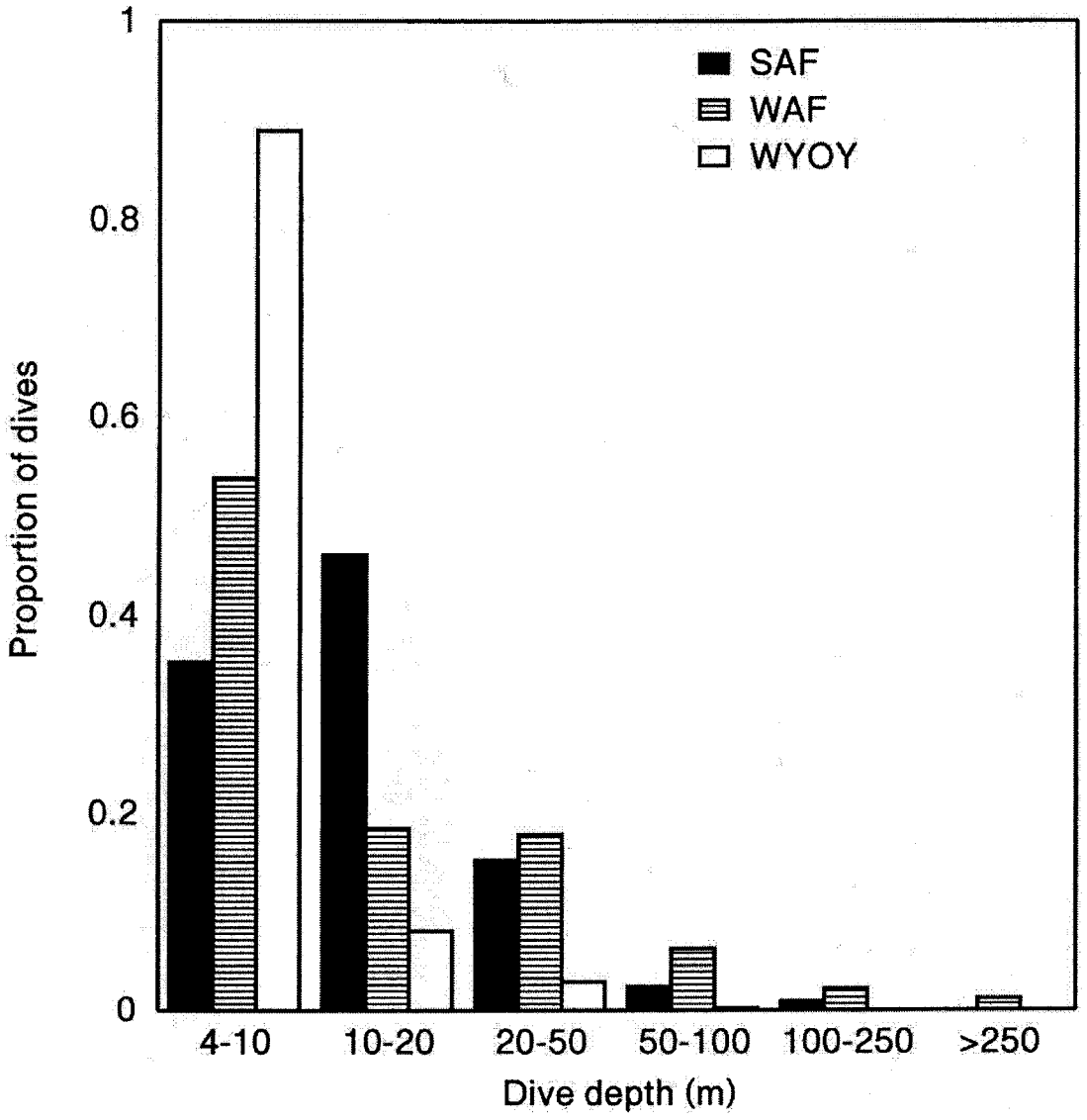


Figure 3.1-8 Frequency of occurrence of prey items occurring in Steller sea lion scats, in all regions and seasons, 1990-1998 (Sinclair and Zeppelin, submitted).

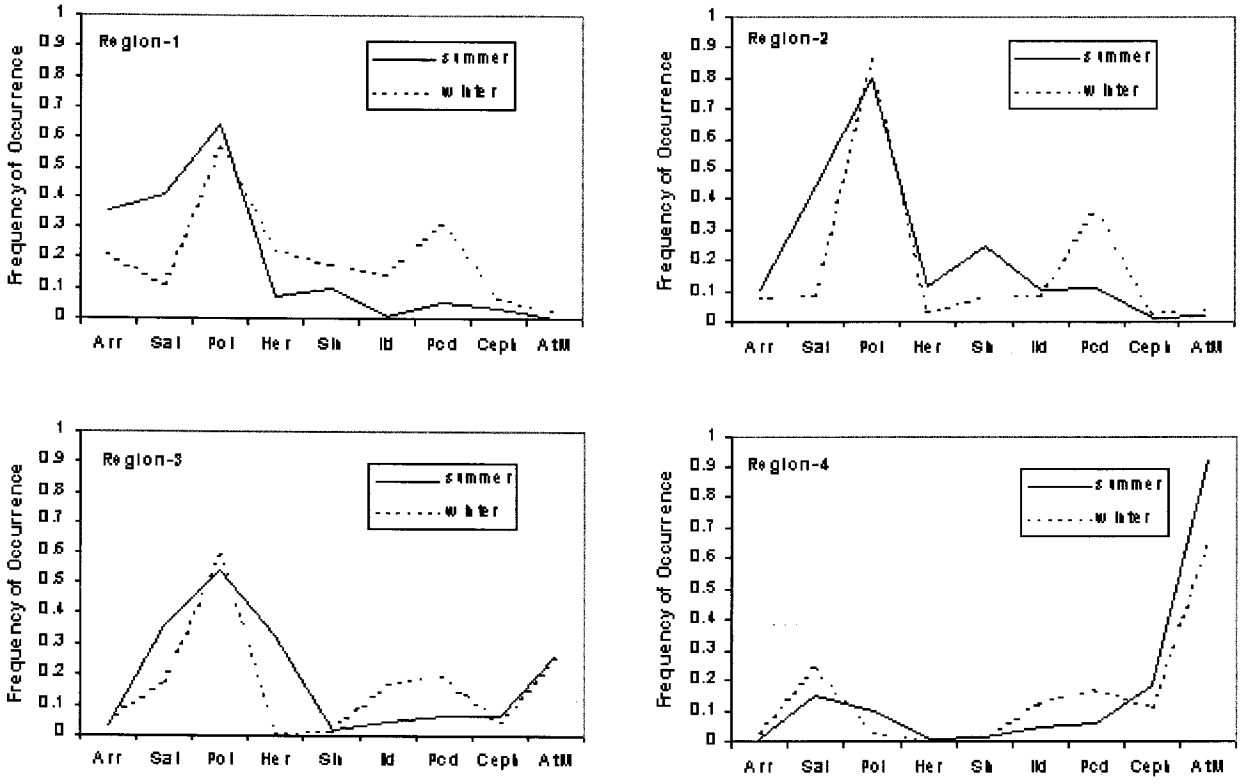


Figure 3.1-9 Steller sea lion diet divisions in relation to population trends (1989-1994) (Sinclair and Zeppelin, submitted).

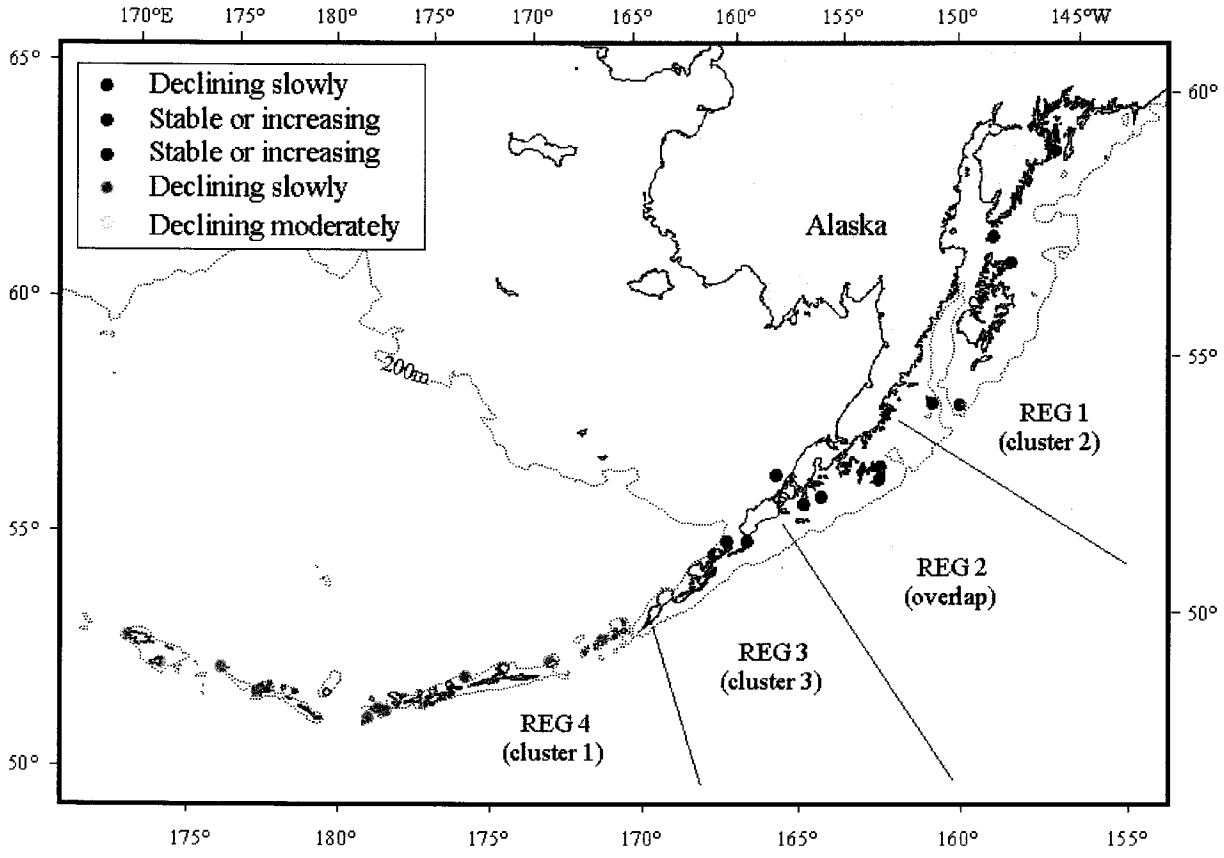
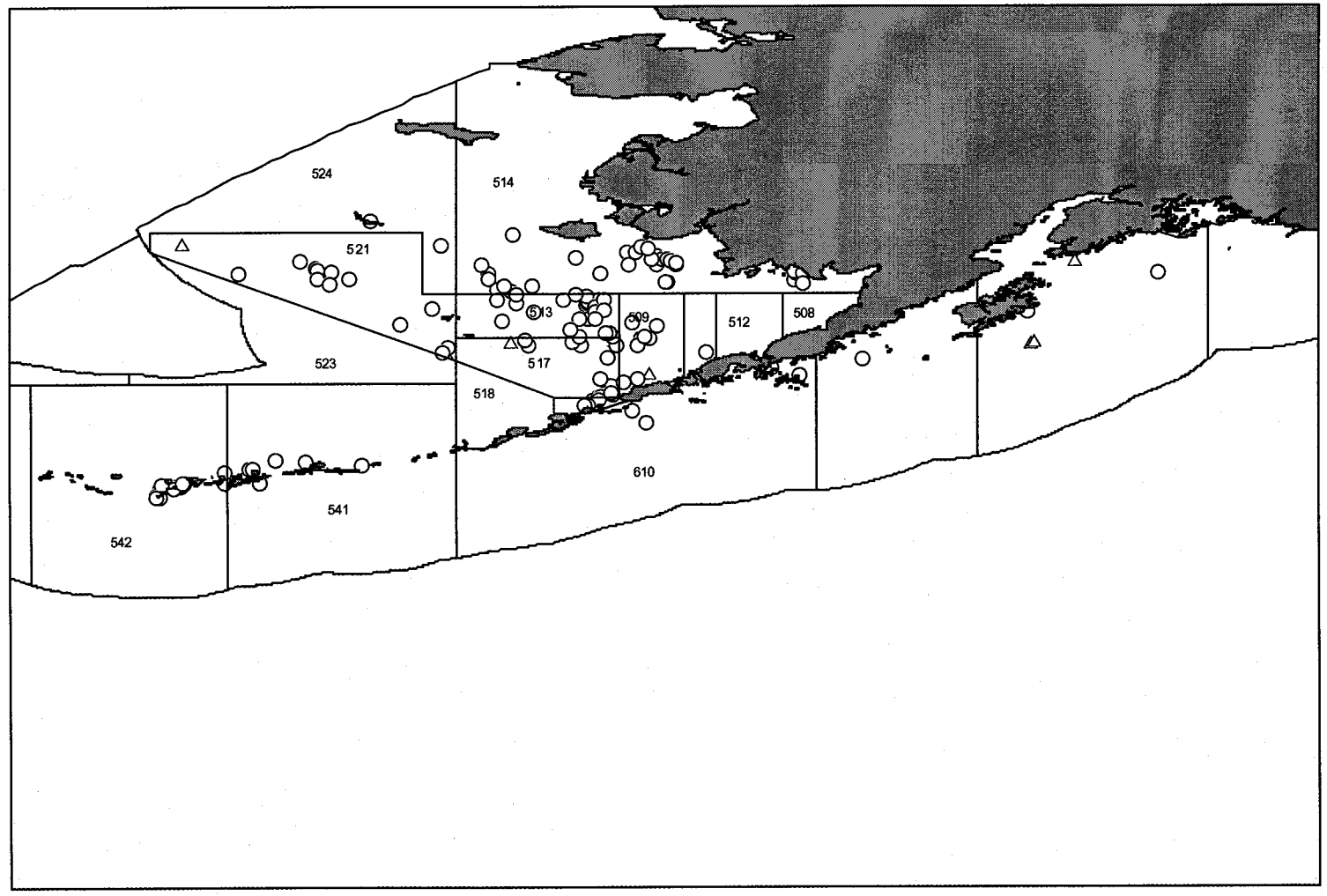


Figure 3.1-10 Locations of Observed Steller Sea Lions Incidentally Caught in Domestic Groundfish Trawl (circles) and Longline (triangles) Fisheries, 1989-1999.



3.2 Principal Target Groundfish Fish Species

In this section, descriptions are provided of the principal target groundfish species affected by proposed fisheries management changes under the Steller sea lion (SSL) protection measures alternatives; walleye pollock (Section 3.2.1), Pacific cod (Section 3.2.2), and Atka mackerel (Section 3.2.3). Information presented for these species includes a brief description of life history and stock structure, trophic interactions (particularly as related to SSL), the fishery, stock assessment, and the acceptable biological catch (ABC) as recommended in the most recent stock assessments. The ABC recommendations are described using the Tier system defined under Amendment 56 to the Bering Sea Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Groundfish Fisheries Management Plans. The information presented for each species supports the development of this SEIS and is not intended to be exhaustive.

Several other groundfish species are targeted in the Alaska groundfish fishery. These species are described in Section 3.2.4, but are not covered in great detail here as no changes in management directly affecting these species are proposed under this SEIS. Detailed information on these species and additional information on the principal target species described herein can be found in the following documents: Environmental Assessment for Essential Fish Habitat (NPFMC 1999a); Essential Fish Habitat Assessment Report for the Groundfish Resources of the Bering Sea and Aleutian Islands (BSAI) Region (NPFMC 1998a); Essential Fish Habitat Assessment Report for the Groundfish Resources of the Gulf of Alaska (GOA) Region (NPFMC 1998b); the year 2000 Stock Assessment and Fishery Evaluation Reports (SAFE Report) for the Groundfish Resources of the Bering Sea/Aleutian Islands and Gulf of Alaska Regions (NPFMC 2000a, 2000b); and the Draft Programatic SEIS (NMFS 2001a). Harvest data for all groundfish species for the year 2000 is available from NMFS (2001f)

3.2.1 Pollock

Walleye pollock (*Theragra chalcogramma)* is the most abundant groundfish species in the eastern Bering Sea (EBS) and the second most abundant groundfish stock in the GOA. It supports the largest fishery in Alaskan waters. Pollock is also known to be a major prey item of Steller sea lions. Concerns regarding the possible adverse effects of the fishery for pollock and other groundfish species on sea lions has prompted the development of this SEIS. Modification of the spatial and temporal distribution of the pollock fishery are central to this SEIS. For this reason pollock are covered in some detail here. More detailed information regarding the pollock and the pollock fishery is available in the Draft Programatic SEIS (NMFS 2001a) and the 2000 SAFE Reports (NPFMC 2000c, 2000d).

Stock Description and Life History

Pollock is the most abundant fish species within the eastern Bering Sea and the second most abundant groundfish stock in the GOA. It is widely distributed throughout the North Pacific Ocean in temperate and subarctic waters (Wolotira *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 southeast, north of Unimak Pass. In the GOA, the largest spawning concentrations occur in Shelikof Strait and the Shumagin Islands (Kendall *et al.* 1996). 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 pollock stocks are recognized in the BSAI for management purposes: eastern Bering Sea, Aleutian Islands, and Aleutian Basin. 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 eastern Bering Sea has been studied extensively (Dwyer 1984; Lang and Livingston 1996; Livingston 1991a; Livingston and DeReynier 1996; Livingston *et al.* 1993). Juvenile pollock are pelagic and feed primarily on copepods and euphausiids. As they age, pollock become increasingly piscivorous and can be highly cannibalistic. Juvenile pollock is known to be the dominant fish prey of adult pollock in the EBS. Other fish consumed by pollock include juveniles of Pacific herring, Pacific cod, arrowtooth flounder, flathead sole, rock sole, yellowfin sole, Greenland turbot, Pacific halibut, and Alaska plaice. On the shelf area, 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 1991a; Livingston and DeReynier 1996; Livingston *et al.* 1993). 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 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 *et al.* 1987). Early juveniles (25–100 mm) primarily eat juvenile and adult copepods, larvaceans, and euphausiids; late juveniles (100–150 mm) eat mostly euphausiids, chaetognaths, amphipods, and mysids (Brodeur and Wilson 1996; Grover 1990; 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 are the dominant prey of GOA pollock, constituting a relatively constant proportion of the diet by weight across size classes. Shrimp and fish are the next two important prey items. Copepods are a less dominant food source (Yang 1993). Fish prey become an increasing fraction of GOA pollock diet with increasing size. A high diversity of species are preyed upon. Over 20 different fish species have been identified in the stomach contents of GOA pollock, with capelin being the dominant prey (Yang 1993). Commercially important prey species include Pacific cod, pollock, arrowtooth flounder, flathead sole, Dover sole, and Greenland turbot. In addition to capelin, forage fish including eulachon and Pacific sand lance were also found in pollock stomach contents.

Various studies have modeled pollock cannibalism and other sources of predation, particularly in the eastern Bering Sea (Dwyer 1984; Honkalehto 1989; Knechtel and Bledsoe 1981, 1983; Laevastu and Larkins 1981; Livingston 1991b, 1993, 1994; Livingston *et al.* 1993; Livingston and DeRenyier 1996; Wespestad and Dawson 1992). Early efforts treated cannibalism in either a static or dynamic fashion. Trends in more recent efforts have used more standard stock assessment procedures such as virtual population analysis or integrated catch age models (Methot 1990). In summary, modeling efforts for pollock populations in total lead to the following conclusions regarding the effects of predation from cannibalism and other sources affecting recruitment and population dynamics:

- Cannibalism is a stabilizing influence on pollock populations. Modeled populations including cannibalism show less variation than when this factor is not included.
- Cannibalism is the largest source of juvenile predation, and is apparently responsible for observed declines in recruitment at high levels of pollock spawning biomass.

- 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 are not constant, varying across time with changes in predator abundance but perhaps also with heavier predation on more abundant year classes.
- Environmental factors such as surface currents are important determinants juvenile pollock survival, transporting larvae to areas with more or less favorable food availability and predation levels from adults or other sources.
- Availability of zooplankton prey is limiting, particularly for adult pollock.
- Under conditions simulating the current fishing mortality rate ($F = 0.3/yr^{-1}$) modeled pollock populations tend toward equilibrium.
- Maximization of average catch in the eastern Bering Sea occurs at a modeled fishing mortality rate approximately 10 times higher than the current F value ($F = 3.0/yr^{-1}$).

The modeling efforts summarized above, and the extent and dynamics of pollock cannibalism are described in more detail in the Alaska Groundfish Fishery Draft PSEIS (NMFS 2001a).

While cannibalism is the significant source of juvenile mortality in the EBS, several other groundfish predators are also important consumers. Other juvenile pollock predators include Greenland turbot, arrowtooth flounder, Pacific cod, halibut, and flathead sole (Livingston 1991b; Livingston and DeReynier 1996; Livingston *et al.* 1993). These species are some of the more abundant groundfish in the EBS, and pollock constitute a large proportion of their diets. Other less abundant species that consume pollock include Alaska skate, sablefish, Pacific sandfish, various sculpins, and small-mouthed flounders such as yellowfin sole and rock sole (Livingston 1989; Livingston *et al.* 1993; Livingston and DeReynier 1996). Age-0 and age-1 pollock are the targets of most of these predators, with the exception of Pacific cod, halibut, and Alaska skate, which may consume pollock ranging in age from age-0 to greater than age-6.

Unlike the EBS, the main source of predation mortality on GOA pollock at present appears to be from the arrowtooth flounder instead of cannibalism (Livingston 1994). Other dominant GOA groundfish populations that prey on pollock include sablefish, Pacific cod, and 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 halibut in this area. Other predators include great sculpins (Carlson 1995) and shortspined thornyheads (Yang 1993). As in the eastern Bering Sea, halibut and Pacific cod tend to consume larger pollock, while arrowtooth flounder consume pollock that are mostly under age 3. Predation mortality on juvenile pollock in the GOA appears to be an increasingly controlling factor on recruitment. Prior to the ecological regime shift of the late 1970s, environmental factors controlling larval survival appeared to be the dominant factor controlling recruitment. Since this shift however, juvenile predation by expanding populations of predatory flatfish and cod has become the principal controlling factor.

Pollock is a major prey item for Steller sea lions in the GOA and the Bering Sea (Merrick and Calkins 1996; Pitcher 1980a, 1980b, 1981). In the GOA, pollock is a major prey of both juvenile and adult Steller sea lions. 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 GOA Steller sea lions range from 5 to 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. In the Bering Sea, the preponderance of available data indicates that pollock and Atka mackerel are currently the two dominant prey species. Pollock is the principal prey year around in the Bering Sea out to the central Aleutian

Islands. In the Aleutian Islands, pollock is replaced by Atka mackerel as the major prey source (see Section 3.1.1.7).

Pollock is also significant prey item for other species of marine mammals in the eastern Bering Sea. Studies suggest that pollock is a primary prey item of northern fur seals when feeding on the shelf during summer (Sinclair *et al.* 1997 and 1994). The pollock consumed by fur seals are primarily age 0 and age 1 fish. Older age groups of pollock may appear in the diet, when young pollock are less abundant (Sinclair *et al.* 1997). Pollock has been noted as a prey item for other pinnipeds, including harbor seals, spotted seals, and ribbon seals. Harbor seals tend to have a variable diet and the pollock component varies with abundance. Spotted seals and ribbon seals feed on pollock in the winter and spring in the areas of drifting ice and pollock are their most common prey during these seasons (Lowry *et al.* 1997). Fin whales, minke whales, and humpback whales in the EBS are also known to be pollock predators. Stomach samples from the whale species have been very limited, so the importance of pollock in their diets has not been well-defined (Kajimura and Fowler 1984).

In the EBS, age 0 and age 1 pollock are variably the dominant component in the diets of northern fulmars, black-legged kittiwakes, common murres, and thick-billed murres. Red-legged kittiwakes also consume pollock but tend to rely more heavily on myctophids (Hunt *et al.* 1981; Kajimura and Fowler 1984; Springer *et al.* 1986). These species are the dominant avifauna of the eastern Bering Sea (Kajimura and Fowler 1984; Shuntov 1993). Fluctuations in chick production by kittiwakes have been linked to the availability of fatty fishes, such as myctophids, capelin, and Pacific sand lance (Hunt *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).

Research on the diets of marine mammals and birds in the GOA was less intensive than for the Bering Sea, but has recently 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, 1980b, 1981) (Section 3.5). The main piscivorous birds that consume pollock in the GOA are black-legged kittiwakes, common murres, thick-billed murres, tufted puffins, horned puffins, and probably marbled murrelets. The diets of common murres have been shown to contain around 5 percent to 15 percent age 0 pollock by weight, depending on the season. Both horned puffins and tufted puffins consume age 0 pollock (Hatch and Sanger 1992). The amount of pollock in the diet of tufted puffins 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 puffins at the Semidi Islands varied by year and was related to pollock year-class abundance. Seabird reliance on pollock and other groundfish as prey is covered in more detail in Section 3.7.

The Fishery

Pollock supports the largest fishery in Alaskan waters. In the BSAI, pollock comprise 75–80 percent of the total annual catch. In the GOA, pollock constitute 25–50 percent of the catch. Fisheries management has restricted pollock to be harvested with pelagic trawl gear to minimize the potential interaction with other groundfish species and to reduce the magnitude of bottom disturbance. Pollock are also caught with bottom-trawl gear as bycatch from other fisheries.

The directed fishery for BSAI pollock is conducted by catcher-processors and catcher vessels using pelagic and bottom trawl gear. The season has traditionally been broken into two parts, a roe season during early winter, and a surimi (imitation crab) and filet season during the second half of the year. Currently, to minimize the potential indirect interaction with Steller sea lions, the seasons have been managed to occur over broader areas and over longer seasons. Observed pollock fishery trawl locations in 1999 by season are shown in Figure 3.2-1.

BSAI pollock are caught as bycatch in other directed fisheries, but because they occur primarily in well-defined aggregations, the impact of this bycatch is typically minimal. Recent discard rates through the early 1990s (discards/retained catch) of pollock in the directed fishery have been about 7–8 percent, reaching as high as 11 percent. In 1998, the discard rate dropped to 1.5 percent due to prohibitions on the discarding of pollock in fisheries where pollock are in bycatch-only status (trawl Pacific cod, rock sole, and yellowfin sole fisheries). In 1999, the discard rate was estimated at 3.0 percent (Iannelli *et al.* 2000).

In the GOA, major exploitable concentrations are found primarily in the Central and Western Regulatory Areas (147°W–170°W). Pollock from this region and the West Yakutat District are managed as a single stock that is separate from the BSAI pollock stocks (NPFMC 2000d). The pattern of the fishery generally reflects the broad spatial distribution of pollock throughout the central and western regions of the GOA. Shifts in the location of fishable concentrations of pollock reflect the seasonal migrations to spawning locations. The fishery generally occurs at depths between 100 and 200 m (Hollowed *et al.* 1997). Observed pollock fishery trawl locations in 1996 are shown in Figure 3.2-2. Important pollock fishery locations include Shelikof Strait, the canyon regions of the east side of Kodiak Island, and Shumagin Canyon.

Megrey (1989) documented the historical expansion of the pollock fishery in the GOA. He identified four phases of expansion, beginning with a developmental phase between 1964 and 1971 when the fishery was dominated by foreign trawlers that incidentally captured pollock in mixed-species catches. The second phase occurred between 1972 and 1980, when directed pollock harvests were initiated by foreign and joint-venture fisheries. Floating freezer-surimi trawlers were active in the GOA during the second phase of fishery development. The third phase of development occurred between 1981 and 1985. This phase was characterized by joint-venture operations. During this period, the Shelikof Strait spawning concentrations were discovered. Surimi production and roe harvest were emphasized during this phase of development. In recent years, foreign vessels have been eliminated from the pollock fishery. This final phase was marked by the passage of the inshore/offshore amendment, which mandated that 100 percent of the pollock catch be processed at shoreside plants. During this period the fishing community moved from a bottom trawl fishery to a pelagic fishery due to management measures established to control bycatch of prohibited species. Pacific halibut taken in the pollock fishery are added to the total for the shallow water complex halibut mortality cap. When the halibut cap is reached for the shallow water complex, trawling for species in the complex is prohibited, except for vessels using pelagic trawls.

In 2000, revised final Reasonable and Prudent Alternatives (RFRPAs) were implemented to reduce the potential for adverse modification of SSL foraging habitat (NMFS 1998b). The RFRPAs modify the TAC allocation in the BSAI and GOA to achieve this goal. Three types of measures were implemented in each area:

- Additional pollock fishery exclusion zones around sea lion rookery or haulout sites,
- Phased in reductions in the seasonal proportions of TAC that can be taken from critical habitat, and
- Additional seasonal TAC releases to disperse the fishery over time.

As a result of the RFRPAs, an additional 83,080 km^2, or 22 percent of critical habitat, was closed to the pollock fishery in the Aleutian Islands, and 43,170 km^2 was closed in the GOA and eastern Bering Sea. Consequently, after the RFRPAs were implemented, and total of 210,350 km^2, or 54 percent, of critical habitat was closed to the fishery. The remainder consisted primarily of the area between 10 and 20 nm from rookeries and haulouts in the GOA and parts of the EBS foraging area.

The BSAI fishery was also subject to reductions in total catch and changes in catch distribution. The reductions resulted from closures of the Aleutian Islands region to pollock fishing, and by phased in reductions in the proportions of seasonal TAC that could be caught in the Sea Lion Conservation Area, which overlaps considerably with critical habitat. The closure of the Aleutian Islands region reduced the amount of pollock caught in the area from 22,000 mt in 1998 to zero metric tons in 1999 and 2000 (Ianelli *et al.* 2000). Specific modifications to the GOA and BSAI fisheries are described in more detail in Section 2.2.

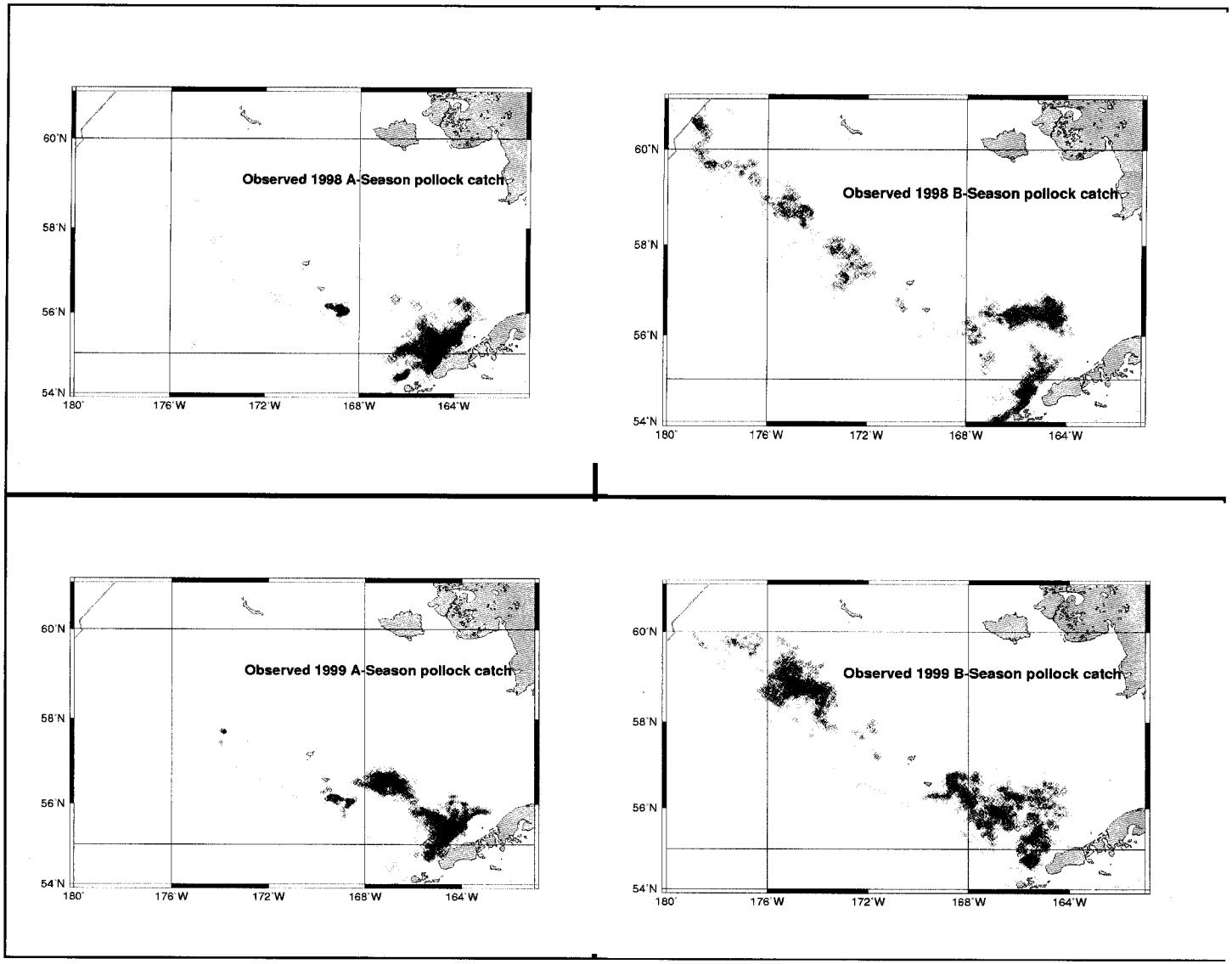


Figure 3.2-1 Distribution of fishery operations during 1998–1999. A-Season represents pollock caught during January 20–March 31, B-Season represents pollock caught during the second half of the calendar year. Source: NMFS

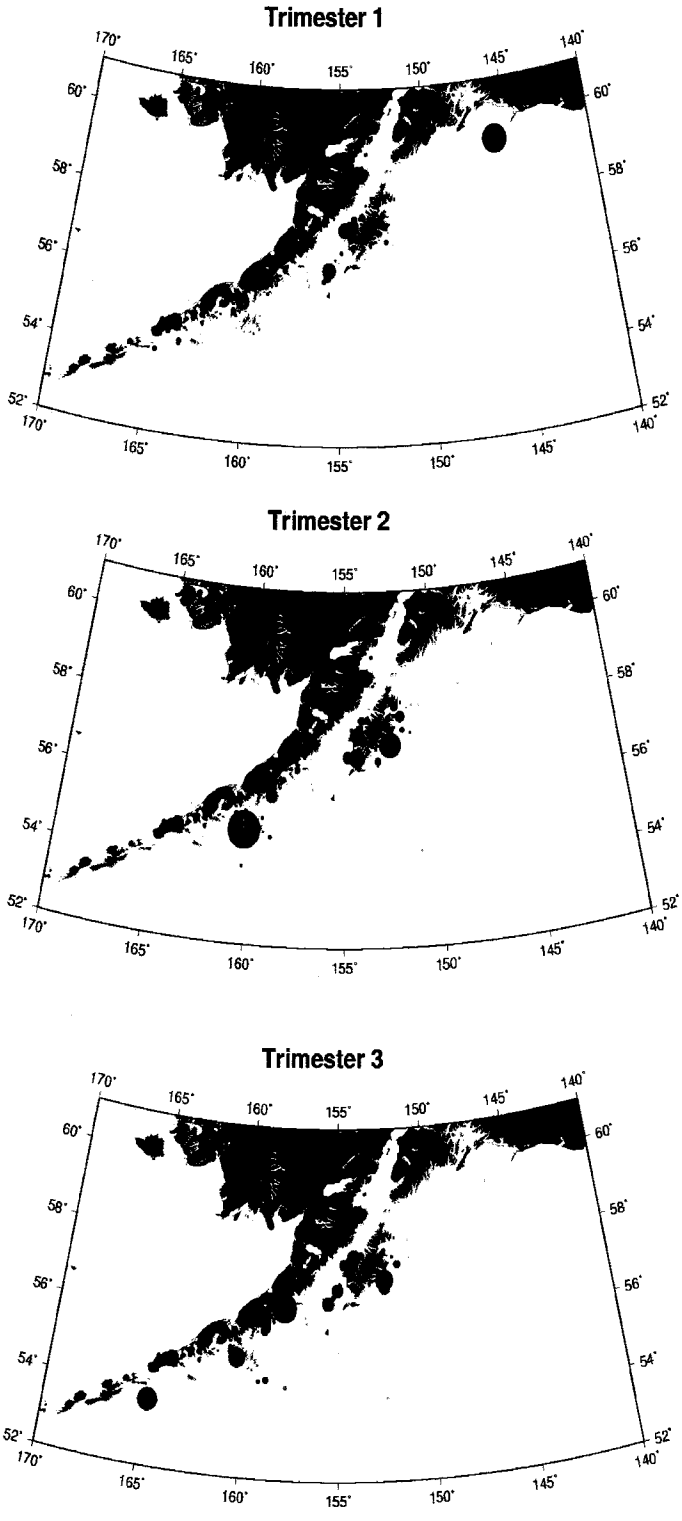


Figure 3.2-2 Distribution of observed trawl locations in the Gulf of Alaska where pollock was the target species, 1996. Source: NMFS

Stock Assessment

Currently, information on pollock in the EBS comes from the National Marine Fisheries Service (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 Strait 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. In addition, 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; annual bottom trawl surveys (from 1982 to 1997), and triennial echo-integration trawl (EIT) surveys. The results of the statistical model applied to these data are updated annually and presented in the BSAI pollock chapter of the annual SAFE report. Included in the year 2000 SAFE Report are separate analyses on pollock stocks in the Aleutian Islands and Bogoslof areas (Ianelli *et al.* 2000). 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 both the plan team and the Council's Scientific and Statistical Committee before being presented to the Council.

Data available through the year 2000 has been used to estimate the age structure of the EBS pollock stock. Pollock ages 4 through 15 represent the recruited population of this stock. The age composition of the recruited population has historically been dominated by strong year classes. Most recently there appears to be a larger-than-average year-class for 1996; prior to that, the 1989 year class was very large. The abundance of these year classes is evident from the EIT and bottom trawl surveys, in addition to extensive age-composition data for the fishery. The fishery for EBS pollock has demonstrated variable selectivity over time, but generally targets fish that are 5 or more years old. The selectivity of the fishery has cumulative impacts on stock structure over time.

Like the EBS stock, GOA pollock are assessed with an age-structured model incorporating fishery, bottom trawl, and EIT survey data. The data and data sources used to derive estimates of age composition are detailed in Section 3.3.1.1 of the Draft Programatic SEIS (NMFS 2001a), and in the pollock chapter of the 2000 SAFE Report (Dorn *et al.* 2000). 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). Ages 3 through 15 represent the recruited population in the GOA stock, although reliable estimates of abundance for ages 2 and above exist. Based on observer sampling of pollock catch, the GOA stock as of 1999 was dominated by a strong year classes in 1994 and 1995. The large 1988 and 1989 year classes were still evident in the population, but their relative abundance was much lower than in previous years (Dorn *et al.* 2000).

Ongoing research efforts are targeted on the processes influencing recruitment of pollock in the GOA. These efforts are reviewed in Section 3.3.1.1 of the Draft Programatic SEIS (NMFS 2001a). The best available data and information available from these efforts 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. This is demonstrated by the apparent shift in control of recruitment from environmental

influences on larval mortality to increasing juvenile predation from expanding populations of predatory flatfish (Bailey and Macklin 1994; Bailey et al 1996; Bailey 2000; Bograd *et al.* 1994; Canino 1994; Hermann *et al.* 1996; Hollowed and Wooster 1995; Kendall *et al.* 1996; Megrey *et al.* 1996; Schumacher *et al.* 1993; Stabeno *et al.* 1995; Theilacker *et al.* 1996).

Acceptable Biological Catch as Recommended in the Most Recent Stock Assessments

Acceptable biological catch (ABC) and total allowable catch (TAC) limits relative to overfishing levels (OFLs) for the BSAI and GOA pollock stocks in 2001 are presented in Table 3.2-1. These values are based on the most recent stock assessments as reported in the Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the BSAI (Ianelli et al 2000) and the GOA (Dorn *et al.* 2000). The BSAI has been split into three separate areas for identification of ABC; EBS, Aleutian Islands, and Bogoslof. ABC and TAC determination for each area are discussed further below.

Based on information available for projecting harvest alternatives in 2000, estimates of maximum sustianable yield (MSY) were available for the EBS pollock stock which would allow for classification under Tier 1 of the ABC and overfishing levels (OFL) definitions. The fishing mortality used to set ABC (F_{ABC}) may be less than this level, but not greater. However, given that the reliability of the reference points used to set MSY was questionable, the option was retained to classify the pollock stock under either Tier 1a or Tier 3a of the ABC/OFL definitions (Ianelli *et al.* 2000).

The estimate of biomass of spawning female pollock for the EBS in 2001 is 2.761 million metric tons (mt). This was well above the $B_{40\%}$ value of 2.426 million tons. Under Tier 1a, this equates to a max ABC of 2.125 million mt. Under Tier 3a, this equates to a max ABC of 1.842 million mt, relative to an OFL of 3.536 million mt. The total stock biomass (age 3+) is estimated at 10.5 million mt (Ianelli *et al.* 2000). The more conservative ABC was selected for 2001 to provide stability for the fishery, provide added conservation for SSL protection, and to compensate for uncertainty regarding unknown levels of pollock harvest in Russian waters. This corresponds to a TAC of 1.4 million mt for the BSAI in 2001 (Table 3.2-1).

Separate OFL, ABC, and TAC levels were calculated for the Aleutian Island and Bogoslof District components of the EBS pollock stock per request of the (NPFMC) plan team. Current information indicates that these fish belong to the same group of 4 to 5 year old adults which are distinct from the EBS stock, partitioned primarily by age structure (although not necessarily a genetically distinct stock). This separation appears to be density dependent, driven by the influences of strong year classes on the surrounding shelves in the US or Russian EEZ. Due to limited information, these "stocks" are managed under Tier 5 of the ABC/OFL definitions. Based on available information, the ABC for the Aleutian Island stock for 2001 is set at 23,800 mt. The TAC for this area is set at 2,000 mt, well below the estimated OFL of 31,700 mt. The ABC for the Bogoslof region in 2001 is set at 8,470 mt. The TAC is set at 1,000 mt, again well below the estimated OFL of 60,200 mt. The same TACs were set for both areas in 2000, and incidental catch of pollock (the only source of fishing mortality) was well below these levels (Table 3.2-1).

In 2000, GOA pollock east of 140 W longitude fell into subtier 'b" of Tier 3 of the ABC/OFL definitions, which require reliable estimates of biomass, $B_{40\%}$, and fish mortality $F_{30\%}$ and $F_{40\%}$ (Dorn *et al.* 2000). Under the definitions and current stock conditions, the overfishing rate is the fishing mortality rate that reduces the spawner stock biomass to 35 percent of its unfished level (the $F_{35\%}$ rate). Spawning biomass in 2001 was projected to be 204,600 mt, which is less than $B_{40\%}$. This translated to a recommended 2001 ABC of 99,350 mt for the combined W/C/WYK area , and a corresponding TAC of 89,615 mt for the area. In the Southeast Outside District pollock fell into Tier 5, OFL was set at 8,160 mt and ABC and TAC levels were set at 6,460

mt. Gulfwide OFL, ABC, and TAC levels are presented in Table 3.2-1. Current harvest rates were set to ensure a healthy spawning stock, large enough to ensure successful recruitment over long time and recruitment variations in both the BSAI and GOA..

Table 3.2-1 Estimated Overfishing Levels (OFL), Acceptable Biological Catch (ABC), and Total Acceptable Catch (TAC) for Pollock in the BSAI and GOA for 2001, and Total Catch Figures for 2000 by Area (all values in metric tons)

Area	OFL	ABC	TAC	2000 Catch
Eastern Bering Sea	3,536,000	1,842,000	1,400,000	1,019,067
Aleutian Islands	31,700	23,800	2,000	1,174
Bogoslof	60,200	8,470	1,000	29
Gulf of Alaska	126,360	105,810	95,875	71,877

Source: National Marine Fisheries Service - Alaska Regional Office, fishery updates and reports, available at http://www.fakr.noaa.gov

3.2.2 Pacific Cod

Pacific cod (*Gadus macrocephalus*) is an important fishery in both the BSAI and GOA. It is the second largest groundfish fishery overall. Pacific cod is known to be important prey for Steller sea lions year around, becoming more significant during winter months when salmon are less available (see Section 3.1.1.7.3). Concerns regarding the possible adverse effects of the fishery for Pacific cod and other groundfish species on sea lions has prompted the development of this SEIS. Modification of the spatial and temporal distribution of the Pacific cod fishery are central to the alternatives analyzed in this SEIS. Hence this species is described in additional detail. More detailed information on the Pacific cod fishery is available in the Draft Programmatic SEIS (NMFS 2001a) and the SAFE Reports for 2000 (NPFMC 2000c, 2000d).

Stock Description and Life History

Pacific cod 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 GOA and Aleutian Islands. GOA, Bering Sea, and Aleutian Islands cod stocks are genetically indistinguishable (Grant *et al.* 1987), and tagging studies show that cod migrate seasonally over large areas (Shimada and Kimura 1994).

Pacific cod spawn in the late winter, massing in large spawning aggregations 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 GOA (Shimada and Kimura 1994). Spawning takes place in the sublittoral–bathyal zone near the bottom—the area of the continental shelf and slope about 40–290 m deep. The eggs sink to the bottom and are somewhat adhesive (Hirschberger and Smith 1983).

Pacific cod reach a maximum recorded age of 19. Estimates of natural mortality vary widely, ranging from 0.29 (Thompson and Shimada 1990) to 0.83–0.99 (Ketchen 1964). For stock assessment purposes, a value of 0.37 is used in both the BSAI (Thompson *et al.* 1999) and the GOA (Thompson and Dorn 1999). In the BSAI, 50 percent of Pacific cod are estimated to reach maturity by the time they reach 67 cm in length, or

an age of about 5 years (Thompson and Dorn 1999). The same length in the GOA stock corresponds to an age of about 7 years (Thompson *et al.* 1999)

Trophic Interactions

Pacific cod are omnivorous. In the BSAI and GOA, 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. 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 piscivorous (Livingston 1991a). Predators of juvenile Pacific cod include pollock and the predatory flatfishes. Adult Pacific cod are preyed upon by halibut and salmon shark. Marine mammal predators include Steller sea lions, northern fur seals, harbor porpoises, various whale species, and tufted puffins (Westrheim 1996).

Frequency of occurrence (FO) analyses of Pacific cod in the diet of Steller sea lions indicate that overall Pacific cod is a major prey item behind pollock, Atka mackerel, and salmon. During winter months when salmon are less available, the FO of cod in sea lion diet increases. Studies of winter diet indicate that Pacific cod have become a top prey item for both the western stock and the eastern stock of Steller sea lions since the 1970s (see Section 3.1.1.7.3).

Fishery

The Pacific cod fishery is the second largest Alaskan groundfish fishery. In 2000, Pacific cod constituted 12 percent of the groundfish catch in the BSAI and 27 percent of the groundfish catch in the GOA. The fishery for Pacific cod is conducted with bottom trawl, longline, pot, and jig gear. Of these, the fishery conducted with jig gear is by far the smallest. More than 100 vessels participate in each of the three larger fisheries. The age at 50 percent recruitment to the fishery varies between regions. For trawl, longline, and pot gear, the ages at 50 percent recruitment in the EBS are approximately four and five years, respectively (Thompson *et al.* 1999, 2000). For all three gears, the age at 50 percent recruitment in the GOA is approximately six years (Thompson and Dorn 1999, 2000). The trawl fishery is typically concentrated during the first few months of the year, whereas fixed-gear fisheries may sometimes run essentially year-round. Bycatch of crab and halibut often causes the Pacific cod fisheries to close prior to reaching the TAC. In the EBS, trawl fishing is concentrated immediately north of Unimak Island, whereas the longline fishery is distributed along the shelf edge to the north and west of the Pribilof Islands. In the GOA, the trawl fishery has centers of activity around the Shumagin Islands and south of Kodiak Island, while the longline fishery is located primarily in the vicinity of the Shumagins. Pacific cod is also taken as bycatch in a number of trawl fisheries. In the EBS, Pacific cod is taken as bycatch in the trawl fisheries for pollock, yellowfin sole, and rock sole. In the Aleutian Islands region, Pacific cod is taken as bycatch in the trawl fishery for Atka mackerel. In the GOA, Pacific cod is taken as bycatch in the trawl fisheries for shallow water flatfish, arrowtooth flounder, and flathead sole. Since 1998, discarding of Pacific cod has been prohibited except in fisheries which Pacific cod has bycatch only status.

Stock Assessment

Beginning with the 1993 BSAI SAFE report (Thompson and Methot 1993) and the 1994 GOA SAFE report (Thompson and Zenger 1994), a length-based synthesis model (Methot 1990) has formed the primary analytical tool used to assess Pacific cod. Although the Pacific cod stocks in the EBS and GOA are modeled separately, the model structures in recent years have been identical (Thompson and Dorn 2000; Thompson

et al. 2000). No formal assessment model exists for the Aleutian Islands portion of the BSAI stock. Instead, results from the EBS assessment are inflated proportionally to account for Aleutian Islands fish.

Annual trawl surveys in the EBS and triennial trawl surveys in the Aleutian Islands and GOA are the primary fishery-independent sources of data for Pacific cod stock assessments (Thompson and Dorn 2000; Thompson *et al.* 2000). For the most recent assessments, fishery size compositions were available, by gear, from Aleutian Islands bottom trawl surveys for the years 1978 through 1997. For the year 2000 stock assessment, size composition data from the 2000 eastern Bering Sea bottom trawl surveys were incorporated.

The catch history was divided into two portions, determined by the relative importance of the domestic fishery. A *pre-domestic* portion was defined as those years in which the domestic fishery took less than half the catch, and a *domestic* portion was defined as those years in which the domestic fishery took at least half the catch. Within each year (in both portions of the time series), catches were divided according to three time periods: January–May, June–August, and September–December. This particular division, which was suggested by participants in the EBS fishery, is intended to reflect actual intra-annual differences in fleet operation (e.g., fishing operations during the spawning period may be different than at other times of year). Four fishery size composition components were included in the likelihood functions used to estimate model parameters: the period 1 trawl fishery, the periods 2–3 trawl fishery, the longline fishery, and the pot fishery. In addition to the fishery size composition components, likelihood components for the size composition and biomass trend from the bottom trawl surveys were included in the model. All components were weighted equally.

Quantities estimated in the most recent stock assessments include parameters governing the selectivity schedules for each fishery and survey in each portion of the time series, parameters governing the length-at-age relationship, population numbers at age for the initial year in the time series, and recruitments in each year of the time series. Given these quantities, plus parameters governing natural mortality, survey catchability, the maturity schedule, the weight-at-length relationship, and the amount of spread surrounding the length-at-age relationship, the stock assessments reconstruct the time series of numbers at age and the population biomass trends (measured in terms of both total and spawning biomass). The model around which the most recent Pacific cod assessments are structured uses an assumed survey catchability of 1.0 and an assumed natural mortality rate of 0.37. Other outputs of the assessments include projections of biomass and harvest under a variety of reference fishing mortality rates. Based on these projections, the scientists responsible for conducting the assessments recommend a pair of ABC values for the coming year (one value for the BSAI and one for the GOA).

ABC as Recommended in the Most Recent Stock Assessments

Acceptable biological catch (ABC) and total allowable catch (TAC) limits relative to overfishing levels (OFLs) for the BSAI and GOA Pacific cod stocks in 2001 are presented in Table 3.2-2. These values are based on the most recent stock assessments as reported in the Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the BSAI (Thompson *et al.* 2000), and the GOA (Thompson and Dorn 2000). The determination of ABC and TAC for each stock is described further below.

Pacific cod is currently managed under Tier 3 of the ABC/OFL definitions Management under Tier 3 requires reliable estimates of projected biomass, $B_{40\%}$, $F_{40\%}$ (for ABC), and $F_{35\%}$ (for OFL). The maximum permissible ABC depends on the relationship of projected spawning biomass to $B_{40\%}$. For the BSAI, the base model in the 2000 assessment projected a 2001 spawning biomass of 315,000 mt, about 19 percent below the $B_{40\%}$ estimate of 389,000 mt, leading to a maximum permissible ABC of 214,000 mt (Thompson and Dorn

2000). For the GOA, the base model in the 2000 assessment projected a 2001 spawning biomass of 93,800 mt, about 5 percent above the $B_{40\%}$ estimate of 89,600 mt, leading to a maximum permissible ABC of 76,700 mt (Thompson *et al.* 1999, 2000). In contrast to prior years, the analysis of statistical uncertainty used as the basis for a risk-averse ABC recommendation was not applied. Instead, the ratio between the recommended F_{ABC} and $F_{40\%}$ in 2000 (0.87) was assumed to apply to 2001 as well. This ratio was applied to the maximum permissible value of F_{ABC} rather than $F_{40\%}$. These analyses resulted in recommended ABCs of 188,000 mt in the BSAI and 67,800 mt in the GOA (see Table 3.2-2).

Table 3.2-2 Estimated Overfishing Levels (OFL), Acceptable Biological Catch (ABC), and Total Acceptable Catch (TAC) for Pacific Cod in the BSAI and GOA for 2001, and Total Catch Figures for 2000, by Area (all values in metric tons)

Area	OFL	ABC	TAC	2000 Catch
Bering Sea/ Aleutian Islands	248,000	188,000	188,000	177,435
Gulf of Alaska	91,200	67,800	52,100 (excluding state waters)	54,493

3.2.3 Atka Mackerel

Atka mackerel (*Pleurogrammus monopterygius*) is a significant fishery in the Aleutian Islands region, where it is pursued by midwater and bottom trawls in relatively shallow water. The abundance of Atka mackerel in the GOA is limited and their distribution is patchy. Atka mackerel is known to be a major prey item of Steller sea lion in the central and western Aleutian Islands throughout year, although its importance declines in winter. Concerns regarding the possible adverse effects of the fishery for Atka mackerel and other groundfish species on sea lions has prompted the development of this SEIS. Modification of the spatial and temporal distribution of the Atka mackerel fishery are central to the alternative analyzed in this SEIS. Hence this species is described in additional detail. More detailed information on the Atka mackerel fishery is available in the Draft Programmatic SEIS (NMFS 2001a) and the SAFE Reports for 2000 (NPFMC 2000c, 2000d).

Stock Description and Life History

Atka mackerel are distributed from the east coast of the Kamchatka Peninsula, throughout the Aleutian Islands and the EBS, eastward through the GOA to southeast Alaska (Wolotira *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. 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 *et al.* 2000). Adults are semipelagic 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 documented in August, 1999.[1] Genetic studies

[1]Robert Lauth, "Personal Communication," NMFS, Alaska Fisheres Science Center, 7600 Sand Point Way NE, Seattle, WA 98115.

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 *et al.* 1998; Lowe and Fritz 2000). Age and size at 50 percent maturity has been estimated at 3.6 years and 33–38 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. Natural mortality estimates vary extensively, and estimates have ranged from 0.12 to 0.74 as determined by various methods. For stock assessment purposes, a value of 0.3 is used (Lowe et. al 2000).

An Atka mackerel population existed in the GOA primarily in the Kodiak, Chirikof, and Shumagin areas, and supported a large foreign fishery until the early 1980s. By the mid-1980s the fishery, and presumably the population had disappeared. Over this same period Atka mackerel bycatch in other groundfish fisheries declined sharply, further evidence of the loss of the population. This dramatic decline suggests that the GOA may be at the edge of the species range and may only be populated during periods when recruitment, probably as juveniles, from the Aleutian Islands portion of their range is strong (Lowe and Fritz 2000).

Trophic Interactions

Yang (1996) found that more than 90 percent of the total stomach content (by weight) of Atka mackerel in Aleutian Islands was made up of invertebrates, with less than 10 percent made up of fish. Euphausiids (mainly *Thysanoessa inermis* and *T. rachii*) were the most important prey items, followed by calanoid copepods. The two species of euphausiids comprised 55 percent of the total stomach contents, and copepods comprised 17 percent. Larvaceans and hyperiid amphipods had high FO levels (81 percent and 68 percent, respectively), but comprised less than 8 percent of the total stomach content weight. Squid was another item in the diet of Atka mackerel; it had a FO of 31 percent, but comprised only 8 percent of total stomach content. Atka mackerel are known to eat their own eggs. Yang (1996) found that Atka mackerel eggs comprised 3 percent of the total stomach content and occurred in 9 percent of the analyzed Atka mackerel stomachs. Walleye pollock were the second most important prey fish of Atka mackerel, comprising about 2 percent of the total stomach content. 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 content. Atka mackerel diet in the GOA has not been studied extensively. 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).

Atka mackerel are an important component in the diet of other commercial groundfish in the Aleutian Islands, mainly arrowtooth flounder, Pacific halibut, and Pacific cod. The importance of Atka mackeral as groundfish prey in the GOA is minimal (Yang 1993). Seabirds, mainly tufted puffins, followed by thick-billed murres, and horned puffins prey on Atka mackerel. Marine mammals, mainly northern fur seals and Steller sea lions, also prey on Atka mackerel, as well as harbor seals and Dall's porpoise (Byrd *et al.* 1992; Livingston *et al.* 1993; Fritz *et al.* 1995; Yang 1996).

Atka mackerel is a major prey species year around for Steller sea lions in the BSAI, becoming the dominant species from the central Aleutian Islands west. However, the importance of Atka mackerel in their diet declines in winter, when the availability of cod and pollock increase (see Section 3.1.1.7.3).

The Fishery

The directed fishery for Atka mackerel is prosecuted by catcher/processor bottom trawlers. The fishery patterns generally reflect species behavior in that the fishery is highly localized, occurring in the same few

locations each year, generally at depths between 100 and 200 m (Lowe and Fritz 1999). Observed Atka mackerel fishery trawl locations during 1998 and 1999 in the Aleutian Islands are shown in Figures 3.2-3 and 3.2-4. Important Atka mackerel fishery locations include Seguam Bank, Tanaga Pass, north of the Delarof Islands, Petrel Bank, south of Amchitka Island, east and west of Kiska Island, and on the seamounts and reefs near Buldir Island.

Since 1979, the Atka mackerel fishery has occurred largely within areas designated as Steller sea lion critical habitat. While total removals from critical habitat may be small in relation to total biomass estimates in the Aleutian Islands, fishery harvest rates in localized areas may have been high enough to affect the availability of prey to Steller sea lions (Lowe and Fritz 1997). The localized pattern of fishing for Atka mackerel apparently does not affect fishing success from one year to the next, since local Aleutian Islands populations appear to be replenished by immigration and recruitment. However, this pattern could create temporary reductions in the size and density of localized Atka mackerel populations, which could affect Steller sea lion foraging success during the time the fishery is operating and for a period of unknown duration after the fishery is closed.

To address the possibility that the fishery creates localized depletions of Atka mackerel and adversely modifies Steller sea lion critical habitat by disproportionately removing prey, the Council passed a fishery management regulatory amendment that proposed a four-year timetable to temporally and spatially disperse and reduce the level of Atka mackerel fishing within Steller sea lion critical habitat in the BSAI in June 1998. The temporal dispersion is accomplished by dividing the BSAI Atka mackerel TAC into two equal seasonal allowances. The first allowance is made available for directed fishing from January 1 to April 15 (A season), and the second seasonal allowance is made available from September 1 to November 1 (B season). The spatial dispersion is accomplished through maximum catch percentages of each seasonal allowance that can be caught within Steller sea lion critical habitat as specified for the central and western Aleutian Islands. No critical habitat closures are established for the eastern subarea, but the 20-nm trawl exclusion zones around the Seguam and Agligadak rookeries that have been in place only for the pollock A-season, are in effect year-round. The regulations implementing these management changes became effective January 22, 1999. The four-year timetable for spatial dispersion of the Atka mackerel fishery outside of critical habitat is presented in Table 3.2-3.

The rapid depletion of the GOA Atka mackerel population could have adversely affected western stock Steller sea lion foraging success, which raised concerns regarding how the fishery may have affected food availability and the potential for recovery of the sea lion populations. There has not been a directed Atka mackerel fishery in the GOA since 1996.

Table 3.2-3 Timetable for Spatial Dispersion of total allowable catch (TAC) of Atka Mackerel in Steller Sea Lion Critical Habitat (CH) in the Aleutian Islands

	Area 542(TAC)		Area 543(TAC)	
Year(s)	Inside CH	Outside CH	Inside CH	Outside CH
1999	80%	20%	65%	35%
2000	67%	33%	57%	43%
2001	54%	46%	49%	51%
2002	40%	60%	40%	60%

CH = Critical Habitat

Relative to 1998, the biggest shift in the distribution of fishing effort was observed in Area 542, where effort shifted to Petral Bank in 1999 (Figure 3.2-4).

Atka mackerel are not commonly caught as bycatch in other directed fisheries. The largest amounts of discards, which are likely undersized fish, occur in the directed Atka mackerel trawl fisheries. Recent discard rates (discards/retained catch) of Atka mackerel in the directed fishery have been below 10 % (Lowe *et al.* 2000). Atka mackerel are also caught as bycatch in the trawl Pacific cod and rockfish (primarily Pacific ocean perch, sharpchin, and northern rockfish) fisheries. It is difficult to discern the level of natural bycatch of Atka mackerel in the rockfish fisheries, as vessels may actually be targeting Atka mackerel in particular hauls, but overall they are designated as targeting rockfish on a particular trip. In 1998, 4,597 mt of Atka mackerel were discarded in the directed rockfish fishery as compared to 1,072 mt discarded in all other fisheries (Lowe *et al.* 2000).

Stock Assessment

Atka mackerel are a difficult species to survey because they do not have a swim bladder and are therefore 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 patchier relative to the BSAI. Because of this, it has not been possible to estimate population trends for the species in the GOA in recent years. The stock assessment in the Aleutian Islands is based on NMFS triennial trawl surveys, as well as total catch and catch at age data from the commercial fishery.

BSAI Atka mackerel are assessed with an age-structured model incorporating fishery and survey catch data and age compositions. Fishery catch statistics (including discards) are estimated by the NMFS Regional Office. These estimates are based on the best blend of observer reported catch and weekly production reports. Stock assessments include catch history, characterizations of the fishery, key life history parameters, survey and model-estimated abundance trends, historical exploitation rates, reference fishing mortality rates, projected catch and abundance trends for a range of fishing mortalities and recruitment assumptions, and a recommended harvest rate and catch for the upcoming year. The results of the analyses, which are updated annually, are presented in the BSAI Atka mackerel stock assessment, which is incorporated into the BSAI Stock Assessment and Fishery Evaluation report.

The 2000 age and size distributions of BSAI Atka mackerel are discussed by Lowe *et al.* (2000). As of 2000, the age composition of the stock is dominated by strong year classes in 1998 (2-year-olds) and 1995 (5-year-olds), and there is still evidence of the strong 1992 year class (8-year-olds) in the population. The estimated mean age of the 2000 Aleutian Islands population is 5.0 years. The current fishery tends to select fish aged 3 to 12 years old (Lowe and Fritz 1999). It is not known how the age composition of the population would look in an unfished population.

The temporal distribution of the BSAI Atka mackerel stock is an issue of concern for the purpose of seasonal TAC apportionment relative to estimates of groundfish prey consumption by Steller sea lions. Specifically, it is desirable to incorporate knowledge of the seasonal abundance of Atka mackerel in critical habitat when evaluating alternatives for setting TACs by area and season. Biomass estimates of Atka mackerel are available on an annual basis from the stock assessment (Lowe *et al.* 2000). However, these stock assessments do not provide sufficient information to determine the temporal and spatial distribution of biomass in critical habitat. The groundfish surveys which examine biomass distribution in the Aleutian

Islands are also limited. They are only conducted every 3 years, and only in the summer (May-August), and the survey design does not allow for evaluation of biomass data within critical habitat alone. Therefore, there is no direct information on which to base spatial or temporal estimates of Atka mackerel biomass distribution in the Aleutian Islands.

Despite these limitations, other sources of information can be used to estimate Atka mackerel biomass inside critical habitat on a monthly basis. Specifically, knowledge of the general habitat distribution of Aleutian Islands Atka mackerel, and the temporal and spatial distribution of the stock can be used to infer the monthly biomass distribution. Survey data indicates that the effective limit of Atka mackerel habitat in the Aleutian Islands is confined to depths of less than 200 m, the depth limit of the shelf area. An average of less than 1% of the total Atka mackerel biomass estimated from the 1980 to 2000 trawl surveys was found at greater than 200 m (Lowe *et al.* 2000). While there is considerable inshore/offshore movement of Atka mackerel for spawning and feeding within this depth limit, there is no evidence of a net seasonal movement of Atka mackerel biomass across critical habitat boundaries and the total distribution of biomass is essentially uniform (L. Fritz and S. McDermott, NMFS Alaska Fisheries Science Center, unpublished data).

Given the relationship between critical habitat and Atka mackerel habitat and the assumption of relatively uniform distribution of biomass it was estimated that, on average, approximately two-thirds of the Atka mackerel population is inside critical habitat in the Aleutian Islands on a monthly basis. Approximately 68.8% of the Aleutian Islands shelf area, the effective limit of Atka mackerel habitat, is inside critical habitat for Steller sea lions (NMFS 1998g, Figure 11). Monthly Atka mackerel biomass estimates within critical habitat were obtained by the following method. The January 1995 estimate was 67% of the age 3+ biomass for 1995, as shown in Table 3.2-4 (Lowe and Fritz 1999). This was converted to numbers by assuming an average weight of 1 kg per fish. Numbers were then decayed by 1/12 of M (M=0.3) each month for the year, and increased by 1/12 of the difference between current year and next year's biomass to account for recruitment. These calculations were done for February-December each year, and the January estimate for the following year was 2/3 of the age 3+ begin-year biomass. The "average" year was based on the average of the monthly estimates of biomass in critical habitat (not subtracting catch) from January 1995-December 1999 (Table 3.2-5).

Table 3.2-4. Estimates of begin-year age 3+ Atka mackerel biomass in the Aleutian Islands in 1995-2000 (thousands of mt).

Year	Biomass in the Aleutian Islands			Biomass in Critical Habitat		
	Mean	-95%	0.95	Mean	-95%	0.95
1995	1,016	660	1,372	681	442	919
1996	846	550	1,143	567	368	765
1997	679	441	917	455	296	614
1998	614	399	829	411	267	555
1999	588	382	794	394	256	532
2000	565	367	763	379	246	511

95th percentile confidence limits (±35% of the mean) were estimated from the mean of the 1997 Aleutian Islands groundfish trawl survey. Estimates of critical habitat mean biomass and confidence limits are 2/3 of the Aleutian Island estimates.

Table 3.2-5. Average age 3+ Atka mackerel biomass (mt) in critical habitat by month for 1995-1999 and 95% confidence limits (+/- 35% of the mean).

Month	Average	-95%	+95%
Jan	501,589	326,033	677,145
Feb	494,239	321,255	667,223
Mar	487,071	316,596	657,545
Apr	480,079	312,052	648,107
May	473,261	307,619	638,902
Jun	466,610	303,297	629,924
Jul	460,124	299,081	621,168
Aug	453,798	294,969	612,627
Sep	447,628	290,958	604,298
Oct	441,611	287,047	596,175
Nov	435,742	283,232	588,252
Dec	430,018	279,512	580,524

The estimated 95% confidence limits in Tables 3.2-4 and 3.2-5 are based solely on the variance of the 1997 bottom trawl survey biomass estimate for Atka mackerel in the Aleutian Islands. For this survey, the difference between the mean and each upper and lower confidence limit was 35% of the mean, which served as the estimate of the confidence limit. This is a conservative estimate of the real confidence limits (which are larger), since variance around the survey biomass estimate is only one of many components of the true variance.

No reliable estimate exists of current Atka mackerel biomass in the GOA. Atka mackerel have not been commonly caught in the GOA triennial trawl surveys. It has been determined that the general GOA groundfish bottom trawl survey does not assess the GOA portion of the Atka mackerel stock well, and resulting biomass estimates have little value as absolute estimates of abundance or as indices of trend (Lowe and Fritz 2000). Because of this lack of fundamental abundance information, GOA Atka mackerel are not assessed with a model. The stock assessment that consists of descriptions of catch history, length and age distributions from the fishery (1990–1994) and length and age distributions from the trawl surveys (1990, 1993, and 1996). This information is presented in the GOA Atka mackerel stock assessment, which is incorporated into the GOA SAFE report.

Age and size distributions of GOA Atka mackerel are discussed by Lowe and Fritz (2000). 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, indicating the population is skewed towards the 1988 year class. It appears as though little recent recruitment has occurred in the GOA population.

Acceptable Biological Catch as Recommended in Most Recent Stock Assessments

In 2000, BSAI Atka mackerel fell into Tier 3a of the ABC and OFL definitions, which requires reliable estimates of biomass, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$. Under the definitions and current stock conditions, the OFL for BSAI Atka mackerel would be reached at 138,100 mt. The maximum allowable fishing mortality rate for ABC (F_{ABC}) is $F_{40\%}$, estimated to be 0.19 for Atka mackerel, which translated to a yield of 58,700 mt (Lowe *et al.* 2000). In 2000, the stock assessment ABC recommendation for the 2001 Atka mackerel fishery was

below the maximum rate prescribed under Tier 3a, to provide a more risk averse harvest rate and to accommodate uncertainty. The stock assessment F_{ABC} is 0.35, which translated to a yield of 108,100 mt. A recommendation lower than $F_{40\%}$ was recommended in the 1999 stock assessment because: (1) stock size as estimated by the age-structured analysis has declined since 1991; and (2) the 1997 Aleutian trawl survey biomass estimate fell to roughly 50 percent of the 1992 and 1994 estimates. The stock biomass increased somewhat in the 2000 survey driven by a strong 1998 year class.

There is currently no reliable estimate of current GOA Atka mackerel biomass. Therefore, GOA Atka mackerel fall under Tier 6 of Ammendment 56 to the BSAI and GOA Groundfish FMPs. Under Tier 6, OFL level is defined as the average catch from 1978 to 1995, and ABC is defined as not exceeding 75 percent of OFL. The average annual catch from 1978 to 1995 is 6,200 mt; thus ABC cannot exceed 4,700 mt. Given the uncertainty regarding stock size, the current ABC recommendation from the stock assessment is below the maximum prescribed under Tier 6 providing a very conservative harvest strategy. The 2000 stock assessment for the 2001 fishery recommended an ABC of 600 mt, with the intention of precluding a directed fishery, but providing for bycatch needs in other trawl fisheries. An ABC lower than the maximum prescribed under Tier 6 was recommended for the following reasons.

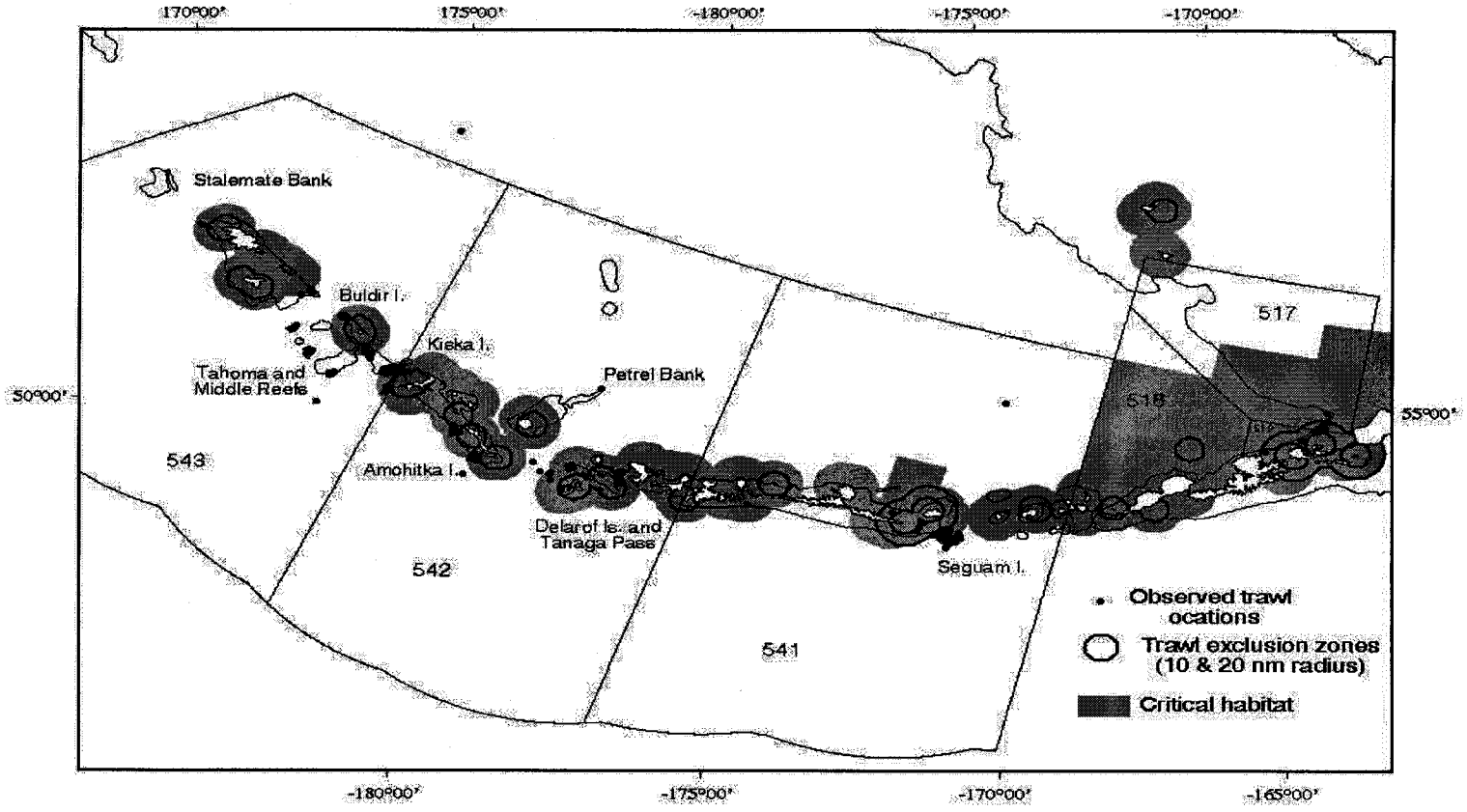
1. The GOA Atka mackerel population appears to be particularly vulnerable to fishing pressure because of sporadic movement of fish eastward from the Aleutian Islands.
2. There is currently a high level of uncertainty regarding the size of the population.
3. It has been shown that the GOA Atka mackerel fishery might have created localized depletions at catch levels lower than the estimated ABC of 4,700 mt. These localized depletions may have reduced foraging success for Steller sea lions (Lowe and Fritz 1996).
4. Analyses of local fishery catch per unit of effort (CPUE) indicated that Atka mackerel populations may have declined significantly between 1992 and 1994 (Lowe and Fritz 1996), reflecting the trend of the Aleutian Islands Atka mackerel population during that period, which continued declined through 1994 before rebounding somewhat in 2000 (Lowe *et al.* 2000).

Estimated OFLs, ABCs, and TACs for Atka mackerel in the BSAI and GOA for 2001, and TAC figures for 2000 are shown in Table 3.2-6.

Table 3.2-6 Estimated Overfishing Levels (OFL), Acceptable Biological Catch (ABC), and Total Acceptable Catch (TAC) for Atka Mackerel in the BSAI and GOA for 2001, and Total Catch Figures for 2000, by Area (all values in metric tons)

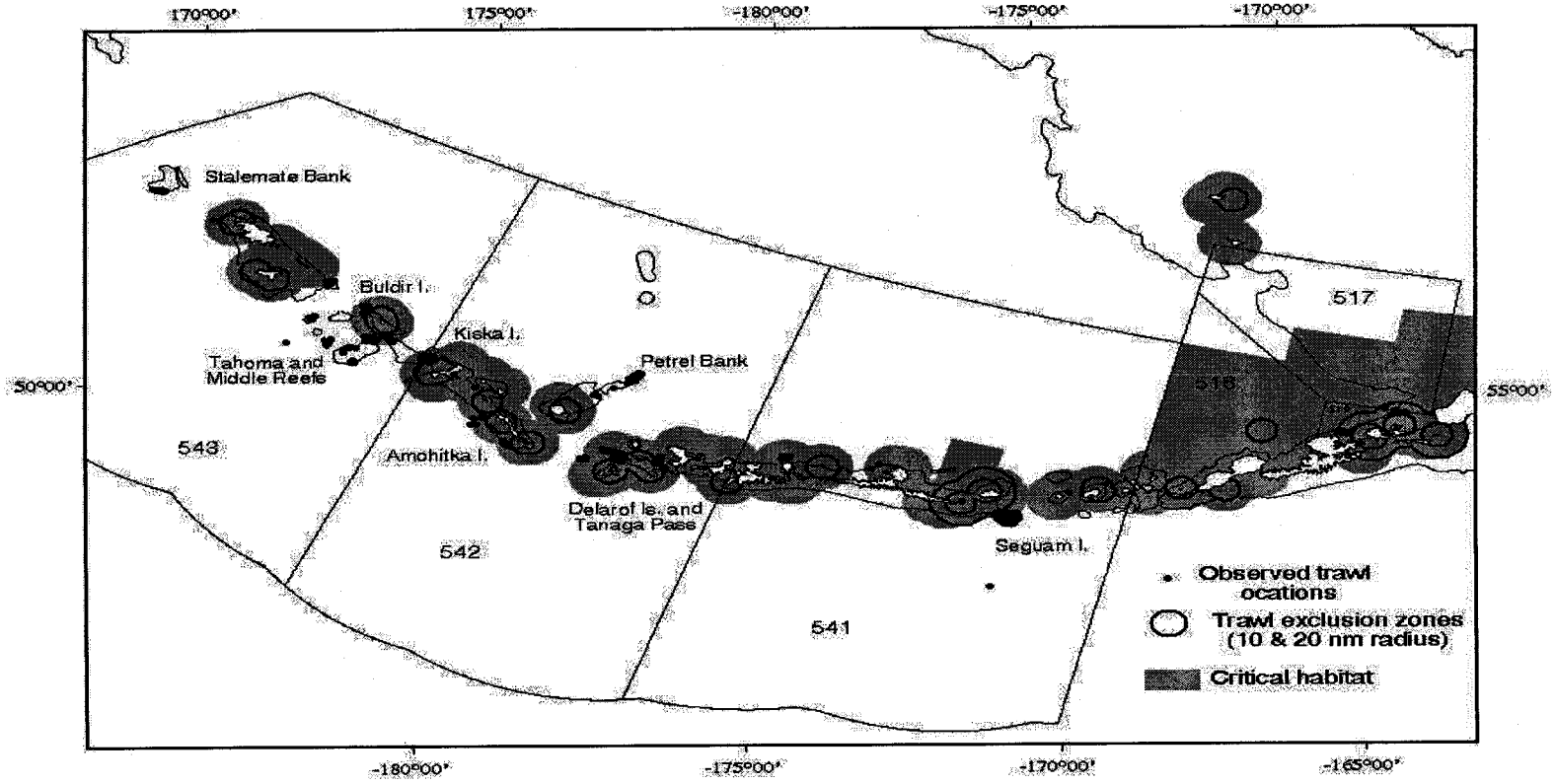
Area	OFL	ABC	TAC	2000 Catch
Bering Sea/ Aleutian Islands	138,100	69,000	69,300	42,394
Gulf of Alaska	6,200	600	600	170

Figure 3.2-3 Observed Atka mackerel fishery locations in the Aleutian Islands region in 1998. Trawl exclusion zones, Steller sea lion critical habitat zones around rookeries and haulouts, the 200-m isobath, management Areas 541–543, and names of locations fished are shown.



Source: NMFS

Figure 3.2-4 Observed Atka mackerel fishery locations in the Aleutian Islands region in 1999. Trawl exclusion zones, Steller sea lion critical habitat zones around rookeries and haulouts, the 200-m isobath, management Areas 541-543, and names of locations fished are shown.



Source: NMFS

3.2.4 Flatfish

Several species of flatfish occurring in the BSAI and GOA are currently targeted in the Alaska groundfish fishery. However, none of these species are directly affected by proposed management changes under the Draft SSL Protection Alternatives. However, these fisheries may be impacted by management changes for pollock, Pacific cod, and Atka mackerel. Because flatfish are not directly addressed by this SEIS, they are not described in detail here. Detailed information on life history, trophic interactions, fisheries, stock assessment, and ABC recommendations for each species or complex are provided in the Draft Programmatic SEIS (NMFS 2001a), and the Stock Assessment and Fishery Evaluation reports for the BSAI and GOA (NPFMC 2000c, 2000d).

Flatfish species are by nature demersal, and frequent variable habitat types depending on species. Flatfish are of variable importance as prey for Steller sea lions, ranging from a minor prey item to a significant diet component near specific haulout areas and rookeries in terms of frequency of occurrence (FO). Arrowtooth flounder has an increasing FO in Steller sea lion diets in the western GOA (see Section 3.1.1.7), which reflects the increasing abundance of this flatfish species.

For the purpose of this SEIS, target flatfish species are grouped based on the availability and suitability of information to identify the level of direct, indirect, and cumulative effect of the alternatives analyzed in this SEIS. Flatfish species with a greater degree of available information are yellowfin sole (*Limanda aspera*), rock sole (*Lepidopsetta bilineata*), flathead sole (*Hippoglossus elassodon*), Greenland turbot (*Reinharditus hippoglossoides*), arrowtooth flounder (*Reindhardtius stomais*), and Alaska plaice (*Pleuronectes quadriterculatus*), in the BSAI, and arrowtooth flounder in the GOA. Under the current management regime (Alternative 1) Bering Sea flatfish are classified under Tier 3 of the ABC/OFL definitions. For each flatfish species in the FMP, the 2001 TAC was set at a level lower than the ABC. Harvest is further restricted by halibut bycatch limits (with the exception of yellowfin sole in recent years) where fisheries have been closed before reaching the TAC because of halibut bycatch limits.

Flatfish with more limited information include: the "other flatfish" complex in the BSAI (excluding Alaska plaice), and shallow and deep water flatfish, and flathead sole in the GOA. The BSAI "other flatfish" complex as described here includes rex sole (*Glytocephalus zachirus*), Dover sole (*Microstomus pacificus*), starry flounder (*Platichthys stellatus*), English sole (*Parophrys vetulus*), butter sole (*Iopsetta isolepis*), sand sole (*Psettichthys melanostictus*), and deepsea sole (*Embassichthys bathybius*). These stocks are managed under a Tier 4, 5, or 6 harvest strategy per as appropriate to the available level of data on stock structure and biomass. ABC determinations for these species are detailed in the 2000 SAFE Reports (NMFS 2001*c,* 2001d).

Flatfish species comprise a large proportion of the exploitable groundfish biomass in the BSAI and the GOA. These fisheries are typically prosecuted by bottom trawlers, with the exception of BSAI Greenland turbot fishery. Longlines have become the dominant gear type for this species since the early 1990s. No halibut bycatch has been apportioned to the Greenland turbot trawl fishery since 1996, effectively prohibiting this gear type. The "other flatfish" species, with the exception of Alaska plaice, are not harvested economically, but are taken as bycatch in other high value trawl fisheries. In general, the biomass of flatfish in the BSAI remains high, following significant population expansions and high recruitment levels throughout the 1980s. Greenland turbot is an exception. Biomass for this species has declined from the 1981 through 1997 due to a series of poor year classes. Recruitment for many of the flatfish species in both the GOA and BSAI has been declining in recent years, and stock declines are predicted in the future as a consequence. Fisheries have not harvested the exploitable biomass of any flatfish species or complex in the BSAI for several years due

to bycatch limits on halibut and crab and conservative quotas. In the GOA, arrowtooth flounder biomass is currently at peak levels and the fishery is experiencing increasing economic development. From NMFS catch data it shows the remaining flatfish species are not fully harvested due to bycatch limits on halibut.

3.2.5 Rockfish

At least 32 rockfish species of the genera Sebastes and Sebastolobus have been reported to occur in the GOA and BSAI (Eschmeyer *et al.* 1984), and several of them are of commercial importance. Pacific ocean perch (*Sebastes 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 (*Sebastolobus alascanus*), yelloweye rockfish (*ruberrimus*), and dusky rockfish (*S. ciliatus*) are also important to the overall rockfish catches. Rockfish are long lived species, with maximum ages ranging from 60 to 140 years depending on the species. They are slow growing, reaching maturity after periods ranging from

Rockfish are all demersal species which do not tend to form dense aggregations. The rockfish complex was commonly found in the Steller sea lion diet prior to the 1970s but is currently a significant prey item, having a FO of less than 5 percent in recent studies. The overall catch of rockfish in the BSAI and GOA is relatively low in comparison to other groundfish species. Rockfish TACs are generally not fully exploited. Given the lack of importance of rockfish in SSL diet and relatively low levels of exploitation, they are not specific focus of the Draft SSL Protection Alternatives. Because of this lack of emphasis, the rockfish species are not described in detail here. More detailed information is available in the Draft Programmatic SEIS (NMFS 2001a) and the 2000 SAFE Reports (NPFMC 2000c, 2000d).

For the purpose of this SEIS, target rockfish species are grouped based on the availability and suitability of information to identify the level of direct, indirect, and cumulative effect of the alternatives analyzed in this SEIS. BSAI Pacific ocean perch (POP) are the most well known and are evaluated separately. Red rockfish (sharpchin, northern, rougheye, and shortraker) and other rockfish in the BSAI are evaluated as a group, and all GOA rockfish are evaluated as a group. Shortspine and longspine thornyheads *(Sebastolobus alascanus* and *Sebastolobus altivelis,* respectively) are treated separately and are described in the following section.

POP are the dominant species of red rockfish in the BSAI. They are caught primarily along the Aleutian Islands and to a lesser extent in the EBS. Biomass has increased significantly following heavy exploitation by foreign fisheries prior to 1978. POP, like all rockfish, is long lived and slow growing relative to many groundfish species, with an advanced age at maturity. These factors make the population vulnerable to overfishing. Given these life history characteristics and past fishing history, they are conservatively managed. POP currently fall under Tier 3a of the ABC/OFL definitions, which equates to an ABC of 10,200 mt for the AI and 1,700 mt for the eastern Bering Sea.

Little is known about the other red rockfish (ORR) and other rockfish complexes in the BSAI. These stock complexes were developed to separate management of the commercially valuable POP and ORR species, and to avoid overfishing of any one stock in the complex. Further division of the ORR complex is being established to provide further management protection. The ORR and other rockfish complexes are managed under Tier 5 of the ABC/OFL definitions. The combined OFL for the group for 2001 under Tier 5 is 11,700 mt. The ABC/TAC for the combined group is set at 8,800 mt.

Rockfish in the GOA include at least 30 species which have been organized into three management assemblages based on habitat and distribution: demersal shelf rockfish, pelagic shelf rockfish, and slope

rockfish. The slope rockfish assemblage has been subdivided to manage POP, northern, and rougheye and sharpchin rockfish separately from other species. A 1998 prohibition on trawling east of 140° W longitude affected rockfish fisheries that are now prohibited in the East Yakutat/Southeast Outside area of the eastern GOA. All rockfish species in the GOA are similarly affected by the Draft SSL Protection Alternatives and are evaluated as a group in this EIS. GOA rockfish are managed under either Tier 3, 4 or Tier 5 of the ABC/OFL definitions, depending on the level of knowledge of the species complex. The POP stock is the primary species in the slope rockfish group. POP is currently rebounding from a period of low abundance in the 1980s, with strong year classes contributing to recent abundance. However, the spawning stock is currently below the $B_{40\%}$ level. The recommended ABC for the stock complex in 2001 is 13,510 mt. For pelagic shelf rockfish, the recommended ABC for 2001 is 5,980 mt. The ABC/TAC recommendations for demersal shelf rockfish are keyed to the abundance of yelloweye rockfish. The recommended ABC for the stock complex in 2001 is 330 mt (NPFMC 2000d). Most of the GOA rockfish harvest in 2000 was below TACs, although harvest for some species with low TAC levels did exceed TAC.

3.2.6 Thornyheads

Thornyheads in Alaskan waters are comprised of two species, the shortspine thornyhead and the longspine thornyhead, close relatives to the rockfish. As with rockfish, no changes to the thornyhead fishery are proposed under this SEIS, and any impacts on the fishery are indirect results of changes in the management of pollock, Pacific cod, and Atka mackerel. Because thornyheads are not directly addressed by this SEIS, they are described in less detail than pollock, cod, and Atka mackerel. Detailed information on life history, trophic interactions, fisheries, stock assessment, and ABC recommendations for each species or complex are provided in the Draft Programmatic SEIS (NMFS 2001a), and the SAFE Reports for the BSAI and GOA (NPFMC 2000c, 2000d).

Only the shortspine thornyhead is of commercial importance. It is a demersal species found in deep water, from 93 m to 1,460 m, from the Bering Sea to Baja California (Ianelli and Gaichas 1999). This species is not identified as a principal prey item of Steller sea lions or other marine mammals. 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 and 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. Yang (1993, 1996) showed that shrimp were the top prey item for shortspine thornyheads in the GOA, while cottids were the most important prey item in the Aleutian Islands. Biologically, the greatest 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, like many other groundfish species, do not tend to form dense aggregations.

Until recently, thornyheads were not targeted by the commercial fishery. However, they are now among the most valuable rockfish species and are harvested by trawl and longline gear. Most of the domestic harvest is exported to Japan. Thornyheads are taken with some frequency in the longline fishery for sablefish and cod, and are often part of the bycatch of trawlers concentrating on pollock and other rockfish species. In the GOA, shortspine thornyheads are assessed with an age-structured model incorporating data from two fisheries (longline and trawl) and two types of survey data. Surveys used to assess this species are described in Section 2.7.3 of the Draft Programmatic SEIS (NMFS 2001a). The estimated biomass in 2000 was 23,084 mt, and the recommended ABC/TAC for 2000 was 2,310 mt. A stock assessment was not performed for

thornyheads in 2000 due to limited data. Therefore same the ABC and TAC levels for 2000 were adopted for 2001.

In the BSAI, thornyheads are managed as the primary species in, the other rockfish management assemblage. The assessment is based on the most recent catch and survey data. Thornyheads are currently managed under Tier 5 harvest strategy. The best estimate of complex-wide biomass under Tier 5 results in recommended ABCs of 361 mt in the eastern Bering Sea and 676 mt in the Aleutian Islands for 2001. Recommended OFLs under Tier 5 for 2001 are 482 mt in the EBS and 901 mt in the Aleutian Islands.

3.2.7 Sablefish

Sablefish (*Anoploma fimbria*) are found from northern Mexico to the GOA, westward to the Aleutian Islands. The directed fishery for sablefish is conducted by longliners, with this gear type accounting for approximately 90 percent of the total catch. Trawlers also catch sablefish as bycatch in other fisheries. A minimal amount of sablefish is caught by pot boats. The directed fishery occurs on the upper continental slope and a few deep water gullies, the areas inhabited by adult sablefish. As with flatfish, rockfish, and thornyheads, no changes to the sablefish fishery are proposed under this SEIS, and any impacts on the fishery are indirect results of changes in the management of pollock, Pacific cod, and Atka mackerel. Because sablefish are not directly addressed by this SEIS, it is not described in detail here. More detailed information on life history, trophic interactions, fisheries, stock assessment, and ABC recommendations sablefish are provided in the Draft Programmatic SEIS (NMFS 2001a), and the Stock Assessment and Fishery Evaluation reports for the BSAI and GOA (NPFMC 2000c, 2000d).

Sablefish are not identified as a significant prey item for Steller sea lions, most probably due to their deep water distribution and demersal nature as adults. They are typically found in gullies and deep fjords at depths greater than 200 m. Sablefish observed from a manned submersible were found on or within 1 m of the bottom (Krieger 1997). Studies have shown sablefish to be highly migratory for at least part of their life cycle, and substantial movement between the BSAI and the GOA has been documented (Heifetz and Fujioka 1991; Maloney and Heifetz 1997). Adults reach maturity at 4 to 5 years and a length of 51 to 54 cm (McFarlane and Beamish 1990). Sablefish are long-lived, with a maximum recorded age in Alaska of 62 years (Sigler *et al.* 1997). Spawning is pelagic and occurs 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 nearshore areas where they spend the first 1 to 2 years (Rutecki and Varosi 1997). It appears that sablefish are opportunistic feeders, with some studies showing a diet primarily composed of fish, while other studies have found a diet dominated by euphausiids (Laidig *et al.* 1997; Tanasichuk 1997). Sablefish prey includes variety of benthic invertebrates, benthic fishes, as well as squid, mesopelagic fishes, jellyfish, and fishery discards. Larval sablefish feed on a variety of small zooplankton, ranging from copepod nauplii to small amphipods, while young juveniles feed primarily on large zooplankton and euphausiids. Gadid fish (mainly pollock) comprise a large part of the sablefish diet. Young-of-the-year sablefish are commonly found in the stomachs of salmon taken in the southeast Alaska troll fishery during the late summer. Nearshore residence during their second year provides the opportunity to feed on young salmon during the summer months. This near shore residency may make juvenile sablefish available as occasional prey for Steller sea lions.

Due to their migratory nature, Alaskan sablefish are considered a single stock and assessed in a combined area (BSAI and GOA) with an age-structured model incorporating fishery and survey catch data and age and length compositions. Survey data come from annual sablefish longline surveys in the GOA, and biennial longline surveys in the BSAI. These surveys indicate that the stock size peaked in the mid-1980s because of

a series of strong years and has declined to lower levels ever since. Declining abundance is due to insufficient recruitment 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 stock is currently stable at a relatively low abundance (Sigler *et al.* 2000).

Sablefish fall into Tier 3 of the ABC and OFL definitions, which requires reliable estimates of biomass, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$. The ABC for 2001 considers the declining trend evident in the population and is conservatively recommended at 16,900 mt for the combined BSAI/GOA stock (Sigler *et al.* 2000).

3.2.8 Squid and Other Species

In the BSAI Groundfish Fisheries Management Plan, species of squid and sculpin, skate, shark, and octopi which occur in the fishery are managed collectively as the squid and other species group. These species are aggregated for management because insufficient data exist to manage each of the other species groups separately. None of the species in the squid and other species category are currently targeted by the BSAI and GOA groundfish fisheries. None of these species are directly affected by management changes under this SEIS, however, changes in the spatial and temporal distribution of pollock, Pacific cod and Atka mackerel fisheries could impact bycatch rates in some cases. Because the complex is not directly addressed by this SEIS, it is not described in detail here. More detailed information on life history, trophic interactions, fisheries, stock assessment, and ABC recommendations for the complex is provided in the Draft Programmatic SEIS (NMFS 2001a) , and the Stock Assessment and Fishery Evaluation reports for the BSAI and GOA (NPFMC 2000c, 2000d).

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. Forty-one sculpins species were identified in the EBS and 22 species in the Aleutian Islands (Bakkala 1993; Bakkala *et al.* 1985; Ronholt *et al.* 1985). During these same surveys, 15 skate species 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*). Many species in the squid and other species assemblage are important prey for marine mammals and birds, as well as commercial groundfish species. Squid, octopus, sculpins, and skates are occasional prey for Steller sea lions. However, around some Steller sea lion rookery and haulout areas these species may be predominant prey items (see Section 3.1.1.7). Evidence exists that Pacific sleeper sharks (*Somniosus pacificus*) occasionally prey on Steller sea lions (Section 3.1.1.7).

Assessment data are not available for squid from NMFS 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 is generally lacking. While biomass estimates have been made for sharks and octopuses, the NMFS 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 a species usually caught, and the Pacific sleeper shark has been taken on occasion. Two octopus species have been recorded: *Octopus dofleini* is the principal species, *Opisthoteuthis california* appears only intermittently.

Data from NMFS bottom trawl and EIT surveys provide the only abundance estimates for the various groups and species comprising the other species category. Stock assessments using these data are described in detail in the Draft Programmatic SEIS (NMFS 2001a) and the 2000 SAFE Report for the BSAI (Fritz 2000). The

estimated biomass of other species for 2000, excluding squid, was 566,900 mt. Skates represent 30 to 40 percent of the other species biomass from all surveys and are the most common species in each year except 1984 when sculpin biomass was highest within the category. Total biomass for the other species category increased between 1984 and 2000. 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. No reliable biomass estimates for squid exist, and no stock assessment per se. Sobolevsky (1996) cites an estimate of 4 million tons for the entire Bering Sea made by squid biologists at the Pacific Research Institute of Fisheries and Oceanography (Shuntov 1993), and an estimated 2.3 million tons for the western and central Bering Sea (Radchenko 1992), but admits that squid stock abundance estimates have received little attention. NMFS bottom trawl surveys almost certainly underestimate squid abundance.

Squid catches and ABCs are inferred to be a very small percentage of the total squid biomass in the EBS and GOA. BSAI squid ABC and OFL are set using criteria in Tier 6, as described in Amendment 44 to the BSAI FMP, given the lack of data on squid population dynamics and biomass. OFL is set equal to the average annual catch from 1978 to 1995 (2,624 mt), while ABC is capped at no greater than 75 percent of OFL. This equates to an ABC of 1,970 mt. The ABC and TAC for BSAI squid are set at this level for 2001. OFL and ABC values will remain constant unless management changes for squid are proposed by the Council.

The remaining species in the Other Species category are managed under Tier 5 of the OFL/ABC definitions. Using Tier 5 criteria, ABC is capped at 75 percent of OFL. Recent interest in developing fisheries for some species in this complex resulted in increases in ABCs beyond these criteria in recent years. For the 2000 fishery, the Council capped the ABC at a level approximately 10 percent higher than the ABC recommendation in the 1999 SAFE Report. BSAI other species TAC has been set equal to the other species ABC by the Council. The 2001 ABC for the BSAI other species category set using this process is 26,500 mt. This equates to an exploitation rate of about 5 percent of the best estimate of current biomass, set at 566,900 mt. The annual TAC for GOA Squid and Other Species for 2001 is set equal to 5 percent of the sum of all GOA groundfish TACs, which equates to 13,619 mt. Catches of other species in the GOA ranged between 1,570 mt and 6,867 mt from 1990 to 2000.

3.3 Non-specified Fish Species

This category inclose those fish, invertebrates, and other organisms which are not included in BSAI and GOA FMPs, primarily because of their minor commercial importance or in some cases because they are managed by the State of Alaska. Non-specified species (not including species prohibited in the groundfish fisheries off Alaska such as salmon, herring, and crab) managed by the state include sea urchins, sea cucumbers, clams, shrimp, scallop, lingcod, black rockfish, and blue rockfish. These species are managed by ADF&G and the fisheries are described by Kruse et al (2000) in their report titled "Overview of State-Managed Marine Fisheries in the Central and Western Gulf of Alaska, Aleutian Islands, and Southeastern Bering Sea, with Reference to Steller Sea Lions." There are some data collected for non-specified species using small mesh and bottom trawl surveys and zooplankton surveys but biomass estimates are not available for most non-specified species for all of the BSAI and GOA (NMFS 2001a). The draft SEIS (NMFS 2001a) and the 2001 Ecosystem Considerations (NPFMC 2000c, appendix D) provides the latest regarding research and current status for non-specified species and is summarized in this section.

These species comprise critical trophic levels in the marine ecosystem. The presence or absence of such indicator species as corals and sponges can be used to help describe the diversity of benthic marine communities being considered for further conservation measures. Due to the small size of most of these

species they are uneffected by conventional fishing gear. Sessile organisms may be negatively affect by fishing gear that come in contact with the sea floor and larger sized animals may be taken by fishing gear. From 1997 to 1999 non-specified species (including many invertebrates) averaged 1.4% of the total catch in the BSAI (about 23,076 mt) and 6.7% in the GOA (about17,436 mt).

One of the more important non-specified species group are caridean shrimp which include the commercially important pandilid shrimp. Shrimp is a major food source for commercial fish species, marine mammals, and birds. GOA pandalid shrimp have declined sharply from 1973 levels and the decline is possibly linked to climatic changes (NPFMC 2000a, appendix D).

Examples of unmanaged non-specified fish species include grenadiers, prowfish, eelpouts, lumpsuckers, poachers, and greenling. Since the vast majority of these species are unassessed, the condition of these stocks is largely unknown. Non-specified fish are not presently targeted but are taken as incidental catch in other directed groundfish fisheries in the BSAI and GOA.

The most commonly caught fish in this category are grenadiers. Grenadier biomass is estimated at 38,100 in the Bering Sea, 618,100 mt in the Aleutian Islands, and 410,810 mt in the GOA. Incidental catch of grenadier from 1997 through 1999 averaged 6,610 mt, about 50% by weight of the total catch of all non-specified species combined. Of this amount in the BSAI 84% of the incidental catch occurs in the hook-and-line fisheries targeting sablefish and Greenland turbot, 10% in the Pacific cod fishery, 1% in the pollock fishery, and less than 1% in the Atka mackerel fishery. Incidental catch of grenadier from 1997 to 1999 in the GOA averaged 12,700 mt, almost 80% by weight of the total catch of all non-specified species combined. Of this amount in the GOA 92% of the incidental catch of grenadier occurs in the hook-and-line sablefish fishery, 2% in the Pacific cod fishery, and less than 1% in the pollock fishery.

Many non commercial epibenthic species show significant declines in abundance from 1970 in the small mesh trawls surveys for shrimp. Declining species include eelpouts, poachers, spiny lumpsuckers, and pricklebacks. In the GOA sea-stars make up much of the epibenthic echinoderm incidental catch and have shown large fluctuations in abundance since 1971. The sea-stars are currently at a high level of abundance which may impact abundance of bivalves and support the foraging of shrimp and crab. Jellyfish in the GOA is also sampled in small mesh trawls was found to be at a moderate level of abundance in 1999. Jellyfish abundance may be an indication of primary trophic level conditions which may indicate impacts on year class strength for commercial fish.

3.4 Forage Fish

Forage fish are abundant fishes that are preyed upon by marine mammals, seabirds, and commercially important fish species. The following forage species are included in the forage fish definition in 50 CFR 679.2: Osmeridae (which includes capelin and eulachon), Myctophidae (laternfishes), Bathylagidae (deep sea smelts), Ammodytidae (sand lances), Trichodontidae (sandfishes), Pholididae (gunnels), Stichaeidae (pricklebacks), Gonostomatidae (bristlemouths), and the Order Euphausiacea (krill). For further discussion of forage fish species see section 3.3.3.13 of the TAC-setting SEIS (NMFS 1998a), section 3.3.3.13 of the draft Alaska groundfish programmatic SEIS (NMFS 2001a), and the EA for Amendments 36/39 to the BSAI and GOA FMPs (NMFS 1998e).

Forage fish perform a critical role in the complex ecosystem functions of the BSAI and GOA management areas by providing the transfer of energy from the primary or secondary producers to higher trophic levels. For example, eulachon and capelin play a key role in the trophic interaction of species, transferring energy

from primary production (such as phytoplankton) to high trophic level predators (such as salmon) in the GOA (NPFMC 2000c, appendix D) and are seen in the diet of Steller sea lions (Pitcher 1981). Sand lance form large migrating schools in the late summer and early fall and move inshore to spawn in the winter, providing one of the few sources inshore in the winter while most other fish species migrate off shore at this time of year (Appendix D of NPFMC 2000c).

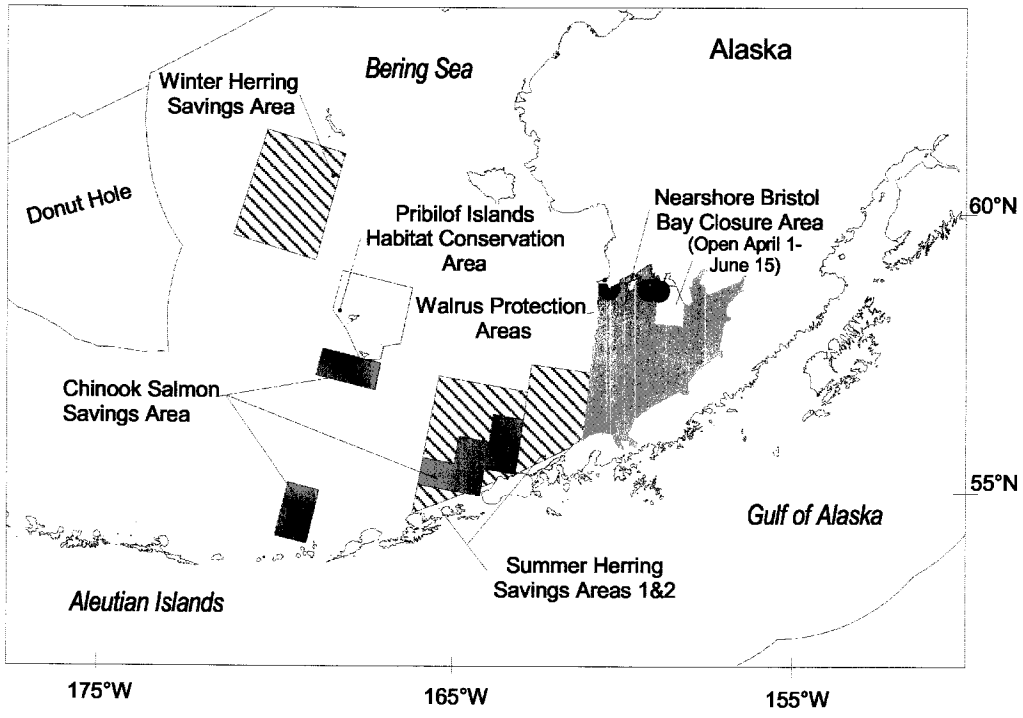
Because of their importance to so many ecosystem components, a management assemblage for forage fish was established in 1998 in Amendments 36 and 39 to the BSAI and GOA FMPs, respectively (63 FR 13009, March 17, 1998). Although ABC and TAC amounts are not specified for species in the forage fish category, the amendments provide protection for forage fish by preventing the development of commercial fisheries for these species groups. Directed fishing for forage fish species is restricted year round with a maximum retainable bycatch of 2%. These amendments also established mandatory reporting by categories for forage fish species groups. Total forage fish incidental catch in the commercial groundfish trawl fisheries between 1997 to 1999 averaged less than 0.1% (39 mt) of the total catch in the BSAI and less than 0.1% (61 mt) of the total catch in the GOA. Of these amounts 9,5% (37 mt) of the total forage fish catch in the BSAI and 93% (57 mt) of the total forage fish catch in the GOA consisted of smelt taken in the pollock fishery (NMFS, 2001a). The incidental catch of all other forage fish species average 2 mt (5% of the total forage fish incidental catch) in the BSAI and 4 mt (7% of the total forage fish catch) in the GOA. Even though the amount of biomass is unknown for the individual forage fish groups, it is assumed that the small amount of incidental catch is not likely to affect the forage species' ability to reproduce, and that the small amount of incidental catch should not cause competition with predators of forage fish species (NMFS 1998a).

Biomass data are not available for most forage species so that managing these species through harvest limits would be of unknown value. Smelt abundance in the GOA during the late 1970s either declined or became redistributed due to warming surface water temperatures (NMFS 2001a). Some information shows a decline of catch per unit effort (CPUE) for capelin and eulachon in the GOA since the 1980s to low levels in the late 1990s (Appendix D of NPFMC 2000c). Sandlance larvae captured in plankton samples show an increase in abundance since the early 1980s (Rugen 1990). Broder et al. (1999) summarized distribution, species associations, and biomass trends for several forage fish in the Bering Sea. The summary includes information on spatial separation of forage species groups based on water temperatures, and 36 years of Russian pelagic trawl data showing different periods of abundance depending on environmental conditions.

3.5 Status of Prohibited Species

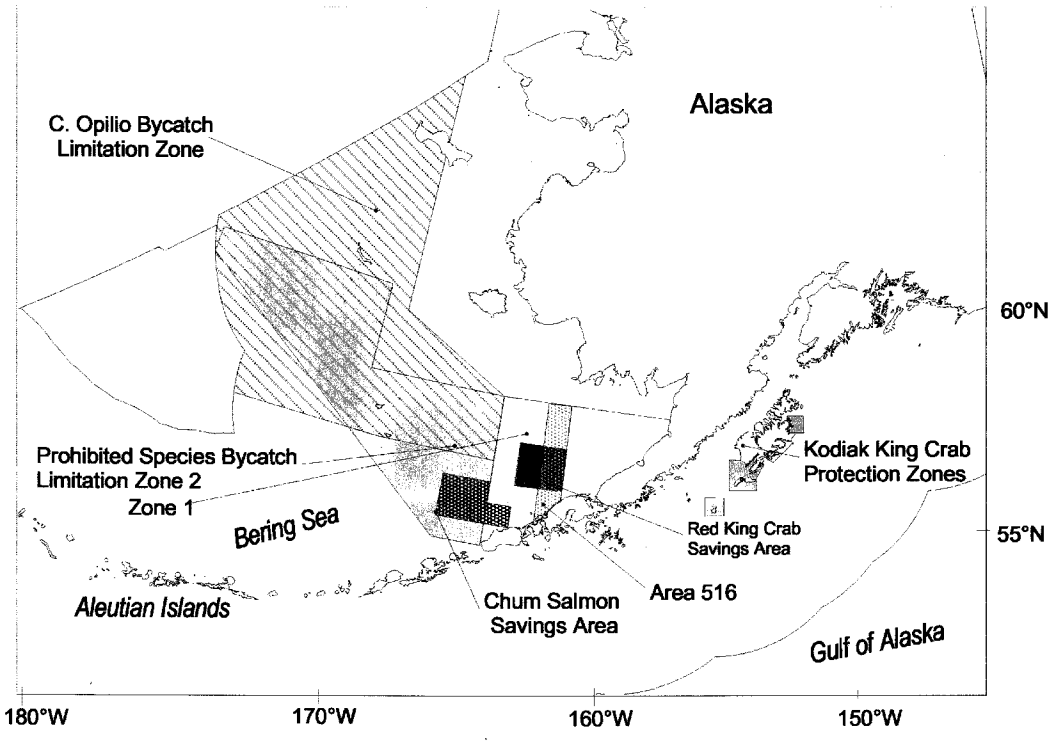
Prohibited species taken incidentally in groundfish fisheries include: Pacific salmon (chinook, coho, sockeye, chum, and pink salmon); steelhead trout; Pacific halibut; Pacific herring; and Alaska king, Tanner and snow crabs. Limits on the amounts of Pacific salmon, crab, and Pacific halibut that can be taken in the federal groundfish fisheries are set by regulations at 50 CFR 679.21. Halibut and other PSC limits in the BSAI are established in regulations as absolute amounts or as annually adjusted numbers based on a specified percent of annual stock abundance estimates. PSC limits are apportioned among fisheries and seasons annually by the Council in a manner intended to optimize groundfish harvest under PSC constraints. During haul sorting, these species or species groups are to be returned to the sea with a minimum of injury except when their retention is required by other applicable law. The status of each prohibited species are summarized in subsections 3.5.1 through 3.5.4. Under the present fishery management regulations, a number of areas in the GOA and BSAI are set aside for the protection of a number of fish, invertebrate and mammal species. These areas are identified in Figures 3.5-1 and 3.5-2; more details may be found in 50 CFR part 679. Table 3.5-1 lists the PSC limits and apportionments for the BSAI 2001 fisheries.

Figure 3.5-1 Management areas involving prohibited species and walrus in the Bering Sea.



Source: Draft SEIS (NMFS 2001a)

Figure 3.5-2 Management areas involving prohibited species in the Bering Sea and Gulf of Alaska



Source: Draft SEIS (NMFS 2001a)

Table 3.5-1 2001 prohibited species bycatch allowances for the BSAI trawl and non-trawl fisheries

Trawl Fisheries	Prohibited Species and Zone					
	Halibut mortality (mt) BSAI	Herring (mt) BSAI	Red King Crab (animals) Zone 1	*C. opilio* (animals) COBLZ	*C. bairdi* (animals)	
					Zone 1	Zone 2
Yellowfin Sole	911	139	11,664	2,876,981	253,894	1,246,502
Rocksole/Other Flatfish/ Flatsole	854	20	64,782	469,130	272,126	415,501
**RKC Savings Subarea			22,674			
Turbot/Sablefish/Arrow		9		40,238		
Rockfish	69	7		40,237		7,658
Pacific Cod	1,334	20	11,664	524,736	136,400	225,941
Pollock/Atka Mackerel/ Other	232	*1,330	1,615	72,428	12,830	19,148
Total Trawl PSC	3,400	1,526	89,725	4,023,750	675,250	1,914,750
Non-Trawl Fisheries						
Pacific Cod	755					
Other Non-trawl	78					
Groundfish Pot and Jig	exempt					
Sablefish Hook-and-Line	exempt					
Total Non-trawl	833					
PSQ Reserve***	342		7,275	326,250	54,750	155,250
Grand Total	4,575	1,526	97,000	4,350,000	730,000	2,070,000

Note: *Midwater pollock trawl for Herring PSC allocation is 1,184 mt
**no more than 35% of rocksole/other flatfish/flatsole, §679.21(e)(3)(ii)(B)
*** Except for herring, 7.5 percent of each PSC limit is allocated to the multi-species CDQ program as PSQ reserve.

3.5.1 Pacific Salmon

Five species of Pacific salmon, pink (*Oncorhynchus gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), coho (*O. kisutch*), and chinook (*O. tschawtscha*) salmon as well as steelhead trout (*Salmo gairdneri* Richardson) occur in Alaska. All five species of salmon are fully utilized and managed by the State of Alaska. A detailed description of salmon management, production history, and life history are contained in Section 3.7.2 of the SEIS (NMFS 1998a).

Alaska commercial salmon harvests generally increased over the last three decades but may have peaked in 1995 (Burger and Wertheimer 1995, Wertheimer 1997). Salmon run sizes off Alaska have exhibited wide variations throughout its known history and have generally been strongly correlated to environmental factors. These factors and management measures contributing to the current high abundance of Alaska salmon, 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. Nonetheless, the potential for overfishing, bycatch in other fisheries, and loss of freshwater and nearshore marine habitat are still important issues that are addressed in the FMPs.

In 2000, statewide salmon harvests in Alaska were estimated at nearly 136 million fish, down from a near record harvest of 208 million fish in 1999. The State's most valuable fishery, sockeye salmon in Bristol Bay, yielded a commercial harvest of 20.5 million fish in 2000, down from 26 million fish in 1999. For 2001 the Bristol Bay sockeye return is forecast to be 24.3 million fish. If all escapement goals are met this return could be expected to yield a commercial harvest of about 17 million fish. This forecast is 37 percent lower than the 20-year mean (38.6 million fish) returns. The statewide pink salmon harvest of 74 million fish in 2000 was down from the record high of 140 million fish set in 1999. The overall harvests of nearly 24 million chum salmon in 2000 ranks among the three historical largest, however poor returns of chum salmon to the Yukon, Kuskokwim, and Norton Sound region remain a concern. The statewide coho salmon harvest totaled 4 million fish in 2000. The statewide harvest of 350,000 king salmon in 2000 is similar to 1999.

Salmon returns (all species) throughout the Yukon and Kuskokwim River drainages and the entirety of Norton Sound were less than 50 percent of the mean 20-year average which resulted in severe constraints on commercial, sport, and subsistence harvest. The State of Alaska declared that an emergency disaster exists in the area July 12, 2000.

Salmon bycatch is currently managed by area closures and seasonal and year round limits. Pacific salmon bycatch data are routinely tabulated by species only for chinook salmon. All other salmon species and steelhead trout are grouped together and reported as "other salmon". An analysis of the species composition of the "other salmon" category based on NMFS observer program reports (as in Berger et al. 1984 and Guttormsen et al. 1990) showed that roughly 95% of bycaught non-chinook salmon are chum salmon. Salmon bycatch are taken primarily in the pollock trawl fishery (Table 3.5-2). Scale pattern analysis performed on salmon sampled in the Bering Sea and North Pacific revealed that nearly all Bering Sea bycaught salmon analyzed by scale sampling in 1979, 1981 and 1982 were from either Alaska or Asia, and approximately 60% of trawl bycaught chinook in the Bering Sea were of Western Alaskan origin (Alaska Department of Fish and Game and North Pacific Fishery Management Council 1998).

In the last 20 years, chinook salmon bycatch saw a high trawl bycatch in the Bering Sea of approximately 115,000 fish in 1980 (Table 3.5-3). This high bycatch was experienced by the foreign trawl fishery operating in the Bering Sea at the time, and regulators took action to reduce bycatch from these levels. Bycatch was relatively low in the following years, however experienced a general rise in the 1990's with the advent of the domestic trawl fisheries in 1990. BSAI FMP Amendment 21b provided incentives to reduce chinook salmon bycatch levels, and Amendment 58 further reduced chinook salmon PSC limits. The later action modified slightly the boundaries of the Chinook Salmon Savings Area (CHSSA) established under Amendment 21b, set new CHSSA closure dates, and reduced the BSAI Chinook salmon bycatch limit triggering pollock trawl fishing closures in the CHSSA to 41,000 fish in 2001, 37,000 fish in 2002, 33,000 fish in 2003, and 29,000 fish in 2004 and after (Figure 3.5-1).

Chum salmon bycatch in the Bering Sea domestic trawl fisheries peaked at approximately 243,000 fish in 1993. (Table 3.5-3). FMP Amendment 35 was adopted in 1995 to prevent chum bycatch from being sustained at these levels. Under Amendment 35, the Chum Salmon Savings area is closed to trawling in August and the Catcher Vessel Operating Area (CVOA) has a seasonal trawl PSC limit for non-chinook salmon of 42,000 fish (Figure 3.5-2). Chum salmon bycatch levels have generally remained between 50,000 - 70,000 fish in recent years (Table 3.5-3).

In the GOA, while PSC limits have not been established for salmon, in previous years the timing of seasonal openings for pollock in the Central and Western GOA have been adjusted to avoid periods of high chinook and chum salmon bycatch. The highest chinook salmon bycatch in the GOA was approximately 74,000 fish in 1984, but bycatch levels have remained relatively low since the instigation of the domestic fisheries in 1990 (Table 3.5-4). With the exception of a bycatch of approximately 56,000 other salmon in 1993, other salmon bycatch in the GOA has also been relatively low in recent years. In the year 2000, the trawl gear groundfish fisheries of the GOA had a bycatch of 26,705 chinook and 13,995 "other salmon" through December 31, 2000. Neither the chinook nor non-chinook PSC limits were exceeded in 2000 to trigger closure of the CHSSA or Chum Salmon Savings Area in the BSAI. Table 3.5-2 shows the incidental take of salmon in the BSAI trawl fisheries for the year 2000 and the first part of 2001. During 2000, 93 percent of the salmon bycatch occurred in the midwater pollock trawl fishery in the BSAI.

Figures 3.5-3 and 3.5-4 show the distribution of Chinook and chum salmon bycatch in the BSAI pelagic trawl fishery. A large amount of bycatch is located in the central and eastern portions of the SCA.

The average chinook salmon bycatch for 1996 through 2000 is 37,844 fish. The chinook bycatch level varied from 7,470 fish in 2000 to 63,179 fish in 1996. The majority of the BSAI chinook salmon bycatch in the P. Cod fishery is taken in the area of the 200 m depth contour northwest of Unimak Island within the SCA and along the 200 m depth contour outside of the SCA during January-April. (NMFS 2000c).

Table 3.5-2 Incidental take of salmon in BSAI trawl fisheries, 2000 and first part of 2001

BSAI Trawl Fishery Group	Year 2000			Year 2001		
	Chinook	Other Salmon	Total	Chinook	Other Salmon	Total
Midwater Pollock	3,968	56,715	60,683	16,842	7,151	23,993
Bottom Pollock	0	0	0	0	0	0
Pacific Cod	2,688	128	2,815	3,478	355	3,832
Yellowfin Sole	75	188	263	43	133	175
Rock Sole/Other Flatfish	462	108	571	2,057	1	2,058
Rockfish	2	0	2	0	171	171
Other	276	460	737	804	139	943
Total	7,470	57,600	65,070	23,224	7,949	31,173

Note: Values are in numbers of fish; 2001 data are from January 20, 2001 through July 14, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

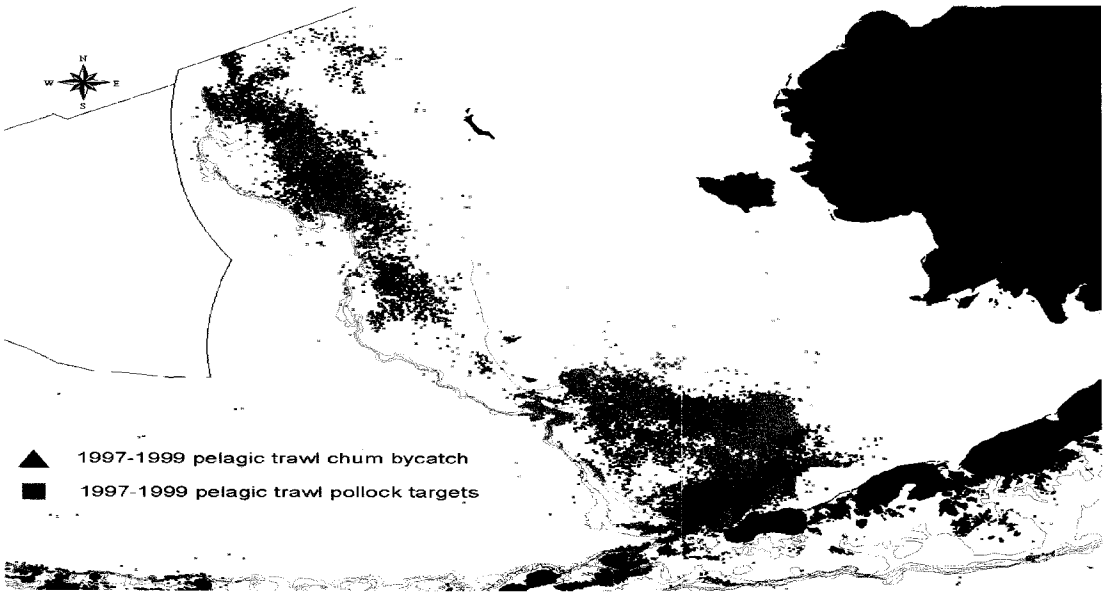
Table 3.5-3 Trawl bycatch of chinook and chum/other salmon in the Bering Sea and Gulf of Alaska, 1980 through the first half of 2001

Year	Bering Sea		Gulf of Alaska	
	Chinook	Chum/Other	Chinook	Chum/Other
1980	115,036	6,726	31,747	4,150
1981	36,218	5,800	28,570	1,963
1982	15,644	7,686	5,914	888
1983	10,334	32,134	9,544	4,162
1984	11,274	72,195	74,353	1,241
1985	11,096	10,598	13,994	75
1986	9,237	14,433	20,760	54
1987	22,221	4,799	761	456
1988	30,320	3,709	88	59
1989	40,354	5,545	6,690	0
1990	13,990	16,661	14,830	4,670
1991	35,766	31,987	37,592	13,288
1992	37,372	38,919	15,964	10,126
1993	45,964	243,246	24,465	56,388
1994	44,380	96,431	13,613	37,226
1995	22,461	21,673	14,647	64,792
1996	63,179	77,926	15,761	4,176
1997	50,218	67,536	15,119	3,420
1998	55,427	65,631	16,984	13,544
1999	12,924	46,295	30,600	7,529
2000	7,470	57,600	26,705	10,995
2001	23,224	31,173	11,531	2,540

Note: 2001 data are through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

Figure 3.5-3 **Critical habitat (shaded circle and square areas) with chinook salmon by catch in pelagic trawl fisheries, 1997-1999, for comparison**

Figure 3.5-4 Distribution of BSAI chum salmon bycatch in pelagic trawl, 1997–1999



3.5.2 Pacific Halibut

Pacific halibut (*Hippoglossus stenolepsis* Schmidt) fisheries are managed by a Treaty between the United States and Canada through recommendations of the International Pacific Halibut Commission (IPHC). Pacific halibut is considered to be one large interrelated stock, but is regulated by subareas through catch quotas. The commercial and recreational fishery has a long tradition dating back to the late 1800s. Further details on the management, production history, and life history of Pacific halibut are described in section 3.7.2 of the SEIS (NMFS 1998a). In an effort to reduce bycatch of halibut, NMFS issued regulations to prohibit non-pelagic trawl gear in the non-CDQ directed pollock fisheries in the BSAI (65 FR 31105, May 16, 2000).

The most recent halibut stock assessment was conducted by the IPHC in December 2000. The halibut resource is considered to be healthy, with total catch near record levels. The current estimate of exploitable halibut biomass for 2001 is estimated to be 249,007 mt. The exploitable biomass of the Pacific halibut stock apparently peaked at 326,520 mt in 1988 (Sullivan and Parma, 1998). 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). The species is fully utilized. Recent average catches (1994-96) were 33,580 mt for the U.S. and 6,410 mt for Canada, for a combined total of 39,990 mt for the entire Pacific halibut resource. This catch was 48 percent higher than long-term potential yield, which reflects the good condition of the Pacific halibut resource. At its January 2001 annual meeting, the IPHC recommended commercial catch limits totaling 37,213 mt (round weight equivalents) for Alaska in 2001 up from 33,910 mt in 2000. For the year 2000, commercial fixed gear IFQ harvests of halibut in Alaska total 24,074 mt (net weight) taking 98 percent of the TAC allocated.

The major change in stock assessment results for the year 2000 came from the elimination of the downward correction in recent survey catch rates that was applied in 1999 to account for a suspected increase in the fishing power of the surveys due to a bait change in 1993. Experiments conducted in 2000 have shown that the precautionary adjustment is not required. The stock assessment shows only minor changes for the southern portion of the range (Areas 2A, 2B, and 2C). Improvements in the estimated biomass of the stock in Area 3A are accounted for largely by the change in the treatment of historical survey data. Weight at age for halibut in the central portion of the range increased slightly in 2000 over the very low values of recent years. However, recruitment of year classes from the years 1989 and 1993 appears to be poor. The outlook for the stock biomass over the near future is for a decline from the record high levels of recent years until increased recruitment to the stock occurs.

Fixed PSC mortality limits have been set for the BSAI groundfish fisheries. Although the annual GOA PSC limits have not changed in recent years, the Pacific halibut mortality limits are not established in regulations but are specified annually by the Council and NMFS. Each year the IPHC evaluates the performance of the groundfish fisheries and recommends discard mortality rates for halibut bycatch in each groundfish fishery. PSC amounts for Pacific halibut mortality are actually the component of fish greater than 81 centimeters deducted from the available constant exploitable yields for the directed Pacific Halibut fishery by the IPHC. Therefore, the allowable commercial catch of halibut is reduced on account of halibut bycatch mortality in the groundfish fisheries. The Council uses the best estimate of halibut bycatch mortality rates each year and the groundfish TAC apportionments to set halibut bycatch mortality allowances for each gear and target fishery group. NMFS monitors halibut bycatch performance throughout the fishing season, including the extrapolation of data to unobserved vessels, and closes fishing by gear group before bycatch mortality limits are reached.

Bycatch of Pacific halibut constrains the groundfish fisheries in both the BSAI and GOA, preventing the TAC of many groundfish target species from being harvested. For each gear type, halibut caps have been apportioned by target species and for each individual target species, further apportioned by season. This halibut bycatch management program has the effect of directing fisheries to the highest volume or highest value target species with the lowest seasonal halibut bycatch rates throughout the fishing year. In recent years pot gear, jig gear, and hook-and-line gear targeting sablefish under the IFQ program have been exempted from halibut mortality limitations. Other measures taken to reduce the bycatch mortality of halibut have included area closures (both seasonal and year round), careful release requirements, a vessel incentive program to hold individual vessels accountable for excessive bycatch, public reporting of individual vessel bycatch rates, and gear modifications.

In the GOA, the PSC mortality limit for halibut is 2,300 mt (allocated as 2,000 mt for the trawl fisheries and 290 mt to the hook & line non-Demersal shelf rockfish (DSR) fisheries and 10 mt to hook-and-line DSR fisheries). Since 1996 pot gear and jig gear targeting groundfish, and hook-and-line gear targeting sablefish have been exempted from PSC caps due to relatively low bycatch by these gear types and since the sablefish and halibut IFQ program requires quota share holders to retain halibut. The 2,000 mt of halibut mortality allocated to trawl gear is further apportioned by season throughout the fishing year and to two target fishery complexes; the shallow water complex (consisting of pollock, pacific cod, shallow-water flatfish, flathead sole, Atka mackerel, and "other species") and the deep-water complex (consisting of sablefish, rockfish, deep-water flatfish, rex sole, and arrowtooth flounder). For 2000, neither the 2000 mt mortality limit for the trawl fisheries nor the 290 mt of halibut mortality allocated to the hook-and-line fisheries were exceeded (Table 3.5-4). The 290 mt PSC cap for other hook-and-line fisheries is further apportioned seasonally throughout the fishing year.

Table 3.5-4 Halibut bycatch mortality (mt) in the GOA, 1995-2001

YEAR	TRAWL Shallow Complex	TRAWL Deep Complex	TOTAL TRAWL	TOTAL TRAWL
1995	1,008	1,043	2,051	330
1996	1,010	937	1,946	172
1997	1,146	865	2,011	217
1998	1,249	779	2,028	296
1999	1,321	817	2,137	348
2000	1,019	869	1,888	276
2001	615	663	1,277	278

Note: 2001 data are through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

The BSAI Pacific halibut PSC mortality limit is 4,575 mt (3,400 mt for trawl and 832 mt for non-trawl gear, and 343 mt for the CDQ program). The trawl mortality component (3,400 mt) is sub-allocated to target groundfish fisheries (Pacific cod, yellowfin sole, rock sole, pollock/Atka mackerel/other species, rockfish, and arrowtooth/sablefish/turbot). Although the yellowfin sole, rock sole/flathead sole/other flatfish, and pollock/Atka mackerel/other species fisheries exceeded bycatch allocations, the overall halibut PSC limit was not exceeded in 2000 (Table 3.5-5). Except for hook-and-line Pacific cod, none of the fixed gear target fisheries have exceeded their bycatch allocations in 2000 (Table 3.5-6).

Table 3.5-5 Halibut bycatch in BSAI trawl fisheries for 2000 and first half of 2001

BSAI Trawl Fishery Group	2000			2001		
	Bycatch (mt)	Cap (mt)	Percent	Bycatch (mt)	Cap (mt)	Percent
Pacific cod	935	1,434	65	553	1,334	41
Yellowfin sole	957	886	108	510	911	56
Rock sole/Flathead sole/Other Flats	885	779	114	758	854	89
Pollock/Atka mackerel/Other Spp.	339	232	146	97	232	42
Rockfish	11	69	16	31	69	45
Turbot/Arrowtooth flounder/Sablefish	80	0	0	63	0	0
Total	3,208	3,400	94	2,011	3,400	59

Note: 2001 data are from January 20, 2001 through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

Table 3.5-6 Seasonal halibut bycatch in BSAI fixed gear fisheries in 2000 and first half of 2001

BSAI Fixed Gear Fishery Groups	2000			2001		
	Bycatch	Cap (mt)	Percent	Bycatch	Cap (mt)	Percent
Pacific cod, Hook & Line	711	673	106	228	755	30
Other species, Hook & Line, Jig	123	159	77	53	78	8
Total	834	832	100	281	833	34

Note: 2001 data taken from January 20, 2001 through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

Figure 3.5-5 shows the halibut bycatch in the bottom trawl fisheries, and figure 3.5-6 shows the halibut bycatch in the hook-and-line fishery for the BSAI. Both fisheries have halibut bycatch spread throughout the BSAI area.

Figure 3.5-5 Observed locations of recent halibut bycatch on longlines, with cod longliner target fishery

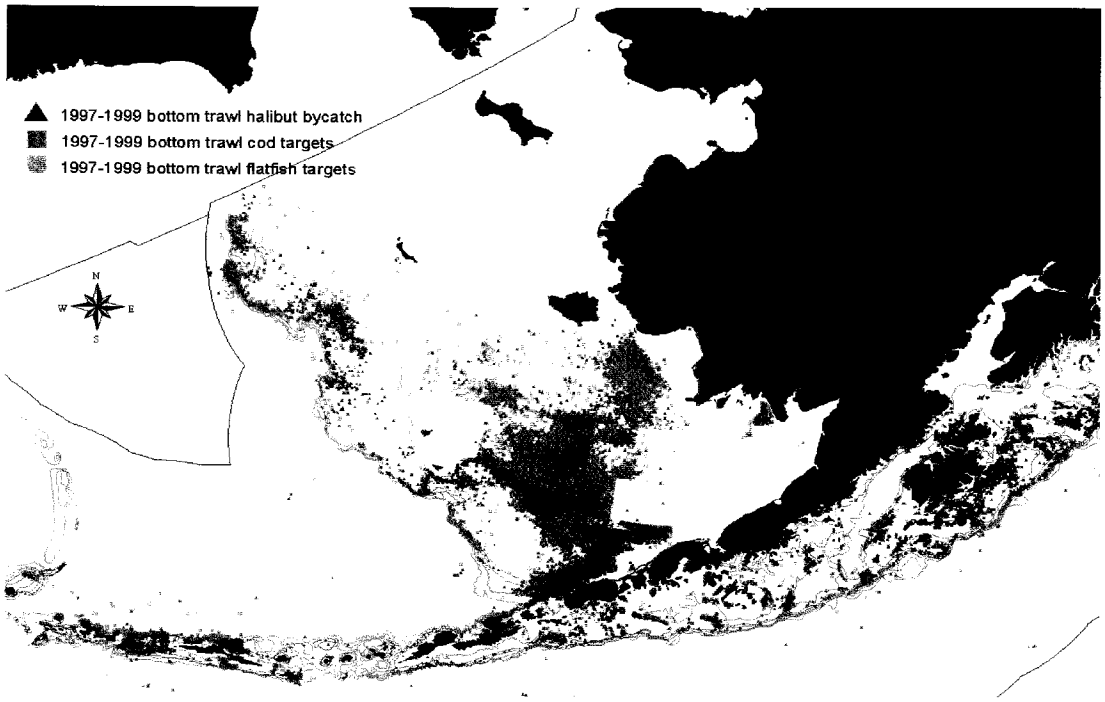
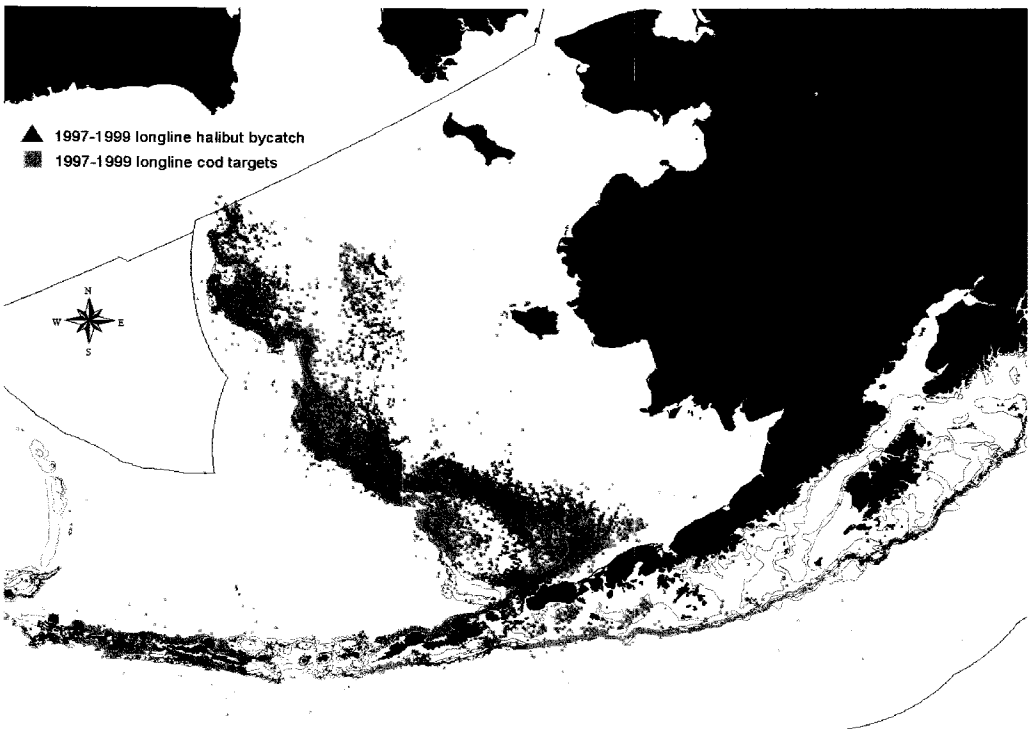


Figure 3.5-6 **Observed locations of recent halibut bycatch in bottom trawls, with target fishery distributions**



3.5.3 Pacific Herring

Pacific herring (*Clupea harengus pallasi*) fisheries are managed by the State of Alaska. A detailed description of its management, production history, and life history are contained in Section 3.7.4 of the SEIS (NMFS 1998a). The fisheries occur in specific areas in the Gulf of Alaska and the Bering Sea when the stocks come inshore to spawn. In the Gulf of Alaska, spawning concentrations occur mainly off southeastern Alaska, in Prince William Sound, and around the Kodiak Island-Cook Inlet area. In the Bering Sea, the centers of abundance are in northern Bristol Bay and Norton Sound. Although most herring are harvested near-shore in the sac-roe season in spring, fall seasons are also designated for food and bait fisheries.

From catch records, it is evident that herring biomass fluctuates widely due to influences of strong and weak year-classes. The major Bering Sea and Gulf of Alaska stocks are currently at moderate levels and in relatively stable condition, with the exception of Prince William Sound and Cook Inlet which are at depressed levels. Stock assessments indicated that the herring biomass in Prince William Sound and Cook Inlet were below the minimum threshold needed to conduct a harvest so these fisheries were closed for 1999 and 2000.

Annual statewide harvests of herring were estimated at 36,091 mt for the sac roe harvest through June 21, 2000 and 2,981 mt for the food and bait fishery through November 6, 2000. The Alaska statewide sac roe harvest was about 20 percent less than forecast for 2000, with harvests less than quotas at Kodiak, Togiak, Security Cove, Goodnews Bay, Nunivak Island, and Norton Sound. At Togiak (the largest herring fishery in Alaska) the main spawning run occurred over a very short period in 2000, during which harvest was

constrained by the amount of processing capacity on the fishing grounds. Unusual run timing, limited fishing effort, herring availability, and weather were factors limiting harvests in the other areas. Recent statewide harvests have averaged 52,800 mt.

Pacific herring PSC limitations in the groundfish fisheries apply to trawl gear in the Bering Sea. Under Amendment 16 to the BSAI groundfish FMP, the herring PSC limit is set at 1% of the EBS spawning biomass, equal to 1,526 mt for 2001. The PSC limit for trawl gear is determined each year during the ABC and TAC setting process, and is further apportioned by target fishery (50 CFR § 679.21 (e)(1)(iv)). Should the herring PSC limit for a particular groundfish target fishery be reached during the fishing year, the trawl fishery for that species is closed in the Herring Savings Areas (Figure 3.5-1), (50 CFR § 679.21 (e)(7)(v)). None of the bycatch allocations have been exceeded in 2000.

The ADF&G estimated that the 2001 spawning biomass of the eastern Bering Sea herring stock will be approximately 152,574 mt, a decrease from the 1999 estimate of 185,330 mt, primarily resulting from a more conservative biomass estimate for herring spawning at Togiak (Alaska Department of Fish and Game website at http://www.cf.adfg.state.ak.us/geninfo/finfish/herring/forecast/01_4cast.htm). All major Bering Sea herring stocks are considered to be healthy and are expected to be above their thresholds in 2001. The 1993 and 1995 year classes appear to be moderately strong in most areas and are expected to sustain healthy spawning populations for several years. The majority of the herring bycatch is taken in the midwater pollock fishery (Table 3.5-7).

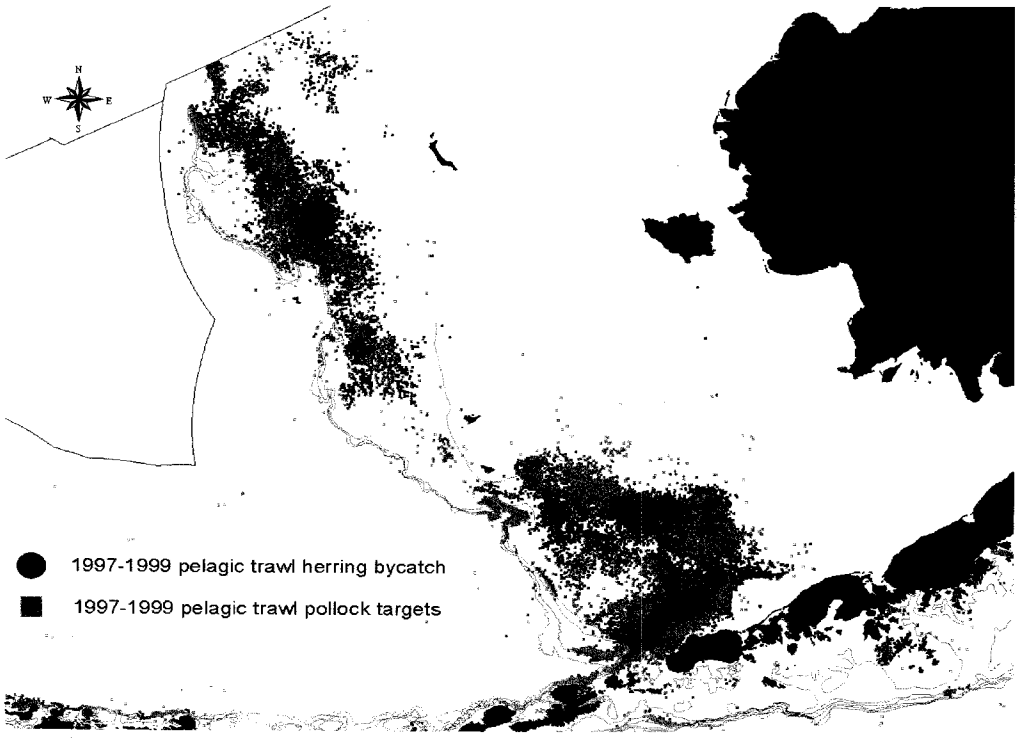
Table 3.5-7 Herring bycatch in the BSAI area in 2000 and 2001

BSAI Trawl Fishery Group	2000			2001		
	Bycatch (mt)	Cap (mt)	Percent	Bycatch (mt)	Cap (mt)	Percent
Midwater Pollock	482	1,616	30	13	1,184	1
Pacific Cod	1	24	4	4	20	22
Yellowfin Sole	25	169	15	11	139	8
Rockfish	0	9	0	0	7	0
Other	3	38	8	0	146	0
Rock sole/Other flatfish	2	24	7	9	20	45
Turbot/Arrowtooth flounder	0	11	0	0	9	4
Total	512	1,891	27	38	1,525	2

Note: 2001data are from January 20, 2001 through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

Figure 3.5-7 shows the distribution of herring bycatch in the BSAI pelagic trawl pollock fishery during 1997-1999. The herring bycatch is widespread throughout the pollock fishery.

Figure 3.5-7 Spatial distribution of herring bycatch within the BSAI pelagic pollock fishery, 1997-1999.



3.5.4 BSAI Alaska King, Tanner, and Snow Crab

BSAI Alaska king, Tanner and snow crab fisheries are managed by the State of Alaska, with federal oversight established in the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (crab FMP). The commercially important crab species are: red king crab (*Paralithodes camtschaticus*), blue king crab (*Paralithodes platypus*), golden or brown king crab (*Lithodes aequispinus*), Tanner crab (*Chionoecetes bairdi*), and snow crab (*Chionoecetes opilio*). A detailed description of their management, production history, and life history are contained in Section 3.7.1 of the SEIS (NMFS 1998a) and in the 2000 Crab SAFE (NPFMC 2000c). In an effort to reduce bycatch of crab, NMFS issued regulations to prohibit non-pelagic trawl gear in the non-CDQ directed pollock fisheries in the BSAI (65 FR 31105, May 16, 2000).

Bycatch of king, Tanner, and snow crab in groundfish fisheries is a significant issue. Typically, the crab bycatch are juveniles. PSC limits for each species by zone and by fishery closes the fishery for the remainder of the season when the PSC limit has been reached. Area closures and a vessel incentive program are also used to limit crab bycatch (Witherell and Pautzke 1997). Trawl fisheries are limited to less than 1% of crab populations, except for Tanner crab in Zone 2. However, trawling may also cause unobserved mortality and habitat degradation, and closed areas are likely to be more effective than PSC limits in reducing the impacts of trawling on crab stocks (Witherell and Harrington 1996).

NMFS conducts annual trawl surveys for crab stock assessments in the BSAI. A length-based analysis, developed by ADF&G, incorporates survey, commercial catch, and observer data to estimate stock abundance (Zheng et al. 1995; Zheng et al. 1998). Abundance estimates generated by this model are used to set guideline harvest levels (GHLs) for the crab fisheries. Catches are restricted by GHLs, seasons, licenses, pot limits, and size and sex limits that restrict landings to legal sized male crabs. Fishing seasons

are set at times of the year which avoid molting, mating, and softshell periods, both to protect crab resources and to maintain product quality.

Based on analysis of the 2000 NMFS survey results, the latest status of red king crabs are as follows. In Bristol Bay the number of mature male red king crab decreased 21 percent in 2000. Numbers of mature female red king crabs (>90mm carapace width), however, increased 21 percent in 2000. The effective spawning biomass is estimated at 18,140 mt. A 10 percent exploitation rate of mature male crabs was established for the 2000 fishery. The guideline harvest level (GHL) for the year 2000 was 3,788 mt, which included 284 mt for the CDQ fisheries. This is a reduction from the 4,835 mt GHL in 1999. The Bristol Bay stock remains depressed compared to past abundance levels. Two hundred thirty-seven vessels participated in the fishery in the year 2000, harvesting 3,402 mt in four days. Twenty-six AFA vessels fished in a cooperative with a pre-specified harvest cap of 384 mt, 10.957 percent of the open access GHL). The Council created the Nearshore Bristol Bay habitat protection area and the Red King Crab Savings Area to protect crab habitat from non-pelagic trawl gear under Amendment 37 which was adopted in 1996 (Figures 3.5-1 and 3.5-2). Besides PSC limits, red king crab is protected in this closed area. Only the yellowfin sole fishery exceeded its PSC limit of red king crab in 2000.

Estimates of red king crabs in the Pribilof Islands area decreased significantly from 1999. The blue king crab population in the Pribilof District is low (Stevens et al. 2000). However, the survey index has very low precision, making the reliability of that estimate extremely low. Given significant declines of blue king crab in that area, the high degree of uncertainty surrounding the estimate of red king crab abundance, and the poor fishery performance of recent years, the red and blue king crab fishery in the Pribilof District were closed in 2000. The Pribilof stock of blue king crab is not below the minimum stock size threshold (MSST) established by the crab FMP but is closely approaching it. The Council created the Pribilof Island habitat conservation area, therefore, bycatch of these crab species is not a concern and no PSC limits have been established (Figure 3.5-1). With the exception of the yellowfin sole fishery, the PSC cap for red king crab in Zone 1 was not exceeded in 2000, and the overall cap was not attained (Table 3.5-8). Red king crab trawl bycatch in Zone 1 has been highest in the rock sole fishery in the last six years (Table 3.5-9).

Table 3.5-8 Bycatch of Red King crab in Zone 1 BSAI fisheries

	2000			2001		
	Number of Crab	PSC Cap (number of crab)	Percent	Number of Crab	PSC Cap (number of crab)	Percent
Rock Sole/Other Flatfish	53,389	64,775	82	23,267	64,782	36
Pacific Cod	4,379	11,656	38	1,733	11,664	15
Yellowfin Sole	13,020	11,655	112	3,942	11,664	34
Pollock/Atka	0	1,660	0	93	1,615	6
RKC Saving Area	na	22,665	na	na	22,674	na
Total	70,787	89,726	79	29,036	89,725	32

Note: 2001 data are from January 20, 2001, through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

Table 3.5-9 Trawl bycatch of Red King crab in Zone 1 BSAI fisheries, 1995-2000

Year	Pacific Cod	Pollock/Atka	Rock Sole/Other	Yellowfin	Total
1995	2,450	3,588	20,523	6,054	32,615
1996	2,918	5,872	8,971	689	18,449
1997	6,769	137	33,249	6,763	46,918
1998	3,015	13,950	15,008	6,194	38,167
1999	7,752	91	62,456	12,774	83,073
2000	4,379	0	53,389	13,020	70,787

Source: NMFS Alaska Region prohibited species catch estimates.

NMFS survey results for blue king crabs in the St. Matthews Island area indicate a steep decline since 1998. This stock is overfished as defined in the crab FMP. As a result, and coupled with the poor fishery performance in 1998, this area was closed for the 1999 and 2000 season. The Council developed a rebuilding plan, Amendment 15, for this stock in accordance with the Magnuson-Stevens Act. The Secretary approved the rebuilding plan on November 29, 2000 (65 FR 76175 December 6, 2000). There is no PSC limit for blue king crab.

ADF&G and NMFS do not estimate abundance annually for Bering Sea golden king crabs and commercial harvest is controlled by ADF&G permit (Morrison et al.1998). Catches have declined from the early years of the fishery as the virgin stock was exploited and recruitment was unable to sustain the fishery at its initial harvest levels (Morrison et al. 1998). In 1995, the State of Alaska mandated observer coverage for all vessels targeting golden king crab in the Aleutian Islands. In 2000, 59 mt were harvested from the Pribilof District and 1,647 mt, (fishery ongoing) have been harvested from the Aleutian Islands District. No PSC limit is established for this stock.

The Tanner crab (*C. bairdi*) fishery has been closed since 1996 due to low abundance and remains closed in 2001. Based on the year 2000 survey results, the population is increasing slightly due to recent recruitment. The stock was declared overfished on March 3, 1999, because survey data indicated that spawning biomass was below the MSST established for this stock. At its October 1999 meeting the Council adopted Amendment 11, a rebuilding plan for this stock. The Secretary approved this amendment on June 8, 2000, (65 FR 38216, June 20, 2000). The plan consists of a conservative and precautionary harvest strategy, crab bycatch reduction measures in the crab fisheries, and increased habitat protection (Figure 3.5-2). The trawl target fisheries have remained well below Tanner crab PSC limits for 2000 (Table 3.5-10), and appear to be at similar levels in 2001 (Table 3.5-11). Tanner crab bycatch rates are higher in the trawl and pot fisheries than in the hook-and-line fisheries and are higher in the Bering Sea than the Aleutian Islands (NMFS 2000c).

Table 3.5-10 Bycatch of Tanner crab (*C. bairdi*) in the BSAI by area in the year 2000

BSAI Trawl Fishery Group	Zone 1			Zone 2		
	Bycatch Crab	Cap	Percent	Bycatch Crab	Cap	Percent
Rock sole/Other Flatfish	192,852	309,326	62	200,639	504,894	40
Pacific cod	55,379	154,856	36	26,484	275,758	10
Yellowfin sole	82,124	288,750	28	422,348	1,514,683	28
Pollock/Atka Mackerel/ Other	69	14,818	0	1,464	25,641	6
Rockfish	0	0	0	28	10,024	1
Turbot/Arrowtooth Flounder/ Sablefish	0	0	0	7,633	0	0
Total	330,424	767,750	43	658,597	2,331,000	28

Source: NMFS Alaska Region prohibited species catch estimates.

Table 3.5-11 Bycatch of Tanner crab (*C. bairdi*) in the BSAI by area in 2001 and the first half of 2001

BSAI Trawl Fishery Group	Zone 1			Zone 2		
	Bycatch Crab	Cap	Percent	Bycatch Crab	Cap	Percent
Rock Sole/Other Flatfish	126,596	272,126	47	202,671	415,501	49
Pacific Cod	46,087	136,400	34	19,278	225,941	9
Yellowfin Sole	21,157	253,894	8	33,060	1,246,502	3
Pollock/Atka Mackerel/ Other	4,692	12,830	37	5,967	19,148	31
Rockfish	0	0	0	0	7,658	0
Turbot/Arrowtooth Flounder/ Sablefish	0	0	0	2,808	0	0
Total	198,532	675,250	29	263,783	1,914,750	14

Note: 2001 data are through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

From a low in 1985, Bering Sea snow crab rebounded sharply, producing high catches in 1991 which have since declined. The biomass of both male and female snow crab in the Bering Sea declined significantly from levels observed during the 1998 survey. The 2000 survey estimates a 147 percent increase in legal sized males, a 24 percent increase in pre-recruits, and a 15 percent decline in large females. The population is believed to be increasing slightly due to recent recruitment. Survey results indicate that the Bering Sea snow crab stock is slightly above the MSST which is one half the long term average mature biomass, as defined in the crab FMP. The Magnuson-Stevens Act directed the Council to develop a rebuilding plan within one year to bring the stock back to the average mature biomass. A rebuilding plan was approved by the Secretary on January 4, 2001 (66 FR 742). Under the current rebuilding plan a very restricted harvest is allowed. In 2000, the GHL was set at 12,928 mt. The fishery was delayed by extensive ice coverage of the fishing grounds until April 1, 2000. Three hundred and two vessels participated in a seven day fishery landing 15,105 mt.

ADF&G has established a GHL of 12,383 mt for the 2001 fishing season, which includes 930 mt for the CDQ fishery. The fishery opened April 1 and closed April 8, delayed because of ice and weather. Beginning in 1999 *C. opilio* bycatch was apportioned by trawl fishery. If the PSC limit is reached, the Opilio Bycatch Limitation Zone is closed to the particular trawl fishery that exceeded the limit (Figure 3.5-2). No PSC allocation was exceeded in the year 2000 (Table 3.5-12).

Table 3.5-12 Bycatch of *C. opilio* crab by trawl fisheries in the BSAI for 2000 and first part of 2001

BSAI Trawl Fishery Group	2000			2001		
	Bycatch Crab	Cap	Percent	Bycatch Crab	Cap	Percent
Rock Sole/Other flatfish	224,124	869,934	26	113,739	469,130	24
Pacific Cod	50,245	123,529	41	8,172	524,736	2
Yellowfin Sole	1,927,702	2,876,579	67	272,634	2,876,981	9
Pollock/Atka Mackerel/ Other Spp.	5,208	71,622	7	1,646	72,428	2
Rockfish	0	41,043	0	0	40,237	0
Turbot/Arrowtooth Flouder/ Sablefish	0	41,043	0	0	40,238	0
Total	2,207,279	4,023,750	55	396,192	4,023,750	10

Note: 2001 data are from January 20, 2001, through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

3.5.5 GOA Alaska King and Tanner Crab

GOA Alaska king and Tanner crab stocks in the GOA are assessed and managed by the State of Alaska exclusively because no federal FMP for crab has been developed in the GOA. Alaska king and Tanner crab are treated as prohibited species in the groundfish fisheries in the GOA.

Alaska king and Tanner crab stocks are severely depressed over much of the GOA. The last king crab fishery in the Kodiak, Chignik, and South Peninsula Districts occurred in 1982, and in Cook Inlet in 1983. The red and blue king crab fisheries will remain closed in all Districts of the GOA in 2001. The only 2000 Tanner crab fishery in the GOA occurred in the Southeast District. In that fishery, 771 mt of Tanner and 254 mt of golden king crab were harvested. The 2000 survey indicated that the number of legal sized males was sufficient to permit a 2001 Tanner crab fishery in portions of the GOA. GHLs are 227 mt within the Kodiak District and 170 mt within the South Peninsula District. These areas have been previously closed since 1994. There are no crab PSC bycatch limits in the groundfish fisheries in the GOA. To protect crab, large areas of historically important crab habitat have been closed to the use of non-pelagic trawl gear in the GOA. Table 3.5-13 shows the amount of red king crab and Tanner crab bycaught in the GOA trawl and fixed gear fisheries. Very little king crab is taken as bycatch in the GOA. A large number of Tanner crabs are taken in the trawl and pot fisheries.

Table 3.5-13 Gulf of Alaska crab bycatch in 2000 and 2001

Gear	2000		2001	
	Red King Crab	Tanner Crab	Red King Crab	Tanner Crab
Trawl	55	48,716	26	74,312
Hook-and-line	45	168	1	28
Pot	7	65,786	6	58,057

Note: Values are numbers of crabs; 2001 data are through July 19, 2001.
Source: NMFS Alaska Region prohibited species catch estimates.

3.6 Endangered Species Act Listed Pacific Salmon

West coast salmon species currently listed under the Endangered Species Act (ESA) originate in freshwater habitat in Washington, Oregon, Idaho, and California. No stocks of Pacific salmon originating from freshwater habitat in Alaska are listed under the ESA. Some of the listed salmon species may migrate as adults into marine waters off Alaska where the potential exists for them to be caught as bycatch in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) groundfish fisheries.

ESA listed west coast salmon species are summarized in Table 3.6-1 and are categorized by Evolutionary Significant Units (ESUs). An ESU is a distinct population segment that is reproductively isolated and contributes to the ecological or genetic diversity of the species (Waples, 1991). To date, nine ESUs of chinook salmon, two ESUs of chum salmon, three ESUs of coho salmon, two ESUs of sockeye salmon, nine ESUs of steelhead, and one ESU of sea-run cutthroat trout have been listed as either threatened or endangered under the ESA. Of those listed, only six ESUs of chinook salmon, one ESU of sockeye salmon, and five ESUs of steelhead are thought to range into marine waters off Alaska during the ocean migration portion of their life history (Table 3.6-1). Those ESUs that are likely to migrate into marine waters off Alaska are highlighted, and are either chinook salmon, sockeye salmon or steelhead from rivers in Washington and Oregon. The NMFS designated critical habitat in 1993 (57 FR 57051) for Snake River sockeye, Snake River spring/summer chinook and Snake River fall chinook salmon. The NMFS designated critical habitat in 2000 (65 FR 7764) for Puget Sound, Lower Columbia River, Upper Willamette River, and Upper Columbia River Spring chinook salmon and Upper Columbia River, Snake River Basin, Lower Columbia River, Upper Willamette River and Middle Columbia River steelhead. These designations did not include any marine waters and, therefore, do not include any habitat where Alaska groundfish fisheries are promulgated.

In the marine waters off Alaska, the ESA listed salmon ESUs are mixed with hundreds to thousands of other salmon stocks originating from the Columbia and Willamette rivers in Washington and Oregon, British Columbia, Alaska, and Asia. ESA listed fish are not visually distinguishable from these 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 effects of the BSAI and GOA groundfish fisheries on listed salmon have been considered through a series of informal and formal ESA Section 7 consultations with the NMFS, Northwest Region from 1992 - 1999 (NMFS 1992b, 1993b, 1994, 1995b, 1999d). ESA listed Pacific salmon were also considered in the Fishery Management Plan (FMP) level consultation on the groundfish FMPs (NMFS, 2000a). The conclusion for Pacific salmon was that "after reviewing the current status, trends, distribution, and abundance 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 steelhead, Upper Willamette River steelhead, Middle Columbia steelhead, Lower Columbia River steelhead, and Snake River Basin steelhead, in the action area, interactions between these species and the BSAI and GOA groundfish fisheries do not appear to be significant." Of the chinook and steelhead ESUs considered likely to migrate into marine waters off Alaska, steelhead were considered to be an unlikely component of groundfish bycatch because none have been reported as such from 1995 to 1999, and only two coded wire tag steelhead were recovered in southeast Alaska seine salmon fisheries sampled from 1982-1993. Chinook salmon, however, are taken as bycatch in both the BSAI and GOA groundfish fisheries. Estimated chinook salmon bycatch levels in the BSAI and GOA are shown for the period 1990 to June 30, 2001, in Table 3.6-2. Estimation is made from extrapolating samples of salmon bycatch in observed groundfish operations.

Factors influencing the level of bycatch are location, gear type, and timing of the fishery. The following numbers are for the 1999 groundfish fisheries, which represents the most recent, representative fishing year, prior to implementation of Steller sea lion protection measures. In the BSAI, 92% of chinook bycatch is taken in the midwater pollock trawl fishery and in the GOA about 69% of chinook bycatch is taken in the midwater trawl fishery with the remaining take nearly evenly distributed between bottom trawl fisheries for pelagic shelf rockfish, Pacific cod and rex sole (NMFS, 2001a). In the BSAI, chinook salmon bycatch is higher in January through April and September through December in the BSAI (NMFS 1999 observer data)[1]. In the GOA, the majority of chinook salmon bycatch is taken in January, February, September and October although salmon bycatch is more evenly distributed throughout the year for some component's of the fishery, such as July and August take of salmon in the rockfish fishery (NMFS 1999 observer data)[2].

Coded wire tag recoveries of listed chinook salmon surrogate stocks since 1984 are given in Table 3.6-3. Most tag recoveries are from Upper Willamette River chinook ESU surrogate stocks in the GOA with Lower Columbia River chinook surrogate stock tags also recovered in the GOA. Only two coded wire tags have been recovered in the BSA from surrogate stocks. Because it is not possible to know if any actual fish from the listed chinook salmon were taken , the 1999 biological opinion assumed that these would be a small fraction of the observed recovery of coded wire tags. An incidental take statement was appended to the biological opinion that allowed for an observed take of 55,000 chinook salmon in the BSAI and 40,000 chinook salmon in the GOA. These are the non-extrapoloated bycatch levels expected from current fishing operations. Should incidental take levels exceed these amounts, then consultation should be reinitiated with the anticipated outcome of an incidental take statement commensurate with expected take resulting from normal operations in these fisheries. The NMFS Alaska Region was also given conservation recommendations for chinook salmon to continue to monitor bycatch levels, seek ways to improve region-of-origin and stock composition estimates and reduce bycatch through regulatory action such as time and area restrictions and incentive programs.*

The indirect effects of the BSAI and GOA groundfish fisheries could include impacts to chinook salmon or steelhead prey if they are taken as bycatch in the BSAI and GOA groundfish fisheries, or if prey habitat is disrupted by fishing operations. Chinook salmon prey upon fish and invertebrates including herring (adult and larval), sand lance, juvenile rockfish, pilchards, crab larvae, pelagic amphipods and euphausiids (Groot and Margolis, 1991). Chinook salmon are considered opportunistic feeders, but fish are more dominant in diets of larger fish while invertebrates are more dominant in the diets of smaller fish (<25 in. (63cm)long). Chinook salmon appear to feed most actively in spring and summer. Steelhead trout are also considered opportunistic feeders although fish (including juvenile sablefish and rockfish), squid, amphipods and polycheates (in some years) predominated in ocean diet studies in the Gulf of Alaska (LeBrasseur, 1966; Manzer, 1968; Pearcy et a l., 1988). Squids predominated in the subarctic current, from 51-49 degrees N, fishes in areas south of 50 degrees N and amphidpods and polycheates in areas north of 50 degrees N. High similarities were found in the diets of all Pacific salmon species and there is little evidence for specialization of diets between them, except for chum salmon.

Many of the prey of salmon are either target species (sablefish, rockfish), prohibited species (herring)or other bycatch species in the BSAI and GOA groundfish fisheries. Squid and other species (sculpin, skate, shark and octopi) are not targeted by the groundfish fisheries but bycatch levels are estimated. Forage fish include

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1 David Ackley, NMFS, Sustainable Fisheries Division, P.O. Box 21668, Juneau, AK 99802.

2 Ibid.

smelt, euphausiids, deep sea smelts and lanternfishes. Amendments 36 & 39 of the BSAI and GOA FMPs limit forage fish bycatches through specific catch percentages on all groundfish participants to prevent development of directed forage fish fisheries. Although most of the prey species listed are pelagic, some marine polycheates and some species of fish, such as rockfish are associated with seabed habitats, such that disturbance of benthic habitats by bottom trawling could affect them or their habitat at various life history stages (Auster and Langton, 1999).

Table 3.6-1 Summary of Salmonid species listed and proposed for listing under the Endangered Species Act. Evolutionarily significant units (in bold italic) represent those likely to range into marine waters off Alaska.

Species	Evolutionarily Significant Unit	Status	Federal Register Notice	
Chinook Salmon (*O. tshawytscha*)	Sacramento River Winter-Run	Endangered	59 FR 440	01/04/94
	Snake River Fall	Threatened	57 FR 14653	04/22/92
	Snake River Spring/Summer	Threatened	57 FR 14653	04/22/92
	Puget Sound	Threatened	64 FR 14307	03/24/99
	Lower Columbia River	Threatened	64 FR 14307	03/24/99
	Upper Willamette River	Threatened	64 FR 14307	03/24/99
	Upper Columbia River Spring	Endangered	64 FR 14307	03/24/99
	Central Valley Spring-Run	Threatened	64 FR 50393	09/16/99
	California Coast	Threatened	64 FR 50393	09/16/99
Chum Salmon (*O. keta*)	Hood Canal Summer-Run	Threatened	64 FR 14570	03/25/99
	Columbia River	Threatened	64 FR 14570	03/25/99
Coho Salmon (*O. kisutch*)	Central California Coast	Threatened	61 FR 56138	10/31/96
	S. Oregon/N. California Coast	Threatened	62 FR 24588	05/06/97
	Oregon Coast	Threatened	63 FR 42587	08/10/98
Sockeye Salmon (*O. nerka*)	**Snake River**	Endangered	56 FR 58619	11/20/91
	Ozette Lake	Threatened	64 FR 14528	03/25/99
Steelhead (*O. mykiss*)	Southern California	Endangered	62 FR 43937	08/18/97
	South-Central California	Threatened	62 FR 43937	08/18/97
	Central California Coast	Threatened	62 FR 43937	08/18/97
	Upper Columbia River	Endangered	62 FR 43937	08/18/97
	Snake River Basin	Threatened	62 FR 43937	08/18/97
	Lower Columbia River	Threatened	63 FR 13347	03/19/98
	Central Valley California	Threatened	63 FR 13347	03/19/98
	Upper Willamette River	Threatened	64 FR 14517	03/25/99
	Middle Columbia River	Threatened	64 FR 14517	03/25/99
Cutthroat Trout Sea-Run (*O. clarki clarki*)	Southwest Washington/Columbia River	Proposed Threatened	64 FR 16397	04/5/99

Table 3.6-2 Estimated numbers of chinook salmon taken by groundfish fisheries in the BSAI and GOA from 1990 - 2000.

Year	BSAI (Numbers of Fish)	GOA (Numbers of Fish)
1990	13,990	14,832
1991	48,880	38,894
1992	41,955	16,794
1993	46,014	19,260
1994	44,563	13,975
1995	23,436	14,652
1996	63,205	15,761
1997	50,530	15,230
1998	58,971	16,941
1999	13,545	18,214
2000	26,729	7,474

Source of data: (NMFS 1999d) Andy Smoker, Sustainable Fisheries Division, Alaska Region, P.O. Box 1668, Juneau, Alaska pers. comm. NMFS observer blend data.

Table 3.6-3 Coded wire tag recoveries of listed salmon species surrogate stocks from 1984 -1999 in the GOA and BSAI groundfish fisheries.

Year	GOA	BSAI	ESU
1999	16	1	UWR
1998	4	0	UWR
1998	1	0	LCR
1997	0	0	UWR
1996	1	1	UWR
1995	2	0	UWR
1994	3	0	UWR
1994	2	0	LCR
1993	14	0	UWR
1999	1	0	LCR
1992	2	0	UWR
1992	2	0	LCR
1991	1	0	UWR
1990	4	0	UWR
1990	1	0	LCR
1988	0	0	-
1987	1	0	LCR
1986	0	0	-
1985	1	0	LCR
1984	1	0	LCR
1984	10	0	UWR

Source of data: NMFS CWT database.

Notes: No data yet available for 2000 or 2001. UWR=Upper Willamette River Chinook, LCR=Lower Columbia River Chinook. Fisheries before 1990 were foreign joint-venture (not under management of Magnuson-Stevens Act).

3.7 Seabirds

The seabird component of the environment affected by the Bering Sea and Aleutian Islands (BSAI) Groundfish FMP and Gulf of Alaska (GOA) Groundfish FMP was described in detail in section 3.5 of the Draft Programmatic SEIS (NMFS, 2001a).

The Draft Programmatic SEIS identified how BSAI and GOA groundfish fisheries activities may affect, directly or indirectly, seabird populations. A direct effect on some seabird species may include incidental take (in fishing gear and vessel strikes) and is more fully described in section 3.5.4 of the Draft Programmatic SEIS (NMFS, 2001a). Indirect effects on some species may include: prey (forage fish) abundance and availability, benthic habitat, processing waste and offal, contamination by oil spills, nest predators in islands, and plastics ingestion. These indirect effects are more fully described in sections 3.5.2, 3.5.3, 3.5.5, and 3.5.6 of the Alaska Groundfish Fisheries Draft Programmatic SEIS (NMFS, 2001a).

Thirty-eight species of seabirds breed in Alaska. More than 1,600 colonies have been documented, ranging in size from a few pairs to 3.5 million birds. The U.S. Fish and Wildlife Service (USFWS) is the lead federal agency for managing and conserving seabirds and is responsible for monitoring the distribution and abundance of populations. Breeding populations are estimated to contain 36 million individual birds in the Bering Sea and 12 million in the GOA; total population size (including subadults and nonbreeders) is estimated to be approximately 30 percent higher. Five additional species that breed elsewhere but occur in Alaskan waters during the summer months contribute another 30 million birds.

As noted in the Draft Programmatic SEIS, a major constraint on seabird breeding is the distance between the breeding grounds on land and the feeding zones at sea, thus seabird populations are usually limited by food availability. The availability of prey to seabirds depends on a large number of factors and differs among species and seasons. Prey availability may also depend on the ecology of food species, including productivity, other predators, food-web relationships of the prey, and prey behavior. Once prey is captured, its value depends on its energy content. Many factors that influence prey availability are relatively 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.

3.7.1 ESA Listed Seabirds

Three species of seabirds that range into the BSAI and/or GOA are listed under the Endangered Species Act (ESA): the endangered short-tailed albatross (*Phoebastria albatrus*), the threatened spectacled eider (*Somateria fischeri*) and the threatened Steller's eider (*Polysticta stelleri*). The current population status, history of ESA section 7 consultations, and NMFS actions carried out as a result of those consultations are described in section 2.95 of the Draft Programmatic SEIS (NMFS, 2001a). The life history, population biology, and foraging ecology of these three species are described in sections 3.5.1.3 and 3.5.1.15 of the Draft Programmatic SEIS (NMFS, 2001a).

Based on new information from site visits to the two known breeding colonies of the short-tailed albatross, the current world total population is estimated at 1500 individuals---200 birds at Minami-kojima in the

Senkaku Islands and 1300 birds at Torishima Island, both islands in Japan.[3]

The USFWS published final rules designating critical habitat for the spectacled eider (66 FR 9146; February 6, 2001) and the Steller's eider (66 FR 8850; February 2, 2001). The marine areas designated as critical habitat are reduced from the areas that were proposed and discussed in sections 2.9.5.2 and 2.9.5.3 of the Draft Programmatic SEIS (NMFS, 2001a).

Critical habitat is defined as the specific areas containing the physical or biological features essential to the conservation of the species and that may require special management considerations or protection. Qualitative criteria used in identifying the eider critical habitat were focused on identifying: 1) areas where eiders have been documented as consistently occurring at relatively high densities, 2) areas where eiders are especially vulnerable to disturbance and contamination during breeding, molting, wintering, or flightless periods, and 3) areas essential to the survival and recovery of the species. These final rules do not include requirements or regulations for special management measures or protection areas.

For the spectacled eider, the proposed marine units in the Yukon-Kuskokwim Delta and the North Slope were not designated critical habitat. The proposed marine units in Norton Sound and Ledyard Bay were reduced by 40 percent and 35 percent, respectively. The proposed wintering marine unit between St. Lawrence Island and St. Matthew Island did not change and was designated as critical habitat. For the Steller's eider, the majority of the proposed marine units were eliminated (Ninivak Island, Eastern Aleutians, south side of the Alaska Peninsula, Kodiak Archipelago, and Kachemak Bay/Ninilchik). The four units that are designated as critical habitat are subsets of the proposed Kuskokwim Bay (Kuskokwim Shoals and Seal Islands) and the north side of the Alaska Peninsula [Nelson Lagoon (including portions of Port Moller and Herendeen Bay) and Izembek Lagoon]. See Figure 3.7-1 for the designated critical habitats for both species and see the published final rules for exact coordinates and additional details.

NMFS initiated two section 7 consultations with USFWS in 2000. The first FMP-level consultation is on the effects of the BSAI and GOA FMPs in their entirety on the listed species (and any designated critical habitat) under the jurisdiction of the USFWS (NMFS, 2000a). The second consultation is action-specific and is on the effects of the 2001 to 2004 TAC specifications for the BSAI and GOA groundfish fisheries on the listed species (and any critical habitat) under the jurisdiction of the USFWS (NMFS, 2000b). This action-specific consultation will incorporate the alternatives proposed in this SSL PM SEIS for the 2002 groundfish fisheries. The most recent Biological Opinion on the effects of the groundfish fisheries on listed seabird species expired December 31, 2000. NMFS requested and was granted an extension of that Biological Opinion and its accompanying Incidental Take Statement (USFWS, 2001). USFWS intends to issue a Biological Opinion in late 2002. This will allow for the consideration of new information: recommendations by Washington Sea Grant Program on suggested regulatory changes to seabird avoidance measures based on a two-year research program as well as Council and NMFS action on the proposed alternatives in this Steller sea lion Protection Measures SEIS.

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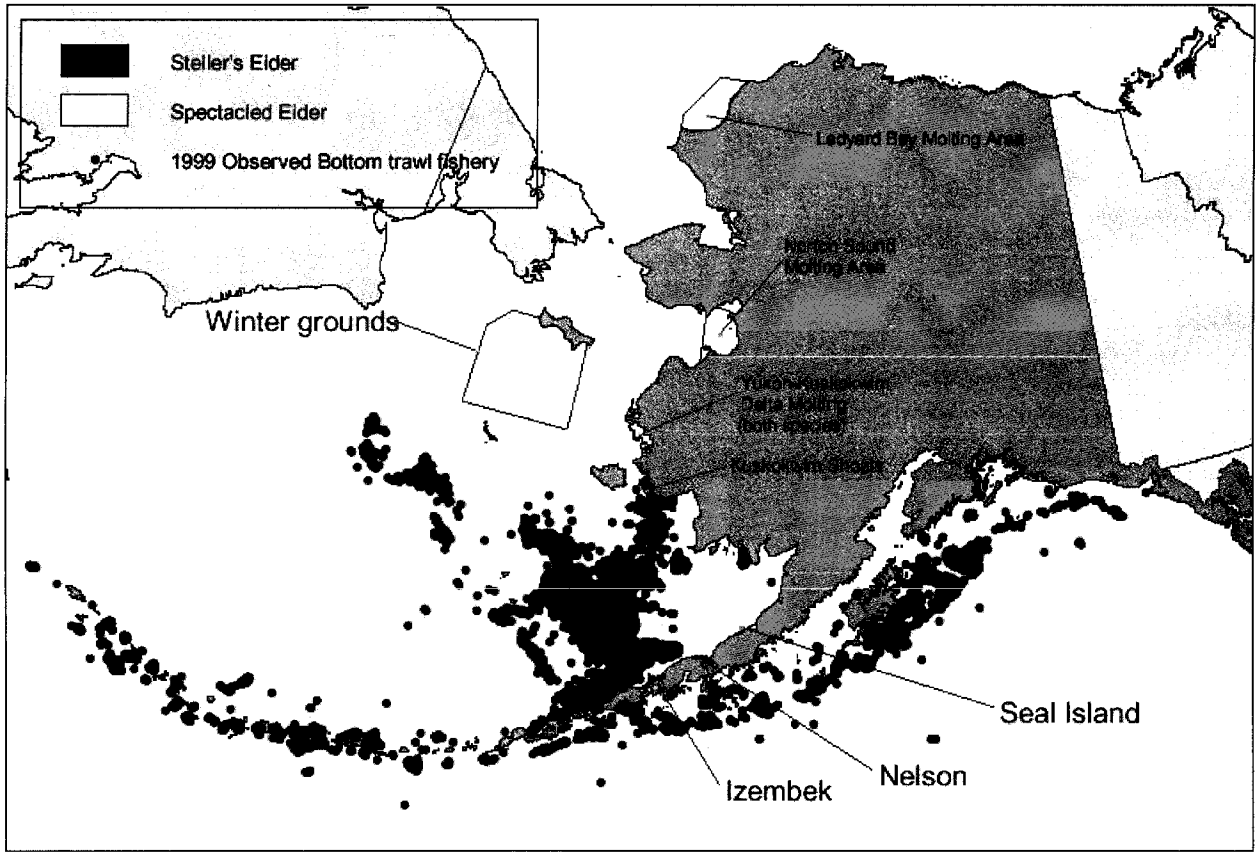
[3]Dr. Hiroshi Hasegawa, "Personal Communication," Toho University, Faculty of Science, Miyani 2-2-1, Funabashi, Chiba 274, Japan.

3.7.2 Other Seabirds

Breeding and non-breeding seabird populations ranging into the BSAI and/or GOA include: the northern fulmar (*Fulmarus glacialis*), storm petrels, albatrosses and shearwaters (non-breeders in Alaska), cormorants, jaegers, gulls, kittiwakes, terns, murres, guillemots, auklets, murrelets, puffins, and eiders. Most of these species rely primarily on forage fish, although several auklets are more planktivorous and eiders take more crustacea.

The life history, population biology, and foraging ecology of these species and species groups are described in detail in section 3.5.1 of the Draft Programmatic SEIS (NMFS, 2001a).

Figure 3.7-1 Final Critical Habitat for Spectacled and Steller's Eider



3.8 Effects of Fishing on Habitat, Including Essential Fish Habitat

The alternatives under consideration in this environmental impact statement (EIS) are intended to protect the western population of Stellers sea lions by reducing potential competition for prey. These measures were not designed with the purpose of affording additional protection to essential fish habitat (EFH). However, some of these measures can be expected to prove beneficial to benthic habitat; common sense tells us that reducing bottom trawling and other types of fishing in critical habitat for sea lions will also mean fewer impacts to their prey species and to associated habitats. Conversely, human disturbances to habitat may increase in areas outside critical habitat due to increased effort outside the restricted or closed areas.

The kinds of benthic habitat disturbances associated with harvest by trawling and fixed gear, both generally and specifically as observed in the North Pacific, are discussed in this section. For this purpose, trawling will be defined as the use of any trawl gear in contact with the seafloor. In Section 4.8, the ways in which changes proposed in the five alternatives may be expected to affect benthic habitat disturbance associated with harvest by various gear groups are analyzed. Additionally, Section 4.8 contains a determination of whether the alternatives will or will not adversely affect EFH.

Although habitat considerations have been integrated into the North Pacific fishery management process since its inception (see the Draft Programmatic groundfish SEIS (NMFS 2001, Sec. 4.7), for a chronology of such efforts), the requirement to explicitly look at the potential effects of each new regulation on fish habitat derives from the 1996 revision of the Magnuson-Stevens Act. The Sustainable Fisheries Act, as the revision was called, defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Councils are required to "define and identify EFH" for their managed fisheries, and "to minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat." In June 1998, the North Pacific Fishery Management Council (Council) adopted five amendments, one for each fishery management plan, in order to comply with these EFH requirements; the amendments were approved by the Secretary of Commerce on January 20, 1999. A primary element of these amendments was mapping EFH for managed species at different life stages.

After a lawsuit in 2000, the U. S. District Court ruled that Alaska's NEPA analysis of its EFH amendments, along with several other such analyses nationwide, was "insufficient in scope and analytical substance." The NMFS is therefore in the process of preparing an EIS that will be more comprehensive than the EA prepared previously. The first step in the preparation of the EIS has been completed; scoping meetings were held in Alaska communities through July 21, 2001, to identify issues of concern and help determine the appropriate range of management alternatives to consider. The final EIS for the EFH amendments will include a comprehensive discussion of the effects of fishing on EFH in the North Pacific.

3.8.1 Assessing Habitat Impacts

The effects of fishing gears on habitat depend on a number of factors, including the magnitude and frequency of the impact and the recovery time of the habitat and biological community affected by the gear[1]. These factors in turn depend on characteristics of the gear (i.e., type, weight, towing speed, depth of penetration),

[1]Portions of this and some following sections are extracted from relevant sections of a draft summary of fishing gear impacts to EFH, prepared by Korie A. Johnson of the NMFS Office of Habitat Conservation. These excerpts have been edited to focus on their relevance to Alaska groundfish fisheries.

the areal extent of the disturbance, and the biological, physical, chemical and oceanographic characteristics of the area impacted (Auster and Langton 1998, Brylinsky et al. 1994, DeAlteris et al. 1999, Hall et al. 1993, Hall 1994, Kaiser 2000). The influence of so many factors complicates our ability to understand the effects of fishing gear on habitat and ultimately to the populations of fishes and invertebrates that utilize that habitat.

To date, considerable research has focused on the impact of fishing to habitat. Unfortunately, despite these efforts, most of the completed research has been limited in scope. Thus, we still lack definitive information. For example, the majority of research focuses on trawls, with much less effort on dredges, pots/traps and other gear types. In addition, most studies concentrate on a single gear type and, thus, do not address cumulative effects of all gears used within a given fishing ground. Often research projects are simplified by examining effects to a specific habitat type. These small scale studies may not be applicable over larger areas (i.e., scale of fishing ground) that consist of a mosaic of different habitat types. Because of logistical and financial constraints, most directed experiments are restricted to a short period of time and do not consider cumulative effects over long periods of time. Furthermore, estimates of recovery are often limited to measurements of recovery from a single (or limited) disturbance event rather than from ongoing impacts that normally occur due to fishing. And, typically, the habitats against which recovery is measured have already been significantly altered by longterm effects of fishing, leaving us with an inaccurate picture of recovery times. Finally, where information is available on physical or biological effects, the role these habitat impacts have on harvested populations, in most cases, is unknown.

Fishing Effort Distribution

In order to assess the effects of fishing gear we also need a better understanding of the distribution of fishing effort by gear type. Analyses of fishing effort have been completed in other countries (Rijnsdorp et al. 1998, Jennings et al. 1999, Greenstreet et al. 1999). Churchill (1989) attempted to summarize trawling effort in the Middle Atlantic Bight off the northeast U.S. using fishing effort data in 30' latitude x 30' longitude blocks. While areas impacted could be estimated over blocks, a lack of data on the extent of the area actually disturbed, especially for static gears, made analysis of the impacts to habitat from that effort difficult. For Alaska fisheries, observer information provides some data on most of the fishing effort distribution, but there are some gaps and resolution is limited to one, and more recently two, points per tow. Vessel monitoring systems (VMS) are coming into use that will allow analyses like that of Pitcher et al. 2000.

Bering Sea

Beginning about 1960, the Bering Sea experienced rapid and intensive development of commercial bottom trawl fisheries. Because of good recordkeeping, particularly after passage of the Magnuson-Stevens Act in 1976, and the relatively brief period that the area has been fished, it is possible to reconstruct spatial and temporal fishing patterns.

For the period 1973–1997, the NMFS observer database program (NORPAC) has counted 412,040 records of bottom trawls, using observed gear type information for the domestic fleet and selecting gear type for the joint venture and foreign fleets based on the presence of benthic organisms, such as crab, snails, and seastars, in the catch.

Two general spatial patterns are apparent from the historical trawl data. Virtually all areas of the Bering Sea have experienced some degree of exposure to bottom trawls. The intensity of exposure, measured in trawls made per unit area, varies substantially. These patterns reflect the nonrandom behavior of fishing fleets, which is based on historical patterns of performance and regulatory restrictions. Relatively heavy trawling

has occurred in three places: along the shelf edge, along the Alaska Peninsula near Unimak Island, and in Togiak Bay. The primary composition of the catch in these three areas, respectively, was pollock, Pacific cod and Greenland turbot; Pacific cod and pollock; and yellowfin sole (Fritz et al. 1998). For maps and more information, see the PSEIS (NMFS 2001a, Sec. 3.2).

Gulf of Alaska and Aleutian Islands

Coon et al. (1999) described the spatial and temporal patterns of bottom trawl effort in the GOA and Aleutian Islands from 1990 to 1998 by analyzing domestic observer data. Fishing effort is not evenly distributed; some areas are rarely fished and some are fished very often. The greatest bottom trawl effort in the GOA has taken place in the Kodiak Island region, where directed fisheries have targeted Pacific ocean perch, Pacific cod, and flatfish. In the Aleutian Islands, intense bottom trawl effort has been directed at Atka mackerel and Pacific ocean perch. During a period from 1990–1998, a total of 57,948 tows were observed in the GOA and 35,498 in the Aleutian Islands. The total number of trawl tows would increase to an estimated 116,288 tows for the GOA and 41,015 tows for the Aleutian Islands if unobserved tows were included. The total bottom trawl effort, based on a 24-hour day, was estimated at 11,829 trawl-days for the GOA and 4,427 trawl-days for the Aleutian Islands. Density of trawling in the entire Aleutian Islands region was 0.56 trawls/km^2. The eastern Aleutian Islands area had the highest density of 1.56 trawl/km^{2}over an area of 7,909 km^2 and ranged from 101–200m in depth. The highest estimated number of bottom trawls in both the Aleutian Islands and on the GOA continental shelf were recorded in the 101–200 m depth range. For maps and further information see the PSEIS (NMFS 2001a, Sec. 3.2).

Natural and other sources of disturbance

Once we have a grasp of fishing effort and the effects that occur as a result of this effort, we need to be able to weigh the consequences in relation to disturbances resulting from natural events. Natural impacts that occur over large scales may render local effects of fishing insignificant. Furthermore, the strength and occurrence of natural or non-fishing anthropogenic influences are strong determinants of recovery time (Flint and Younk, 1983, DeAlteris et al 1999, Hall 1994). In theory, communities in variable (or high energy) environments are capable of recovering more quickly than communities in more stable (or low energy) environments, and thus, are more resistant to disturbance (Collie et al. 2000a, Flint and Younk 1983). So again, effects of fishing may be insignificant when compared to effects of natural disturbances. For example, Stevenson and Confer 1978) concluded that while dredging resulted in piece-meal destruction of SAV, natural forces were responsible for bay-wide impacts, and thus, were ultimately responsible for SAV distribution and abundance. Daan (1991) concluded that fisheries in the southern North Sea have a relatively small impact on the biomass of benthos compared to sources of natural mortality. An argument to the contrary is provided by Hall (1999) who states that "while it is important to appreciate a range of natural variation in disturbance from wind, currents and waves to put fishing in context, the fact that the natural range is large *in itself*, gives no basis for arguing that the additional perturbation imposed by fishing is inconsequential."

Generalizations about trawl-related effects on the benthos and relative sensitivities of different habitat types should be considered with caution because of important differences in scientific methods and the likelihood of site-specific responses. For example, Thrush et al. (1998) comment that there has been a general failure to detect experimental fishing effects in areas exposed to extreme natural disturbances or very strong tidal flows. However, recent research in the Bering Sea, as mentioned above, demonstrates a significant overall difference in benthic populations and community structure in a high-energy, soft-bottom environment that have been exposed to bottom trawling, compared to similar untrawled areas (McConnaughey et al. 2000).

Although the study area was generally deeper than the study areas supporting Thrush's statement (Thrush et al. 1998, Kaiser and Spencer 1996a, Brylinsky et al. 1994), it was nevertheless located well within the depth range for seabed disturbance by storm waves and is clearly affected by strong tidal flow.

One interpretation of this apparent discrepancy is related to the experimental methods used. The studies cited by Thrush et al. (1998) compared conditions before and after experimental trawling/dredging and focused on short-term, acute impacts. The Bering Sea study considered differences attributable to a long history of trawling and addressed more chronic effects. The results suggest that acute and chronic impacts from bottom trawls may be different or, alternatively, that exposure thresholds may exist beyond which chronic effects begin to appear. Additionally, small-scale experiments, such as those examined by Auster and Langton (1999), are usually completed in reasonably homogeneous habitats and within short time frames. Such a study could not detect chronic or cumulative effects of fishing. The recovery rates of benthic populations can be dependent on proximity to areas from which new organisms can be recruited, so broader areas of fishing disturbance would be expected to recover much more slowly than small, isolated experimental areas (Thrush et al. 1998).

To fully evaluate the impacts of fishing gear on habitat, and how those habitat impacts affect sustainability of fish populations, information is needed on:

(1) the spatial extent of fishing-induced disturbance (fishing effort) by gear type;
(2) distribution of habitat types;
(3) effects of specific gear types (and configurations within gear types), along a gradient of effort, on specific habitat types;
(4) the relative importance of fishing gear effects and natural disturbance;
(5) the role that seafloor habitats and impacts on those habitats have in the population dynamics of fishes; and
(6) natural changes/trends in communities and ecosystems.

3.8.2 Assessing Impacts of Fishing Gear

A number of research approaches have been used to assess gear impacts to habitat. One method compares closed (or lightly fished) areas to open (or heavily fished) areas to identify changes to habitat that may be attributable to fishing activities. Oftentimes comparisons are difficult, however, because the unfished areas are unfished precisely because they are ecologically different from the fished areas, making it difficult to decipher the actual cause of observed differences. Furthermore, those areas currently closed to fishing may have been significantly altered from previous fishing, such that differences are masked (Auster et al. 1996, Bradshaw et al. 2000, Caddy 1973, Dayton et al. 1995, Frid and Clark 2000, Kaiser et al. 1996, Margetts and Bridger 1971). For example, sessile organisms accounted for 50% of the catch in virgin trawl tows in Arctic Canada (McAllister and Spiller 1994), causing researchers to speculate on the amount of sessile organisms that might have been caught in initial trawls over the Atlantic shelf.

To avoid the difficulties with control areas (and historical data) many researchers have undertaken small scale experiments looking at varying levels of fishing intensity on habitats. As mentioned above, these types of studies are often restricted to a specific gear type on a very specific habitat type at a scale that may not be capable of detecting effects (Hewitt et al. 1998, Cappo et al. 1998, Thrush et al. 1995, Bradshaw et al. 2000) and that does not allow us to extrapolate to the scale of the fishing grounds (Daan 1991) or to the range of habitats utilized by a given fish species (Langton et al. 1995).

Another approach taken to elucidate effects of fishing on habitat is the comparison of historical (or pre-fishing) biological community data with present day data. With this approach, the same area is sampled over time and the historical data is used as the control. Long-term data sets that allow this comparison, however, are not always available. When such data are available, it is difficult/impossible to separate out effects resulting from fishing activities from effects of natural and other human induced effects (Botsford et al. 1997, Glemarec et al. 1996, Hall et al. 1993, Kaiser 2000, Kroencke 1995). Riesen and Reise (1982) compared benthic samples from the 1920s and 1980s and found large scale changes in the communities attributed to a combination of fishing and natural events: oyster reefs were overexploited by the commercial fishery and then replaced by mussel banks and associated species; seagrasses were lost to a natural epidemic; and *Sabellaria* reefs were destroyed by trawlers. Other studies suggest similar shifts in species composition, but often fail to demonstrate that fishing activity is actually the cause (Thompson 1993). As discussed extensively in Hall (1994), studies on long-term effects of fishing, taken as a whole, provide evidence for long-term trends in benthic communities; but "the case for invoking fisheries as a primary cause for the recorded changes is not very strong." However, Lindeboom and deGroot (1998) state that "combined with the results ...on the immediate effects of bottom fisheries on the benthos and the comparison between fished and unfished areas, it has to be concluded that the observed trends in benthic invertebrates were to a great extent caused by the direct and indirect effects of fisheries and not solely by eutrophication and/or pollution as interpreted in previous studies."

In addition to problems with research approach, there are questions concerning details of experimental design. Moran and Stephenson (2000) conclude that net sampling is not an accurate method of measuring effects to habitat because it does not indicate the number or types of organisms that are damaged or detached, but not caught, by the net. Rogers et al. (1999) question the level of sampling that we should be focusing on (i.e., community indices, species abundances) to best examine quantifiable effects of exploitation. For example, Sanchez-Jerez and Espla (1996) found that community changes due to trawling in *Posidonia* meadows were not evident at the phyla and class levels of benthic fauna, but that family and species levels of amphipods and isopods did show significant differences, and thus were the best indicators of trawling impacts for this geographic area. According to McConnaughey et al. (2000) lumping taxa for analytical purposes can mask species effects that are a result of functional processes rather than taxonomy. Jennings and Cotter (1999) state that vulnerable species are better indicators of fishing effects than community based measures that can be explained by factors other than fishing. These types of issues need to be evaluated when designing and interpreting studies on effects of fishing gear to habitat.

Ideally, in order to understand the ecosystem effects of fishing on habitat, research needs to be done using comparable fished and non fished areas at the scale of fishing grounds for specific fisheries, and at a time-scale greater than the life span of the longest-lived species (Hall 1994). Unfortunately, the time and resources needed to complete this research can be prohibitive.

3.8.3 Interpreting Observational Data

Given the paucity of existing information, and the limitations on our ability to gather needed information, different philosophies have developed as to how we should address management of fishing gear impacts to habitat. Many believe that we should look beyond scientific literature to anecdotal information and signs of effects of fishing. For example, Pederson and Hall-Arber (1999) discuss the extensive information on habitat condition and long-term changes that can be gained from fishermen and incorporated into management.

Until comprehensive information is available to decision makers, some scientists have argued for a precautionary approach to management to address any adverse impacts of fishing gear on habitat. It has been argued that, although definitive evidence may not be available, studies have shown "beyond doubt" that some negative impacts from mobile fishing gear are occurring, and thus, that management decisions need to be made without waiting for more scientific evidence (Kenchington 1995, Gray 2000, Watling and Norse 1998, Lindeboom and deGroot 1998). Kenchington (1995) argues that the burden of proof required in scientific research is not appropriate in fisheries management and that we need to take into account the risk that mobile fishing gear is significantly reducing fish production by modifying benthic habitats. Dayton et al. (1995) state that, while policymakers clearly understand the financial implications of reducing fishing effort when no adverse effects are occurring, there is no clear understanding of the financial implications of ecosystem effects and loss of resources by continuing to fish when impacts have not been detected. These authors and others support a precautionary or risk averse approach to habitat conservation and protection (Auster 2001, Auster et al. 1997, Auster and Malatesta 1995, Auster and Shackell 2000, Carr and Milliken 1998, Collie 1998, Dayton et al. 1995, Fogarty and Murawski 1998, Frid and Clark 2000, Goni 1998, Hall-Spencer et al. 1999, ICES 2000, Koslow and Garrett-Holmes 1995, Langton and Auster 1999, McAllister and Spiller 1994, McConnaughey et al. 2000, Mirarchi 1998, Norse and Watling 1999, Thrush et al. 1998, Turner et al. 1999).

Under the precautionary approach to management, measures to minimize effects of fishing to habitat should be implemented now, based on the concept that the risk of allowing possibly irreversible damage to continue is too great and far outweighs the short-term economic hardships that might be incurred by such methods. A number of authors recommend the use of closed areas for research and conservation (Auster and Shackell 2000, Ball et al. 2000, Bergman et al. 1990, Bergman and Hup 1992, Engel and Kvitek 1998; Hall-Spencer et al. 1999, Rumohr 1998). Hutchings (1990) recommends periodic closures of areas, strip trawling to leave regularly spaced islands of untrawled areas to supply recruits for replenishment, and modification to gear to minimize impacts. Carr and Milliken (1998) recommend that nations modify gear to target specific species, encourage the use of lighter sweeps over heavier gears, reduce the amount of sea bottom available to mobile gear, and opt for stationary gear over mobile gear. McAllister and Spiller (1994) recommend the establishment of nearshore continental shelf and slope protected areas, regular monitoring of impacts of different gear types, and a switch to gear types with low habitat impacts and low bycatch. Ball et al. (2000) recommend large areas closed to fishing to allow large scale experiments, with particular attention to deeper waters at the shelf edge and slope where natural disturbance is less common, sediments are highly bioturbated, and faunal assemblages are less capable of sustaining disturbance. Auster et al. (1997) recommend a more extensive use of closed areas, starting with a specific fishing gear within a geographical region and if existing knowledge suggests that negative effects to seafloor habitats are occurring from that gear (even if the available information is uncertain or inadequate), then we define the habitats likely to be affected by that gear and designate marine protected areas for those habitats. Based on a fishermen survey by Fuller and Cameron (1998), fishermen generally approved of closing spawning areas during spawning and concurred that fisheries management should occur on an ecosystem level including habitat protection.

The precautionary approach would also allow the use of adaptive management, in which fisheries research provides feedback to management decisions (Thrush et al. 1998; Sainsbury et al. 1993, Turner et al. 1999). For example, managers could implement closed areas and then adjust the size or location of those closed areas as scientific research bears new information, and we have a better understanding of effects of fishing to ecosystems.

Others argue, however, that we do not have sufficient information to suggest that fishing is having a significant effect on the ecosystem, and that establishing closed areas and reducing fishing effort to protect habitat is premature and would be burdensome to the fisheries. Kaiser et al. (1999) argue that the magnitude

of fishing effects varies greatly relative to background of natural disturbances and that we need to consider subtle differences in habitat structure and assemblage composition before we can understand the consequences of fishing. Kaiser (1998) reviewed scientific studies on the effects of fishing in the North Sea and concluded that oceanic influences have greater ecological effects than localized effects of either eutrophication or fishing disturbance. Langton et al. (1996) suggest protection of "essential" habitats using a decision tree based on scientific information. Messieh et al. (1991) argue that we need to study effects to habitat that have the potential of causing widespread and long-term changes (i.e., gradual modification to surficial sediments and increased suspended sediment loads).

In light of this diversity of information and philosophies, regional Fishery Management Councils must make a determination about the effects of fishing gear on habitat and evaluate the need for management measures to minimize those effects. Under National Standard 2 of the Magnuson-Stevens Act, regional councils and the Secretary of Commerce must base conservation and management measures on the "best scientific information available." Under the Administrative Procedures Act, the decision to approve a measure must be supported by scientific information that suggests the measure will contribute to the conservation and management of the fishery resource so as to be neither arbitrary nor capricious. This document attempts to compile the "best scientific information available" and provide a basis for the determination of effects and evaluation of the proposed management measures.

3.8.4 Description of Essential Fish Habitat and Habitat Areas of Particular Concern

Whatever management plan is adopted in order to protect habitat areas for Stellers sea lions will cause patterns of fishing effort to change not only in those areas but throughout the Bering Sea, Aleutian Islands, and Gulf of Alaska fishing grounds. NMFS has collected EFH information including species-by-species descriptions, habitat requirements at different life stages, and descriptions of the habitat areas found in the North Pacific fishing grounds. This information may be found in print form in the Draft Programmatic SEIS (NMFS 2001a) and in the EA that was prepared in connection with the EFH amendments (NPFMC 1998). NMFS also has a website at http://www.fakr.noaa.gov/habitat/efh.htm. This website incorporates all the EFH information from the printed sources, and allows members of the public to query its data base to ask such questions as: where in the North Pacific do juvenile king crab occur, and how good is our information about them? (Levels of information are designated from 0, nothing much known, to 4, well studied). The website also has bathymetry information, and links to life history information for each species.

Habitat Areas of Particular Concern

EFH is defined by the Magnuson-Stevens Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The definition adopted by the Alaska region defines EFH as all habitat within a general distribution for a species' life stage, for all information levels and under all stock conditions (NPFMC 1998). Given the broad definition of EFH, the Council undertook to identify Habitat Areas of Particular Concern (HAPCs), which are areas, or types of habitat, that may need greater levels of protection than other habitat from adverse effects, including impacts from nonfishing activities, as well as from fishing and from activities supporting the fishing industry. Habitats that are limited geographically and provide unusually productive habitat could be designated as reserves or sanctuaries where appropriate. Identifying HAPC is by no means a simple or static exercise, given that the ocean floor and the flora and fauna inhabiting it are largely unmapped and very changeable. Identifying potential threats to HAPC is also a complex task, since impacts from different activities, or from the same activity repeated over time, can be cumulative, with rippling effects through the ecosystem.

The interim final rule (62 FR 66531 December 19, 1998) on EFH, together with its complementary technical guidance manual, provides guidance in defining HAPC. The interim final rule specifies that FMPs should identify HAPC within EFH. In identifying HAPC, one or more of the following criteria, taken from the Magnuson-Stevens Act (50 CFR 600.815(a)(9)) must be met (these are paraphrased):

- The habitat provides an important ecological function.
- The habitat is sensitive to human-induced environmental degradation.
- Development activities are stressing the habitat or will do so in the future (exposure).
- The habitat type is rare.

For further explanation of these criteria, see the Draft Programmatic SEIS (NMFS 2001a).

Three habitat types in Alaska meet all of the criteria specified in the interim final rule, and were adopted as part of the five EFH amendments to Alaska's fishery management plans:

1. living substrata in shallow water;
2. living substrata in deep water; and
3. freshwater areas used by anadromous fish.

These habitat types have important ecological functions, are sensitive and vulnerable to human impacts, and are relatively rare. The first two types are described below, but given that this federal action applies only to the groundfish fishery, freshwater areas used by anadromous fish are not discussed further.

Living Substrata in Shallow Water

HAPCs include nearshore areas of intertidal and submerged vegetation, rock, and other substrata. These areas provide food and rearing habitat for juvenile groundfish and spawning areas for some species, such as Atka mackerel and yellowfin sole, and may have a high potential to be affected by shore-based activities.

Shallow nearshore areas (less than 50 m depth) provide important structural habitat for early juvenile instars of red king crab (Sundberg and Clausen 1977). Early juvenile instars are cryptic and occupy the protective refuges provided by high-relief habitat or coarse substrate, such as boulders, cobble, and shell hash, and living substrates (macroalgae, bryozoans, stalked ascidians, etc.) (Sundberg and Clausen 1977). Adult red king crabs also use highly structured shallow water habitat during the mating period and will use macroalgae as cover during this period (Stone et al. 1993).

All nearshore marine and estuarine habitats used by fish, such as eelgrass beds, submerged aquatic vegetation, emergent vegetated wetlands, and certain intertidal zones, are sensitive to natural or human-induced environmental degradation. Juvenile rockfish are known to use eelgrass beds (Murphy et al. 2000). Herring also require living substrata in shallow water for reproduction. Spawning takes place near the shoreline between the high tide level and 11 m depth. Herring deposit their eggs on vegetation, primarily rockweed (*Fucus* spp.) and eelgrass (*Zostera* spp.). These seaweeds are found along much of the Alaska coastline, but they often occur in discrete patches.

Living Substrata in Deep Waters

HAPCs include offshore areas with substrata of high microhabitat diversity that serve as cover for groundfish and other organisms. These can be areas or habitat types with rich epifaunal communities (e.g., coral, sponges, anemones, bryozoans), or with large particle size (e.g., boulders, cobble). Since many deep water areas are characterized as stable environments dominated by long-lived species, the impacts of fishing can be substantial and long term (Auster and Langton 1999).

Coral, for example, is a living substrate in deep water that has been defined as a type of HAPC. Coral is a common name for a number of diverse invertebrate species within the phylum Coelenterata. Five major taxonomic groups and at least 34 species of coral occur in waters off Alaska (Cimberg et al. 1981): Alcyonacea (soft corals), Gorgonacea (sea fans, bamboo corals, and tree corals), Scleractinia (cup corals or stony corals), Stylasterina (hydrocorals), and Antipatharia (black corals). Some corals grow upright and branch out, whereas others species are low-growing encrusting forms. In Alaska, gorgonian corals, particularly members of the genera *Primnoa* (red tree coral) and *Paragorgia*, may be especially valuable as fish habitat due to their longevity and large size–they grow up to 3 m high and 7 m wide.

Gorgonian corals are colonies of animals composed of individual polyps which deposit a tree- or fanlike skeleton that supports the colony. In general, corals are very slow-growing organisms. Some species of gorgonians may live to be over 100 years old (Risk et al. 1988). Large *Primnoa* colonies may be hundreds of years old; a 5-cm-diameter specimen of *Primnoa reseda* from Nova Scotia, Canada was estimated at 500 years, using isotope dating (Risk et al. 1998). The habitat created by these gorgonians may be occupied by communities with high biodiversity and may provide shelter for fish (Risk et al. 1988, Fossa et al. 1999). Given their size and longevity, gorgonian corals may be especially vulnerable to fishing impacts (Witherell and Coon, 2001). Although scientists have limited understanding of its importance as fish habitat, deep water coral clearly provides vertical structure for fish to use for protection and cover. This has been observed in Alaska during submersible dives (Krieger and Wing 2000).

3.8.5 Gear Types

In considering the potential effects of fishing gear on benthic habitats of off of Alaska, it is useful to understand the characteristics of that gear. There are three main classes of fishing gear used in the fisheries affected by the proposed alternatives, otter trawls , longlines and pots. Each of these gear types are composed of several components whose characteristics will affect their actions on the benthic environment and hence their effects and the amount of habitat encountered. Effects will also be dependant on vulnerabilities of the subject substrate and organisms. The following will describe the characteristics of those gears as used in Alaska groundfish fisheries. Because there have been no comprehensive, systematic surveys of such gear, this information is based on the knowledge of NMFS gear researchers and related information available to them.

Otter trawls

Otter trawls pull conical nets through the water, gathering fish that encounter the open forward end into a restricted bag (codend) at the back end. They have four main components that contact can contact the seabed: doors, sweeps, footrope and netting. Doors are flattened metal structures that ride vertically in the water and use the force of their motion through the water to spread the net horizontally. Some bottom trawl doors also use contact with the seafloor to augment this hydrodynamic spreading force. On pelagic trawls the doors are

fished above the seafloor, without bottom contact. The weight of the doors (and some hydrodynamic forces) overcome the upward pull of the towing cables to force the net down into the water.

Sweeps (as the term is used here; nomenclature varies between regions and individuals) are steel cables which connect the doors to the trawl net. On bottom trawls these are commonly in contact with the seafloor and often have protective disks strung on them (> 7 cm diameter). Use of fiber and combination fiber/steel cables also occurs. The sweeps pass over the bottom at a narrow angle (i.e. 15 - 20 degree) from the direction of travel and herd near-bottom fish toward the trawl net.

The footrope of the trawl is a cable or chain connected along the bottom edge of the trawl net and is designed to contact the seafloor on bottom trawls. A 1996 survey of footrope types used off Alaska (unpublished data, Craig Rose) indicated that all vessels used large diameter (averaging (by fishery) 39 - 47 cm) cones, spheres or disks (we will use the generic term, bobbins), usually made of rubber, strung over the entire length of their footropes. These serve to limit damage to the netting and reduce bycatch of crabs and other invertebrates. Large-diameter supporting elements were separated by sections of small diameter disks, creating openings under the footrope, averaging 13 cm high and occupying an average of two-thirds of the footrope length. During fishing, the footrope takes a shape like a horizontally spread 'U' with the opening forward. Bobbins were used nearly always on the sides of the U (wings). In the center section, an alternative called 'tire gear' was indicated by all six reports from the Atka mackerel fishery and about half of those from the Gulf of Alaska fisheries for cod, rockfish and Dover and rex soles. This gear consists of vehicle tires or sections of tires linked side-by-side to form a continuous cylinder (averaging 68 cm diameter). This gear is very effective at protecting the netting and allows fishing in areas of rougher substrates than would otherwise be possible.

The netting is the least likely component of bottom trawls used in Alaska to directly contact the seafloor. The bobbin or tire footropes raise the netting so that only particularly prominent seafloor features should touch the netting without entering the trawl. An exception to that is if the codend contains enough fish that are heavier than water (typically flatfish; pollock and cod have swim bladders to keep neutrally bouyant) or rocks to pull it down to the seafloor. Then the bottom of the codend would drag across the seafloor. Because of the need to pull codends up the vessel's stern ramp, codends are equipped with ropes that limit their diameter to less than 8 feet. This would also limit the amount of bottom affected by a dragging codend.

An important aspect of gear design, when considering bottom habitat effects is the proportion of the trawl contact footprint that is made by each of the components. Trawl doors used in Alaska are typically less than 3 m long and, because they are fished at an angle to their direction of movement, will affect a path narrower than that. Sweeps length will vary with target species, substrate and individual preference. A large vessel targeting flatfish on smooth bottom may use 350 m of sweeps, while a small rockfish trawler on rough bottom may only use 30 m. Adjusting for the angle of the sweeps, sweep path may vary from 100 m to 10 m on either side of the net. Thus, the area covered by the sweeps can be highly variable. The width of the trawl net itself will depend on how large a trawl the vessel can pull and whether a high opening or wide, low trawl is selected. An approximate range would be from 12 to 30 m across. Thus, most of the trawl's footprint will be affected by the sweeps, followed by the footrope, with a relatively small area contacted by the doors.

A special case of otter trawls that is very important in Alaska groundfish fisheries is the pelagic trawl, a class designed for harvesting fish that may inhabit the waters above the seabed. These trawls have very large mesh openings in their forward sections and the doors are fished above the bottom. More detailed descriptions will be included below in conjunction with the considerations of EFH effects.

Longlines

Demersal longlines consist of two buoy systems that are situated on each end of a mainline to which are attached leaders (gangions) and hooks. The mainline, usually made of line that sinks, can be several miles in length and have several thousand baited hooks attached. Small weights may be attached to the mainline at intervals. At the bottom of each buoyed end is a weight or an anchor. A vessel may set a number of lines, depending on the area, fishery and site. The principal components of the longline that can contact the seabed are the anchors or weights, the hooks and the mainline (ICES 2000).

Longline gear in Alaska is fished on-bottom. In 1996, average set length was 9 km for the sablefish fishery, 16 km for Pacific cod and 7 km for Greenland halibut; average hook spacing was 1.2 m for the sablefish fishery, 1.4 m for Pacific cod and 1.3 m for Greenland halibut. The gear is baited by hand or by machine, with smaller boats generally baiting by hand and larger boats generally baiting by machine. Circle hooks usually are used, except for modified J-hooks on some boats with machine baiters. The gear usually is deployed from the vessel stern with the vessel traveling at 5-7 knots. Some vessels attach weights to the longline, especially on rough or steep bottom, so that the longline stays in place and lays on-bottom.

Pots

Pots are enclosures, usually with one-way entrances, that retain entering fish. Pots used in the Alaska cod fishery are generally modified from the designs developed for the crab fishery, with one way entrances modified to prevent fish escape. The most common design is a rectangular frame approximately 2 X 2 X 1 m made of welded steel rods with entrances on opposite walls. These weigh 5 - 700 pounds and, because of solid steel construction, that weight is not greatly reduced by immersion in water. Alaska groundfish regulations require that each pot have its own buoyed line, so there are no underwater lines connecting adjacent pots (longlining). Each pots is sufficiently heavy that no additional anchors are required.

3.8.6 Gear Effects By Habitat

A number of scientific reviews summarize existing information on the effects of fishing gear to habitat (Auster and Langton 1999, Blaber et al. 2000, Collie et al. 2000a, ICES 1992, Jennings and Kaiser 1998, McAllister 1991, Lindeboom and deGroot 1998). Within these reviews, types of effects fall into specific categories, including alteration of physical structure, sediment suspension, chemical modifications, benthic community changes, and ecosystem changes. These effects are discussed below.

Alteration of physical structure:

Physical effects of fishing gear can include scraping, ploughing, burial of mounds, smoothing of sand ripples, removal of stones or dragging and turning of boulders, removal of taxa that produce structure, and removal or shredding of submerged aquatic vegetation (Lindeboom and deGroot 1998, Schwinghammer et al. 1998, Gordon et al. 1998, Messieh et al. 1991, Black and Parry 1994, Auster and Langton 1999, Ardizzone et al. 2000, Kaiser et al. 1998, 1999, Fonseca et al.1984). These physical alterations reduce the heterogeneity of the sediment surface, alter the texture of the sediments, and reduce the structure available to biota as habitat. As mobile gear is dragged across the seafloor, parts of the gear can penetrate up to 5-30 cm into the substrate under usual fishing conditions, and likely to greater depths under unusual conditions (Drew and Larsen 1994). Direct effects to the seafloor are evident in tracks left by mobile gear that can endure for up to 16 hours in hard sand sediments or for as long as 5 years in soft sediments (Thompson 1993). Effects to hard substrates, such as coral reefs, can persist much longer. Within these tracks, large percentages of emergent

epifauna, such as sponges, corals or gorgonians, are often removed, crushed, or broken (Behnken 1994, Van Dolah et al. 1987).

A number of review papers have focused specifically on the physical effects of bottom trawls. According to an ICES working report (1973), otter trawls, beam trawls and dredges are all similar in their types of impacts to the seabed, but the magnitude of impact increases from shrimp beam to sole beam with tickler and stone guards, to Rapido trawl to mollusc dredge. Moran and Stephenson (2000) conclude that semi-pelagic trawls towed above the seafloor inflict no detectable damage/mortality on benthos, but result in lower catches of target fishes. They found that the light, large-diameter (20 cm diameter disks separated by 30 - 60 cm sections of 9 cm disks) footropes currently in use in northwest Australia results in less mortality (15.5% vs 89% documented by Sainsbury et al. in 1997) than heavy, small gear used in the past (continuous 15 cm disks).

Sediment suspension:

Resuspension of sediments occurs as fishing gear is dragged along the seafloor. Effects of sediment suspension can include reduction of light available for photosynthetic organisms, burying benthic biota, smothering of spawning areas, and negative effects on feeding and metabolic rates of organisms. If resuspension occurs over a large enough area it can actually cause large scale redistribution of sediments (Messieh et al. 1991, Black and Parry 1994). Resuspension can also have important implications for regional nutrient budgets due to burial of fresh organic matter and exposure of deep anaerobic sediment, upward flux of dissolved nutrients in pore water, and change in metabolism of benthic infauna.

Effects of sediment resuspension are site-specific and depend on sediment grain size and type, hydrological conditions, faunal influences, and water mass size and configuration (Coen 1995, Hayes et al. 1984, Barnes et al. 1991, LaSalle 1990). Effects are likely more significant in waters that are normally clear compared with areas that are already highly perturbed by physical forces (Kaiser 2000). Schoellhamer (1996) concluded that resuspension by natural mechanisms in a shallow estuary in west-central Florida was less frequent and of smaller magnitude than anthropogenic mechanisms (i.e., fishing) and that sediments disturbed by fishing were more susceptible to resuspension by tidal currents. Modeling by Churchill (1989) concluded that resuspension by trawling is the primary source of suspended sediment over the outer continental shelf, where storm-related stresses are weak. In the Kategat Sea, Sweden, sandy sediments above the halocline were more affected by wind induced impacts than by fishing effort, but mud sediments below the halocline experienced an increase in the frequency of disturbance by 90% in the spring and summer and by 75-85% in the autumn and winter due to fishing (Floderus and Pihil 1990). Thus, even when recovery times are fast, persistent disturbance by fishing could lead to cumulative impacts. In contrast, Dyekjaer et al. (1995) found that in Denmark, although local effects of short duration might occur, annual release of suspended particles by mobile fishing gear is relatively unimportant compared with that resulting from wind and land runoff.

Chronic suspension of sediments and resulting turbidity can also affect aquatic organisms through behavioral, sublethal and lethal effects, depending on exposure. Species reaction to turbidity depends on life history characteristics of the species. Mobile organisms can move out of the affected area and quickly return once the disturbance dissipates (Simenstad 1990, Coen 1995). Even if species experience high mortality within the affected area, species with short life history stages and high levels of recruitment or high mobility can repopulate the affected area quickly. However, if effects are protracted and occur over a large area relative to undisturbed area, recovery through recruitment or immigration will be hampered. Furthermore, chronic resuspension of sediments may lead to shifts in species composition by favoring those species that are better

suited to recover or those that can take advantage of the pulsed nutrient supply as nutrients are released from the seafloor to the euphotic zone (Churchill 1998).

Changes in Chemistry:

Fishing gear can result in changes to the chemical makeup of both the sediments and overlying water mass through mixing of subsurface sediments and pore water. In shallow water this mixing might be insignificant in relation to that from tidal and storm surge and wave action, but in deeper, more stable, waters, this mixing can have significant effects (Rumohr 1989). In a shallow, eutrophic sound in the North Sea, fishing caused an increase in average ammonia content (although horizontal variations prevented interpretations of these increases) and a decrease in oxygen due to the mixing of reduced particles from within the sediments (Reimann and Hoffman 1991). Also in the North Sea, fishing enhances phosphate released from sediment by 70-380 tonnes per year for otter trawls and by10,000-70,000 tones per year for beam trawlers (ICES 1992).

It is unclear how changes in chemistry might affect fish populations. During seasons when nutrients are low, the effective mixing of the sediments could cause increased phytoplankton primary production and/or eutrophication. Rijnsdorp and Van Leeuwen (1996) found increased growth (based on back calculated growth from otolith growth zones) in the smallest size classes of plaice in the North Sea correlated to eutrophication in nearshore areas and both eutrophication and increased beam trawling farther offshore. The authors hypothesized that increased nutrient release (availability) due to anthropogenic activities, including fishing, increased prey availability, and thus resulted in higher growth. Alternatively, ICES (1992) concluded that these pulses are compensated by lower fluxes after the trawl has passed, and that the releases from fishing gear that recycle existing nutrients are probably less influential than new inputs from rivers and land runoff (ICES 1992).

Changes to Benthic Community:

Benthic communities are affected by fishing gear through damage to the benthos in the path of the gear and disturbance of the seafloor. Specific impacts from fishing depend on the life history, ecology and physical characteristics of the biota present (Bergman and Van Santbrink 1997). Mobile species that exhibit high fecundities and rapid generation times will recover more quickly than non-mobile, slow-growing organisms. In Mission Bay, California, polychaetes with reduced larval phases and postlarval movements had small-scale dispersal abilities which permitted rapid recolonization of disturbed patches and resulted in maintenance of high infaunal densities (Levin 1984). Those with long-lived larvae were only available for successful recolonization if the timing of disturbance coincided with periods of peak larval abundance, however, these species were able to colonize over much larger distances. In the Wadden Sea, 60 years of observations revealed longterm changes in abundance and species composition of benthic communities as a result of continued trawling (Rinjsdorp 1988). Slow growing and reproducing epibenthic species had been replaced by fast growing species, the total number of individuals had grown, and the diversity of species of molluscs and crustaceans had decreased while that of polychaetes had increased.

The physical structure of biota also affects their ability to sustain and recover from physical impacts with fishing gear. Thin shelled bivalves and starfish show higher damage than solid-shelled bivalves in fished areas (Rumohr and Krost 1991). Animals that are able to retract below the surface of the seafloor or live below the penetration depth of the fishing gear will sustain much less damage than epibenthic organisms. Animals that are more elastic and can bend upon contact with fishing gear will suffer much less damage than those that are hard and inflexible (Eno et al. 2001). Kaiser et al. (2000) found that chronic fishing around

the Isle of Mann, UK had removed large-bodied fauna such that benthic communities are now dominated by smaller-bodied organisms that are less susceptible to physical disturbance.

Increased fishing pressure can also lead to changes in distribution of species, either through movement of animals away from or towards the fished area (Bradshaw et al. 2000, Demestre et al. 2000, Kaiser and Ramsay 1997, Kaiser and Spencer 1993, 1996, Ramsay et al. 1996, 1998). For example, Morgan et al. (1997) documented large scale changes in the structure of spawning cod shoals after otter trawling, and concluded that high trawling effort could lead to persistent disturbances over large distances. On the other hand, opportunistic feeders are attracted to areas disturbed by mobile fishing gear. Frid and Hall (1999) found higher prevalence of fish remains and scavengers and a lower abundance of sedentary polychaetes in stomach contents of dabs in the North Sea in areas of higher fishing effort. Kaiser and Spencer (1994) document that gurnards and whiting aggregate over beam trawl tracks and have higher numbers of prey items in their stomachs shortly after trawling. Based on these studies, researchers have speculated that mobile fishing may lead to increased populations of species that exhibit opportunistic feeding behavior. Fonds and Groenewold (2000) modeled results for the southern North Sea indicated that the annual amount of food supplied by beam trawling is approximately 7% of the food demand of common benthic predators. This level could help maintain populations but is insufficient to support further population growth.

Changes to Ecosystem:

The role these physical and community effects have on harvested populations is unknown in most cases. However, a growing body of empirical observations and modeling suggests that effects can be seen in population responses. For example, population models for Atlantic cod indicate that when the adult stock is at low levels (i.e., spawning and larval survivorship does not produce sufficient recruits to saturate available habitats), a reduction in habitat complexity has measurable effects on population dynamics. Off the northwest shelf of Australia, removal of epibenthic fauna by trawling resulted in a switch of dominant species from Lethrinids and Lutjanids (which are almost exclusively associated with habitats supporting large epibenthos) to Saurids and Nemipterids (which were found on open sand; Sainsbury 1998). The ICES Impact II Report edited by Lindeboom and deGroot (2001) concludes that bottom trawling affected the food web structure of the North Sea and Irish Sea, although the magnitudes and seriousness of the consequences of these effects on ecosystem properties are uncertain.

3.9 Ecosystem Issues

An ecosystem is a spatially explicit unit of area that includes all the organisms, along with all components of the abiotic environment within its boundaries. Two large marine ecosystems have been identified off Alaska, the eastern Bering Sea/Aleutian Islands (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 U.S. continental shelves. These two areas have distinct geographic and biological features. These ecosystems, and their features, are briefly described in this section; additional detail can be found in the Draft Programmatic SEIS (NMFS 2001a).

Three processes underlie population structure of species in marine ecosystems: competition, predation, and environmental disturbance. Natural variations in recruitment, survivorship, and growth of fish stocks are consequences of these processes. Competition is a process basic to many ecological theories; it requires an assumption that species in an ecosystem are limited in their access to critical resources such as food, space, mates, and time for important activities. Another process, predation, is also important as it changes prey density, thereby directly or indirectly affecting populations throughout the ecosystem. Environmental disturbances induced by climatic change do occur in the North Pacific Ocean (Francis and Hare 1994), and have been proposed as major structuring processes in these ecosystems. Climate has the potential to influence the important biological processes of reproduction, growth, consumption/predation, movement, and, ultimately, the survival of marine organisms. Finally, human activities, such as commercial fishing, can also influence the structure and function of marine ecosystems.

Fishing has the potential to influence ecosystems in several ways (Jennings and Kaiser 1998). Fishing may alter the amount and flow of energy in an ecosystem by removing energy and altering energetic pathways though the return of discards and fish processing offal back into the sea. The recipients, locations, and forms of this returned biomass may differ from those in an unfished system. Selective removal of species and sizes of organisms has the potential to change predator-prey relationships and community structure. Introduction of nonnative species to the marine ecosystem has the potential to cause large changes in community dynamics. Species introductions may have occurred off Alaska through emptying of ballast water in ships (i.e., oil tankers) from other regions, but are not thought to have not been fishing vessel related. Fishing can alter different measures of diversity. Species level diversity, or the number of species, can be altered if fishing essentially removes a species from the system, however there is no evidence that fishing has reduced species diversity off Alaska. Fishing can alter functional or trophic diversity if it selectively removes a trophic guild member and changes the evenness with which biomass is distributed among a trophic guild. Certain species, such as pollock, are at a central position in the food web and their abundance is an indicator of prey availability for many species. Fishing can alter genetic level diversity by selectively removing faster growing fish or removing spawning aggregrations that might have different genetic characteristics than other spawning aggregations. Fishing gear may alter bottom habitat and damage benthic organisms and communities.

Ecosystem-based management strategies for fisheries are being developed around the world to address the larger impacts due to fishing. Ecosystem-based fishery management aims at conserving the structure and function of marine ecosystems, in addition to conserving fishery resources. An ecosystem-based management strategy for marine fisheries is one that minimizes potential impacts while at the same time allowing the extraction of fish resources at levels sustainable for both the fish stock and the ecosystem. In 1997, a NMFS Ecosystem Principles Advisory Panel (the Panel) was appointed to report to Congress on the extent to which ecosystem principles are applied in fishery conservation and management, including research, and propose actions that should be undertaken to expand the application of ecosystem principles in fishery conservation and management. The panel's report provides updated information on ecosystem-

based management of fisheries (NMFS 1999e). The panel described ecosystem-based management for marine fisheries:

> Ecosystem-based management can be an important complement to existing fisheries management approaches. When fishery managers understand the complex ecological and socioeconomic environments in which fish and fisheries exist, they may be able to anticipate the effects that fishery management will have on the ecosystem and the effects that ecosystem change will have on fisheries. However ecosystem-based management cannot resolve all of the underlying problems of the existing fisheries management regimes. Absent the political will to stop overfishing, protect habitat, and support expanded research and monitoring programs, an ecosystem-based approach cannot be effective.
>
> A comprehensive ecosystem-based fisheries management approach would require managers to consider all interactions that a target fish stock has with predators, competitors, and prey species; the effects of weather and climate on fisheries biology and ecology; the complex interactions between fishes and their habitat; and the effects of fishing on fish stocks and their habitat. However, the approach need not be endlessly complicated. An initial step may require only that managers consider how the harvesting of one species might impact other species in the ecosystem. Fishery management decisions made at this level of understanding can prevent significant and potentially irreversible changes in marine ecosystems caused by fishing.

Table 3.9-1 Recommended measures to achieve an ecosystem-based management approach

1.	Adopt conservative harvest levels for single species fisheries.
2.	Incorporate ecosystem considerations into fishery management decisions.
3.	Adopt a precautionary approach to deal with uncertainty.
4.	Reduce excess fishing capacity and define and assign fishing rights.
5.	Establish marine protected areas as a buffer for uncertainty.
6.	Include bycatch mortality in TAC accounting.
7.	Develop institutions to achieve goals.
8.	Conduct more research on structure and function of marine ecosystems.

In 1999, the National Research Council (NRC), an agency organized by the National Academy of Sciences, set out new performance standards for fishery management in *Sustaining Marine Fisheries* (National Research Council 1999), (Table 3.9-1). The publication reviews the status of global fisheries, the problems facing fishery managers, and provides recommendations on how to improve management to achieve sustainable marine fisheries. The NRC's overall recommendation was adoption of an ecosystem-based approach for fishery management with the goal "to rebuild and sustain populations, species, biological communities, and marine ecosystems at high levels of productivity and biological diversity, so as not to jeopardize a wide range of goods and services from marine ecosystems, while providing food, revenue, and recreation for humans" (National Research Council 1999). To achieve an ecosystem-based approach, the NRC made eight specific recommendations as shown in Table 3.9-1.

The management measures implemented for Alaska groundfish fisheries generally achieve all of the measures recommended by the NRC (Table 3.9-1) so current fishery management policies can be considered an ecosystem-based approach. A review of management measures implemented for Alaska groundfish fisheries to reduce ecosystem impacts is provided by Witherell et al. (2000). An evaluation of how well the status quo groundfish management regime achieves ecosystem-based management policies is contained in the draft programmatic groundfish SEIS (NMFS 2001a). The current management regime provides for conservative harvest limits, incorporation of ecosystem considerations, a precautionary approach for

uncertainty, limited access to reduce fishing capacity, marine protected areas for sensitive habitat, inclusion of bycatch mortality into catch accounting, coordination with other agencies, and ecosystem research through the NMFS, Universities, Alaska Department of Fish and Game, and other agencies.

3.9.1 Bering Sea and Aleutian Islands Ecosystem

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 deep water basin. Its broad continental shelf is one of the most biologically productive areas of the world. In contrast, the Aleutian Islands shelf is very narrow. 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 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 Islands, 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.

The Bering Sea contains about 300 species of fish, 150 species of crustaceans and molluscs, 50 species of seabirds, and 25 species of marine mammals (Livingston and Tjelmeland 2000). Nevertheless, diversity of commercial fish species is lower than the GOA. Groundfish species which are the target of Bering Sea fisheries include pollock, cod, sablefish, Atka mackerel and several species of flatfish including arrowtooth, Pacific halibut, rocksole, flathead sole, rex sole, and Dover sole. Squid, sharks, sculpins, and salmon are also found along the shelf, along with forage species such as herring, sand lance, and capelin (Bakkala 1993). Large invertebrates on the shelf subject to fishing include red king crab, blue king crab, snow crab, and Tanner crab, as well as golden king crab on the continental slope. Many species of erect epifauna occur here, with corals and sponges found in abundance throughout the Aleutian Islands.

The eastern Bering Sea supports some of the largest commercial fisheries in the world. The biological and oceanographic dynamics of this region have been monitored to watch for trends and potential sources of problems, such as overfishing or fishery-induced declines in species not targeted by these fisheries. Livingston et al. (1999) reviewed the trends in the fisheries and potential impacts to the eastern Bering Sea ecosystems. Historical biomass trends of three different trophic guilds in the Bering Sea were examined to see if there was a relationship between fishing or climate in changes in total guild biomass or changes in species in the guild. For example, large fishing removals of one guild species might result in increases in other members of that guild as competitive pressures ease. Similarly, if fishing removes large numbers of a prey important to all members of the guild, an overall decrease in abundance of the guild species might be observed, as well as decreased mean size at age of predators relying on that prey. Alternatively, if the factor inducing observed change was environmental, trends in mean size at age or abundance that correlate positively or negatively with temperature or other climate factors might be seen. (Figure 3.9-1)

Livingston et al. (1999) found that despite conservative exploitation rates, a variety of species in diverse trophic groups showed either long-term increases or decreases in abundance (e.g., arrowtooth flounder, Greenland turbot, some seabirds, and marine mammals) while both fished and unfished species have shown cyclic fluctuations in abundance over the last two decades (pollock, cod, crab, sea stars, among others). There appeared to be no link between species declines and prey abundance. The timing of some species declines, such as marine birds, were more related to increases in the adult populations of their main prey

species, pollock. Similarly, the timing of increases in some guild member biomasses did not relate to fishing intensity of other guild members (e.g., skate and cod). However, this study did not consider spatial changes in prey abundance or availability that could occur. Environment was linked to the recruitment of some guild members, and decreases in individual growth of some species (rock sole) were linked to increases in rock sole biomass. Diversity changes in some trophic guilds were related to increases in a dominant guild member (e.g., pollock in the pelagic fish consumer guild and rock sole in the benthic infauna consumer guild) rather than to fishing-induced changes in diversity. Study results also show a stable trophic level of catch, and stable populations overall. The trophic level of the Bering Sea harvest has risen slightly since the early 1950s, and appeared stable as of 1994.

Other studies have also linked production, recruitment, or biomass changes in the Bering Sea with climate factors. For example, the large increase in gelatinous zooplankton in the Bering Sea has been linked to a climate regime change that might have occurred around 1990 (Brodeur et al. 1999). Recruitment in both crabs and groundfish in the Bering Sea has been linked to climate factors (Zheng

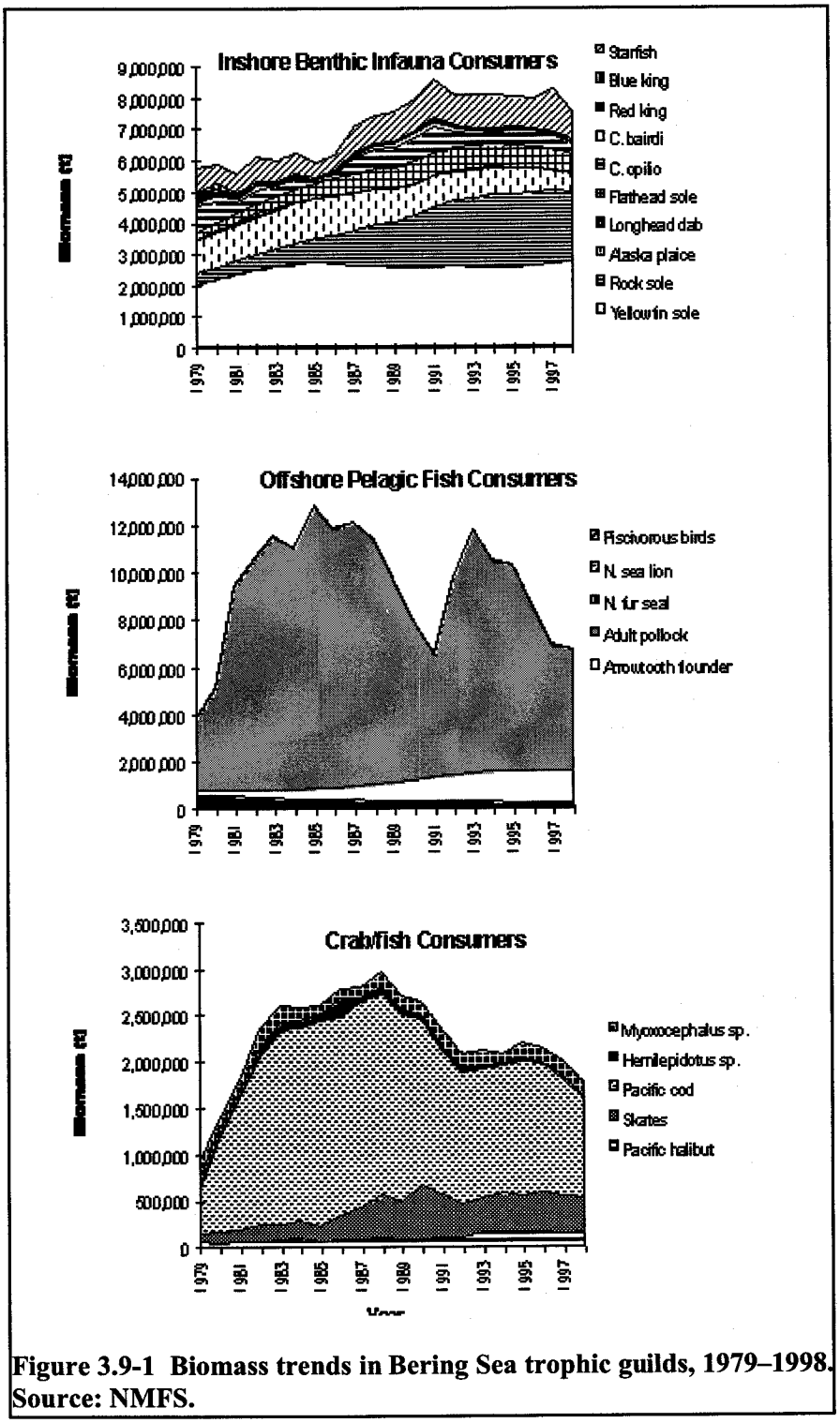


Figure 3.9-1 Biomass trends in Bering Sea trophic guilds, 1979–1998. Source: NMFS.

and Kruse 1998, Rosenkranz et al. 1998, Hollowed et al. 1998, Hare and Mantua 2000). There are indications from several studies that the Bering Sea ecosystem responds to decadal oscillations and atmospheric forcing, and that the 1976–1977 regime shift had pronounced effects there (Francis et al. 1999; Hare and Mantua. 2000). Chlorophyll concentrations did show a peak in the late 1970s, which was closely related to the increase in summer mixed-layer stability (Sugimoto and Tadokoro 1997).

3.9.2 Gulf Of Alaska Ecosystems

The GOA is characterized by a narrow continental shelf with a total shelf area of about 160,000 square km, which is less than 25% of the eastern Bering Sea Shelf. The GOA is a more open marine ecosystem, with land mass to the east and north. The dominant circulation in the GOA is characterized by the cyclonic flow of the Alaska Gyre. Large seasonal variations in the wind-stress curl in the GOA affect the meanders of the Alaska Stream and nearshore eddies. It is the variations in these nearshore flows and eddies that affect much of the region's biological variability.

Diversity of commercial bottomfish species in the Gulf of Alaska is intermediate between the Bering Sea, where fewer species occur, and the Washington-California region, where more species are present. The most diverse set of species in the Gulf of Alaska is the rockfish group (genus Sebastes), of which 30 species have been identified in this area. Other groundfishes which are the target of fisheries in the Gulf include pollock, cod, sablefish, Atka mackerel and several species of flatfish including arrowtooth, Pacific halibut, rocksole, flathead sole, rex sole, and Dover sole. Squid, sharks, sculpins, and salmon are also found along the shelf, along with forage species such as herring, sand lance, and capelin. Along the slope of the continental shelf, rattails and thornyhead rockfish are larger components of the groundfish community. Large invertebrates subject to fishing include several species of scallops, crabs, and clams. Corals, sponges, and many other invertebrates are found throughout the shelf and continental slope.

Mueter (1999) examined GOA groundfish communities using groundfish and shrimp trawl data collected over several years from the eastern and western GOA (Figure 3.9-2). The data were analyzed for species richness, diversity, total abundance, and indices of species composition as they were related to depth, temperature, salinity, sediment composition, geographic location, and time of sampling to identify spatial and temporal patterns in community structure. The data were then compared to local and larger scale atmospheric and oceanographic changes. In general, species richness and diversity peaked at water depths of about 200–300 m in the GOA. Higher abundance, lower species richness and diversity, and a different species composition of demersal fishes were found in the western GOA compared with the eastern GOA. These large-scale spatial patterns were related to upwelling differences between the two regions. Lowest species richness (number of species per haul) was observed in 1984 while lowest species diversity (as measured by the Shannon-Wiener diversity index) was seen in 1996. It is difficult to tell whether these trends are real because of changes in trawl survey techniques and gear used in different years. General increases in total groundfish biomass were seen from 1984 to 1996, coupled with significant changes in species composition.

The total groundfish biomass assessed in bottom trawl surveys in shelf and slope areas increased from 1984 to 1996, despite a considerable, concurrent increase in harvest effort. At the same time, the abundances of unexploited (or underexploited) species including skate, some shark species, forage species, arrowtooth flounder, and other flatfishes had also increased (Mueter 1999). Populations of an overexploited species, the Pacific ocean perch, had also rebounded from low population levels. However, total groundfish biomass since that time appears to be declining (NPFMC 2000d). The controlling factor for these changes appears to be environmental, with changes in the species composition in nearshore areas linked to an increase in

advection in the Alaska Coastal Current. Increased flow around the GOA may enhance the supply of nutrients and plankton on the shelf and upper slope areas, resulting in an increase in productivity during certain flow regimes.

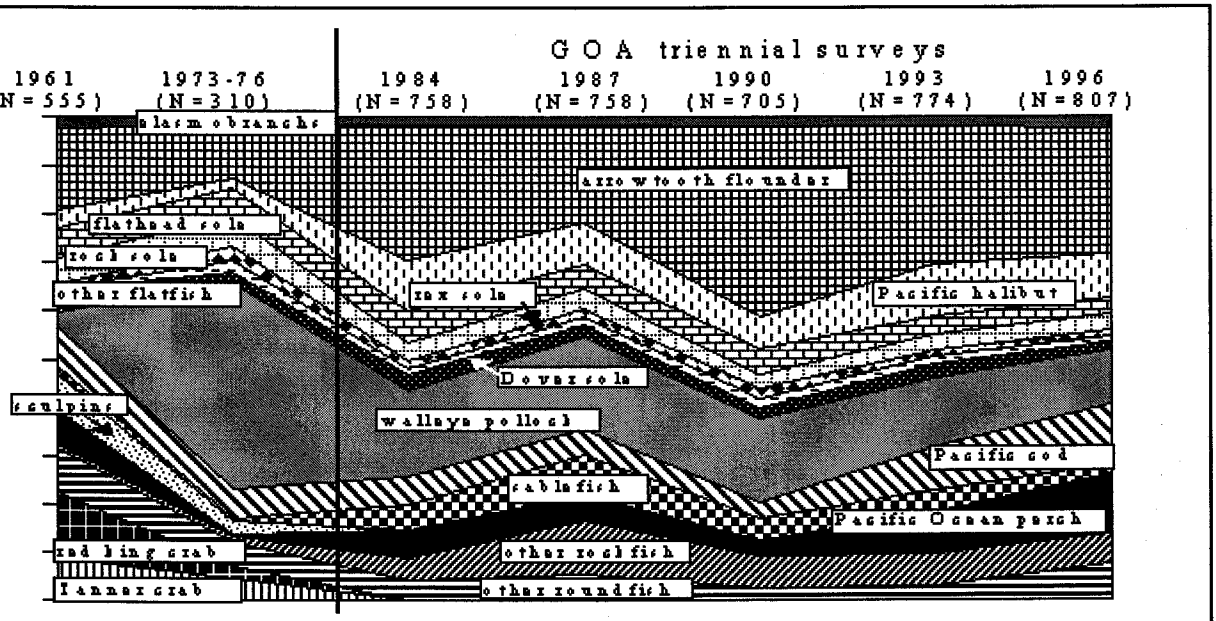


Figure 3.9-2. Trend in index of species composition based on ordination of species abundance data from five triennial surveys on Gulf of Alaska shelf and slope with approximate 95 percent confidence interval. Source: NMFS.

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

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

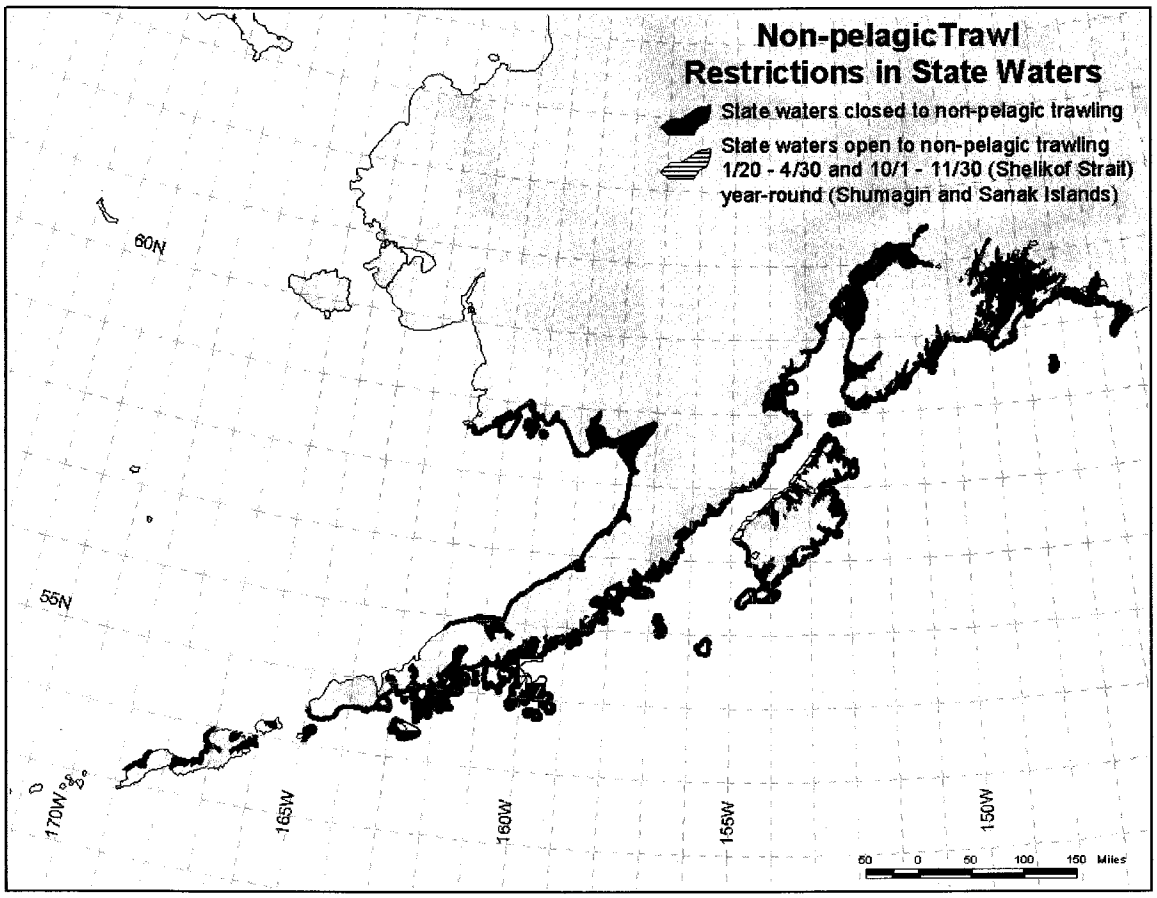
3.10 State Managed Fisheries

A comprehensive overview of the state-managed fisheries and Steller sea lion considerations was provided by Kruse et al. (2000) in their report titled "Overview of State-Managed Marine Fisheries in the Central and Western Gulf of Alaska, Aleutian Islands, and Southeastern Bering Sea, with Reference to Steller Sea Lions." West of 144° west longitude, where Steller sea lions are listed as an endangered species, the State of Alaska manages fisheries for invertebrates, groundfish, herring and salmon. These fisheries are conducted at various times of the year depending on species and management area. Because much of state waters fall within Steller sea lion critical habitat as defined by NMFS, many state-managed fisheries occur within Steller sea lion critical habitat. In order to manage productive fisheries over the long-term in accordance with the sustained yield principle in the State of Alaska's constitution, state fishing regulations are in some cases more conservative for target species than associated federal fishing regulations. The Alaska Board of Fisheries has adopted various policies that guide state fishery management toward this end. Examples include the specification of guideline harvest levels (GHLs), the state equivalent of a total allowable catch (TAC), that are well below those permitted in the federal FMP for some species groups. State regulations also prohibit directed fisheries for sharks and, except for the herring fisheries statewide and capelin in northern Bristol Bay, no commercial fisheries are permitted for forage fishes (as defined in the State Fisheries Management Plan) owing to their ecological role in the marine environment. Additionally, spatial, temporal, gear, and vessel size restrictions are enforced in many fisheries.

The Alaska Board of Fisheries created "Guiding Principles for Groundfish Fishery Regulations" (5 AAC 028.89) which stipulate that state groundfish fisheries are managed conservatively to (1) conserve groundfish resources to ensure sustained yield, (2) minimize bycatch and prevent localized depletion of stocks, (3) protect habitat and other associated fish and shellfish, (4) maintain slower harvest rates by methods and means and time and area restrictions, (5) extend the length of fishing seasons by methods and means and time and area restrictions, (6) harvest the resource in a manner that emphasizes quality and value of the product, (7) use the best available information, and (8) manage cooperatively with the North Pacific Fishery Management Council and other federal agencies associated with groundfish fisheries.

Another broad conservation measure is the closure of most state waters to non-pelagic trawling (Figure 3.10-1). Most areas are closed year-round, and some areas are closed seasonally in Shelikof Strait. Moreover, a portion of eastern Prince William Sound is closed to pelagic trawl gear during the pollock fishery (5 AAC 28.263) and most of eastern Prince William Sound is closed to all (non-pelagic and pelagic) trawling year-round (5 AAC 39.165; Figure 3.10-2, shaded polygon inside PWS). These trawl closures were established by the Alaska Board of Fisheries to protect sea floor habitats, shellfish such as depressed crab populations, and non-target demersal fishes. Although only the 3 nm closures around most rookeries were designed specifically for Steller sea lions, the trawl area closures protect bottom habitats within Steller sea lion critical habitat, and they afford protection to non-target species that are part of the Steller sea lion diet in various amounts, including octopus, sculpin, flatfish, greenling, and other forage fishes which are associated with bottom habitats. The non-pelagic trawling ban also reduces the possibility of direct cumulative impacts from state managed fisheries on marine habitat and particularly the benthic community.

Figure 3.10-1 Year-round non-pelagic trawl closure areas (shaded areas) in state waters of the central and western Gulf of Alaska and southeastern Bering Sea



The State of Alaska has developed fishery management plans for Pacific cod, walleye pollock, sablefish, lingcod, and rockfish (Kruse et al. 2000). State management is generally confined to 0-3 nm of shore. Exceptions include fisheries for lingcod and black and blue rockfishes, nearshore species for which the state management authority extends to cover their distribution within the EEZ. Technically, lingcod and black and blue rockfishes are not considered "groundfish" under federal definitions owing to their exclusion from federal fishery management plans. Also, the state manages all rockfishes within state waters of Prince William Sound and Cook Inlet, and the state cooperatively manages the fisheries for demersal shelf rockfishes throughout the EEZ in the eastern Gulf of Alaska, east of 144°W longitude (within the range of the eastern stock of Steller sea lions) under the auspices of a federal fishery management plan. State-managed fisheries are confined to specific management areas: the pollock fishery is limited to Prince William Sound, Pacific cod fisheries occur in the Prince William Sound, Cook Inlet, Kodiak, Chignik, and South Alaska Peninsula areas, and sablefish fisheries occur in Prince William Sound, Cook Inlet, internal waters of southeast Alaska, and Aleutians Island Management areas (Kruse et al. 2000). Groundfish season openings and closures in state waters are managed to coincide with concurrent federal season openings and closures. These openings in state waters have also been referred to as parallel seasons or parallel fisheries.

Overall, the harvest of pollock, sablefish and rockfish in the state fisheries is a small portion of the total harvest for these species in the GOA and BSAI (Table 3.10-1). In comparison to the federal harvest from the GOA, harvest from state fisheries in 2000 ranged from 1.1 percent for rockfish to 18.4 percent for Pacific cod of the total harvest. For all practical purposes, all of the remaining harvest of other groundfish species is taken in the federal groundfish fisheries. Because harvest of rockfish and sablefish in the State managed fishery is such a small percentage of annual total harvest of rockfish and sablefish, it is very unlikely global scale cumulative impacts would occur to the marine environment.

Table 3.10-1 State and Federal managed groundfish harvest in the GOA in 2000

State Fishery	State Managed Harvest	Federal Managed Harvest	State Harvest as a Percentage of Total Harvest
Pollock****	1,193 mt	71,877 mt	1.6
Pacific cod***	12,265 mt	54,493 mt	18.4
Sablefish*****	408 mt	15,408 mt	2.6
Rockfish**	304 mt	28,182 mt*	1.1

Notes:
* includes Pacific ocean perch, other rockfish, other red rockfish, sharpchin, northern, rougheye, shortraker, pelagic shelf rockfish and demersal shelf rockfish.
** includes rockfish of the genus *Sebastes*.
***Pacific cod guideline harvest levels (GHL) are set up to 25% of the federal TAC for GOA only.
****Estimates of pollock biomass in PWS are included in the assessment of the WYK/C/W GOA pollock stock and the recommended ABC for WYK/C/W GOA pollock fishery is reduced by the amount of the GHL established for PWS(NPFMC 2000b).
***** Includes both the BSAI and GOA.
Source:

The NMFS 2001 Biological Opinion (Appendix A of this SEIS) discusses possible direct and indirect cumulative effects of state managed fisheries on Steller sea lions in section 6.2. Earlier studies by the Alaska Steller Sea Lion Restoration Team (ADF&G, August 2001), NMFS (November 2000a), and ADF&G (Kruse et al October, 2000) have also discussed possible effects of state managed fisheries on Steller sea lions including

3.10.1 State Pacific Cod Fishery

The state developed its fishery management plans for Pacific cod in the GOA in 1996. The state manages five Pacific cod fisheries in the GOA in the Prince William Sound, Cook Inlet, Kodiak, Chignik, and South Peninsula Areas. The GHLs for these areas are based upon a percentage of federal ABC apportionment in the Western, Central, and Eastern GOA. The GHL for Prince William Sound is based upon 25% of the annual Eastern GOA apportionment, Cook Inlet is based on up to 3.75% of the Central GOA apportionment, Kodiak is based on 12.5% of the Central GOA apportionment, Chignik is based on up to 8.75% of the Central GOA, and the South Peninsula is based on 25% of the Western GOA apportionment. For 2001 GHLs were set at levels equal to 25% of the federal ABC in management areas in the Western and Eastern GOA

and at 21.75% of the federal ABC in the Central GOA. In consideration of the developing Pacific cod fisheries in state waters the NPFMC has since 1996 recommended that the federal Pacific cod TACs in the GOA be set at levels equal to ABC minus the states GHL levels so that the total harvest of Pacific cod in both the federal and state fisheries would not exceed recommended ABC levels. The state Pacific cod fisheries as still under development and full utilization of the GHLs has not yet been achieved in all areas of the GOA. In 2000 18.4% of the total GOA ABC for Pacific cod was harvested in the states fisheries leaving 4,335 mt of the combined state GHLs unharvested. This unharvested portion of the state's GHLs was available as forage for Steller sea lions in nearshore areas. The state does not conduct an assessment of Pacific cod biomass within state waters, however the state conducts an annual trawl survey in the GOA, primarily to assess crab stocks but which also capture groundfish at additional locations to the NMFS trawl surveys. This information along with dockside sampling results are provided to NMFS to assist with the assessments of groundfish stocks in the GOA.

Largely to promote sustained seasonal employment in the seafood industry and in agreement with the Alaska BOF Guiding Principals for Groundfish, the state has attempted to slow harvest rates and extend the fishing season. The actual management measures adopted by the state to achieve this objective include: (1) gear prohibitions – only pot or jig gear is allowed (no trawls and longlines); (2) gear limits – only a maximum of 60 pots per vessel or five jigging machines per vessel are allowed; (3) gear allocations that limit the race to fish – catch is allocated among pots and jigs with a provision to reallocate unused allocations from one gear to the other if the slower paced gear type has not taken its share toward the end of the season; and (4) vessel size limits of no more than 58 feet in the South Alaska Peninsula and Chignik areas. Finally, the state does not open the state-managed cod fishery until 1 to 7 days after the federal fishery has been closed. This delay primarily addresses enforcement concerns, but also spreads out the catches of Pacific cod over time between the federal and state fisheries. As a result of these measures, landings from the state-managed cod fisheries in 1999 were dispersed over March to December (Kruse et al. 2000). Even though the fishing season extends from March through December, most of the harvest in 2001 and previous years has occurred from March through June. In 2001, seasonal apportionments of the federal Pacific cod TAC were adopted. There is no seasonal apportionment of the GHLs in the state fisheries. The state waters fisheries close when GHLs are reached or December 31 each year. For 2001 this means that in areas where the GHLs have been reached prior to the opening of the federal Pacific cod B season (for example the South Peninsula area) a parallel fishery in state waters would occur and harvests in state waters would accrue towards the federal TAC. In areas where the GHLs have not been reached prior to the opening of the federal Pacific cod B season (for example possibly Kodiak), there would not be a parallel B season. Rather, the state managed fisheries would continue. Trawl and hook-and-line gear could not be used to target Pacific cod in these areas and the catch by pot and jig gear would continue to accrue towards the GHLs in these areas.

As stated previously state fishing regulations are in many instances more conservative for target species than associated federal fishing regulations in adjacent waters. In three instances state regulations are more liberal are the exceptions. The state has not closed directed fishing for groundfish within 3 nm of all of the federal listed Steller sea lion haulouts and does not have a mandatory observer program. These federal regulations would still apply to federal permitted fishing vessels in state waters but not to fishing vessels without federal permits in state waters. In 2001, 13 vessels over 60 feet LOA have surrendered their federal fishing permits following the federal Pacific cod A season so that they could participate in the state waters fisheries without incurring the additional costs of meeting observer coverage requirements and 12 vessels under 60 feet LOA returned their federal fishing permits in order to be able fish within 3 nm of some the Steller sea lion haulouts

(NMFS, RAM Division)[1]. The federal LLP program does not apply to fishing within state waters and the state waters Pacific cod fisheries are open access within exclusive registration areas. The state further limits effort with length and gear restrictions in some areas. New entrants to the Pacific cod fishery may participate in the parallel fishery within state waters during federal seasons and in the state managed Pacific cod fisheries. In the future, the state may find adjustments to current state regulations to be necessary to achieve the objective to protract the fishing season, especially if additional vessels enter the state-managed fishery.

With specific regard to the endangered population of Steller sea lions, the state has established no fishing zones around rookeries in 1992 and a few haulouts out to 3 nm (ADF&G by Emergency Order, March 17, 1999), and it has seasonally closed several haulout sites in Prince William Sound out to 10 nm. Four rookeries on the federal listing (Agattu Island/Gillion Point, Agattu Island/Cape Sabak, Wooded Island and Seal Rocks (Cordova)) are not protected from commercial fishing out to 3 nm by the state emergency order. Four haulouts are included in the March 17, 1999 emergency order because the entire island where a rookery was located is protected by the 3nm fishing closure. These protected haulouts are Seguam Island/Finch Point, Seguam Island/South Side, Kiska/Sobaka and Vega, and Amchitka/Cape Ivakin. The 3nm closures and 10 nm fishing restricted areas are based upon federal regulations in 1999. Since this time, additional Steller sea lion haulout sites have been added to the federal regulations at 50 CFR part 679.

3.10.2 State Pollock Fishery

The state managed pollock fishery occurs within internal waters of Prince William Sound (PWS) and is managed by the ADF&G. The state conducts an annual assessment of the PWS pollock. Because reliable estimates of biomass and natural mortality are available, the PWS pollock GHL is based upon Tier 5 calculations. The GHL is calculated as the product of the biomass estimate, instantaneous natural mortality rate (0.3) and a safety factor of 0.75. For 2001 the estimate of biomass is 6,304 mt which when multiplied by the mortality rate of 0.3 and the safety factor of 0.75 yielded a GHL of 1,420 mt (Bechtol, 2000). This is a more conservative harvest strategy than the Tier 3b calculations of ABC and OFL made for the W/C/WYK pollock stock. Because it cannot conclusively be demonstrated that the PWS pollock is a distinct population from the W/C/WYK, nor that the PWS pollock is completely unassessed by the NMFS EIT and bottom trawl surveys in recent years, the state's GHL for pollock in PWS has been deducted from the federal ABC for the W/C/WYK pollock stock.

Prior to 1995, less than 4 mt of pollock were harvested annually in PWS, principally as incidental catch in other fisheries by vessels using jig and trawl gear. The serendipitous discovery of pollock near Port Bainbridge by transiting pelagic trawl vessels in 1995 led to a harvest of 2,960 mt that year in PWS. Since 1996 the season has opened January 20 and closed between January 25 and March 31. Each year 2 to 11 vessels have participated, annual harvested has ranged from 1,193 mt to 2,348 mt with an average harvest of 1820 mt (Bechtol, 2000).

In 1999 the Alaska State Board of Fish directed the ADF&G to establish an FMP for pollock in PWS to reduce potential impacts on the endangered western population of Stellar sea lions. Beginning in 2000 the FMP divides the Inside District of PWS into three management sections: 1) Bainbridge Section - Inside District waters west of 148 degrees W. long, 2) Knight Island Section - Inside District waters between 148 degrees W. long. and 147.33 degrees W. long, and 3) Hinchinbrook Section - Inside District waters east of 147.33 degrees W. long. The FMP also specifies that no more than 40% of the GHL be taken from any

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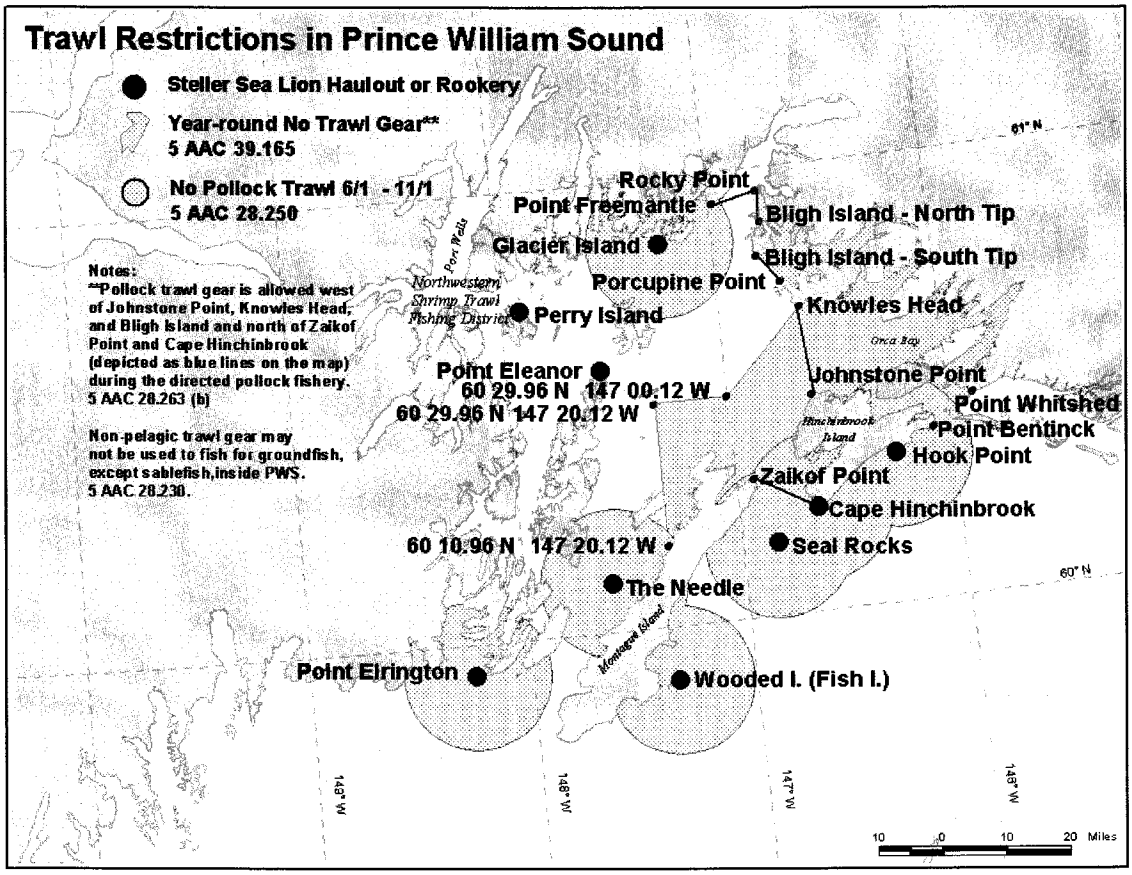
single section. To implement this plan ADF&G targets 30% of the GHL from each section with the remaining 10% as a buffer in the event of unforeseen changes in harvest rates or incorrect inseason hail weights.

Figure 3.10-2 Year-round and seasonal trawl restrictions in Prince William Sound



In PWS additional Steller sea lion protective measures were incorporated into the state management plan for pollock. These measures include time and area closures and spatial apportionments. There are seven Steller sea lion critical habitat sites and two RPA sites in the PWS area, including two rookeries. The PWS outside district (including Wooded Island, Seal Rocks, Cape Hinchinbrook and Hook Point) is closed to pollock fishing. Because the pollock fishery occurs only in the PWS inside district, it reduces the potential for cumulative impacts of prey removal for Steller sea lion critical habitat sites Cape St. Elias, Hook Point, Middleton Island, the Wooded Island rookery and most of Seal Rock and Cape Hinchinbrook sites. Pollock fishing is prohibited during June 1 through November 1 within 10 nm of seven rookeries and haulouts in PWS (5 AAC 28.250) which protects these sites during this time period from the potential cumulative impact of prey removal. This closure time period was based upon similar measure in federal regulations at the time the state rule was adopted. These sites are shown in Figure 3.10-2 with shaded circles. Two haulout sites within PWS, Perry Island and Point Eleanor have no pollock fishing restrictions. The Needles, Point Elrington, and Glacier Island haulouts have no pollock harvest restrictions during November 2 through May

must be published in the *Federal Register*, which requires NMFS to decide on a closure date from one to five days before the closure must be effective. The Office of the Federal Register is closed on weekends and Federal holidays. The requirement to publish closures in the *Federal Register* is an important reason why NMFS is limited in how quickly it can assess catch data and close a fishery. In-season closure notices are not required for individual quota programs such as the halibut and sablefish Individual Fishing Quota (IFQ) Program or the Community Development Quota (CDQ) fisheries, because individual quota holders are responsible for maintaining catch within assigned quota limits.

In general three types of closures are triggered by in-season actions. The first is a target species quota closure issued when a TAC, or apportionment of a TAC, is harvested. The second is a prohibited species closure in which vessels participating in a fishery approach a prohibited species bycatch allowance before harvesting all of the groundfish species available to them. The third is closure of a target species fishery when the catch of an incidentally caught species approaches its overfishing limit.

Under the current inseason management system, a species is either open, or on bycatch or prohibited status at any given point in time. When a species is open, vessels are allowed to target and retain it with no restrictions on the amount harvested. Once a particular species TAC or prohibited species bycatch allowance specified for a fishery has been reached, NMFS closes the directed fishery for that species and it goes on bycatch status. Vessel operators are then limited in the amount of the species closed to directed fishing that they may retain. They are allowed to retain up to the MRB amounts. If the harvest of a given species goes beyond the TAC and approaches the acceptable biological catch (ABC), NMFS will put the fishery on prohibited species status, which prohibits the retention of any fish of that species for the remainder of the year.

NMFS uses information from a variety of sources to determine how much groundfish and prohibited species are caught in the groundfish fisheries. This information is used to determine when to close a directed fishery so that the groundfish or prohibited species catch limit will not be exceeded. In general, data submitted by both NMFS-certified observers and by at-sea and shoreside processors are used to accrue catch against a quota, including the critical habitat area catch limits. The non-CDQ fisheries generally are managed through the "blend," which combines information from observers on vessels and information submitted by processors in a weekly production report (WPR) to determine the best estimate of catch for each processor and week. In some cases, NMFS requires more timely submission of catch data. For example, AFA shoreside processors are required to submit pollock landings data daily through the electronic shoreside logbook. For fisheries with small quotas or those rapidly approaching a catch limit, NMFS in-season managers also rely on daily catch data and anecdotal information from the industry to decide when closures should occur.

Any increase in the number of quota categories that must be monitored and closed on time increases the complexity of the fisheries management system. The difficulty of accurately determining when a quota will be reached and when to close a fishery increases as the number of quota categories increases and the amount of quota available in each category decreases.

Catch limits inside critical habitat areas are a form of quota. For the non-CDQ and non-AFA fisheries, it is NMFS's responsibility to estimate how much catch of the species has occurred inside critical habitat and to close directed fishing in critical habitat when this amount is reached. The challenge is to obtain accurate and timely data so that the closure can be made as close to the catch limit as possible. For the CDQ and AFA fisheries, both the participants in the fishery and NMFS monitor the location of catch. Participants are expected to manage their fisheries so that catch inside the critical habitat areas does not exceed catch limits. Although NMFS monitors the critical habitat area catch limits by these groups, it generally does not issue

closure notices for these fisheries. However, NMFS retains the ability to close these critical habitat areas if the CDQ or AFA participants are unable to manage their fisheries within their catch limits.

Management of a critical habitat area catch limit is complicated when only catch made by vessels directed fishing for a particular species accrues against the catch limit (rather than all catch of the species by all vessels). This situation requires NMFS to determine the location catch occurred, the amount of catch, and the directed fishery that the vessels participated in. Further complexity is added if a vessel has catch onboard from inside and outside of the areas in which the catch limit applies.

3.12 Social and Economic Parameters

3.12.1 Existing Economic Conditions

A review of existing economic conditions of the fisheries is provided in the Regulatory Impact Review (Appendix C of this document).

3.12.2 Existing Social Conditions

The socioeconomic analysis provided in this section is driven by requirements of the National Environmental Policy Act, the Magnuson-Stevens Act, and Executive Order 12898. Under NEPA, 'economic' and 'social' effects are specific environmental consequences to be examined (40 CFR § 1508.8). This section contains an overview of the standard socioeconomic variables typically found in an EIS, including a summary of population, income and employment data for each region.

This section is also guided, in part, by National Standard 8 under the Magnuson-Stevens Act (MSA). National Standard 8 is part of a set of standards that apply to all FMP's and regulations promulgated to implement such plans. Specifically, National Standard 8 states that:

> Conservation and management measures shall, consistent with the conservation requirements of this [Magnuson-Stevens] Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities and (B) to the extent practicable, minimize adverse economic impacts on such communities (Sec. 301(a)(8)).

The MSA defines a 'fishing community' as "...a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and United States fish processors that are based in such community" (Sec. 3 [16]). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops)" (63 FR 24235, May 1, 1998). 'Sustained participation' is defined by NMFS as "...continued access to the fishery within the constraints of the condition of the resource" (63 FR 24235, May 1, 1998). Consistent with National Standard 8, this section first identifies affected regions and communities and then describes and assesses the nature and magnitude of their dependence on and engagement in the groundfish fisheries of the North Pacific.

Beyond NEPA and MSA requirements, this section takes into account Executive Order 12898 (59 FR 7629 [1994]), which requires federal agencies to address environmental justice concerns by identifying "disproportionately high and adverse human health and environmental effects...on minority populations and low-income populations." Consistent with these requirements, the socioeconomic analysis presented here includes demographic data on minority and low-income populations specific to the relevant groundfish communities, presented in its own section for ease of review.

3.12.2.1 Regions and Communities Involved in the North Pacific Groundfish Fishery

In support of the community impact analysis of the various management alternatives under consideration, this section provides a description of the existing regional and community context of the North Pacific groundfish fishery. First, an overview is provided of the fishery as a whole. Next, socioeconomic profiles of six geographic areas with ties to the North Pacific groundfish fishery are provided: four in Alaska, one in Washington, and one in Oregon. The regions were defined based on logical socioeconomic and geographic units. Internal consistency with respect to type of engagement or dependence upon the groundfish fishery was more important in defining the regions than attempting to make them comparable for non-groundfish-related criteria. The regional definitions are consistent with the recently released programmatic Groundfish Draft EIS (NMFS 2001a). The regions and their constituent jurisdictions or geographies are listed in Table 3.12.-1. and shown on Figures 3.12-1 and 3.12-2. Figure 3.12-3 shows the adjacent FMP areas and subareas.

Table 3.12-1 Study regions and their acronyms

AKAPAI	**Alaska Peninsula and Aleutian Islands Region**. Includes the Aleutians East Borough and the Aleutians West Census Area.
AKKO	**Kodiak Region**. Includes the Kodiak Island Borough and other parts of the Kodiak archipelago.
AKSC	**Southcentral Alaska Region**. Includes Valdez-Cordova Census Area, Kenai Peninsula Borough, Matanuska-Susitna Borough, and Municipality of Anchorage.
AKSE	**Southeast Alaska Region**. 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.
WAIW	**Washington Inland Waters Region**. 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.
ORCO	**Oregon Coast Region**. Counties bordering the northern Oregon coast including Lincoln, Tillamook, and Clatsop.

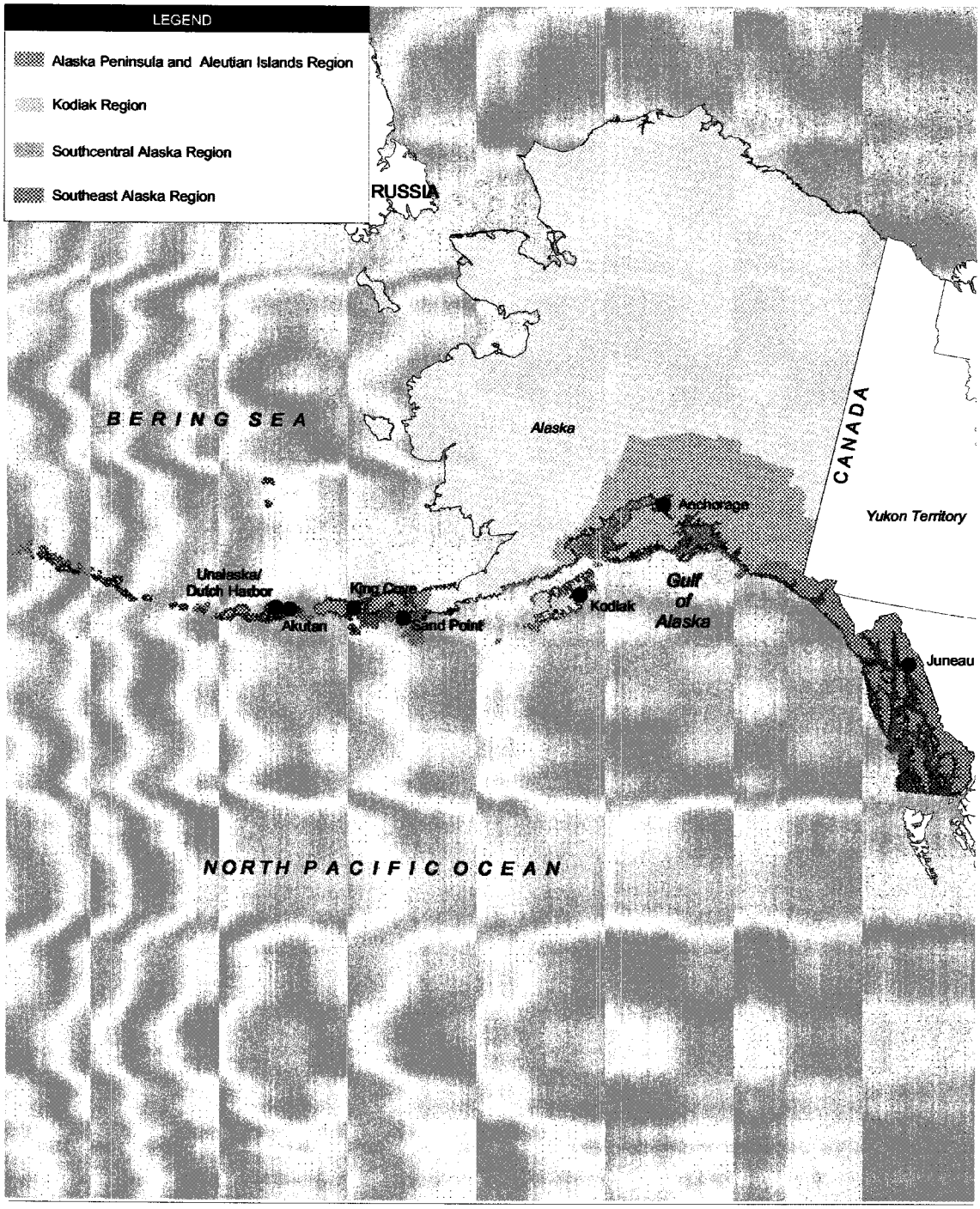


Figure 3.12-1. Alaska Regions

Steller Sea Lion SEIS
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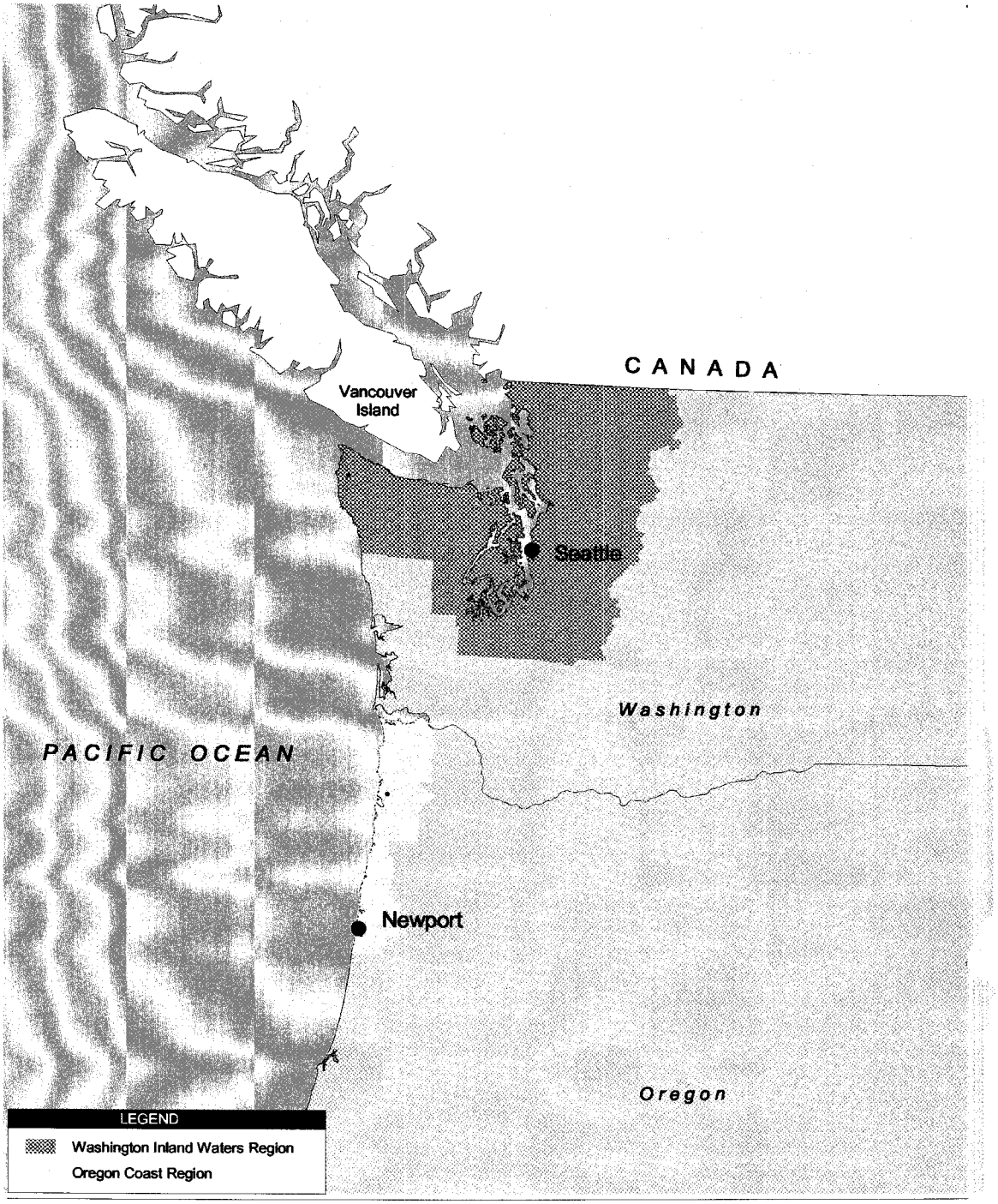

Figure 3.12-2. Pacific Northwest Regions

Steller Sea Lions
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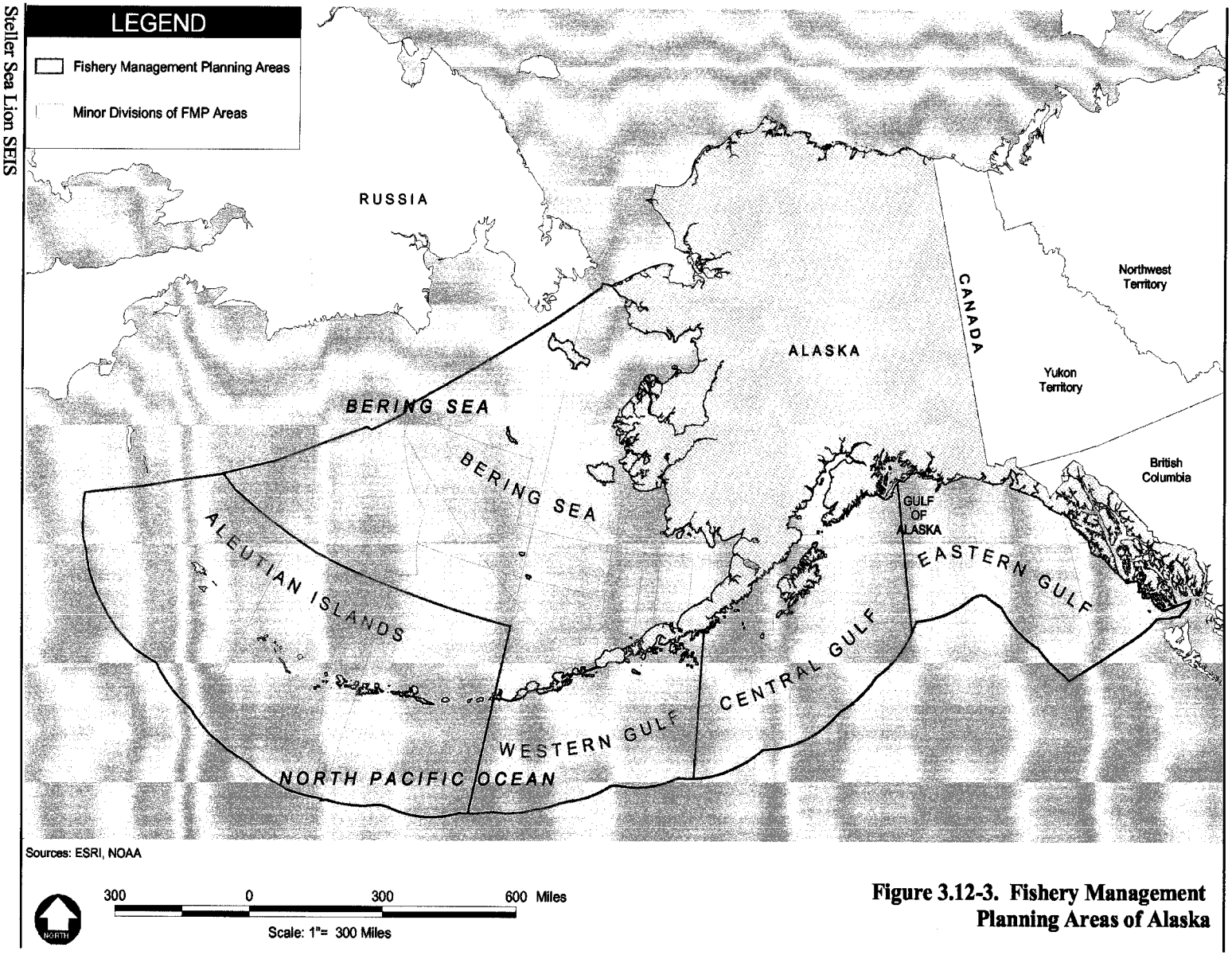

Figure 3.12-3. Fishery Management Planning Areas of Alaska

The regional descriptions complement the sector descriptions presented in the Sector and Regional Profiles of the North Pacific Groundfish Fisheries (NPFMC: in press) to provide a rounded perspective on the socioeconomic aspects of the fishery. Quantitative data used in these regional descriptions are derived from the same data sources used in the sector profiles. Specific data sources, and their limitations, are described in those sections. The sector profiles provide descriptions of the groups engaged in the fishery and their activities, while these regional profiles describe how these groups fit into a regional socioeconomic context. The profiles focus primarily on the regional rather than the community level of analysis. The geographic reach of the areas of Alaska, Washington, and Oregon potentially related to the North Pacific groundfish fishery – and likely to experience socioeconomic impacts due to the proposed management alternatives – is enormous. At the same time, these areas encompass many communities with few or no direct ties to the fishery itself. Detailed community level descriptions of existing socioeconomic conditions for the communities most engaged in the groundfish fishery and, therefore, most likely to experience impacts based on the proposed management measures are contained in Appendix F(1) of this report.

3.12.2.2 Overview of the North Pacific Groundfish Fishery Socioeconomic Context

This subsection presents comparative information on population, employment and income, processing, processing ownership, and catcher vessel ownership and activity across the regions. In subsequent sections, each region is broken out separately, with a broad regional overview following a common format. The intent is to provide the reader with enough information to place the region in terms of its level of participation in the fishery in comparison with other regions, as well as to understand the relative level of importance of pollock and Pacific cod vis-a-vis other groundfish fisheries within each region. Following the general overview, the regionally important groundfish communities are discussed to the extent appropriate for that region, based on the likely distribution of impacts of the range of management alternatives.

Fisheries data have been provided in full time series format (1992-2000) where appropriate. 1992 represents the earliest year for which comparable data are available across processing and harvesting sectors, and 2000 represents the most recent full year for which data are available. Where single year "snapshot" data are more appropriate to the discussion than time series information, data for 1999 and 2000 are provided. 1999 data are presented as this represents the last full year prior to the implementation of the more sweeping Steller sea lion-related protection management measures, and for this reason, 1999 socioeconomic conditions are highlighted in the text discussions. 2000 data are also presented because they represent the most recent information available. Interpretation of 2000 data in terms of analyzing the impacts of Steller sea lion protection measures is problematic for several reasons, not the least of which is that management conditions changed dramatically during the year itself, so that the year as a whole represents neither pre- nor post-Steller sea lion RPA conditions.

It should be noted that the 1999-2000 period was a time of structural change for a good part of the groundfish fishery independent of Steller sea lion related issues. The most obvious of these changes were those associated with the American Fisheries Act (AFA) which, among other things, reduced the offshore catcher-processor fleet, shifted quota from offshore to inshore, and facilitated the formation of co-ops for offshore catcher processors in 1999 and for inshore and mothership catcher vessels in 2000. A comprehensive discussion of the social impacts of the AFA is beyond the scope of this document, but is provided in the North Pacific Fishery Management Council's report to Congress (in public review Draft at the time of this writing). It is sufficient to note that 1999 as a base year for this analysis does not represent a socioeconomic context in static equilibrium and it is not realistic to assume that all other things are being held equal.

As a methodological note, it should be stated that while the time series data in this document are similar to those found in the recent Groundfish Draft SEIS, they are not identical. The reason for this variation is discussed in detail in the sector profile section of this document, but in general results from both a different methodological approach and a refinement of data resulting from an improved ability to focus on directed catch (and exclude bycatch). It is the target fisheries that will be subject to the more direct impacts of proposed management alternatives. While consistency between documents might be valuable in an abstract sense, it is not particularly important in a practical (pragmatic) sense for the present task. For the purposes of the regional and community impact discussions, the precision of individual numbers is much less important than the accuracy of direction and magnitude of trends in existing conditions, and the direction and magnitude of change resulting from the proposed alternatives.

Population. The communities and regions that are engaged in the Bering Sea pollock fishery specifically, and the North Pacific groundfish fishery in general, are diverse in many ways. Perhaps the most obvious of these can be seen in the variation in regional populations. In Alaska, AKAPAI had a 1999 population of approximately 6,000, AKKO had approximately 14,000, and AKSC and AKSE had about 375,000 and 73,000, respectively. In the Pacific Northwest, the WAIW region had about 3.9 million residents and the Oregon Coast region has about 105,000. Specific population figures are presented in Appendix F(2). Beyond overall population, the types of communities and the population structures in the regions vary considerably. The fishery has an impact on the male/female population balance for some Alaska communities, primarily those where intensive groundfish processing facilities are located. In Alaska, particularly AKAPAI and AKKO, there is also a relationship between percent of population that is Alaska Native and commercial fisheries development. Communities that previously were predominantly Native and have developed as large commercial fishing centers have become less Native in composition over time compared to other non-fishing communities in the region. There are, of course, many variables involved, but for a few of the communities noted the relationship is straightforward. These differences in the male/female and Native/non-Native population segments tend to vary by the degree to which the directly fishery-related population is integrated with the rest of the population of the community. As a general rule, where development has been of an "industrial enclave" nature (which is also consistent with where the development has been the largest relative to the long-term resident population), the population structural shifts have been the greatest. Again, this articulation varies considerably from place to place, and is not as apparent in AKSC and AKSE as it is in the more western regions.

Employment and Income. Employment and income (payments to labor) information presented for each region provides a look at types and levels of economic engagement with the groundfish fishery. Specific employment and income figures for each region are provided in Appendix F(2). Information on employment in the processing sector provides insight on the level of employment in the communities that is directly attributable to groundfish fishery activity. Our assumptions in regard to community employment in groundfish processing are relatively crude, due to the limits of the information available. Employees of shoreplants are counted as part of the labor force for the community in which the shoreplant itself is located, while those of the more mobile processors are counted as part of the labor force of the community of residence of the owner of the processing entity. With these assumptions, during 1999 primary or direct Alaska groundfish processing employment ranged from none in ORCO to more than 2,600 persons in AKAPAI and more than 3,700 persons in WAIW. Interpretation of these data in terms of engagement with the community is less straightforward for some regions than for others. For some, processing plants tend to be industrial enclaves that are somewhat separate from the rest of the community, while for others there is no apparent differentiation between the processing workforce and the rest of the regional or local labor pool. For the WAIW region, Alaskan groundfish processing work is at sea, so in some respects it does not take place 'in' a community at all. In all cases, however, processing employment tends to be seasonal in nature.

A further complication for attribution of socioeconomic impacts to a regional base is the fact that many workers in many sectors perform groundfish-related work in a region or community other than the locations where they have other socioeconomic ties. It is not uncommon for fishery-related workers to spend little money in their work region and to send pay 'home' to another community or region (and, further, legal residence may or may not be consistent with what people think of as 'home' or what may be considered 'home' in terms of where economic benefits ultimately accrue). In this sense, regional employment is indicative of the 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 for the communities that are most heavily engaged in the processing aspect of the groundfish fishery.

Tax and Revenue. Tax and revenue information is presented for each Alaska region to provide a perspective on the role of the groundfish fishery in the underpinning of the local economy. Data are from the Alaska Department of Revenue (ADOR), DCED, and local sources, as appropriate. Information on the local tax structure of each relevant community is provided, and the communities and regions vary in the way that direct revenue is collected on fishery-related transactions that occur in the regions. For communities (and boroughs) in the western Alaska regions, a local fish tax is often a significant source of local revenue. For other regions, direct revenue benefits are more closely tied to the state fish tax. Information is provided for each region on shared taxes and the role of state shared fish tax in relation to these other taxes. Again, there is considerable variability from region to region. Also apparent is the regional differentiation in the importance of the relatively new fishery resource landing tax. This source of revenue comes from the offshore sectors of the fishery, is designed to capture some of the economic benefits of offshore activity for adjacent coastal Alaska regions, and is far more important to the revenue structure of the AKAPAI region than for any other region.

Inshore Processing. Inshore groundfish processing information is presented for each region to facilitate analysis of the volume and value of the groundfish that are landed in a region. The information is broken out by species, and historical information is provided on utilization rate, product value, and value per ton. When examined on a region-by-region basis, these data point out that the groundfish fishery varies widely from one region to another. For example, for AKAPAI, local groundfish processing activity is relatively focused on pollock, while in AKSE, the fishery is focused much more on the non-pollock, non-cod, non-flatfish, "other" (ARSO) species. Therefore, there are sharp differences in value per ton (over eight times greater in AKSE) and in volume (greater in AKAPAI, which accounts for 80 percent of the total volume for the state). These differences correspond with differences in a number of other factors, including the extent to which a local labor force is used in processing and the degree to which a local fleet is harvesting the resource (both measures are high in AKSE, but low in AKAPAI). Overall, this information is useful in looking at where fishery resources come ashore, and can be used as a rough indicator of the economic activity generated in processing communities. The relative amount of economic benefit to regions and specific communities varies considerably from place to place, as processing entities are articulated with communities in different ways in different places, and patterns of ownership influence the flow of economic benefits.

Processor Ownership. In part to address the flow of economic benefits and to help characterize them on a regional basis, ownership information is presented for processing entities by region. Caution must be taken in interpreting this information, however, as assignment of entities to regions is based on ownership address information, and this is known to be less than precise in a number of cases due to different criteria for assigning addresses. Also, for entities with ownership interest divided among entities residing in two or more regions, the entire operation was counted for the region with the majority of the ownership interest (and

therefore caution must be exercised in the use of this information and this known shortcoming taken into account in interpretation of results). This information includes all processing sectors, both fixed processors in communities and mobile, at-sea processors (motherships and various catcher processor sectors). This information is presented by region, by sector, and by groundfish species. The data in this section facilitate consideration of how resource utilization is linked to ownership patterns and how those ownership patterns play out among regions. For example, AKAPAI has the greatest volume and value processed inshore among all the regions, but ownership of shore processing facilities in this region is highly concentrated among individuals and firms located in the WAIW region. The large mobile processors that work the Bering Sea have varying catch and processing locations and at least some ties to adjacent Alaska regions (through CDQ group ownership interest, for example), but ownership again clearly shows predominant ties to the Pacific Northwest. Combining all types of processors (inshore, mothership, and offshore), processors owned by WAIW residents accounted for 96 percent of total reported tons and 94 percent estimated wholesale value of all North Pacific groundfish processed in 1999.

Catcher Vessel Ownership and Activity. Information on catcher vessel ownership patterns is presented to demonstrate the links between resource harvesting and specific regions. As for processors, region of ownership is based on the address of record of the majority owner, so some caution in the interpretation of this information is warranted. It is not unusual for vessels to have complex ownership structures involving more than one entity in more than one region, but the region of majority ownership provides a rough indicator of the direction or nature of ownership ties when patterns are viewed at the sector or vessel class level. Data are presented on the number and types of vessels in the regionally owned fleet and the employment and payments to labor that result from catcher vessel resource activities. Resources from FMP subregions adjacent to the AKAPAI, AKKO, and other Alaska regions are not uniformly harvested by catcher vessels from those regions. Different regions have varying combinations of local harvesting activity, local processing activity, and ownership of both harvesting and processing entities, and all of these have implications for the role of the groundfish fishery in the local socioeconomic context. For example, in terms of groundfish harvest value and volume, AKAPAI features a mostly nonresidential fleet, except for some of the smaller vessel classes. While the highest volume and value of groundfish resources harvest occur near this region, the catcher vessels accounting for most of this activity are from elsewhere (primarily WAIW and ORCO). As discussed in the individual region profiles, the higher the catcher vessel harvest volume in a given area, the less 'local' the fleet tends to be. Put another way, the more important the region is to the overall groundfish fishery, the lower the proportion of total catch is likely to be harvested by the local fleet in that region, although recent CDQ partnership arrangements may serve to ameliorate this historical disjunction.

Information on total groundfish harvest by FMP area for each region is provided to allow consideration of distribution of effort by the fleets of the individual regions in different groundfish management areas. In other words, this information facilitates gauging the relative importance of groundfish from each management area to the catcher vessel fleets based in each region. Regions vary widely in how 'local' the catch effort is by the local fleet. For example, catcher vessels in AKSE have a very high concentration of effort in the Eastern Gulf of Alaska FMP area, while efforts of catcher vessels based in Kodiak are more wide-ranging. More detailed regional harvest of Pacific cod and pollock, the two most important groundfish species for SSL interactions, is also provided by FMP. Total regional groundfish harvest is also broken out by species so that relative dependency on species by area can be assessed. In this way, relative dependence on alternative measure impacted resources can be examined, at least in general terms.

Harvest Diversity. Extended sector and regional profiles contained in the Groundfish SEIS (Appendix I) include a treatment of diversity in the catcher vessel fleet, and discusses a brief treatment of the annual cycle

for groundfish catcher vessels and information on how groundfish fit into that cycle both in terms of timing and value. Information is also presented on how groundfish has fit into overall catcher vessel effort for groundfish catcher vessels over the last several years so that the relative role of groundfish can be seen over time. This information is abstracted for this document, and clearly shows that the relative importance illustrates marked differences between regions.

Processor Diversity. Diversity information similar to that presented for catcher vessels is also presented in the Groundfish SEIS (Appendix I) for processors for each of the regions to allow at least a general-level consideration of the relative importance of groundfish, and that information is abstracted in this document. For the larger Bering Sea pollock inshore plants, for example, groundfish accounted for more than 60 percent of total ex-vessel value over the period 1995-1997, while in AKSE, analogous value ranged from 10 to 35 percent over the period 1991-1998. The estimates provided in also indicate the amount of groundfish and non-groundfish processed at all regional processors that take deliveries of at least some quantity of groundfish.[1] We have examined changes in patterns of processor diversity to a limited degree, as they are more clearly associated with local community effects.

Subsistence. Each Alaska region profile contains a brief summary of subsistence resource use for selected communities with known ties to the groundfish fishery. The basic data used for this description were taken from the ADF&G subsistence database. The management of the consumptive use of subsistence resources in Alaska is complex, and is summarized in Appendix I of the Groundfish SEIS (NMFS, 2001a). Groundfish comprise up to 9 percent of total subsistence resources consumed in some communities. Level of Steller sea lion take for subsistence purposes in Alaska coastal communities is mentioned in each of the regional profiles, but is described in more detail in Appendix F(3) of this document.

Tables 3.12-2 through 3.12-7 present information on participation in the groundfish fishery by region for processing and catcher vessel sectors. Parallel tables are presented for each of the individual regions and provide time series information on most of these same indicators. Confidentiality has been preserved for vessels and processors with few members in any particular class or sector by using a normative value for operations within a particular class that are then adjusted regionally so that regional subtotals will match the actual regional total.

[1] A summary analysis of processors within the four Alaskan regions defined in this study revealed that shore based processors that took deliveries of at least some amount of groundfish accounted for approximately 77 percent of all non-groundfish processed at shore based processors within those regions.

Table 3.12-2 Selected North Pacific groundfish participation measures by region, 1999

	AKAPAI	AKKO	AKSC	AKSE	WAIW	ORCO	Total
Processor Employment and Payments to Labor							
Employment (Est. FTEs)	2,648	749	170	112	3,718	0	7,397
Payments to Labor ($Millions)	113.0	26.8	13.5	12.6	245.8	0	411.7
Groundfish Processing by Regional Inshore Plants							
Reported MT (Thousands)	544.0	116.7	10.82	4.75	NA	NA	676.27
Product MT (Thousands)	191.0	31.4	6.64	3.51	NA	NA	232.55
Utilization Rate (Percent)	0.35	0.27	0.61	0.74	NA	NA	NA
Product Value ($Millions)	376.3	94.7	29.77	26.91	NA	NA	527.68
Value per Ton ($)	692	811	2,751	5,665	NA	NA	780.28
Processors Owned by Regional Residents							
No. of Processors Owned	4	9	13	10	109	0	145
Reported Tons (Thousands)	0.54	34.3	24.40	11.14	1,553	0	1,623.38
Wholesale Value ($Millions)	0.53	24.8	33.59	18.12	1,120	0	1,197.04
Catcher Vessels Owned by Regional Residents							
No. of Catcher Vessels	67	158	170	235	262	42	934
Retained Tons (Thousands)	24.5	69.5	12.4	6.3	547.1	72.6	732.4
Ex-vessel Value ($Millions)	10.12	30.0	10.31	17.67	140.0	24.07	232.17
Employment (Persons)	306	797	820	1,328	1,258	198	4,707
Payments to Labor ($Millions)	4.05	12.0	4.12	7.07	55.99	9.63	92.86

Notes: 1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.

Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-3 Groundfish harvests delivered to inshore plants by species, 1999

Region	Total Reported Harvest by Species									
	Thousands of Tons					Millions of Dollars				
	ARSO	Flatfish	Pacific Cod	Pollock	Total	ARSO	Flatfish	Pacific Cod	Pollock	Total
AKAPAI	8.4	5.0	56.11	474.4	543.92	5.58	1.2	81.87	287.66	376.31
AKKO	11.69	10.08	35.18	59.75	116.71	11.0	3.34	50.26	30.06	94.65
AKSC	4.58	0.87	3.34	2.03	10.82	20.61	0.21	6.13	2.81	29.77
AKSE	4.38	0.25	0.12	0	4.75	26.72	0	0.19	0	26.91
WAIW	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ORCO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	**29.05**	**16.2**	**94.75**	**536.18**	**676.20**	**63.91**	**4.75**	**138.45**	**320.53**	**527.64**

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-4 Groundfish wholesale value of regionally owned processors by processor class, 1999

Processor Class	Region						
	AKAPAI	AKKO	AKSC	AKSE	WAIW	ORCO	Total
Catcher/Processors	0.08	23.00	2.04	10.96	571.07	0	607.15
Motherships	0	0	0	0	57.92	0	57.92
Shoreplants	0.45	1.75	31.56	7.16	490.81	0	531.73

Note: Value - $Millions.
Source: Derived tables, Northern Economics (1994); adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-5 Groundfish retained harvest by catcher vessels owned by residents of various regions by FMP subarea, 1999

	AI	BS	WG	CG	EG	Total
Total Ex-Vessel Value ($Millions)						
AKAPAI	0	0.40	8.65	0.77	*	10.12
AKKO	0.79	4.83	0.78	22.98	0.66	30.04
AKSC	0.34	0.36	1.01	8.19	0.40	10.31
AKSE	0.15	0.16	0.70	4.07	12.59	17.67
WAIW	4.98	106.18	7.69	13.76	7.36	139.97
ORCO	0	13.16	0.34	9.05	*	22.78
Total	**6.26**	**125.09**	**19.17**	**58.82**	**21.01**	**230.89**

Note: *Due to the confidentiality of the data presented, this value has been suppressed.
Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001

Table 3.12-6 Number of boats and retained catch by weight and value, by species group, by catcher vessel ownership, and by region, 1999

Data	AKAPAI	AKKO	AKSC	AKSE	WAIW	ORCO
ARSO						
Number of Catcher Vessels	20	93	129	229	205	37
Retained Tons (Thousands)	0.1	3.5	1.3	4.3	6.1	1.5
Ex-vessel Value ($Millions)	0.42	4.48	3.71	16.48	16.58	1.24
Flatfish						
Number of Catcher Vessels	15	35	7	13	104	29
Retained Tons (Thousands)	0	2.2	0.2	0.1	3.4	1.7
Ex-vessel Value ($Millions)	0	0.59	0.09	0.03	0.50	0.35
Pacific Cod						
Number of Catcher Vessels	67	150	151	107	191	31
Retained Tons (Thousands)	14.5	27.5	8.1	1.9	40.8	18.5
Ex-vessel Value ($Millions)	7.54	17.67	5.91	1.15	21.82	10.23
Pollock						
No. of Catcher Vessels	19	62	31	13	109	27
Retained Tons (Thousands)	9.8	36.3	2.8	0	496.9	53.0
Ex-vessel Value ($Millions)	2.15	7.29	0.60	0.01	101.07	10.96
All Groundfish Species						
Total Number of Catcher Vessels	67	158	170	235	262	39
Total Retained Tons (Thousands)	24.5	69.5	12.4	6.3	547.1	74.7
Total Ex-vessel Value ($Millions)	10.12	30.04	10.31	17.67	139.97	22.78

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001.

Table 3.12-7 Retained harvests by FMP area and species of regional catcher vessels, 1999

Region of Catcher Vessel Owner	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
APAI	0.12	0	0.46	0.59	9.60	5.86	3.81	3.82	0.02	0.05	24.34
AKKO	1.60	0.01	6.70	14.57	4.43	3.30	14.00	18.78	0.10	0.26	63.75
AKSC	0.38	0	1.48	0.71	0.94	0.29	5.28	1.70	0.06	0.03	10.87
AKSE	0.06	0	0.07	0.06	0.37	0.13	1.18	0.04	0.02	0	1.94
WAIW	5.49	0.01	21.61	462.51	5.91	10.83	10.13	19.99	0.04	1.15	537.67
ORC	1.68	0.03	6.77	34.11	0.73	2.51	5.72	19.81	0.01	0.10	71.47
Value ($Millions)											
APAI	0.07	0	0.26	0.12	4.75	1.25	2.43	0.78	0.01	0.01	9.69
AKKO	0.94	0	3.87	3.05	2.43	0.75	9.69	4.11	0.07	0.06	24.97
AKSC	0.25	0	0.96	0.16	0.58	0.07	4.04	0.40	0.05	0.01	6.51
AKSE	0.03	0	0.04	0.01	0.20	0.03	0.83	0.01	0.01	0	1.16
WAIW	2.82	0	11.02	92.73	3.01	2.32	6.58	4.16	0.03	0.23	122.89
ORC	0.93	0.01	3.70	7.27	0.40	0.58	3.83	4.45	0.01	0.02	21.19

Source: Spreadsheet from Northern Economics (1994) adapted from ADF&G Fish Tickets and NMFS Observer Data, June 2001.

In general, there are a number of other "big picture" points to keep in mind when constructing a baseline for examining community impacts that may result from various Steller sea lion protection-related management alternatives. Among these are the fact that some aspects of the industry can not be 'held equal,' although they are clearly important. First, in trying to isolate community impacts by looking at the intersection of communities and sector entities, the picture is complicated by entities that have a presence in multiple areas, such as both the BSAI and GOA areas, that may experience different types of impacts. Second, some entities have a presence in two or more different sectors (CV's, CP's and shore processing), such that impacts that may be seen as accruing to one sector may be influenced by other sector changes. Third, entities in the groundfish fishery differ markedly in the degree to which they participate in and depend on other fisheries. This, of course, helps to determine the magnitude of impacts - or the consequences of impacts - experienced by the individual entities and communities. Other types of factors that confound the analysis in fundamental ways are aspects of the fisheries context that are outside of the control of the entities engaged in the fishery. As mentioned above, AFA-related consequences have recently changed the fishery in a number of ways at approximately the same time that Steller sea lion RPA impacts were being realized. Also, Area M salmon changes have had interactive impacts on alternative measure influenced entities and communities. In sum, while Steller sea lion-related management measures do have significant effects on the groundfish fishery, which will be discussed in this document, there are known limitations on the degree to which recent sector and community changes can be attributed to these measures.

3.12.2.3 Alaska Peninsula and Aleutian Islands Region

Overview. AKAPAI region, shown in Figure 3.12-4, is in several ways the center of the Alaska groundfish fishery in general and the Bering Sea pollock fishery in particular. The adjacent FMP area features the greatest groundfish harvest, and it sees significant activity from both onshore and offshore fishery sectors. In 1999, the region accounted for 80 percent by volume and 71 percent by value of all groundfish processed in Alaska. During 1992-2000, this region accounted for more than four times the volume of groundfish processed inshore than in the other Alaska regions combined. This volume includes 89 percent of the pollock, 68 percent of the Pacific cod, 42 percent of the flatfish, and 31 percent of the ARSO processed. The relative dependence of regional communities on the groundfish fishery varies greatly. While four of Alaska's top five groundfish landing ports are in this region, some other communities in the region have little, if any, direct involvement with the fishery. Extended profiles of the regionally important groundfish communities of Unalaska/Dutch Harbor, Akutan, King Cove, and Sand Point are provided in Appendix F(1). No groundfish data are yet available for False Pass, but it is known that substantial processing investment has been made in the community, and groundfish is being locally processed during 2001. Groundfish has not been a major focus of processing in St. Paul in recent years, but groundfish do appear in the processing reports for 2000.[2] Additionally Adak, a former military community, has become a significant regional processor of groundfish in the recent past. Although production figures are confidential, it is common knowledge that although no groundfish were landed in the community prior to 1998, it has since become a significant and growing purchaser of groundfish, particularly cod, within the region. This community is quite different in sociocultural terms from the other communities of the region, given its recent development as an industrial site on a converted military base rather than within or adjacent to a traditional community. It is also important to note that within this region the Aleutians East Borough encompasses the communities of Akutan, Cold Bay, False Pass, King Cove, Nelson Lagoon, and Sand Point. Given that changes in tax revenue resulting from changes in groundfish landing patterns in one community within the borough is directly linked to expenditures in other communities in the borough (for example, a decline in fish tax revenue in King Cove paid to the Borough would impact Nelson Lagoon if it were large enough to necessitate reductions in school expenditures), the borough structure would serve to distribute impacts to communities in a different way than seen in the rest of the region that has no such structure.

[2] It is worth noting that Chignik - although not geographically in the region, it is lumped analytically in regional totals for the fishery - does run some groundfish as well, but like St. Paul this is clearly not the main focus of local processing. Brief information on the Chignik groundfish fleet is provided in Appendix F(1).

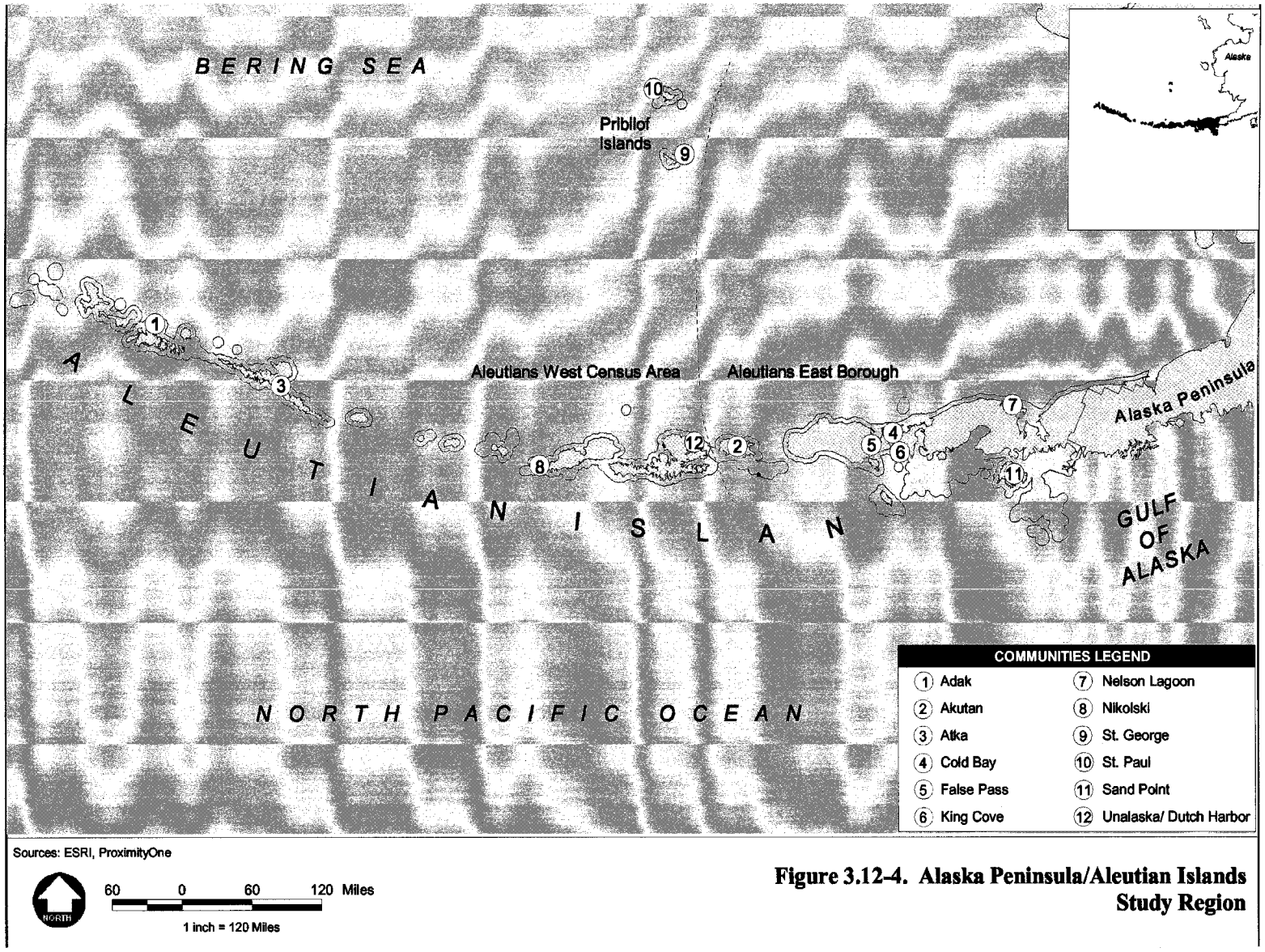

Figure 3.12-4. Alaska Peninsula/Aleutian Islands Study Region

Population. The AKAPAI region has the smallest population (6,092 in 1999) of the four Alaska regions characterized. The regional population has declined in recent years with the closure of the military installation at Adak, formerly the largest community in the region. Unalaska (population 4,283 in 2000) is the largest community in the region, and the number one fishing port in the nation for value and volume of catch landed. Of the other four communities with more than 200 residents in 2000, three (Akutan [population 713], King Cove [population 792], and Sand Point [population 842, the second largest community in the region]) are substantially involved with the groundfish fishery and are the sites of large processing facilities. These communities have a disproportionately male population, consistent with a predominantly male workforce at the seafood plants that, in turn, comprises a significant proportion of the total community population. Although they vary between plants and communities, processor workforces tend to be made up of short-term residents housed in industrial-enclave-type settings.

Employment and Income. AKAPAI communities have a wide range of employment opportunities and income levels. These opportunities are closely related to the commercial fishery in general, and the groundfish fishery in particular. Communities with sizeable seafood processing operations (Akutan, King Cove, Sand Point, and Unalaska) have very low official unemployment rates. Processing workers tend to be in the community because of the employment opportunity, tend to leave when employment terminates, and comprise a significant portion of the population. Among civilian employment sectors, manufacturing, typically associated with seafood processing in this region, has dominated employment. In 1999, 2,958 persons were employed in manufacturing, almost five times as many as in the next most important sector, state and local government. Regional personal income and earnings from manufacturing exceeded earnings of all other sectors combined in 1999.

Tax and Revenue. Commercial-fisheries-related taxes are important to the region in absolute and relative terms. Akutan, King Cove, Sand Point, and Unalaska all have local raw fish taxes, and the first three are also subject to a borough raw fish landing tax. Fisheries-related shared taxes accounted for 99.7 percent of all the shared taxes and fees coming to the region from the state in 1999, and total fisheries-related tax revenues exceeded $7 million. The offshore processing component paid more than $2 million in Fisheries Resource Landing tax in 1999. This tax is considerably more important in AKAPAI, in both absolute and relative terms, than for any other Alaska region.

Inshore Processing. In AKAPAI in 1999, pollock comprised more than 87 percent of the groundfish volume processed, Pacific cod 10 percent, and ARSO and flatfish 2 percent and 1 percent, respectively. This pattern by species varies considerably from those of other Alaska regions. With 544,000 total reported metric tons of groundfish processed and 191,000 metric tons of total groundfish final product in 1999, AKAPAI dominates the other regions in inshore processing. With a total product value of $376 million and a value of $692 per metric ton, this region has the highest total value (reflecting enormous volume processed) and the lowest value per ton (reflecting disproportionate dependence on pollock). Within this region, shoreplants are divided into two subsectors: the Bering Sea pollock shoreplants, and the Alaska Peninsula/Aleutian inshore plants, based on distinctive operational profiles. The Bering Sea pollock shoreplants include three large shore processors in Unalaska, one large shore processor in Akutan, one floating processor currently (2001) in Beaver Inlet on Unalaska Island, and one floating processor in Akutan Bay. These same plants have operated every year during the 1992-2000 period (although one of the floaters has moved from Beaver Inlet to Akutan Bay during this time). The Alaska Peninsula/Aleutian inshore plants are all other groundfish plants in the region (Aleutians East Borough and the Aleutians West Census Area) exclusive of the six Bering Sea plants (and including the plants in Sand Point and King Cove, among others). The Bering Sea plants dominate processing in the region (and, indeed, the state) in terms of volume of groundfish processed. The number of smaller plants in the region has varied from 5 to 8 per year from 1992 to 2000. In 2000, eight

Alaska Peninsula/Aleutian inshore plants (i.e., the regional non-Bering Sea pollock sector plants) reported processing groundfish in Adak (1), Chignik (1), Unalaska/Dutch Harbor (3), King Cove (1), Sand Point (1), and St. Paul (1).

Processor Ownership. Though the center of both onshore and offshore groundfish processing activity, AKAPAI has by far the least ownership of groundfish processing entities of any Alaska region. None of the largest shore plants are owned by resident entities, and the number of smaller inshore plants regionally-owned varied between zero and six per year over the period 1992-2000. To the extent that economic benefits flow to the location of ownership, most of these benefits leave the region. In terms of reported tons in 1999, groundfish processed by inshore plants owned by residents of the region was equal to less than one-tenth of one percent of the total groundfish processed at plants located in the region. Offshore processing in the region displays the same pattern. Regionally owned shoreplants had a wholesale product value of approximately $0.45 million in 1999, while the analogous figures for catcher-processors and motherships were $80,000 and $0, respectively.

Catcher Vessel Ownership and Activity. Groundfish catcher vessel ownership is lower in AKAPAI than in any other region. In recent years, none of the AFA trawl catcher vessels (which supply a very large proportion of the groundfish processed in the region) have been locally owned. Ownership is clustered in two vessel classes (TCV 60' and FGCV 33'-59') that tend to work the nearshore fisheries in the GOA. Vessel ownership within the region is strongly clustered in Sand Point and King Cove, with a secondary cluster in Unalaska. Sand Point residents owned 49 percent of the regionally owned groundfish vessels that, in turn, accounted for 59 percent of the total regionally owned vessel value landed during the period 1992-2000. King Cove residents owned 24 percent of the vessels that, in turn, accounted for 23 percent of the regionally owned vessel landings value over this same period. Analogous figures for Unalaska were 21 percent of regional vessels and 14 percent of regionally owned vessel landings value, respectively. No other community accounted for more than 3 percent of regional vessels or 1 percent of regional value landed by regionally owned vessels. In 1999, these vessels employed 306 persons, with $4 million in payments to labor in groundfish. In 1999, 85 percent of the retained harvest from these vessels came from the Western Gulf FMP area. About 59 percent retained harvest was Pacific cod, and 40 percent was pollock. For that same year, Pacific cod accounted for 74 percent of total groundfish value, and pollock 21 percent. (Additional existing conditions information on the Unalaska/Dutch Harbor small boat fleet relevant to the specific analysis of Alternative 4/Option 2 [Unalaska/Dutch Harbor/Area 9 small boat exemption] is presented in Sections 1.1 and 1.4 of Appendix F[1].)

Harvest Diversity. For groundfish catcher vessels owned by regional residents, groundfish has accounted for roughly half of the ex-vessel value for major fisheries since 1996, a substantial increase over the early 1990s. These vessels are primarily dependent on the groundfish and salmon fisheries, as each of these two fisheries is economically more important by a factor of four or more than any other fishery. About 7 out of 10 vessels participated in the salmon fishery, about one-third in the halibut fishery, and about one-quarter in crab or other fisheries (Groundfish SEIS, Appendix I).

Processing Diversity. For the smaller groundfish processing plants in the region, groundfish roughly accounted for between 10 and 25 percent of ex-vessel value of landings during 1991-1998, with a general increase over this period. In 1998, groundfish accounted for 23 percent of value, while salmon and crab accounted for 30 and 44 percent, respectively. For the larger Bering Sea pollock inshore plants, groundfish has accounted for more than 50 percent of ex-vessel value of landings from 1991-1998, and well over 60 percent of value for 1995-1997. At these larger plants in 1998, crab accounted for roughly the same proportion of total value as in the smaller AKAPAI inshore plants, and groundfish alone accounted for

roughly the same value as groundfish and salmon combined in the smaller plants (Groundfish SEIS, Appendix I).

Subsistence. Akutan, King Cove, Sand Point, and Unalaska have a subsistence resource consumption ranging from about 200 pounds per capita to more than 450 pounds per capita. Of this total, groundfish specifically ranges from 4 to 9 percent of the total. Subsistence use of Steller sea lions is not well documented, but is heaviest in Southwest Alaska and is historically concentrated among relatively few communities (Atka, Akutan, St. George, St. Paul, and Unalaska). Such use has decreased significantly since 1992 (see Appendix F(3)).

Tables 3.12-8 through 3.12-13 summarize information on the AKAPAI regional engagement with the groundfish fishery through 2000.

Table 3.12-8 North Pacific groundfish fishery participation measures for Alaska Peninsula/ Aleutian Islands region, 1992-2000

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	2,053	1,947	2,273	2,532	2,645	2,544	2,313	2,648	3,157
Payment to Labor ($Millions)	112.9	65.4	88.5	116.2	99.7	99.3	85.1	113.0	131.3
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	516.5	534.1	551.6	567.0	548.2	532.5	486.4	544.0	590.6
Product (Thousands of Tons)	153.1	152.7	172.7	183.2	177.7	176.2	165.2	191.0	217.1
Utilization Rate (Percent)	0.3	0.29	0.31	0.32	0.32	0.33	0.34	0.35	0.37
Product Value ($Millions)	374.0	217.9	291.3	386.6	331.6	330.5	283.1	376.3	437.2
Value per Ton ($)	724	408	528	682	605	621	582	692	740
Processors Owned by Regional Residents									
No. of Processors Owned	1	0	2	6	5	4	4	4	4
Reported Tons (Thousands)	0	*	*	1.89	1.98	1.42	0.90	0.54	0.74
Wholesale Value ($Millions)	0	*	*	1.52	1.40	1.18	0.81	0.53	0.83
Catcher Vessels Owned by Regional Residents									
No. of Catcher Vessels	61	46	60	71	70	74	76	67	70
Retained Tons (Thousands)	14.1	12.0	14.8	13.4	23.7	28.9	27.8	24.5	20.3
Ex-vessel Value ($Millions)	5.74	3.47	4.38	4.98	8.02	9.86	7.39	10.12	9.86
Employment (Persons)	320	201	305	352	351	382	351	306	318
Payment to Labor ($Millions)	2.3	1.39	1.75	1.99	3.21	3.95	2.96	4.05	3.94

Notes: 1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.
Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-9 Groundfish reported by Alaska Peninsula/Aleutian Islands region inshore plants by species group

Groundfish Reported	Species Group				
	ARSO	Flatfish	Pacific Cod	Pollock	Total
1999 tons (Thousands)	8.4	5.0	56.11	474.4	543.92
1999 Product Value ($Millions)	5.58	1.2	81.87	287.66	376.31
2000 Tons (Thousands)	5.95	5.87	56.73	522.08	590.63
2000 Product Value ($Millions)	6.88	1.61	80.48	348.28	437.24

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-10 Groundfish wholesale value of processor class owned by residents of the Alaska Peninsula/Aleutian Islands region, 1992-2000

Processor Class	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Catcher/Processors	0.16	0	0.05	0.51	0.41	0.36	0.12	0.08	0.60
Motherships	0	0	0	0	0	0	0	0	0
Shoreplants	0	0	0.25	1.01	0.99	0.82	0.69	0.45	0.23

Note: Value - $Millions.
Source: Derived tables, Northern Economics (1994) adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-11 Groundfish retained harvest ex-vessel value, catcher vessels owned by Alaska Peninsula/Aleutian Islands region residents by FMP subarea, 1999-2000

Retained Harvest	FMP Subarea					
	AI	BS	WG	CG	EG	Total
1999 Ex-vessel ($Millions)	0	0.40	8.65	0.77	*	10.12
2000 Ex-vessel ($Millions)	0	0.65	9.09	0.08	*	9.86

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001

Table 3.12-12 Number of boats and retained catch by weight and value, by species group, and by catcher vessel ownership for the Alaska Peninsula/ Aleutian Islands region

Data	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
ARSO									
Number of Catcher Vessels	16	8	11	9	20	24	16	20	19
Retained Tons (Thousands)	0.1	0.1	0.1	0.2	0.4	0.1	0.2	0.1	0
Ex-vessel Value ($Millions)	0.31	0.18	0.26	0.70	0.79	0.59	0.32	0.42	0.05
Flatfish									
Number of Catcher Vessels	2	3	7	6	12	24	15	15	15
Retained Tons (Thousands)	0	*	0.1	0	1.7	0.1	0	0	0.1
Ex-vessel Value ($Millions)	0	*	0.04	0.01	0.92	0.02	0	0	0
Pacific Cod									
Number of Catcher Vessels	60	45	58	70	67	74	73	67	70
Retained Tons (Thousands)	12.3	8.5	10.0	8.3	13.9	17.0	16.3	14.5	11.5
Ex-vessel Value ($Millions)	5.21	2.85	3.35	3.38	4.85	6.52	5.53	7.54	7.60
Pollock									
Number of Catcher Vessels	12	8	10	12	13	29	23	19	19
Retained Tons (Thousands)	1.6	3.4	4.6	4.9	7.8	11.6	11.2	9.8	8.7
Ex-vessel Value ($Millions)	0.22	0.45	0.74	0.88	1.45	2.73	1.55	2.15	2.21
All Groundfish Species									
Total Number of Catcher Vessels	61	46	60	71	70	74	76	67	70
Total Retained Tons (Thousands)	14.1	12.0	14.8	13.4	23.7	28.9	27.8	24.5	20.3
Total Ex-vessel Value ($Millions)	5.74	3.47	4.38	4.98	8.02	9.86	7.39	10.12	9.86

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-13 Retained harvests by FMP area and species of Alaska Peninsula/Aleutian Islands region catcher vessels

Year	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
1992	0	0	0.62	0.44	6.18	0.24	4.02	2.43	0.02	0	13.95
1993	0.02	0.06	0.35	3.68	3.12	1.21	1.96	1.52	0.01	0	11.94
1994	0.01	0.06	0.56	4.11	2.74	1.76	2.70	2.64	0.02	0.04	14.63
1995	0	0	0.86	0.23	2.47	2.67	4.66	2.28	0.01	0	13.20
1996	0	0	1.34	0.52	6.79	4.61	6.07	2.32	0.03	0	21.68
1997	0.03	0	1.29	0.24	9.21	3.92	6.25	7.59	0.04	0.07	28.64
1998	0	0	0.47	0.31	8.36	4.18	4.93	9.20	0.03	0.02	27.50
1999	0.12	0	0.46	0.59	9.60	5.86	3.81	3.82	0.02	0.05	24.34
2000	0.22	0	0.44	1.49	8.19	5.38	2.46	1.85	0.02	0.13	20.20
Value ($Millions)											
1992	0	0	0.28	0.09	2.56	0.05	1.80	0.64	0.02	0	5.43
1993	0.01	0.01	0.14	0.62	1.21	0.19	0.82	0.29	0.01	0	3.29
1994	0	0.01	0.24	0.80	1.04	0.36	1.07	0.54	0.01	0.01	4.09
1995	0	0	0.33	0.05	0.92	0.46	2.01	0.48	0.01	0	4.26
1996	0	0	0.50	0.08	2.12	0.81	2.31	0.45	0.03	0	6.30
1997	0.03	0	0.71	0.05	3.24	0.87	2.64	1.66	0.03	0.01	9.25
1998	0	0	0.19	0.04	2.85	0.60	1.96	1.40	0.02	0	7.07
1999	0.07	0	0.26	0.12	4.75	1.25	2.43	0.78	0.01	0.01	9.69
2000	0.15	0	0.28	0.37	5.33	1.34	1.84	0.45	0.02	0.03	9.80

Source:

3.12.2.4 Kodiak Island Region

Overview. AKKO encompasses the Kodiak Island Borough (KIB), which includes Kodiak Island, other parts of the Kodiak archipelago, and a portion of the Alaska Peninsula, as shown in Figure 3.12-5. Linkages between this region and the groundfish fishery are predominantly associated with the City of Kodiak and its suburbs. Kodiak is the dominant GOA fishing community for groundfish, and is important for salmon, halibut, and other species. In 1999, the region accounted for 22 percent of the volume and 18 percent of the value of the total groundfish processed in Alaska. The region accounted for almost 16 percent of the volume of groundfish processed inshore in all regions of the state (1992-2000). This volume included 11 percent of the pollock, 28 percent of the Pacific cod, 54 percent of the flatfish, and 30 percent of the ARSO category of groundfish processed. Within this region, the City of Kodiak is the location of virtually all of the direct links with the groundfish fishery. (Processing data does show that groundfish are also run at Atilak, but this is a relatively specialized operation and very small relative to the aggregated operations associated with the City of Kodiak.) An extended community profile of Kodiak is provided in Appendix F(1).

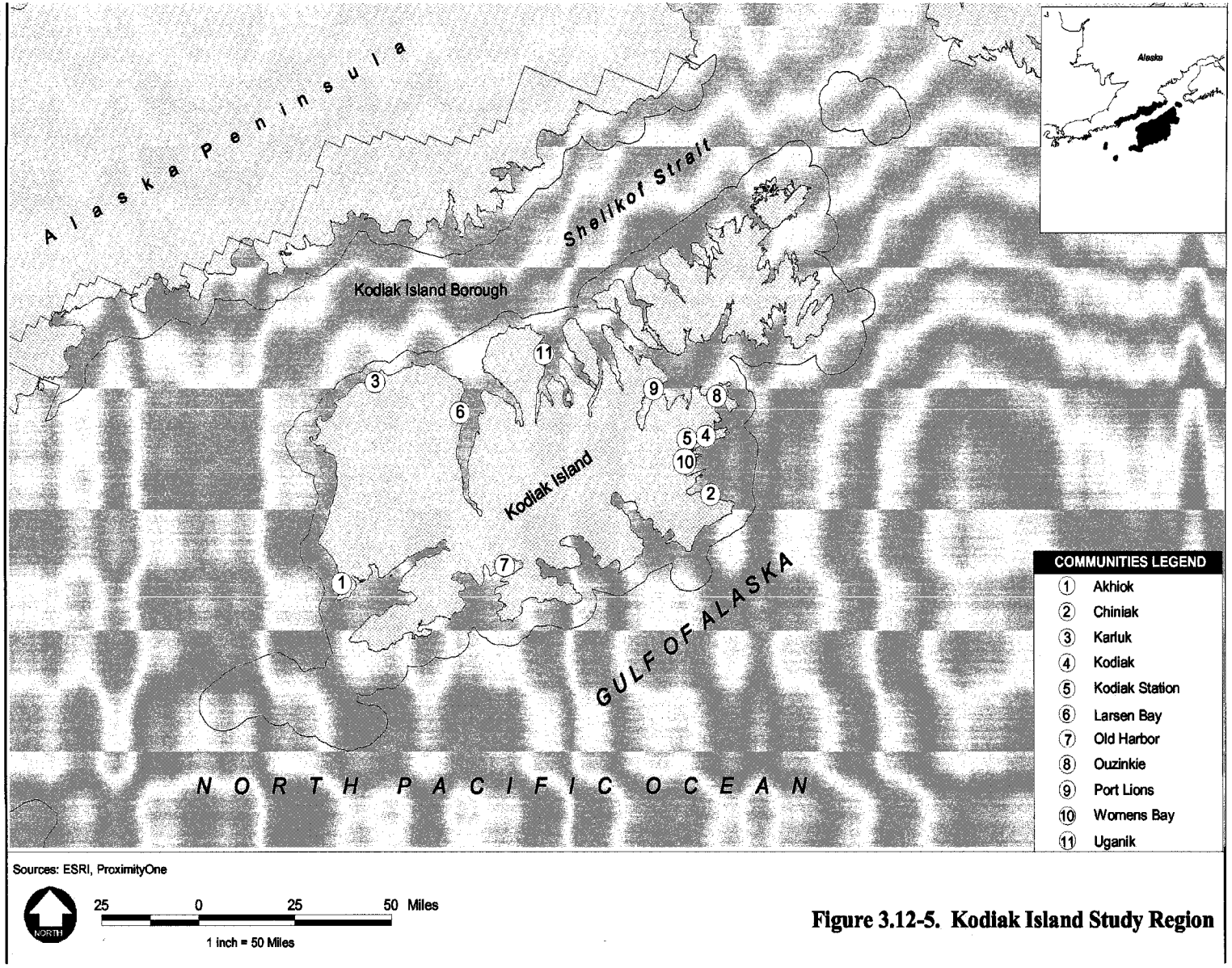

Figure 3.12-5. Kodiak Island Study Region

Population. In 1999, the Kodiak region had a population total of 14,350. The City of Kodiak has become the hub community of the region, at present comprising just less than 50 percent of the KIB population. Furthermore, a significant part of the region's population lives very near Kodiak in unincorporated areas of the KIB. When these areas are taken into account, at present approximately 85 percent of the KIB population lives in and around the City of Kodiak. In ethnicity, the city is about 13 percent Native, while organized communities outside the city are predominantly Native (68 to 94 percent). The predominant minority in the city and its surroundings is Asian and Pacific Islanders, followed by Natives and Blacks. The predominant minority in other regional communities is Caucasian, with few other minorities present.

Employment and Income. The economies of AKKO communities are all heavily dependent on fishing, and for the City of Kodiak, groundfish are an important component of this dependence. In 1999, regional service sector employment outpaced manufacturing, but manufacturing provides more income than any other sector. The fishing sector provides an important base for the retail and government sectors, which follow it in relative size. The military sector is also significant, and is actually second in income and earnings, primarily because of a local Coast Guard base. The City of Kodiak can be distinguished from other regional communities in several ways. Whereas the city has relatively low rates of unemployment and poverty, other communities have higher rates. In terms of income measures, the city ranks highest.

Tax and Revenue. The City of Kodiak and the KIB are the primary taxing entities in the region. City or community services outside the city are quite limited, or are supplied by the KIB or privately. The KIB levies a property tax of 9.25 mills, a 5 percent accommodations tax, and a 0.925 percent severance tax on natural resources. Other communities levy limited taxes. AKKO is also dependent on income from State of Alaska fisheries taxes. The region's share of the fisheries business tax and fishery resource landing tax amounted to $1,330,856 in 1999.

Inshore Processing. Groundfish has made up over 70 percent by weight of the fish processed in the AKKO region. In 1999, pollock comprised about 51 percent of the groundfish by volume. Pacific cod made up about 30 percent, ARSO about 10 percent, and flatfish about 9 percent. This pattern of dependence by species reflects the composition of the groundfish species available. While the volume of groundfish processed in the region is much less than in AKAPAI, value per ton of final product was higher. In terms of value, groundfish has recently comprised 40 to 45 percent of the total fish processed in the AKKO region. Since 1995, one plant has operated at Alitak and the rest of the region's plants reporting groundfish processing (11 in 1999 and 10 in 2000) have operated in Kodiak.

Processing Ownership. Although Kodiak residents own both onshore and offshore processing facilities, onshore plants that process pollock and Pacific cod are owned predominantly by entities outside the region (1995 to present). AKKO residents are active in the ownership of offshore processing vessels for groundfish other than pollock. Residents historically have owned three to six offshore processing facilities, with the lower numbers in earlier years. In 1999, catcher-processors owned by regional residents had a wholesale product value of $23 million, and shoreplants had an analogous figure of $1.75 million. No motherships were owned by regional residents.

Catcher Vessel Ownership and Activity. The AKKO-owned fleet is very diverse. Some vessel classes, especially the larger trawl vessels, have displayed remarkable stability over time. Smaller trawlers have become fewer. Fixed gear vessels have increased in number. Most of the fleet's fishing activity is in the Central Gulf, and product is delivered to Kodiak shore plants. Regional vessel ownership is heavily concentrated in the City of Kodiak, whose residents over the period 1992-2000 owned 87 percent of all regionally owned vessels, and these vessels, in turn, accounted for 95 percent of regionally owned vessels

landings value over this same period. No other community was home to 6 percent or more of the regionally owned vessels, or accounted for more than 2 percent of the total value of the landings of regionally owned vessels over the 1992-2000 period. Since 1991, catcher vessels owned by AKKO residents have harvested a significant amount of fish in the Bering Sea as well. In 1999, the Central Gulf accounted for 76 percent of ex-vessel value, and the Bering Sea accounted for 16 percent. The Aleutian Islands, Western Gulf, and Eastern Gulf areas accounted for 2 to 3 percent each. Pacific cod accounted for 40 percent by volume and 59 percent by value of retained groundfish harvest, while pollock accounted for 52 percent of volume and 24 percent by value.

Harvest Diversity. In terms of the 'annual round' for groundfish catcher vessels owned by residents of AKKO, groundfish and other species tend to complement each other. Groundfish have accounted for less than half of the total ex-vessel value accruing to these vessels in recent years. Halibut, crab, and salmon are also important fisheries to these vessels. More than 50 percent of the groundfish catcher vessels participate in the halibut fishery, and more than 33 percent participate in the salmon fishery (Groundfish SEIS, Appendix I).

Processing Diversity. Groundfish have accounted for roughly 30 to 47 percent of ex-vessel value for all onshore processing plants in AKKO from 1991 to 1999, with a general increase in value over this period. This increased to about 61 percent for 2000 (with the qualification that halibut numbers were not included in the 2000 totals, so that the significance of this increase is suspect). Groundfish are economically more important than any other species or species group. Salmon are second in importance, in some years being close to (or as recently as 1995 exceeding) groundfish in value. Halibut, while relatively more important for AKKO than for AKAPAI, generally accounts for less than 20 percent of the ex-vessel value of fish delivered to shoreplants in AKKO (Groundfish SEIS, Appendix I).

Subsistence. Kodiak is the single regionally important groundfish community. Residents of the City of Kodiak are reported to harvest and consume about 151 pounds of subsistence resource per capita, of which 72 percent is fish. However, groundfish comprise only about 8 percent of the total (12 pounds per capita). Subsistence use of Steller sea lions is not well documented, but has historically been important in the Kodiak region, particularly for the communities of Old Harbor and Akhiok. Such use has decreased since 1992 (see Appendix F(3)).

Tables 3.12-14 through 3.12-19 summarize information on the AKKO regional engagement with the groundfish fishery through 2000.

Table 3.12-14 North Pacific groundfish fishery participation measures for Kodiak region, 1992-2000

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	562	645	585	708	562	673	749	801	730
Payment to Labor ($Millions)	30.8	30.6	32.4	31.4	25.7	26.2	26.8	33.0	32.1
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	106.8	124.9	114.4	82.5	74.8	101.1	115.2	116.7	106.0
Product (Thousands of Tons)	27.1	32.0	28.3	26.4	22.8	25.3	28.8	31.4	29.9
Utilization Rate (Percent)	0.25	0.26	0.25	0.32	0.3	0.25	0.25	0.27	0.28
Product Value ($Millions)	80.3	81.7	85.5	92.0	71.3	76.3	77.7	94.7	89.6
Value per Ton ($)	752	654	747	1115	953	755	674	811	845
Processors Owned by Regional Residents									
Number of Processors Owned	9	9	9	9	7	6	6	9	7
Reported Tons (Thousands)	67.3	73.3	71.5	33.6	29.9	33.8	30.0	34.3	33.1
Wholesale Value ($Millions)	45	41.0	46.1	25.4	22.1	18.3	15.8	24.8	25.5
Catcher Vessels Owned by Regional Residents									
Number of Catcher Vessels	172	130	143	145	144	160	153	158	192
Retained Tons (Thousands)	80.3	77.4	75.5	83.2	82.5	90.8	81.0	69.5	62.7
Ex-vessel Value ($Millions)	28.5	21.1	22.4	27.5	28.3	39.6	22.7	30.0	30.0
Employment (Persons)	856	623	681	709	724	796	749	797	920
Payment to Labor ($Millions)	11.4	8.5	8.9	11.0	11.3	15.9	9.1	12.0	12.0

1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.

Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-15 Groundfish reported by Kodiak region inshore plants by species group

Groundfish Reported	Species Group				
	ARSO	Flatfish	Pacific Cod	Pollock	Total
1999 Tons (Thousands)	11.69	10.08	35.18	59.75	116.71
1999 Product Value ($Millions)	11	3.34	50.26	30.06	94.65
2000 Tons (Thousands)	14.13	14.2	26.82	50.82	105.97
2000 Product Value ($Millions)	13.33	8.97	40.06	27.21	89.57

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-16 Groundfish wholesale value of processor class owned by residents of the Kodiak region, 1992-2000

Processor Class	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Catcher/Processors	11.12	13.62	14.36	15.81	18.19	15.96	13.40	23.00	22.65
Motherships	0	0	0	0	0	0	0	0	0
Shoreplants	33.91	27.32	31.75	9.59	3.90	2.30	2.35	1.75	2.82

Note: Value - $Millions.
Source: Derived tables, Northern Economics (1994) adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-17 Groundfish retained harvest ex-vessel value, catcher vessels owned by Kodiak region residents by FMP subarea, 1999-2000

Retained Harvest	FMP Subarea					
	AI	BS	WG	CG	EG	Total
1999 Ex-vessel ($Millions)	0.79	4.83	0.78	22.98	0.66	30.04
2000 Ex-vessel ($Millions)	0.3	4.25	1.12	23.32	1.08	30.07

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001

Table 3.12-18 Number of boats and retained catch by weight and value, by species group, and by catcher vessel ownership for the Kodiak region

Data	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
ARSO									
Number of Catcher Vessels	113	83	106	83	91	111	108	93	99
Retained Tons (Thousands)	2.5	2.2	2.4	1.6	4.2	4.9	4.4	3.5	5.9
Ex-vessel Value ($Millions)	4.93	4.37	6.30	4.22	7.29	7.76	4.69	4.48	6.47
Flatfish									
Number of Catcher Vessels	38	34	39	45	52	53	46	35	34
Retained Tons (Thousands)	9.7	6.3	4.5	6.0	7.2	11.5	4.5	2.2	5.6
Ex-vessel Value ($Millions)	3.33	1.96	1.41	1.74	2.58	7.38	1.28	0.59	1.06
Pacific Cod									
Number of Catcher Vessels	149	103	105	136	127	150	144	150	190
Retained Tons (Thousands)	15.4	17.4	16.5	26.3	24.8	30.6	24.5	27.5	18.9
Ex-vessel Value ($Millions)	7.36	6.84	6.04	11.74	10.32	14.58	10.00	17.67	14.79
Pollock									
Number of Catcher Vessels	64	38	44	46	49	79	69	62	64
Retained Tons (Thousands)	52.8	51.5	52.1	49.2	46.2	43.9	47.6	36.3	32.2
Ex-vessel Value ($Millions)	12.85	7.97	8.60	9.84	8.13	9.90	6.76	7.29	7.75
All Groundfish Species									
Total Number of Catcher Vessels	172	130	143	145	144	160	153	158	192
Total Retained Tons (Thousands)	80.3	77.4	75.5	83.2	82.5	90.8	81.0	69.5	62.7
Total Ex-vessel Value ($Millions)	28.47	21.14	22.35	27.54	28.33	39.63	22.74	30.04	30.07

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-19 Retained harvests by FMP area and species of Kodiak regional catcher vessels

Year	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
1992	0.43	0.13	6.15	23.58	6.14	0.75	9.94	20.91	0.10	0	68.14
1993	0.06	0.12	7.46	16.78	3.51	2.59	10.33	27.68	0.32	0.08	68.93
1994	0.02	0.1	7.87	13.45	3.01	2.81	9.55	30.18	0.24	1.46	68.69
1995	0.03	0.28	10.85	37.58	2.53	3.51	11.32	9.34	0.08	0.02	75.54
1996	0.28	0.12	13.80	34.04	3.53	3.73	8.74	6.70	0.08	0.04	71.05
1997	0.47	0.05	14.88	18.65	5.78	3.89	12.99	17.25	0.10	0.35	74.42
1998	0.90	0.04	7.87	22.09	4.27	4.02	10.05	22.63	0.09	0.17	72.11
1999	1.60	0.01	6.70	14.57	4.43	3.30	14.00	18.78	0.10	0.26	63.75
2000	1.87	0	6.30	11.95	3.41	3.02	10.34	13.45	0.10	0.68	51.12
Value ($Millions)											
1992	0.17	0.03	2.49	5.04	2.41	0.16	4.63	5.21	0.08	0	20.21
1993	0.02	0.02	2.42	2.28	1.17	0.33	3.95	4.42	0.19	0.01	14.81
1994	0.01	0.02	2.53	2.08	0.93	0.43	3.27	5.03	0.09	0.24	14.64
1995	0.01	0.06	4.25	7.84	1.02	0.66	5.53	2.16	0.04	0	21.58
1996	0.10	0.02	5.09	5.85	1.24	0.71	3.93	1.44	0.07	0.01	18.46
1997	0.26	0.01	6.53	4.17	2.26	0.92	6.17	4.01	0.08	0.07	24.48
1998	0.31	0.01	2.99	3.13	1.58	0.59	4.44	3.64	0.06	0.03	16.77
1999	0.94	0	3.87	3.05	2.43	0.75	9.69	4.11	0.07	0.06	24.97
2000	1.20	0	4.05	2.84	2.21	0.74	8.00	3.24	0.08	0.17	22.55

3.12.2.5 Southcentral Alaska Region

Overview. The AKSC spans the most heavily populated area of the state, and is shown in Figure 3.12-6. In AKSC, participation in the groundfish fishery varies considerably from other Alaska regions, and the region is little involved with the Bering Sea pollock fishery specifically. In 1999, the region accounted for 1.6 percent of the volume and 5.6 percent of the value of all groundfish processed in Alaska. While accounting for less than 1 percent of the pollock, 2 percent of the flatfish, and 5 percent of the Pacific cod processed inshore in Alaska regions over the period 1992-2000, AKSC did account for 19 percent of the ARSO species group. The region is also different by virtue of its connection of communities and ports by a road system. Homer and Seward serve as the primary ports for groundfish trucked on the Alaska road system. During 1991-1999, groundfish were processed in 11 regional communities, with Cordova, Nikiski and Seward accounting for the majority of processing. Steller Sea Lion protection measures may have already had significant effects on the groundfish (and especially pollock) fisheries which do exist in the region.

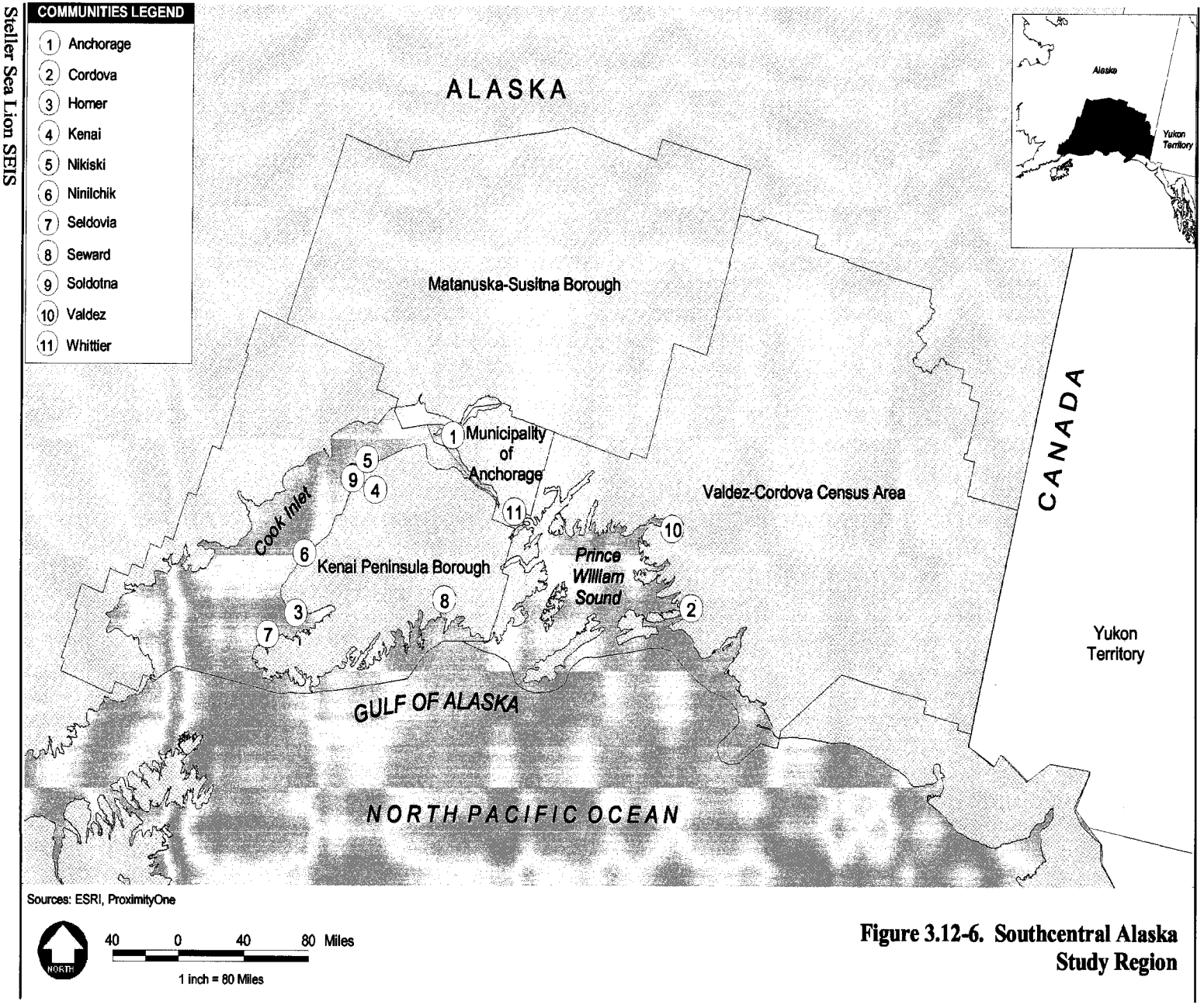

Figure 3.12-6. Southcentral Alaska Study Region

Population. At 374,975 persons in 1999, AKSC is the largest of the four Alaska regions, and it includes Anchorage (population 260,000), as well as small rural communities. Many fishing enterprises and organizations as well as government agencies have offices in Anchorage, and the community is the home of the North Pacific Fishery Management Council (NPFMC). AKSC groundfish communities tend to be largely non-Native. The high male-to-female ratio often present in small to moderate-sized communities with relatively large processing capacity (such as AKAPAI communities) is not present in this region. This circumstance reflects both a smaller scale of processing operations and a more resident workforce.

Employment and Income. The economies of AKSC groundfish communities tend to be more diversified than those of AKAPAI or AKKO. In part, this greater diversification is a function of road-connectedness and associated access to a large population base, as well as the presence of other developable resources. Groundfish are of lesser importance for employment and income to the region in absolute and relative terms than for either AKAPAI or AKKO. In comparison with the manufacturing sector, in 1999 ten sectors had greater employment and income (the service sector alone had 12 times the number of jobs and 8 times the income of manufacturing).

Tax and Revenue. None of the AKSC groundfish processing communities have a local or borough fish tax. At $1,521,569 in fiscal year 1999, 73.3 percent of the region's shared taxes and fees were fisheries-related. This is a higher amount than the Kodiak region received (although derived to a lesser extent from groundfish).

Inshore Processing. The groundfish processed in AKSC in 1999 accounted for less than two percent of the groundfish processed inshore in all Alaska regions. The ARSO species group accounted for 43 percent of the volume reported over the period 1991-1998, and Pacific cod, pollock, and flatfish accounted for 35, 17, and 5 percent of the total, respectively. Pollock landings were highly variable. The value per metric ton (more than $2,751 in 1999) for AKSC was four times higher than in AKAPAI. The total product value, $30 million, was approximately 12 times lower than in AKAPAI. The differences between the regions can be accounted for by dependence on relatively high-value, low-volume groundfish species. In 1999, ARSO accounted for 42 percent of the volume and 69 percent of the product value for all groundfish processed in the region, while Pacific cod accounted for 30 percent of volume and 21 percent of value. Pollock comprised 20 percent of the volume and 9 percent of value of regional processing, with flatfish accounting for 8 percent of volume and 1 percent of value. Furthermore, the ARSO species group varies internally among regions, with Atka mackerel (lower value) concentrated to the west, and rockfish (higher value) becoming more important to the east. Processing is also different in the aggregate, as shown by the much higher utilization rates in AKSC (more than 61 percent in 1999) compared to AKAPAI and AKKO (35 and 27 percent in 1999, respectively). In 2000, 17 regional plants reported processing groundfish in Anchorage (2), Cordova (3), Homer (5), Kenai (4), Ninilchik (1), and Seward (2).

Processor Ownership. Groundfish processor ownership by residents is concentrated in the AKSC shore plant sector, with secondary focus on head and gut trawl and longline catcher processor sectors. More processing entities are owned by AKSC residents than by residents of any other Alaska region. For these processors during 1991-1999, ARSO and flatfish far outdistanced Pacific cod in volume for most years. Although variable, Pacific cod, in turn, represented a higher-volume fishery year to year than pollock. In 1999, 24,000 tons with a wholesale value of $34 million were reported for regionally owned processors. Of the total value, $32 million came from shoreplants and $2 million from catcher-processors. There were no motherships owned by regional residents.

Catcher Vessel Ownership and Activity. More groundfish catcher vessels are owned by AKSC residents than by residents of either AKAPAI or AKKO. Fixed gear catcher vessels predominate, and since 1995, five or fewer trawl vessels have been locally owned. In the fixed gear vessel class, smaller vessel classes predominate by a large margin. This pattern is due, in part, to the relatively small scale of fisheries (and processing capacity) in AKSC, the diversified nature of the fisheries pursued, and the presence of relatively sheltered waters. Ownership of vessels is spread through numerous communities in the region, but Homer, Anchorage, Cordova, and Seward (in that order of importance) combined accounted for 63 percent of the total number of regionally owned vessels between 1992 and 2000, and these vessels, in turn, accounted for 73 percent of the ex-vessel value accrued by regionally owned vessels over this same period. Homer accounted for 26 percent of regional value and 32 percent of regional vessels, Anchorage for 19 percent of value and 14 percent of vessels, Cordova for 15 percent of value and 9 percent of vessels, and Seward for 13 percent of value and 8 percent of vessels, respectively. No other community accounted for more than 5 percent of value for regionally owned vessels, nor for more than 8 percent vessels themselves for the 1992-2000 period. Locally owned vessels harvested groundfish in all five Alaska FMP areas, but very little effort is directed at the AI, BS or EG areas (3 to 4 percent of value of total groundfish retained harvest for these vessels for each of these regions). In 1999, 79 percent of value came from the CG and 10 percent came from the WG. In 1999, for retained harvest, 65 percent of volume and 57 percent of value came from Pacific cod, while ARSO accounted for 10 percent of volume and 35 percent of value. Pollock, while comprising 23 percent of total groundfish volume only accounted for 6 percent of total value; flatfish was 2 percent of volume and 1 percent of value for that same year.

Harvest Diversity. In recent years, groundfish has accounted for roughly 25 percent of ex-vessel value for groundfish catcher vessels owned by AKSC residents. In 1998, halibut was the most important species, accounting for about one-third of total ex-vessel value. Groundfish and salmon account for roughly 25 percent and crab about 15 percent of the total ex-vessel value. Fully 75 percent of all groundfish vessels fished halibut, and 6 out of every 10 fished salmon (Groundfish SEIS, Appendix I).

Processing Diversity. Groundfish has accounted for roughly 10 to 35 percent of ex-vessel value at all AKSC inshore plants over the period from 1991 to 1998. In 1998, ex-vessel value was slightly less for groundfish than for halibut (29 and 31 percent, respectively), and quite a bit less important than for salmon (40 percent of ex-vessel value). Virtually no crab is processed at these plants (Groundfish SEIS, Appendix I).

Subsistence. Until May 2000, Homer, Kenai, and Seward were not classified as subsistence communities. Older data suggest that residents of Homer and Kenai consumed between 84 and 94 pounds of subsistence resources per capita per year and zero or less than one pound of subsistence groundfish. No information exists for Seward. Anchorage is not classified as a subsistence community. For Cordova, groundfish are reported as approximately 4 percent (7 pounds per capita) of the total subsistence consumption (179 pounds per person per year). Subsistence use of Steller sea lions in the region is not well documented, but has historically been important for the community of Tatitlek. No other Southcentral community is noted to have a regular pattern of harvest for Steller sea lions (see Appendix F(3)).

Tables 3.12-20 through 3.12-25 summarize information on the AKSC regional engagement with the groundfish fishery through 2000.

Table 3.12-20 North Pacific Groundfish Fishery Participation Measures for the Southcentral Alaska Region, 1992-2000

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	159	150	135	195	156	260	240	170	148
Payment to Labor ($Millions)	11.9	13.1	12.2	17.1	14.5	16.8	13.1	13.5	14.5
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	12.86	12.88	11.97	12.82	12.65	16.9	17.69	10.82	10.01
Product (Thousands of Tons)	6.6	6.62	5.31	7.05	6.86	9.2	9.7	6.64	5.23
Utilization Rate (Percent)	0.51	0.51	0.44	0.55	0.54	0.54	0.55	0.61	0.52
Product Value ($Millions)	25.68	31.26	28.78	39.91	34.91	40.28	31.68	29.77	32.21
Value per Ton ($)	1997	2427	2404	3113	2760	2383	1791	2751	3218
Processors Owned by Regional Residents									
Number of Processors Owned	19	16	19	19	14	19	15	13	16
Reported Tons (Thousands)	19.46	21.03	19.76	22.55	19.96	26.70	24.15	24.40	23.13
Wholesale Value ($Millions)	23.79	27.77	25.94	35.47	27.80	32.49	24.47	33.59	35.43
Catcher Vessels Owned by Regional Residents									
Number of Catcher Vessels	340	288	303	237	191	197	171	170	198
Retained Tons (Thousands)	32.5	20.6	19.7	18.4	11.3	11.8	11.4	12.4	15.5
Exvessel Value ($Millions)	17.22	12.21	11.17	12.33	9.17	11.21	7.47	10.31	13.75
Employment (Persons)	1672	1,315	1,432	1,148	984	1,001	813	820	933
Payment to Labor ($Millions)	6.89	4.89	4.47	4.93	3.67	4.48	2.99	4.12	5.5

1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.
Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-21 Groundfish reported by Southcentral Alaska region inshore plants by species group

	Species Group				
Groundfish Reported	ARSO	Flatfish	Pacific Cod	Pollock	Total
1999 Tons (Thousands)	4.58	0.87	3.34	2.03	10.82
1999 Product Value ($Millions)	20.61	0.21	6.13	2.81	29.77
2000 Tons (Thousands)	5.44	0.4	2.25	1.92	10.01
2000 Product Value ($Millions)	26.01	0.21	3.85	2.13	32.21

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-22 Groundfish wholesale value of processor class owned by residents of the Southcentral Alaska region, 1992-2000

Processor Class	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Catcher-Processors	3.29	2.87	2.22	2.19	2.2	2.41	1.75	2.04	2.13
Motherships	0	0	0	0	0	0	0	0	0
Shoreplants	20.50	24.9	23.73	33.28	25.60	30.08	22.72	31.56	33.3

Note: Value - $Millions.
Source: Derived tables, Northern Economics (1994), adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-23 Groundfish retained harvest ex-vessel value, catcher vessels owned by Southcentral Alaska region residents by FMP subarea, 1999-2000

Retained Harvest	FMP Subarea					
	AI	BS	WG	CG	EG	Total
1999 Ex-vessel ($Millions)	0.34	0.36	1.01	8.19	0.40	10.31
2000 Ex-vessel ($Millions)	0.77	0.61	1.83	9.72	0.83	13.75

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001.

Table 3.12-24 Number of boats and retained catch by weight and value, by species group, and by catcher vessel ownership for the Southcentral Alaska region

Data	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
ARSO									
Number of Catcher Vessels	299	269	290	207	169	175	145	129	141
Retained Tons (Thousands)	3.5	3.5	2.8	2.0	1.5	1.6	1.2	1.3	1.8
Ex-vessel Value ($Millions)	8.14	7.55	7.31	6.91	4.94	6.28	3.47	3.71	5.28
Flatfish									
Number of Catcher Vessels	16	12	6	7	16	12	17	7	11
Retained Tons (Thousands)	0.5	0.4	0.8	0.1	0.2	0.1	0.2	0.2	1.0
Ex-vessel Value ($Millions)	0.16	0.13	0.16	0.04	0.11	0.12	0.10	0.09	0.20
Pacific Cod									
Number of Catcher Vessels	279	162	116	172	139	160	145	151	174
Retained Tons (Thousands)	9.9	6.6	5.0	7.4	7.6	8.8	8.0	8.1	9.1
Ex-vessel Value ($Millions)	4.92	2.98	1.81	3.70	3.73	4.51	3.62	5.91	7.34
Pollock									
Number of Catcher Vessels	25	16	6	7	15	30	23	31	41
Retained Tons (Thousands)	18.6	10.2	11.1	8.8	2.1	1.3	2.0	2.8	3.6
Ex-vessel Value ($Millions)	4	1.56	1.89	1.68	0.39	0.29	0.28	0.60	0.92
All Groundfish Species									
Total Number of Catcher Vessels	340	288	303	237	191	197	171	170	198
Total Retained Tons (Thousands)	32.5	20.6	19.7	18.4	11.3	11.8	11.4	12.4	15.5
Total Ex-vessel Value ($Millions)	17.22	12.21	11.17	12.33	9.17	11.21	7.47	10.31	13.75

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-25 Retained harvests by FMP area and species of Southcentral Alaska regional catcher vessels

Year	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
1992	0.04	0.30	2.25	17.29	1.20	0.44	5.58	1.16	0.18	0	28.44
1993	0.05	0.11	1.16	6.80	1.12	0.49	4.95	1.68	0.39	0	16.74
1994	0.02	0.11	2.12	7.22	0.85	0.48	3.94	1.13	0.20	0.06	16.12
1995	0.01	0.06	3.49	5.30	0.59	0.31	5.63	0.83	0.05	0	16.28
1996	0.01	0	2.96	0.13	1.09	0.47	4.14	0.73	0.09	0	9.62
1997	0.11	0.01	2.29	2.70	0.94	0.18	3.07	0.69	0.06	0.03	10.10
1998	0.01	0	1.25	0.05	1.24	0.21	4.94	2.22	0.08	0.02	10.02
1999	0.38	0	1.48	0.71	0.94	0.29	5.28	1.70	0.06	0.03	10.87
2000	0.57	0	2.10	0.57	1.27	0.33	5.87	1.83	0.07	0.09	12.70
Value ($Millions)											
1992	0.02	0.08	1.04	3.87	0.54	0.11	2.83	0.29	0.14	0	8.93
1993	0.02	0.02	0.46	0.92	0.40	0.06	2.13	0.26	0.26	0	4.53
1994	0.01	0.02	0.72	1.01	0.25	0.07	1.37	0.17	0.08	0.01	3.71
1995	0	0.01	1.37	0.97	0.22	0.05	2.56	0.17	0.03	0	5.38
1996	0.01	0	1.24	0.02	0.41	0.09	2.09	0.16	0.09	0	4.12
1997	0.1	0	1.57	0.64	0.46	0.05	1.73	0.18	0.06	0.01	4.80
1998	0	0	0.54	0.01	0.49	0.03	2.40	0.36	0.06	0	3.90
1999	0.25	0	0.96	0.16	0.58	0.07	4.04	0.40	0.05	0.01	6.51
2000	0.36	0	1.39	0.14	0.84	0.08	4.91	0.46	0.06	0.02	8.26

3.12.2.6 Southeast Alaska Region

Overview. AKSE encompasses a wide range of communities from Yakutat to Ketchikan and Prince of Wales Island and is shown in Figure 3.12-7. In 1999, AKSE accounted for only 0.7 percent by volume and 5.1 percent by value of the groundfish landed and processed in Alaska. In this regard it is much more similar to AKSC than to AKKO or AKAPAI. For the period 1992-2000, regional processors accounted for 21 percent of the ARSO ("other groundfish") species category, but 1 percent or less for flatfish, Pacific cod, pollock, and groundfish taken as a whole. The top three AKSE ports account for almost all of the region's reported processing. In alphabetical order, they are Petersburg, Sitka, and Yakutat. All three communities support diverse fisheries, pursued by fishers participating in multiple fisheries. Of most importance are salmon and halibut. The main groundfish fisheries are rockfish and sablefish.

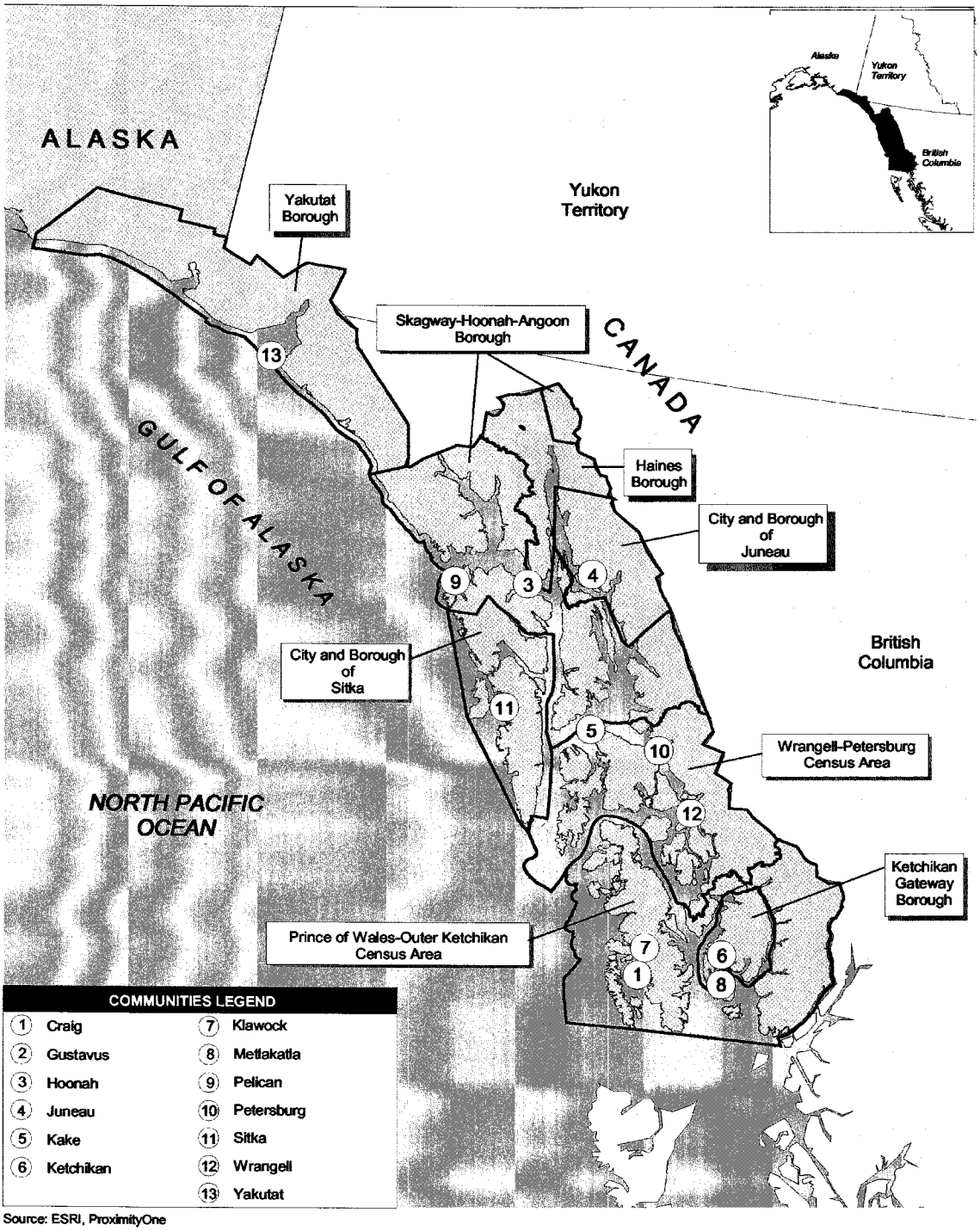

Figure 3.12-7. Southeast Alaska Study Region

Steller Sea Lion SEIS
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Population. In 1999, the region had a total population of 72,525. There is no clear common regional dynamic of community growth in AKSE. Petersburg, Yakutat, and Sitka all display different patterns. Southeast Alaska is ethnically mixed, but communities differ markedly in this matter. Furthermore, ethnic diversity is more limited in AKSE than in the other Alaska regions considered in this document. The main groups present are Caucasians and Alaska Natives, with other groups present only in relatively small percentages. In Sitka and Petersburg, Caucasians are the great majority of the population (74 and 87 percent respectively), with Alaska Natives at 21 and 10 percent, respectively. Yakutat is 55 percent Native and 43 percent Caucasian. This overall population composition reflects the general identity or 'character' of each community, as Petersburg highlights its Norwegian fishing history, Sitka its diverse Native/Russian-American history, and Yakutat its Native heritage. Males outnumber females, but no community shows the great differences that are present in the four large groundfish ports of AKAPAI.

Employment and Income. Fisheries in general, and groundfish fisheries in particular, are relatively small contributors to AKSE employment, especially compared to the government, services, and retail sectors. For the three communities of most concern, fishing and fish processing are more important in absolute terms than the 'average' regional community. Still, the groundfish fishery does not provide a large base for regional employment. There are fewer overall economic opportunities in Yakutat compared to the other two communities.

Tax and Revenue. In contrast to some Alaska groundfish communities in other regions, revenues directly resulting from local landings or processing of groundfish are not the basis for local taxation in AKSE. Only Yakutat has a local fish tax, and it applies to salmon rather than to fish in general (and thus does not apply to groundfish). Shared state fisheries taxes do generate revenue for local communities, however. The region's share of the fisheries business tax and fishery resource landing tax amounted to $2,221,926 in 1999, which was 88 percent of such shared revenue for the region.

Inshore Processing. Most AKSE regional groundfish processing occurs in Petersburg, Sitka, and Yakutat. These communities differ in the degree to which they participate in groundfish fisheries and in the mix of species that they exploit. Of greatest significance, both regionally and for the groundfish fishery as a whole, is ARSO, the mixed category that lumps Atka mackerel, rockfish, sablefish, and other groundfish. Most of the active processors in this region use groundfish only as a supplementary product acquired as bycatch. Rockfish are targeted only sometimes as a primary product, and total volume is still low. The groundfish fishery is important for components of the local fleet, but serves a secondary role for most processors. Southeast Alaska processing plants extract a large return from the fish that they process, with a relatively high utilization rate, compared to AKKO and AKAPAI. At 74 percent in 1999, utilization was over twice that of AKAPAI. At a value per ton of $5,665, this more than 8 times as great as the AKAPAI region and more than twice the value of AKSC, the next closest region. For the most part, regional processors tend to concentrate on higher-value, low-volume species such as sablefish and rockfish that are typically sold whole or as headed and gutted product. In 1999, ARSO accounted for 92 percent of the volume and 99 percent of the value of the groundfish processed in the region. Pacific cod accounted for 2 percent of the volume and 1 percent of the value of the groundfish processed in the region; flatfish accounted for the virtual remainder of the regional volume (5 percent), but its value was negligible on a regional basis. In 2000, 13 regional plants reporting groundfish processing operated in Hoonah (1), Juneau (2), Ketchikan (2), Petersburg (2), Pelican (1), Sitka (3), and Yakutat (2).

Processing Ownership. Groundfish processing capacity in AKSE owned by residents of the region is concentrated in two sectors, inshore processing plants and longline catcher processors. A significant percentage (half or more) of regional onshore processing capacity is owned by residents of other areas. It appears that regional pollock and flatfish processing is concentrated primarily in non-locally owned onshore facilities. For regionally owned facilities, groundfish of greatest importance are Pacific cod and the ARSO category (mainly sablefish and rockfish). In 1999, catcher-processor wholesale product value was $11.0 million, while shoreplant wholesale product value was $7.2 million. No motherships were owned by regional residents.

Catcher Vessel Ownership and Activity. Ownership patterns for catcher vessels are much the same as for processors in that they indicate a fishery more dependent on limited quantities of Pacific cod, rockfish, and sablefish pursued with longline gear rather than higher volumes of fish pursued with trawl gear. Most locally owned vessels are relatively small and use longline gear for groundfish (and probably participate in other fisheries). Sitka, Petersburg, Juneau, and Ketchikan are the most important communities in terms of regional vessel ownership. Over the 1992-2000 period, Sitka vessels accounted for 30 percent of the value of the groundfish landed by the regionally owned fleet, and for 29 percent of the vessels in that fleet. Petersburg residents accounted for 17 percent of the value and 16 percent of the regionally owned fleet, while Juneau residents owned 13 percent of both value and vessels during this period. Ketchikan resident-owned vessels accounted for 7 percent of the ex-vessel value of landings by regionally owned vessels during 1992-2000, and 7 percent of the regionally owned fleet. No other community accounted for more than 4 percent of the regional total for either value or vessels. In 1999, 71 percent of the harvest value came from the Eastern Gulf, 23 percent from the Central Gulf, and 4 percent from the Western Gulf. Approximately 1 percent came from the Bering Sea and the Aleutian Island areas. It is likely that regionally owned vessels harvest and deliver nearly all fish in the ARSO category. In 1999, ARSO accounted for 68 percent of the volume and 93 percent of the value of the harvest, while Pacific cod represented 30 percent of the volume of the total groundfish harvest and 6 percent of the value. This local fleet is a multi-species, multi-gear fleet concentrated in Sitka and Petersburg. For groundfish, the fleet targets sablefish and rockfish. Thus, most of the Pacific cod and pollock processed by the region's shore plants is harvested and delivered by non-local vessels.

Harvest Diversity. In terms of the fishing annual round, groundfish and non-groundfish species tend to complement each other. The importance of groundfish as a proportion of total ex-vessel value has remained relatively stable, between 30 and 40 percent in recent years. Halibut and salmon each contribute about 25 percent each of the total ex-vessel value. The fleet is relatively diversified, with more than 80 percent of groundfish catcher vessels owned by AKSE residents participating in the halibut fishery, and about 70 percent of groundfish vessels participating in the salmon fishery. Twenty-five percent of the vessels also fish for crab. About 60 percent participate in fisheries other than halibut, salmon, and crab (Groundfish SEIS, Appendix I).

Processing Diversity. Groundfish has accounted for roughly 20 to 30 percent of ex-vessel value at regional processing facilities over the period from 1991 to 1998, with a gradual increase in value. Groundfish accounts for roughly 29 percent of the value of total plant production, compared to 40 percent for salmon and 20 percent for halibut (Groundfish SEIS, Appendix I).

Subsistence. Subsistence utilization in the regionally important groundfish communities of Petersburg, Sitka, and Yakutat ranges between about 200 and 400 pounds per capita. Groundfish represents 1 to 5 percent of the total subsistence resources consumed. No community in the Southeast region is noted to have a regular pattern of harvest for Steller sea lions.

Tables 3.12-26 through 3.12-31 summarize information on the AKSE regional engagement with the groundfish fishery through 2000.

Table 3.12-26 North Pacific groundfish fishery participation measures for Southeast Alaska region, 1992-2000

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	128	114	117	93	93	94	121	112	125
Payment to Labor ($Millions)	10.2	11.1	14.9	13.8	14.6	14.2	12.2	12.6	15.7
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	7.43	8.28	9.53	6.25	5.63	4.8	5.48	4.75	5.84
Product (Thousands of Tons)	4.96	5.36	6.4	4.68	4.48	4.22	4.31	3.51	4.16
Utilization Rate (Percent)	0.67	0.65	0.67	0.75	0.8	0.88	0.79	0.74	0.71
Product Value ($Millions)	27.22	30.51	42.01	40.65	38.56	37.16	38.83	26.91	32.08
Value per Ton ($)	3664	3685	4408	6504	6849	7742	7086	5665	5493
Processors Owned by Regional Residents									
Number of Processors Owned	9	9	11	8	13	11	11	10	10
Reported Tons (Thousands)	8.27	8.96	10.18	7.52	9.38	10.66	9.93	11.14	14.37
Wholesale Value ($Millions)	6.82	8.09	11.27	7.56	15.50	17.64	15.45	18.12	24.91
Catcher Vessels Owned by Regional Residents									
Number of Catcher Vessels	403	356	367	293	283	269	238	235	228
Retained Tons (Thousands)	9.4	9.5	8.9	7.4	7.0	6.6	6.1	6.3	6.5
Ex-vessel Value ($Millions)	19.87	19.24	26.44	26.65	25.29	24.42	16.32	17.67	23.51
Employment (Persons)	1951	1,796	1,801	1,608	1,589	1,508	1,303	1,328	1,238
Payment to Labor ($Millions)	7.95	7.70	10.58	10.66	10.12	9.77	6.53	7.07	9.4

Note: 1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.
Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-27 Groundfish reported by Southeast Alaska region inshore plants by species group

Groundfish Reported	Species Group				
	ARSO	Flatfish	Pacific Cod	Pollock	Total
1999 Tons (Thousands)	4.38	0.25	0.12	0	4.75
1999 Product Value ($Millions)	26.72	0	0.19	0	26.91
2000 Tons (Thousands)	5.47	0.31	0.06	0	5.84
2000 Product Value ($Millions)	31.94	0	0.14	0	32.08

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-28 Groundfish wholesale value of processor class owned by residents of the Southeast Alaska region, 1992-2000

Processor Class	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Catcher-Processors	5.85	6.43	6.77	4.79	6.68	5.65	7.10	10.96	13.58
Motherships	0	0	0	0	0	0	0	0	0
Shoreplants	0.97	1.67	4.50	2.78	8.82	11.99	8.36	7.16	11.33

Notes: Value - $Millions.
Source: Derived tables, Northern Economics (1994) adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-29 Groundfish retained harvest ex-vessel value, catcher vessels owned by Southeast Alaska region residents by FMP subarea, 1999-2000

Retained Harvest	FMP Subarea					
	AI	BS	WG	CG	EG	Total
1999 Ex-vessel ($Millions)	0.15	0.16	0.70	4.07	12.59	17.67
2000 Ex-vessel ($Millions)	0.4	0.56	0.56	5.08	16.91	23.51

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001

Table 3.12-30 Number of boats and retained catch by weight and value, by species group, and by catcher vessel ownership for the Southeast Alaska region

Data	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
ARSO									
Number of Catcher Vessels	400	350	362	287	278	265	235	229	224
Retained Tons (Thousands)	7.5	8.2	8.1	6.5	5.7	4.9	4.8	4.3	4.7
Ex-vessel Value ($Millions)	18.93	18.57	26.13	26.22	24.53	23.53	15.73	16.48	22.27
Flatfish									
Number of Catcher Vessels	12	6	6	12	13	9	8	13	11
Retained Tons (Thousands)	0	0.1	0	0	0	0	0.1	0.1	0
Ex-vessel Value ($Millions)	0.01	0.06	0	0	0.02	0.01	0.04	0.03	0.02
Pacific Cod									
Number of Catcher Vessels	137	115	72	88	106	107	93	107	95
Retained Tons (Thousands)	1.9	1.2	0.7	0.9	1.2	1.6	1.2	1.9	1.6
Ex-vessel Value ($Millions)	0.93	0.62	0.31	0.43	0.73	0.88	0.54	1.15	1.18
Pollock									
Number of Catcher Vessels	5	7	2	6	9	15	10	13	7
Retained Tons (Thousands)	0	0	*	0	0	0	0.1	0	0.2
Ex-vessel Value ($Millions)	0	0	0	0	0.01	0.01	0.01	0.01	0.04
All Groundfish Species									
Total Number of Catcher Vessels	403	356	367	293	283	269	238	235	228
Total Retained Tons (Thousands)	9.4	9.5	8.9	7.4	7.0	6.6	6.1	6.3	6.5
Total Ex-vessel Value ($Millions)	19.87	19.24	26.44	26.65	25.29	24.42	16.32	17.67	23.51

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-31 Retained harvests by FMP area and species of Southeast Alaska regional catcher vessels

Year	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
1992	0.01	0	0.07	0.01	0.32	0.01	1.38	0.04	0.06	0	1.90
1993	0	0	0.02	0	0.21	0.07	0.79	0.05	0.06	0	1.20
1994	0	0	0.07	0	0.09	0.03	0.44	0.04	0.02	0	0.70
1995	0	0	0.09	0	0.08	0.05	0.60	0.02	0.01	0	0.85
1996	0	0	0.04	0.01	0.22	0.10	0.87	0.03	0.03	0	1.29
1997	0.02	0	0.40	0	0.28	0.04	0.81	0.06	0.02	0	1.63
1998	0	0	0.01	0	0.27	0.06	0.75	0.10	0.01	0	1.21
1999	0.06	0	0.07	0.06	0.37	0.13	1.18	0.04	0.02	0	1.94
2000	0.08	0	0.11	0.06	0.41	0.17	0.95	0.02	0.02	0	1.79
Value ($Millions)											
1992	0	0	0.05	0	0.14	0	0.68	0.01	0.05	0	0.93
1993	0	0	0.02	0	0.09	0.01	0.43	0.01	0.06	0	0.62
1994	0	0	0.04	0	0.04	0.01	0.21	0.01	0.01	0	0.31
1995	0	0	0.05	0	0.03	0.01	0.33	0.01	0.01	0	0.43
1996	0	0	0.03	0	0.10	0.02	0.54	0.01	0.03	0	0.74
1997	0.02	0	0.29	0	0.12	0.01	0.42	0.01	0.02	0	0.88
1998	0	0	0.01	0	0.11	0.01	0.39	0.02	0.01	0	0.55
1999	0.03	0	0.04	0.01	0.20	0.03	0.83	0.01	0.01	0	1.16
2000	0.04	0	0.07	0.01	0.26	0.04	0.78	0	0.01	0	1.22

3.12.2.7 Washington Inland Waters Region

Overview. The WAIW region spans a good portion of northwestern Washington, as illustrated in Figure 3.12-8. The WAIW region as a whole, and especially the greater Seattle area in particular, is engaged in all aspects of the overall North Pacific groundfish fishery, and is particularly heavily involved in the Bering Sea pollock fishery. While this region is distant from the harvest areas, it is the organizational center of much of the industrial activity that comprises the human components of the fishery. More accurately, specific industry sectors based in or linked to Seattle are substantially engaged in or dependent on the North Pacific groundfish fishery. The scale and diversity of the WAIW makes a socioeconomic assessment directly related to the Alaska groundfish fishery very complex. Seattle's relationship to the Alaska groundfish fishery in general (and the Bering Sea pollock fishery in particular) is paradoxical. When examined from certain perspectives, Seattle is arguably more involved in the Alaska groundfish fishery than any other community. One example is the large absolute number of Seattle jobs in the Alaska groundfish fishery compared to all other communities, whether counted in terms of current residence, community of origin, or community of original hire (setting aside the matter of where the jobs are actually located). On the other hand, when examined from a comparative and relativistic perspective, it could be argued that the fishery is less important or vital for Seattle than for the other communities considered. Using the same example, the total number of Alaska groundfish-fishery-related jobs in greater Seattle compared to the overall number of jobs in Seattle is quite small, in contrast with the same type of comparison for the much smaller Alaska coastal communities. As extended community profile of Seattle is provided in Appendix F(1).

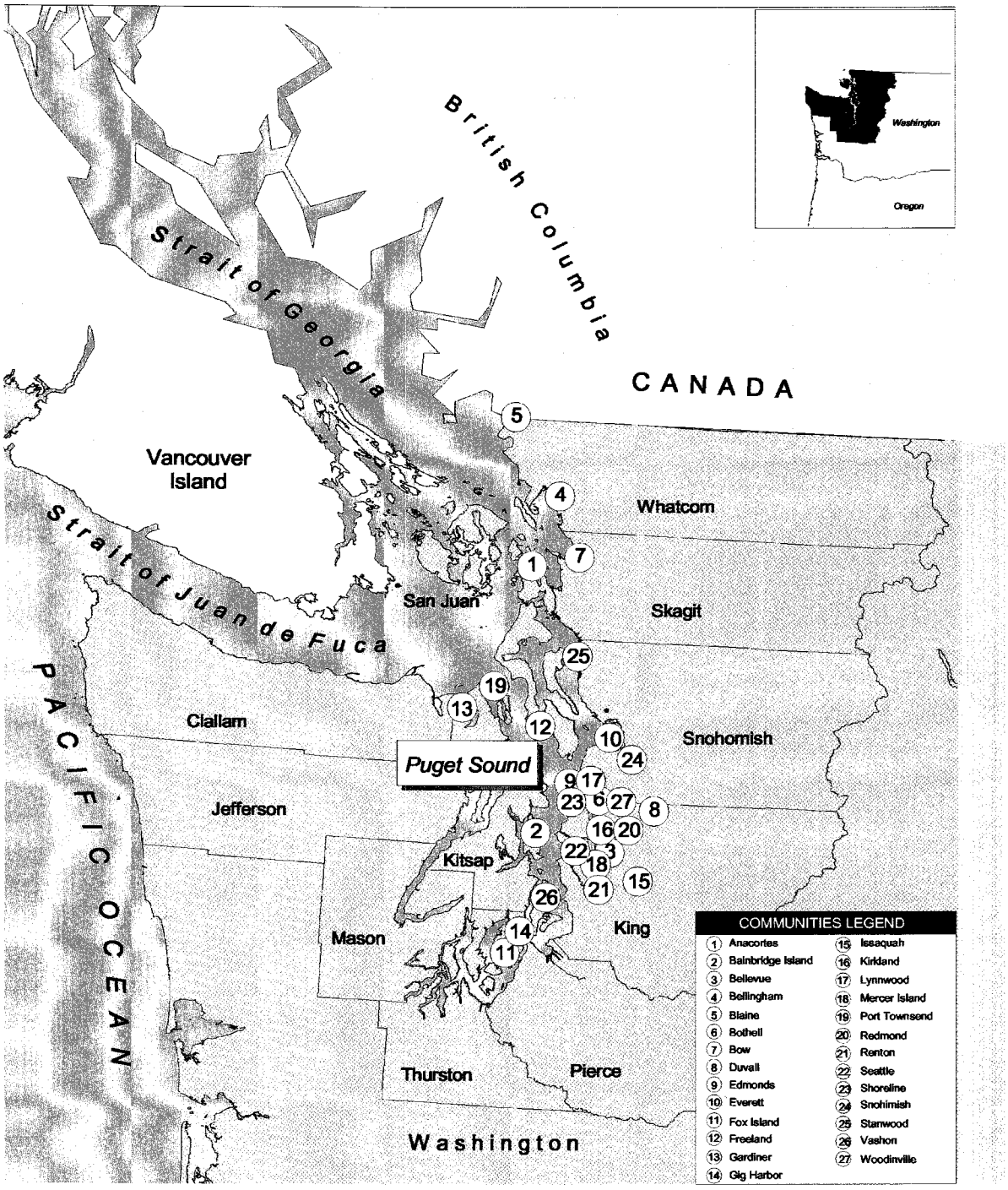

Figure 3.12-8. Washington Inland Waters Study Region

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Regional Economy. As expected of a region encompassing a large metropolitan area and containing 3.8 million residents, retail trade and services are extremely important economic sectors and are the two largest in employment. Manufacturing employs more people than the state and local government sector, followed by finance, construction, wholesale trade, and transportation. The military, civilian federal, agricultural, and mining sectors are relatively small. The fishing industry has a significant presence in parts of WAIW, but is greatly overshadowed in terms of employment by other industry sectors. During the period 1992-1999, between 1,687 and 2,620 WAIW region residents were employed annually by Alaska groundfish processing sectors. At-sea processor sectors (motherships, trawl catcher processors, and longline catcher processors) are by far the most significant contributors. Due to the methodology employed, in which all employment for these entities accrues to the region of the residence of the owner, regional employment attributable to these sectors is probably overstated in absolute terms. On the other hand, many entities in these sectors have various business relationships with Alaska CDQ groups, and have special arrangements to foster Alaska, and especially Native Alaska, hire. Furthermore, shoreplant employment for WAIW residents may be understated, because all such employment except for head office staff is attributed to the region where the plant is located. Payments to labor for processing employment ranged between $183 million and $323 million during this same period.

Processing Ownership. Ownership of Alaska groundfish processing capacity is highly concentrated among owners with residence in the WAIW region. This concentration applies to both shoreplants and catcher processors, and varies in degree between sectors. In 1999, WAIW-owned processors reported processing 1.5 million tons of groundfish (96 percent of all Alaskan groundfish processed in 1999). Of this total, 71 percent was pollock, 13 percent was Pacific cod, 9 percent was flatfish, and 7 percent was ARSO. In terms of estimated wholesale value, WAIW-owned processors processed $1.1 billion worth of groundfish in 1999 (94 percent of the total). Of this value, 64 percent came from pollock, 21 percent from Pacific cod, 9 percent from ARSO, and 5 percent from ARSO. In 1999, wholesale product value from catcher-processors owned by regional residents was $571.1 million, from shoreplants was $490.8 million, and from motherships was $58.0 million.

Catcher Vessel Ownership. Residents of WAIW own catcher vessels in each vessel class that participates in the Alaska groundfish fishery. Numbers in all categories except the smaller vessels (fixed gear vessels less than 60 feet [and especially those less than 32 feet] and trawl vessels less than 60 feet) are significant relative to ownership levels in the Alaska regions. Catcher vessels owned by residents of WAIW tend to be larger than those owned by residents of Alaska, and this comparison emphasizes the region's concentration of ownership (and participation) in the BSAI groundfish fisheries. This is especially true for trawl vessels in general and large, AFA-eligible trawlers in particular. Catcher vessel ownership in this region is strongly concentrated in Seattle. During the 1992-2000 period, Seattle residents owned 45 percent of all regionally owned vessels, and these vessels, in turn, accounted for 65 percent of the total regionally owned vessel value of landings. Outside of Seattle, regional vessel ownership is widely dispersed. Residents of no other community accounted for more than 7 percent of the regionally owned vessels, or more than 5 percent of the regionally owned vessel landings value during this period, and a total of 70 communities have some own at least one or more vessels in this fleet. Catcher vessels owned by WAIW residents accounted for 1,258 employees in 1999, with payments to labor of $56 million. Harvest retained by these vessels is heavily concentrated in the Bering Sea FMP area. In 1999, 76 percent of retained harvest ex-vessel value came from the Bering Sea, 10 percent from the Central Gulf, 5 percent each from the Eastern and Western Gulf, and 4 percent from the Aleutian Islands. In terms of volume of retained harvest, in 1999, 91 percent was pollock, 7 percent Pacific cod, and 1 percent each of ARSO and flatfish. In terms of value, 72 percent derived from pollock, 16 percent from Pacific cod, and 12 percent from ARSO for the same year. Flatfish value was negligible. In the region, 43 percent of the vessels representing 67 percent of the volume and 62 percent of

the value of the harvest are located in Seattle. No other community in WAIW has residents with ownership of more than 6 percent of the region's vessels or 10 percent of the region's total volume or value of harvest.

Catcher Vessel Diversity. While Alaska groundfish make up the greater part of the ex-vessel value of the harvest by Alaska groundfish catcher vessels owned by WAIW residents, other fisheries are seasonally important. Although harvest volumes and values vary, over the period 1988-1998, groundfish has amounted to about 60 percent of the ex-vessel value of the harvest for these vessels. In 1998 specifically, groundfish comprised 57 percent of the ex-vessel value of the annual harvest round. About 27 percent was from crab, 11 percent from halibut, and 5 percent from salmon. Among regionally owned Alaska groundfish vessels, 47 percent also fished for halibut, about 28 percent also fished for crab, about 28 percent also fished for salmon, and about 27 percent also fished for other species in Alaska FMP areas (Groundfish SEIS, Appendix I).

Tables 3.12-32 through 3.12-37 summarize information on the WAIW regional engagement with the groundfish fishery through 2000.

Table 3.12-32 North Pacific groundfish fishery participation measures for Washington inland waters region, 1992-2000

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	4928	4,935	4,556	5,385	5,973	4,788	4,780	3,718	3,949
Payment to Labor ($Millions)	322.6	227.1	246.0	304.2	276.0	261.3	231.9	245.8	282.9
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Product (Thousands of Tons)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Utilization Rate (Percent)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Product Value ($Millions)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Value per Ton ($)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Processors Owned by Regional Residents									
Number of Processors Owned	156	142	142	147	138	126	119	109	118
Reported Tons (Thousands)	2135	1,993	2,051	2.046	1,958	1,943	1,766	1,553	1,714
Wholesale Value ($Millions)	1325	897.7	1,030	1,305	1,149	1,113	979.2	1,120	1,284
Catcher Vessels Owned by Regional Residents									
Number of Catcher Vessels	273	220	245	253	234	252	236	262	271
Retained Tons (Thousands)	551.8	522.0	545.4	559.9	551.5	706.9	555.0	547.1	609.7
Ex-vessel Value ($Millions)	152.6	90.53	106.6	147.9	127.3	212.3	99.70	140.0	188.0
Employment (Persons)	1,312	1,029	1,129	1,240	1,134	1,253	1,130	1,258	1,311
Payment to Labor ($Millions)	61.02	36.21	42.64	59.17	50.91	84.92	39.88	55.99	75.18

Notes: 1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.
Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-33 Groundfish reported by Washington inland waters region inshore plants by species group

Groundfish Reported	Species Group				
	ARSO	Flatfish	Pacific Cod	Pollock	Total
1999 Tons (Thousands)	NA	NA	NA	NA	NA
1999 Product Value ($Millions)	NA	NA	NA	NA	NA
2000 Tons (Thousands)	NA	NA	NA	NA	NA
2000 Product Value ($Millions)	NA	NA	NA	NA	NA

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-34 Groundfish wholesale value of processor class owned by residents of the Washington inland waters region, 1992-2000

Processor Class	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Catcher-Processors	769.55	545.92	584.92	708.70	638.37	598.18	532.11	571.07	637.79
Motherships	92.12	44.06	53.56	74.46	66.52	71.58	58.17	57.92	81.25
Shoreplants	463.51	308.01	391.97	522.23	444.44	443.68	388.96	490.81	564.61

Note: Value - $Millions.
Source: Derived tables, Northern Economics (1994), adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-35 Groundfish retained harvest ex-vessel value, catcher vessels owned by Washington inland waters region residents by FMP subarea, 1999-2000

Retained Harvest	FMP Subarea					
	AI	BS	WG	CG	EG	Total
1999 Ex-vessel ($Millions)	4.98	106.18	7.69	13.76	7.36	139.97
2000 Ex-vessel ($Millions)	7.19	151.81	7.71	11.66	9.59	187.96

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001

Table 3.12-36 Number of boats and retained catch by weight and value, by species group, and by catcher vessel ownership for the Washington inland waters region

Data	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
ARSO									
Number of Catcher Vessels	207	178	210	178	185	199	204	205	204
Retained Tons (Thousands)	7.2	4.5	4.7	7.6	6.1	6.3	5.9	6.1	5.7
Ex-vessel Value ($Millions)	15.87	9.76	14.08	28.57	23.72	25.75	15.71	16.58	21.57
Flatfish									
No. of Catcher Vessels	85	80	85	109	103	104	105	104	123
Retained Tons (Thousands)	15.2	1.9	10.2	15.4	8.6	27.6	2.6	3.4	4.8
Ex-vessel Value ($Millions)	5.11	0.71	2.30	3.22	1.42	7.79	0.44	0.50	0.77
Pacific Cod									
Number of Catcher Vessels	164	123	115	167	146	161	153	191	206
Retained Tons (Thousands)	36.3	30.5	40.2	48.5	60.8	74.9	38.7	40.8	47.4
Ex-vessel Value ($Millions)	13.77	9.72	11.48	17.48	20.87	34.08	12.63	21.82	30.56
Pollock									
Number of Catcher Vessels	97	76	78	94	93	103	100	109	129
Retained Tons (Thousands)	493.2	485.2	490.3	488.4	475.9	598.1	507.8	496.9	551.7
Ex-vessel Value ($Millions)	117.79	70.33	78.74	98.67	81.27	144.67	70.93	101.07	135.06
All Groundfish Species									
Total Number of Catcher Vessels	273	220	245	253	234	252	236	262	271
Total Retained Tons (Thousands)	551.8	522.0	545.4	559.9	551.5	706.9	555.0	547.1	609.7
Total Ex-vessel Value ($Millions)	152.55	90.53	106.60	147.91	127.28	212.28	99.70	139.97	188

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-37 Retained harvests by FMP area and species of Washington inland wasters regional catcher vessels

Year	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
1992	0.24	16.71	16.83	446.92	8.13	10.99	9.29	20.33	0.05	0	529.48
1993	1.4	15.42	17.27	441.48	3.72	11.38	6.23	18.11	0.19	0.49	515.69
1994	0.03	17.93	28.98	436.35	2.83	12.49	6.12	21.46	0.16	4.12	530.49
1995	0.26	18.56	34.18	437.37	5.84	17.44	9.83	13.05	0.03	0.31	536.87
1996	2.69	10.13	43.26	449.30	4.02	10.77	9.54	6.62	0.04	0.36	536.72
1997	4.9	12.89	47.70	561.91	7.13	13.47	8.86	12.88	0.04	3.24	673
1998	3.23	7.53	23.21	454.88	4.98	14.62	8.82	23.46	0.04	5.75	546.52
1999	5.49	0.01	21.61	462.51	5.91	10.83	10.13	19.99	0.04	1.15	537.67
2000	5.34	0	24.32	536.78	5.48	4.42	8.26	14.01	0.04	0.47	599.11
Value ($Millions)											
1992	0.09	4.53	6.14	105.79	3.02	2.90	4.18	4.89	0.03	0	131.57
1993	0.43	2.35	5.19	63.91	1.24	1.61	2.38	2.78	0.10	0.08	80.06
1994	0.01	3.01	8.03	69.92	0.88	2.03	2.07	3.52	0.06	0.69	90.22
1995	0.09	3.85	11.61	87.61	2.09	3.52	4.45	2.82	0.02	0.07	116.12
1996	0.89	1.80	14.49	76.25	1.36	2.00	3.88	1.38	0.02	0.08	102.15
1997	2.2	3.94	20.09	138.49	3.00	3.13	4.11	3.04	0.02	0.72	178.75
1998	1.02	1.10	7.34	62.61	1.66	2.03	3.38	3.44	0.02	0.96	83.56
1999	2.82	0	11.02	92.73	3.01	2.32	6.58	4.16	0.03	0.23	122.89
2000	3.47	0	15.15	132.22	3.63	1.11	6.44	3.45	0.03	0.12	165.62

3.12.2.8 Oregon Coast Region

Overview. For the purposes of this analysis, ORCO is defined as the area encompassing Tillamook County, Lincoln County, and Clatsop County, as illustrated in Figure 3.12-9. This area includes those ports and communities in Oregon with the most direct ties to the Alaska groundfish fishery. ORCO has long had significant involvement in the Alaska groundfish fishery, from the development of the joint venture fishery through the present. The most visible aspect of this participation is the fleet of catcher vessels based in Oregon that participate in a variety of fisheries across the various Alaska regions. Though ORCO residents own fewer catcher vessels than the residents of any of the other regions profiled (42 in 1999), these vessels harvested more North Pacific groundfish by volume than the vessels from any other region except WAIW. In value of harvest, ORCO ranked behind both the Washington and Kodiak regions, but ahead of the other three Alaska regions. This activity is highly concentrated in the community of Newport. According to data in the Groundfish SEIS (NMFS 2001), for the period 1988-1998, Newport accounted for 72 percent of the total harvest volume and 67 percent of the total harvest value of Alaska groundfish by ORCO region owned vessels. No other regional port accounted for eight percent or more of the regional total. ORCO ports are important for local fisheries as well as the distant Alaska fisheries. Most of the fish landed in Oregon is delivered to Astoria or Newport, the county seats of Clatsop and Lincoln counties, respectively. Onshore facilities to process whiting (from Pacific Northwest waters) are concentrated in Newport.

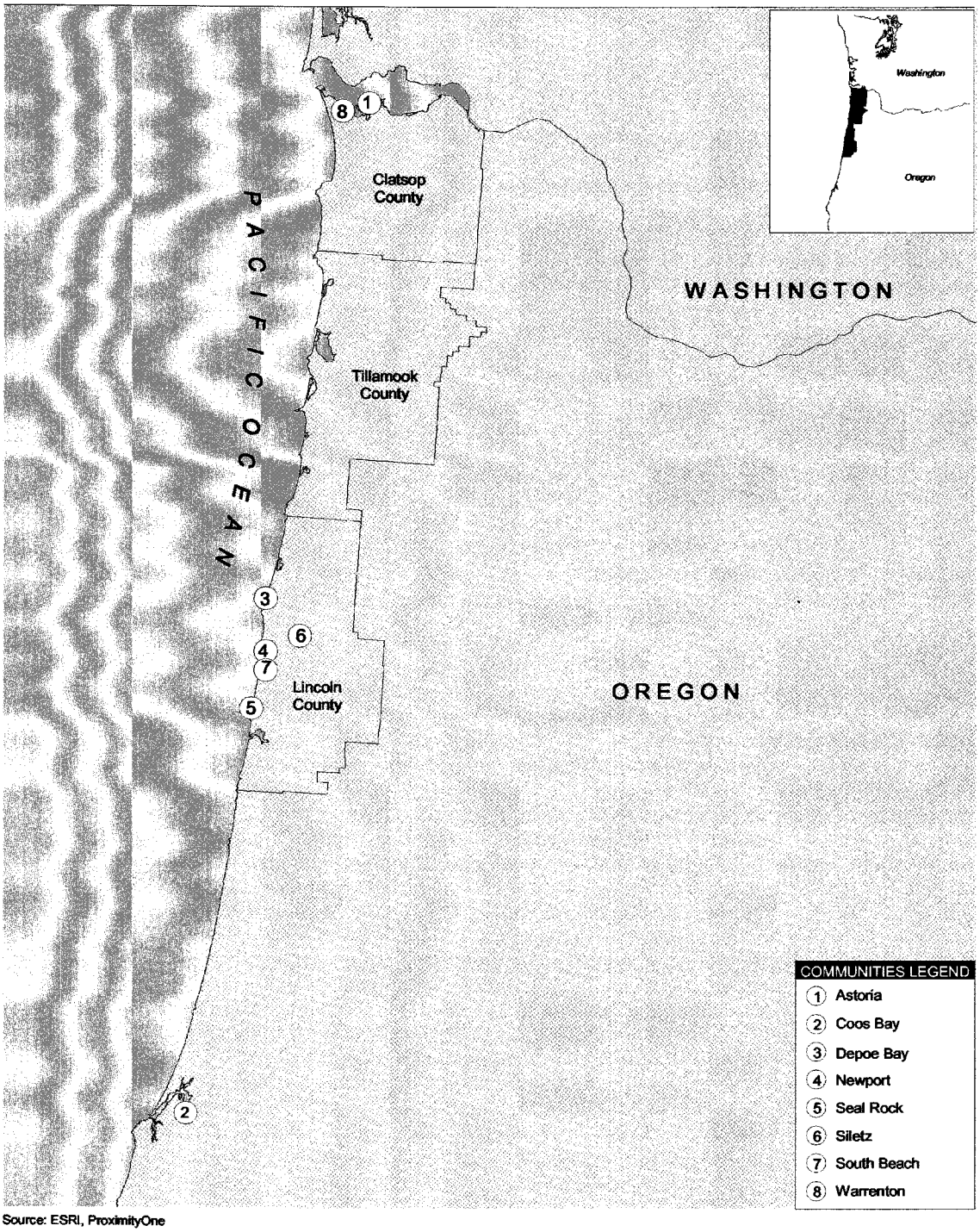

Figure 3.12-9. Oregon Coast Study Region

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Regional Economy. The ORCO economy is relatively diversified and relies heavily on the retail, service, and government sectors. Fish and timber are also significant components of the multi-industry "agriculture, forestry, fishing, and other" and "manufacturing" categories. Manufacturing, as measured by earnings, is similar in magnitude to the retail trade, service, and government sectors. As an aggregated category, however, it is not clear how much of this magnitude is due to fish-related activity. It is almost certain that none of this manufacturing activity is related to Alaska groundfish. There are no onshore plants in this region that process Alaska groundfish, and only one regionally owned longline catcher processor in the years 1992-1994 (none at present). Thus, none of this region's processing employment is attributable to Alaska groundfish.

Processing Ownership. There is no current ORCO ownership of Alaska groundfish processing capacity, and such ownership has been limited in the past.

Catcher Vessel Ownership. Catcher vessel ownership of Alaska groundfish vessels in this region is highly concentrated in Newport. Residents of Newport owned 44 percent of the groundfish vessels owned by the residents of the region over the period 1992-2000, and these vessels, in turn, accounted for 66 percent of the value of all groundfish landings by regionally owned vessels. No other community in the region accounted for more than 14 percent of regionally owned vessels, and none accounted for more than 6 percent of the total value of regionally owned vessels. On all measures, Newport is clearly the dominant ORCO community in terms of engagement with North Pacific groundfish fisheries in general, and the Bering Sea pollock fishery in particular. Of the vessels owned by ORCO residents that participate in the Alaska groundfish fishery, trawlers predominate, followed by pot vessels, longliners, and miscellaneous 'other' vessels in about equal numbers. Trawlers are the most active and productive component of this fleet. They are based primarily in Newport or the nearby area. In employment related to the Alaska groundfish fishery on regionally owned vessels, trawlers supplied the bulk of opportunities in 1998 (about 67 percent of the total). Pot vessels provided 16 percent and longliners about 18 percent. In 1999, retained harvest ex-vessel value derived 58 percent from the Bering Sea, 40 percent from the Central Gulf, and approximately 1 percent each from the Eastern Gulf and the Western Gulf. Value from the Aleutian Islands was negligible. On a species basis, in 1999 pollock accounted for 71 percent of volume and 48 percent of value of regionally owned vessels, while Pacific cod accounted for 25 percent of volume and 45 percent of value. ARSO and flatfish accounted for about 2 percent of volume each, and approximately 5 percent and 1 percent of value, respectively.

Catcher Vessel Diversity. Catcher vessels owned by ORCO residents have a specific dependence on the Alaska groundfish fishery, but generally participate in other Alaska fisheries. As a class, these vessels derive a clear majority of their Alaska ex-vessel value from groundfish activity. In 1998 groundfish accounted for almost two-thirds of the Alaska ex-vessel value accruing to this fleet. Crab make up about one-quarter of the ex-vessel value. About half of the groundfish vessels also participate in the halibut fishery, and about one of five participate in the salmon and crab fisheries. About one-third of the Oregon-owned groundfish catcher vessel fleet participates in Alaska fisheries other than groundfish, halibut, crab, or salmon (Groundfish SEIS, Appendix I).

Tables 3.12-38 through 3.12-43 summarize information on the ORCO regional engagement with the groundfish fishery through 2000.

Table 3.12-38 North Pacific groundfish fishery participation measures for Oregon Coast region, 1992-2000

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	45	45	53	53	0	0	0	0	0
Payment to Labor ($Millions)	2.69	2.77	3.11	2.19	0	0	0	0	0
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Product (Thousands of Tons)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Utilization Rate (Percent)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Product Value ($Millions)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Value per Ton ($)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Processors Owned by Regional Residents									
Number of Processors Owned	2	2	2	2	0	0	0	0	0
Reported Tons (Thousands)	0	*	*	*	0	0	0	0	0
Wholesale Value ($Millions)	0	*	*	*	0	0	0	0	0
Catcher Vessels Owned by Regional Residents									
Number of Catcher Vessels	42	33	38	38	36	36	36	39	42
Retained Tons (Thousands)	73.6	72.4	72.8	84.2	78.6	73.0	76.3	74.7	72.6
Ex-vessel Value ($Millions)	22.82	14.89	14.60	22.41	18.98	21.87	15.94	22.78	24.07
Employment (Persons)	201	152	174	178	174	171	172	181	198
Payment to Labor ($Millions)	9.13	5.96	5.84	8.96	7.59	8.75	6.38	9.11	9.63

1) Includes all employment at all shoreplants located in the region and all employment of at-sea processors (including floaters) owned by residents. In addition the estimate includes administrative employment of all processors owned by residents. 2) All payments to labor from at-sea processors (including floaters) are assigned to the owners region. On-site payments to labor from shore plants are assigned to the region in which the plant is located.
Source: For processing information, NMFS Blend Data and WPR Data, June 2001 and Northern Economics (1994) internally derived tables. For harvest information, ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-39 Groundfish reported by Oregon Coast region inshore plants by species group

Groundfish Reported	Species Group				
	ARSO	Flatfish	Pacific Cod	Pollock	Total
1999 Tons (Thousands)	NA	NA	NA	NA	NA
1999 Product Value ($Millions)	NA	NA	NA	NA	NA
2000 Tons (Thousands)	NA	NA	NA	NA	NA
2000 Product Value ($Millions)	NA	NA	NA	NA	NA

Source: NMFS Blend Data and WPR Data, June 2001.

Table 3.12-40 Groundfish wholesale value of processor class owned by residents of the Oregon Coast region, 1992-2000

Processor Class	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Catcher-Processors	1.12	1.00	0.52	0.87	0	0	0	0	0
Motherships	0	0	0	0	0	0	0	0	0
Shoreplants	0	0	0	0	0	0	0	0	0

Note: Value - $Millions.
Source: Derived tables, Northern Economics (1994) adapted from NMFS Blend Data and WPR Data, June 2001.

Table 3.12-41 Groundfish wholesale value of processor class owned by residents of the Oregon Coast region, 1992-2000

Retained Harvest	FMP Subarea					
	AI	BS	WG	CG	EG	Total
1999 Ex-vessel ($Millions)	0	13.16	0.34	9.05	0.22	22.78
2000 Ex-vessel ($Millions)	0.01	14.37	0.50	8.86	0.33	24.07

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001

Table 3.12-42 Number of boats and retained catch by weight and value, by species group, and by catcher vessel ownership for the Oregon Coast region

Data	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
ARSO									
Number of Catcher Vessels	30	27	30	35	27	29	31	37	35
Retained Tons (Thousands)	0.5	0.4	0.3	0.6	1.6	1.4	1.9	1.5	2.4
Ex-vessel Value ($Millions)	1.19	0.90	0.82	1.87	1.81	1.56	1.16	1.24	1.68
Flatfish									
Number of Catcher Vessels	21	17	17	27	18	22	23	29	27
Retained Tons (Thousands)	1.9	1.3	0.7	2.7	1.4	3.1	2.0	1.7	2.2
Ex-vessel Value ($Millions)	0.57	0.41	0.22	0.57	0.54	0.86	0.50	0.35	0.39
Pacific Cod									
Number of Catcher Vessels	35	25	24	32	27	30	29	31	35
Retained Tons (Thousands)	14.2	15.4	11.1	18.0	18.8	24.1	19.8	18.5	12.7
Ex-vessel Value ($Millions)	6.15	5.16	3.47	6.89	6.58	9.29	6.76	10.23	8.35
Pollock									
Number of Catcher Vessels	26	22	20	25	24	24	27	27	26
Retained Tons (Thousands)	57.1	55.2	60.7	62.9	56.8	44.4	52.6	53.0	55.4
Ex-vessel Value ($Millions)	14.91	8.42	10.10	13.08	10.04	10.16	7.51	10.96	13.65
All Groundfish Species									
Total Number of Catcher Vessels	42	33	38	38	36	36	36	39	42
Total Retained Tons (Thousands)	73.6	72.4	72.8	84.2	78.6	73.0	76.3	74.7	72.6
Total Ex-vessel Value ($Millions)	22.82	14.89	14.60	22.41	18.98	21.87	15.94	22.78	24.07

Source: ADF&G Fish Tickets and NMFS Observer Data, June 2001. Count information does not include "ghost" entities, while weight information includes "ghost" entities in order to minimize instances where data can not be reported due to NMFS confidentiality provisions. In all cases the values for Ghost Vessels are negligible.

Table 3.12-43 Retained harvests by FMP area and species of Oregon Coast regional catcher vessels

Year	FMP Area										Total
	Aleutian Islands		Bering Sea		Western Gulf		Central Gulf		Eastern Gulf		
	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	Pacific Cod	Pollock	
Volume (Thousands of Tons)											
1992	0.22	1.02	3.57	50.86	1.50	1.22	2.74	10.12	0.01	0	71.25
1993	0.09	0.78	6.01	33.87	0.67	2.06	4.48	22.56	0.02	0.10	70.65
1994	0	1.03	5.21	42.66	0.44	1.78	2.48	16.79	0.03	1.36	71.78
1995	0.04	1.03	7.76	58.86	1.02	2.75	3.52	5.89	0.04	0.02	80.93
1996	0.45	0.22	9.74	54.65	0.69	2.37	2.98	4.42	0	0.07	75.60
1997	0.61	0.14	9.36	39.82	1.02	2.62	4.59	10.11	0.02	0.24	68.52
1998	1.57	0.05	8.70	27.68	1.02	4.59	4.49	24.21	0.03	0.12	72.47
1999	1.68	0.03	6.77	34.11	0.73	2.51	5.72	19.81	0.01	0.10	71.47
2000	1.53	0	5.52	44.18	0.62	2.34	2.51	11.1	0.01	0.29	68.1
Value ($ Millions)											
1992	0.1	0.33	1.57	13.61	0.65	0.36	1.49	2.95	0	0	21.06
1993	0.03	0.13	2.02	5.17	0.25	0.30	1.74	3.93	0.01	0.02	13.58
1994	0	0.19	1.59	7.19	0.15	0.30	0.90	3.01	0.01	0.24	13.57
1995	0.01	0.23	2.89	12.73	0.40	0.55	1.72	1.40	0.02	0	19.97
1996	0.16	0.04	3.51	9.85	0.25	0.48	1.31	1.00	0	0.02	16.62
1997	0.28	0.03	3.84	9.38	0.44	0.66	2.26	2.51	0.01	0.05	19.44
1998	0.54	0.01	3.07	3.89	0.38	0.67	1.78	3.90	0.01	0.02	14.28
1999	0.93	0.01	3.70	7.27	0.40	0.58	3.83	4.45	0.01	0.02	21.19
2000	1.07	0	3.78	11.28	0.43	0.62	1.85	2.90	0.01	0.08	22.00

3.12.2.9 CDQ Region Existing Conditions

CDQ region existing conditions are discussed in detail in Appendix F(4), and are not recapitulated here. Additional information is also presented in Section 2.5.1.4 ("The CDQ Fishery") and in the RIR (Appendix C to this document) in Section 1.4.3.4.

3.12.2.10 Environmental Justice Existing Conditions

Introduction[3]

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 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[4] 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

[3] The environmental justice existing conditions information is specifically called out in its own section in this Final SEIS. In the Draft SEIS, data sufficient for environmental justice analysis were presented in Appendix F(1), but those data are now abstracted and drawn together into one focused section for ease of identification and review. Similarly, environmental justice impacts, implicit in the alternatives analysis in the Draft SEIS, are now spelled out in a designated section (Section 4.12.2.3) for ease of review in this Final SEIS.

[4] NOAA *Environmental Review Procedures for Implementing the National Environmental Policy Act* (Issued 06/03/99)

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."

Community Variations and Data Limitations

The population structure of the regions vary considerably. As discussed below and elaborated in Appendix F(1), within Alaska, and particularly in the Aleutian and Kodiak regions, 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. Again, this varies considerably from place to place and is not apparent in the Alaska Southcentral and Southeast regions in the same way it is in the Aleutian and Kodiak regions.

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, and in the community profiles in Appendix F(1), 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.[5] It is

[5] During discussion of the environmental justice analysis for this 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

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 (as discussed in detail in Appendix F(1)). 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. This is noted at the end of this section, and discussed in detail in Appendix F(4).

Alaska Peninsula/Aleutian Islands Region

General Community Population Attributes

Alaska Peninsula/Aleutian Island region communities with the strongest direct engagement in, and dependence upon, the North Pacific groundfish fishery are Unalaska, Akutan, Sand Point, and King Cove.[6] These four communities, and their specific ties to the groundfish fishery, are profiled in detail in Appendix F(1). In this section, community level information relevant to environmental justice analysis is summarized.

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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 not a state directive.)

[6] As noted in Appendix F(1), there are also ties, if less pervasive or historically established ones, to Adak, Chignik, False Pass, and St. Paul, but these communities are not detailed in this section.

Table 3.12-44 provides ethnicity information from the 2000 census for each of the four communities.[7] 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 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 3.12-44 Ethnic Composition of Population, Selected Alaska Peninsula/Aleutian Island Region Communities, 2000

Race/Ethnicity	Unalaska		Akutan		King Cove		Sand Point	
	N	%	N	%	N	%	N	%
White	1,893	44.2%	168	23.6%	119	15.0%	264	27.7%
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.[8] For example, the economic and demographic expansion associated with the King crab boom

[7] 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.

[8] 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

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.[9]

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

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War II, including the Aleut evacuation and the consolidation of the outlying villages, forever changed the community and Aleut sociocultural structure.

[9] 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).

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). As detailed in Appendix F(1), 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 3.12-45 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 3.12-45 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 3.12-46 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 3.12-46 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 3.12-47 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 3.12-48 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 3.12-47 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 3.12-48 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 3.12-49 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 3.12-50 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 3.12-49 Ethnicity and Group Quarters Housing Information, Akutan, 1990

Akutan	Total Population		Group Quarters Population		Non-Group Quarters Population	
	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 3.12-50 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 3.12-51 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 3.12-52 is also consistent with a transient workforce.

Table 3.12-51 Ethnicity and Group Quarters Housing Information, King Cove, 1990

King Cove	Total Population		Group Quarters Population		Non-Group Quarters Population	
	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 3.12-52 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 3.12-53 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 3.12-54, the significant male to female imbalance seen in other communities is present in Sand Point as well.

Table 3.12-53 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 3.12-54 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 groundfish 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 (discussed in Appendix F(1)) suggest that there is a fair degree of mobility among at least part of this workforce.

Kodiak Island Region

General Community Population Attributes

Within the Kodiak region, the City of Kodiak is the location of virtually all of the direct links with the groundfish fishery. Given these circumstances, it will be the only regional community discussed in detail.[10]

Kodiak is a complex community in terms of the ethnic composition of its population. Sugpiaqs (Koniags) were the original inhabitants of Kodiak Island. Beyond earlier development, fishing and military buildup associated with World War II brought many non-Natives to Kodiak, primarily Caucasians but also a substantial number of non-Native minorities, at least initially associated primarily with fish processing employment. Detailed information on community growth and the relative growth of different population segments is provided in Appendix F(1). The Alaskan Native population has remained at approximately the same percentage since the 1970s, but the white (non-minority) population has declined in terms of percentage over time. Overall, there has thus been a gradual, long-term shift in ethnic composition, with Asian and Pacific Islanders increasing in percentage. 2000 Census data detailing ethnicity are presented in Table 3.12-55. As shown, the majority of Kodiak's population is comprised of minority residents.

[10] Processing data does show that groundfish are also run at Alitak, but this is a relatively specialized operation and very small relative to the aggregated operations associated with the City of Kodiak.

Table 3.12-55 Ethnic Composition of Population Kodiak City; 2000

Race/Ethnicity	2000	
	N	%
White	2,939	46.4%
African American	44	0.7%
Native American/Alaska Native	663	10.5%
Native Hawaiian/Other Pacific Islander	59	0.9%
Asian	2,010	31.7%
Some Other Race	276	4.3%
Two or More Races	343	5.4%
Total	6,334	100%
Hispanic*	541	8.5%

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).

The following two tables present information on income, employment, and poverty for the City of Kodiak and the Kodiak Island Borough. 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 3.12-56 displays median household and median family income. As shown, the City of Kodiak is above the borough averages. For example, median family income in Kodiak itself is about 4 percent higher than the borough as a whole. Compared to all communities in the region, the City of Kodiak places at the upper end of the range. In 1990 the highest median family income in the region was in the community of Womens Bay, with a figure of $51,537, while the lowest figure was $17,813 for Old Harbor.

Table 3.12-56 Household Income Information, Selected Kodiak Region Communities, 1990

Community	Total Units	Occupied Units	Vacant Units	Total Households	Average Household Size	Median Household Income	Total Family Households	Median Family Income
Kodiak	2,177	2,051	126	2,051	3	46,050	1,399	49,404
Kodiak Island Borough	4,885	4,083	802	4,083	3	44,815	2,982	47,600

Source: U.S. Bureau of the Census

Table 3.12-57 displays data on employment and poverty for the City of Kodiak and the Kodiak Island Borough for 1990. As shown, there was very little unemployment in these jurisdictions, presumably due in part to the presence of fishery related employment opportunities, and also the fact that the Kodiak economy is relatively diversified by rural Alaska standards, and particularly in comparison to the Aleutian region communities. The City of Kodiak has the lowest unemployment of any community in the region, whereas the villages of Larsen Bay and Old Harbor are at the opposite end of the continuum, with 40 and 39 percent unemployment, respectively. Proportions of the population considered to be below the poverty threshold vary between the communities, but as was the case in the Aleutian region, this is somewhat misleading. For example, Akhiok has the lowest poverty rate of any community in the region at 2.4 percent, but at the same

time 51 percent of the adults in the community are not working. Old Harbor has the highest poverty rate in the region at 31 percent.

Table 3.12-57 Employment and Poverty Information, Selected Kodiak Region Communities, 1990

Community	Total Persons Employed	Unemployed	Percent Unemployment	Percent Adults not Working	Not Seeking Employment	Percent Poverty
Kodiak	3,644	162	4.40%	23.00%	927	6.20%
Kodiak Island Borough	7,218	346	5.30%	23.90%	1,918	5.50%

Source: U.S. Bureau of the Census

Population Attributes of the Resident Groundfish Fishery Workforce

Table 3.12-58 provides information on group housing and ethnicity for Kodiak. Group housing in the community is largely associated with the processing workforce, but not to the nearly exclusive degree seen in the Aleutian communities, due to the greater complexity of the institutional base and range of housing types in Kodiak. As shown, only six percent of the population lived in group housing in 1990. This is a much lower percentage of population residing in group quarters than in the other communities profiled, and is consistent with a workforce more heavily drawn from the local labor pool. Further, while there is still as significant difference between the group quarter and non-group quarter demographics (with the group quarter population being a higher minority group than the community population as a whole), the differences are not as sharp in general or for particular groups as seen in the Aleutian region communities. The male to female imbalance is present in the community, as shown in Table 3.12-59, but it is of a lesser magnitude than seen in the Aleutian region groundfish communities. This is consistent with Kodiak's fishery related workforce being drawn more from the local community labor pool than is the case in the Aleutian communities.

Table 3.12-58 Ethnicity and Group Quarters Housing Information, Kodiak, 1990

	Total Population		Group Quarters Population		Non-Group Quarters Population	
Kodiak City	Number	Percent	Number	Percent	Number	Percent
White	4028	63.28	192	53.93	3836	63.84
Black	29	0.46	3	0.84	26	0.43
American Indian, Eskimo, Aleut	811	12.74	21	5.90	790	13.15
Asian or Pacific Islander	1282	20.14	118	33.15	1164	19.37
Other race	197	3.10	22	6.18	175	2.91
Total Population	6365	100.00	356	100.00	6009	100.00
Hispanic origin, any race	407	6.39	42	11.80	365	6.07
Total Minority Pop	2429	38.16	181	50.84	2248	37.41
Total Non-Minority Pop (White Non-Hispanic)	3936	61.84	175	49.16	3761	62.59

Source: Census 1990 STF2

Table 3.12-59 Population by Age and Sex, Kodiak City: 1990 and 2000

Kodiak City	1990		2000	
	N	%	N	%
Male	3,496	55%	3379	53%
Female	2,869	45%	2955	47%
Total	6,363	100%	6334	100%
Median Age	NA		33.5 years	

Source: U.S. Bureau of the Census

Industry Provided Data

Given the nature of the relationship between the processing workforce and the local communities, industry information comparable to that of the Aleutians region was not systematically collected from Kodiak region entities. The information received was not sufficient to be able to disclose precise community level information due to confidentiality concerns. As a generality however, the 2000 data received indicated that at least some shoreplants in this region have workforces with a greater minority population component than the Aleutian regional average (77.5 percent). This is despite the fact that, as a rule of thumb, the Kodiak processing workforce is drawn to a larger degree from a local labor pool than is the case for the Aleutian communities. As was the case for the Aleutian region, different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce. For some plants the total minority figure was not disaggregated, and not enough plants within this region provided detailed data to allow region specific discussion. However, as mentioned in the Aleutian region discussion, all of the shoreplants in any region that provided detailed data have workforces 5 percent or less African American and 5 percent or less Alaska Native/Native American. For the Kodiak region, the group classified as Asian/Pacific Islander was the largest minority group noted within the limited detailed data received.

Regional Summary

The community in the region that is most engaged in and dependent upon the groundfish fishery (Kodiak) is comprised of more minority residents than non-minority residents. While systematic data do not exist, the data that are available suggest that the workforce at the processing plants that would likely feel the impacts of the alternatives are primarily comprised of minority workers.

Washington Inland Waters Region

General Community Population Attributes

The greater Seattle area is the center for much of economic activity related to the North Pacific groundfish fishery, but the geographic footprint of those activities is difficult to define, and it cannot be attributed to specific communities or neighborhoods in the same manner as Alaska communities may be linked to the fishery, as discussed in Appendix F(1). For comparative purposes, and that the information on the Seattle-based catcher-processor sector described below can be compared to the greater Seattle population base, the Table 3.12-60 provides ethnicity data for the Seattle-Tacoma Consolidated Metropolitan Statistical Area

(CMSA) as defined by the U.S. Bureau of the Census.[11] As shown, unlike the Alaska groundfish communities, the white portion of the population comprises a large majority of the overall population (i.e., minorities are actually a distinct mathematical minority, unlike the relevant Alaska communities).

Table 3.12-60 Ethnic Composition of Population, Seattle-Tacoma CMSA, 1990 and 2000

Race/Ethnicity	1990		2000	
	N	%	N	%
White	2,214,579	86.5%	2,819,296	79.3%
African American	121,702	4.8%	165,938	4.7%
Native Amer/Alaskan	32,980	1.3%	41,731	1.2%
Asian/Pacific Islands*	164,386	6.4%	300,533	8.5%
Other**	25,517	1.0%	227,263	6.4%
Total	2,559,164	100%	3,554,760	100%
Hispanic***	71,069	2.8%	184,297	5.2%
Total minority population	383,198	15.0%	816,858	23.0%
Total non-minority population	2,175,966	85.0%	2,737,902	77.0%

Source: U.S. Bureau of Census.

* In the 2000 census, this was split into Native Hawaiian and Other Pacific Islander (pop 19,837 (0.6%)) and Asian (pop 280,696 (7.9%))

** In the 2000 census, this category was Some Other Race (pop 79,353 (2.2%)) and Two or More Races (pop 147,910 (4.2%)).

*** '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).

Information on household income and employment and poverty information for the Seattle-Tacoma CMSA comparable to that provided for the relevant Alaska groundfish communities is not presented here. These types of data at the CMSA level are not meaningful for this environmental justice analysis.

Population Attributes of the Resident Groundfish Fishery Workforce

Given the nature of engagement with the fishery, the Washington Inland Waters Region does not have the same type of resident workforce focused in individual communities in a manner comparable to that seen in Alaska communities, as discussed in detail in Appendix F(3). Rather, this environmental justice analysis will focus on industry provided sector data as described below.

Industry Provided Data

As noted in the introductory discussion, catcher vessel ownership and crews based in the area are assumed to reflect the overall population structure. Systematic demographic data were not collected for the groundfish catcher vessel crews in the Washington inland waters region, but interviews with local sector association

[11] A Consolidated Metropolitan Statistical Area (CMSA) consists of two or more contiguous MSAs The Seattle-Tacoma WA CMSA consists of Seattle WA PMSA (1) King and Snohomish Counties, and (2) Tacoma (Pierce County). A Metropolitan Statistical Area (MSA) can be defined as a city of over 50,000 inhabitants together with the county in which it is located and contiguous counties which are economically and socially integrated with the central city. It may also consist of an urbanized area of 50,000 with a total metropolitan area population of at least 100,000.

personnel suggest that minority population representation within this sector does not exceed the proportion of minority representation in the general population, therefore environmental justice is not an issue with respect to potential impacts to this sector.

Shore processing plants are not present in this region, and the mothership sector data cannot be presented due to confidentiality restrictions based on the small number of entities. As a working assumption, it is assumed that the mothership employment structure is similar to that of the catcher processor sector, although the catcher-processor sector may have a somewhat higher minority representation in the workforce due to more consistent targeted hiring in rural Alaska.

Information on catcher-processor workforce demographics for 2000 was obtained from seven entities that together account for almost all (99 percent) of the of the non-CDQ target pollock caught by trawl catcher processors in the BSAI as well as 86 percent of the CDQ pollock. (While these entities also catch a significant amount of Pacific cod, catch among catcher-processors in the Pacific cod fishery is more dispersed over a larger group of participating entities.) Different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce, but the detailed information provided encompassed 1,906 out of the 2,126 persons reported, or 90 percent of the total reported workforce. Table 3.12-61 provides ethnicity information for those entities reporting detailed breakouts. As shown, the portion of the workforce within the detailed reporting set was 36.9 percent white or non-minority and 63.1 percent minority. Adding the more highly aggregated data does not significantly change the overall minority/non-minority ratio. Within the total set of responding entities, individual entity workforces ranged from a 36 percent minority workforce to an 85 percent minority workforce. Among entities reporting detailed data, Hispanic was the largest minority component in every entity's minority workforce segment, with one exception (in which case the largest minority segment was Asian/Pacific Islander, and Hispanic was second). Apart from the entity where Asian/Pacific Islander workers were the largest minority worker segment, Asian/Pacific Islanders were the second largest minority group represented for all but one of reporting entities (in which case the second largest group was Alaska Native/Native American).

Table 3.12-61 Ethnic Composition of Workforce for Catcher-Processor Entities Reporting Detailed Demographic Information, 2000

Race/Ethnicity	2000	
	Number of Workers	Percentage of Workers
White non-Hispanic	704	36.9%
Hispanic	585	30.7%
African American	121	6.3%
Alaska Native/Native American	164	8.6%
Asian/Pacific Islands	310	16.3%
Other	22	1.2%
Total	1,906	100.0%

Source: Individual catcher-processor entities contacted through the At-Sea Processors Association, 2001

Regional Summary

For reasons discussed earlier, environmental justice is not a regional or community level issue for North Pacific groundfish management initiatives for the Washington inland waters region or the greater Seattle area. Although quantitative data are not available to confirm this, based on interview data it does not appear to be an issue for the regionally based catcher vessel fleet either. As there are no Alaska groundfish shore based processing entities in this region, the types of environmental justice issues associated with these workforces seen in some of the Alaska regions are not present in this region. Industry provided data for the catcher-processor sector, however, show that environmental justice is a potential issue among that sector's workforce. While the population of the greater Seattle area was 23 percent minority in 2000, this workforce was 63 percent minority for that same year. Therefore, if substantial job losses in this sector were to occur under various management alternatives, they would disproportionately accrue to minority populations. As noted in Appendix F(1), while most of the hiring for catcher-processor entities is done out of the greater Seattle area, there are targeted hiring efforts directed at Alaska residents in general and Alaska Native residents in particular. In addition to CDQ related employment issues associated with this sector and discussed separately, loss of other Alaska Native held jobs in the catcher-processor sector is also a potential environmental justice issue, but not for the Washington inland waters region.

Other/Alaska Native Specific Environmental Justice Issues: CDQ Regions and Community Outreach

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. CDQ region existing conditions are discussed in detail in Appendix F(4), and additional information is also presented in Section 2.5.1.4 ("The CDQ Fishery") and in the RIR (Appendix C to this document) in Section 1.4.3.4. (CDQ specific impacts potentially resulting from the alternatives are summarized in Section 4.12.2).

In terms of specific outreach to include Alaska Native populations in this EIS process, in addition to contacts appropriate for government-to-government consultations, Alaska Native groups were contacted individually over and above the regular scoping process notifications. This was to ensure the opportunity for these entities to provide input and receive information consistent with the notification and disclosure intent of environmental justice concerns. Specific notification of Alaska Native communities and entities was conducted utilizing a contact list developed during the recent North Pacific groundfish programmatic SEIS effort. During that effort, NMFS obtained from the Bureau of Indian Affairs (BIA) a list of all governmental entities that are formally recognized by the federal government as tribal governments in Alaska. A subset of this state-wide list was created by employing (and extending) the CDQ eligibility criteria (summarized in Appendix F(4)), including using a 50 nautical mile buffer from the coast, but enlarging the area from just the Bering Sea/Aleutian Islands area to additionally encompass the entire Alaskan Gulf of Alaska coast. All of entities on the BIA list that fell within this 50 nautical mile wide swath inland from the coast were placed on the contact list for the groundfish programmatic SEIS, and this same contact list was, in turn, used for this Steller sea lion SEIS contact process. This list, containing some 125 Alaska Native entities, appears in Appendix B, along with a copy of the letter that was sent to all entities on the list.