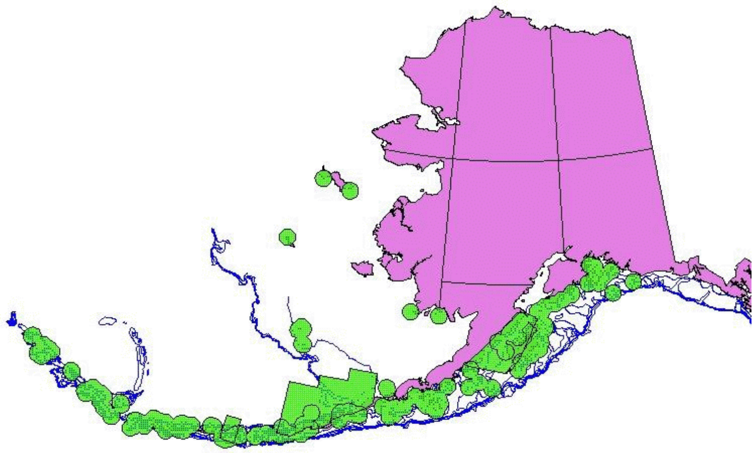
Draft Environmental Assessment

Interactions Between the Pacific Cod Fisheries

in the Bering Sea, Aleutian Islands, and the Gulf of Alaska

and Steller Sea Lions



Agency: National Marine Fisheries Service

Activities Considered: Management measures to mitigate potential impacts between the Federally managed Bering Sea and Aleutian Islands Area (BSAI) and the Gulf of Alaska (GOA) groundfish fisheries for Pacific cod, and the endangered western population of Steller sea lions.

For Further Information Contact: Shane Capron
NMFS - Alaska Region
PO Box 21668, Juneau AK 99802

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Abstract: This document explores a range of three alternatives to modify the Pacific cod fisheries to avoid competition with the Endangered western population of Steller sea lions. Alternative 1, the status quo, results in temporal and spatial concentration of the fishery in critical habitat. Alternatives 2 and 3 would temporally and spatially disperse the Pacific cod fishery. Actions include protecting rookeries and haulouts, multiple fishery seasons, and limits to fishing for Pacific cod inside critical habitat.

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1.0 Purpose and Need for Action

1.1 Introduction

Management of the Federal groundfish fishery located off Alaska in the 3 to 200 nautical mile U.S. Exclusive Economic Zone (EEZ) is carried out under the Fishery Management Plan (FMP) for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area (BSAI) and the FMP for the Groundfish of the Gulf of Alaska (GOA). These FMPs and their amendments are developed under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The purpose of the FMPs is to manage the groundfish fisheries for optimum yield (OY) and to allocate harvest among user groups. The FMPs, their amendments and regulations (found at 50 CFR part 679), must also comply to other applicable Federal laws and executive orders, notably the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act, Executive Order (E.O.) 12866, and the Regulatory Flexibility Act.

The entire population of Steller sea lions in the United States 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, NMFS reclassified Steller sea lions 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.

Section 7(a)(2) of the ESA, 16 U.S.C. § 1531 et seq., requires that each Federal agency shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. When the action of a Federal agency may adversely affect a protected species, that agency is required to consult with either NMFS or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. For the actions described in this document, the “action” agency is the Sustainable Fisheries Division of NMFS. The consulting agency is the Office of Protected Resources (OPR), also of NMFS. Section 7(b) of the Act requires that the consultation be summarized in a biological opinion detailing how the action may affect protected species.

The NMFS’s OPR, on December 3, 1998, issued a biological opinion (NMFS 1998a) on three fisheries proposed for 1999 through 2002 by NMFS: (1) the authorization of an Atka mackerel fishery from 1999 to 2002 under the Groundfish Fishery Management Plan of the BSAI; 2) the authorization of the a pollock fishery from 1999 to 2002 under the Groundfish Fishery Management Plan of the BSAI; and 3) the authorization of the pollock fishery from 1999 to 2002 under the Groundfish Fishery Management Plan of the GOA. The Opinion concluded that the pollock fisheries, as proposed for 1999 to 2002, were likely to jeopardize the endangered western population of Steller sea lions and destroy or adversely modify their critical habitat. The Opinion did not prescribe an entire set of reasonable and prudent alternatives (RPAs) for the two pollock fisheries, but rather established a framework to avoid the likelihood of jeopardizing the continued existence of Steller sea lions or adversely modifying their critical habitat. This framework included guidelines (ranging from specific to general) for management measures to achieve three principles: 1) protection of waters adjacent to rookeries and haulouts, 2) temporal dispersion of the pollock fisheries, and 3) spatial dispersion of the fisheries. These three principles, in combination, were intended to modify the fisheries to avoid jeopardy and adverse modification.

On December 13, 1998, the Council recommended a set of management measures for the pollock fisheries based on these principles to avoid jeopardy and adverse modification. On December 16, those measures were incorporated (with some modification) into the December 3rd opinion (NMFS 1998b) and, on January 22, 1999, the measures were published in an emergency rule for the 1999 pollock fisheries. The emergency rule extended until July 19, 1999. Therefore, at its June 1999 meeting, the Council made further recommendations for the later half of 1999 (extension of the emergency rule) and for 2000 and beyond (permanent rule). On December 23, 1999, OPR issued a biological opinion on the Authorization of the BSAI and GOA groundfish fisheries based on Total Allowable Catch (TAC) specifications recommended by the North Pacific Fishery Management Council (Council) for 2000; and authorization of both BSAI and GOA groundfish fisheries based on statutes, regulations, and management measures to implement the American Fisheries Act of 1998 (NMFS 1999).

These biological opinions focused primarily on the groundfish fisheries for walleye pollock but also identified areas of concern with respect to the potential for competition between fisheries for Pacific cod (*Gadus macrocephalus*; Pacific cod) and the western population of Steller sea lions. Pacific cod is among the top prey items for Steller sea lions during the winter period from December through March, occurring in 17% - 40% of scats that contain identifiable prey items. These data are consistent with results from earlier studies (NMFS 1995). The greatest frequency occurrence of Pacific cod in the scat samples are from those collected in the GOA (approximately 40%). The scat analyses indicated that Pacific cod also occurs in the diet of Steller sea lions during summer months, but at lower frequencies. The fishery for Pacific cod is conducted with bottom trawl, longline, pot, and jig gear. Fishing generally occurs in depths less than 150 meters. In the BSAI, 4 percent of the total allowable catch (TAC) is allocated to trawl fishing, 51 percent to longline and pot fishing combined, and 2 percent to jig fishing. In the GOA, Pacific cod is allocated between the processing components, 90 percent to inshore and 10 percent to the offshore component. The catch of Pacific cod occurs primarily in the winter months (January - April) in both the BSAI and the GOA. This indicates considerable overlap in time and space between the time the Pacific cod fishery occurs in the BSAI and the GOA, and when and where Pacific cod is consumed by Steller sea lions.

Based on those concerns, the opinions included conservation recommendations requesting that NMFS and the Council further investigate the potential for competition between the Pacific cod fishery and the western population of Steller sea lions. These recommendations were based on the best scientific and commercial data at the time of the 1998 and 1999 consultations. NMFS and the Council recognized the uncertainty in these data with respect to potential competition between the western population of Steller sea lions and the BSAI and GOA fisheries for Pacific cod, but also recognized the continuing responsibility to make a reasonable effort to develop and analyze additional data (51 FR 19952) with respect to this potential for competition.

Because the western population of Steller sea lion is endangered, any Federally-approved groundfish management plan is considered a major action subject to the requirements of the NEPA and, therefore, cannot be authorized until an environmental analyses has been prepared. To fulfill this responsibility, NMFS, the Council and the Alaska Department of Fish and Game (ADFG) has completed additional studies, and evaluated the issue of competition between Steller sea lions and the BSAI and GOA Pacific cod fisheries under a status quo alternative as well as two other alternatives that would substantially reconfigure the Pacific cod fisheries. These analyses will be provided to the Council in September 2000, and are provided in this environmental assessment for review prior to that meeting.

1.2 Purpose and Need

The purpose of this action is to develop and implement management measures that reduce or eliminate competition between the Pacific cod fisheries and Steller sea lions by precluding fisheries around rookeries and major haulouts and by dispersing the fishery over time and space to minimize the likelihood of locally depleting prey resources to foraging sea lions that might lead to adverse modification of habitat.

1.3 Scope of the EA

NMFS established a framework approach to avoiding jeopardy and adverse modification of habitat in the 1998 and 1999 biological opinions on the groundfish fisheries that allowed input by the Council and the public. NMFS's 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 pulsed or derby fishing, and 3) spatially disperse the fisheries to reduce the probability of localized depletions from concentration of catch in local areas. NMFS used these three principles as the foundation for its 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.

This framework was used to initially evaluate the potential for competition between the Pacific cod fisheries and Steller sea lions. The initial analysis was provided to the Council at it's April 2000 meeting as a discussion paper. In that document NMFS identified issues of concern with respect to the GOA and BSAI Pacific cod fisheries, and their potential effects on the western population of Steller sea lions. Data were sufficient to indicate that there may be an impact by the Pacific cod fishery to the western population Steller sea lions and their habitat based on the likelihood for competition between the fishery and Steller sea lions. The evidence was not conclusive, but indicated a need to further evaluate the possibility that the Federal Pacific cod fishery was competing with the western population of Steller sea lions.

The scope of this document is, therefore, to analyze alternatives to the status quo Pacific cod fishery in the BSAI and GOA to mitigate the impacts of this potential competition.

1.3.1 Related NEPA Documents

The original EIS for the BSAI and GOA FMPs were completed in 1981 and 1979 respectively. NMFS issued a Supplemental Environmental Impact Statement (SEIS; NMFS 1998c) in December 1998. This

SEIS analyzed the impacts of fishing under the FMPs over a range of TAC alternatives. Only July 9, 1999, the United States District Court for the Western District of Washington concluded that the SEIS was limited in scope and did not adequately consider the entirety of the FMPs. On October 1, 1999, NMFS announced its intention to prepare a programmatic SEIS for the BSAI and the GOA Groundfish FMPs.

In addition to these documents, three other documents describe the possible impacts of implementing similar Steller sea lion conservation measures under emergency interim regulations:

! Environmental Assessment, dated January 1999, for the first emergency interim rule to implement Reasonable and Prudent Alternatives (NMFS 1999a);

! Environmental Assessment, dated July 1999, for the extension of the first emergency interim rule to further implement Reasonable and Prudent Alternatives (NMFS 1999b); and

! Environmental Assessment, dated January 2000, for the second emergency interim rule to implement Revised Final Reasonable and Prudent Alternatives (NMFS 2000).

Each of the environmental assessments is an expansion of the first, incorporating new information and new alternatives as they became relevant. These documents initially served to inform the Council on the possible physical, biological, and economic consequences of various reasonable and prudent alternative options allowable under the guidelines of the 1998 biological opinion. As such, these environmental assessments show options and sub-options under each alternative that may or may not have been viable actions as required by the 1998 biological opinion.

1.3.2 Issues Studied In Detail

This document will highlight the areas of concern that arise from implementing the possible alternatives. The following issues will be studied in detail in this document:

- Pacific cod stock status and biomass distribution;
- Temporal and spatial distribution of Pacific cod fishing effort;
- Prey availability for Steller sea lions;
- Areas of special concern for Steller sea lions;
- Other marine mammals;
- Sea birds;
- Bycatch of prohibited species;
- Incidental catch of other groundfish species;
- Essential fish habitat; and
- Socioeconomic impacts.

1.4 Public Participation

These analyses were 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 Pacific cod fishery and the western population of Steller sea lions. The issue was first discussed at the April 2000 Council meeting in Anchorage, Alaska. A discussion paper was presented at the June 2000 Council meeting in Portland, Oregon, that outlined data available at that time which indicated the potential for competition. The public and the Council's Advisory Panel provided to NMFS recommendations for additional analyses that would help in further discussions. At that meeting, two public meetings were scheduled; the first occurred in Kodiak, Alaska on June 27, 2000, and the second was held in Seattle, Washington, on June 29, 2000. Notification of these meetings was published in the Federal Register on June 21, 2000 (65 FR 38508). Both of these meetings provided additional opportunity for further comment and recommendations. The intent of the special September 2000 Council meeting is to review possible protection measures for Steller sea lions.

1.6 Decisions That Must Be Made And Applicable Regulatory Requirements

NMFS will issue a comprehensive biological opinion on the groundfish fisheries in the BSAI and GOA by October, 2000. In anticipation of management measures for the Pacific cod fisheries which may be required by that Biological Opinion, this EA analyzes a range of alternatives that potentially could mitigate the impacts of the fishery on Steller sea lions. The Council is expected in October to take final action on this issue, recommending either the status quo (if appropriate) or alternatives which would require regulatory changes to the fishery to be implemented by NMFS under an emergency rule before the 2001 fishery would begin. This would then be followed by permanent rulemaking.

2.0 DESCRIPTION OF THE ALTERNATIVES

2.1 NEPA Guidance for Alternatives

Because the western population of Steller sea lion is endangered, any Federally-approved groundfish management plan is considered a major action subject to the requirements of the National Environmental Policy Act (NEPA) and, therefore, cannot be authorized until an environmental analyses has been prepared. NEPA guidelines require consideration of several, or a range of, alternatives, to be evaluated in addition to the proposed action and the environmental impacts of activities, in this instance, fishing, under each of these management alternatives to be evaluated. Three alternatives are, therefore, presented for analytical purposes. These can be evaluated from information and analysis provided in Chapter 3 (Environmental Consequences of the Alternatives) and Chapter 4 (Economic Consequences of the Alternatives). These chapters present the issues and impacts, thus providing the basis for choice among alternatives by the agency and the public.

2.2 Background and History Specific to Understanding the Process Used to Formulate the Alternatives for this Federal Action

The Steller sea lion species in the United States 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, NMFS reclassified Steller sea lions 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.

The decline of the western population of Steller sea lions is not the result of a single factor, and to search for *the single cause* is a misleading oversimplification. Multiple factors have contributed to the decline, and multiple factors may still be preventing recovery. The identification of one such factor does not rule out the possibility that others are also acting, perhaps synergistically, to prolong the decline. Furthermore, the causes for the decline appear to include both natural and anthropogenic influences. Major changes have occurred in the BSAI and GOA ecosystems. Variation in physical and biological factors, in combination, likely contributed to the observed shift in trophic structure, and the dominance of pollock and flatfish in these systems. However, at the same time, the BSAI and GOA ecosystems have experienced the development and expansion of major fisheries for essential sea lion prey. Between the late 1950s and the early 1990s, the total annual removal of groundfish from Alaskan waters increased from about 27,000 mt to about 2.1 million metric tons (mmt). Growth of the fishery and decline of Steller sea lions coincided in time and space, and the two overlapped in target (or prey) species. With respect to Steller sea lions, however, fisheries target important prey resources at times and in areas where Steller sea lions forage.

In the face of all these changes and influencing factors, the western population of Steller sea lions has not been able to maintain itself. The available evidence suggests that a significant part of the problem is lack of available prey. Studies of animals collected in the GOA in 1975-1978 and 1985-1986 indicate that animals in the latter collection were smaller, took longer to reach reproductive maturity, produced fewer offspring, tended to be older, and exhibited signs of anemia --- all observations consistent with the hypothesis of nutritional stress. In addition, survival of juvenile animals appeared to have dropped in both the eastern Aleutian Islands (Ugamak Island) and the GOA (Marmot Island). These results, the evidence of substantial changes in the physical and biological features of the BSAI and GOA ecosystems, and the expansion of fisheries in these regions all support the contention that lack of available prey has contributed significantly to the past decline of the western population, and may still be so contributing. 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.

2.2.1 History of Federal Actions Affecting Steller Sea Lions or Their Critical Habitat

In 1989, the Environmental Defense Fund and 17 other environmental organizations petitioned NMFS to list all populations of Steller sea lions in Alaska as endangered. 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. Since 1990, the decline, while continuing, has slowed to an average of about 5 percent per year.

Concurrent with the sea lion decline, Alaskan groundfish fisheries underwent a period of unprecedented growth. Between the late 1950s and the early 1990s, the total annual removal of groundfish from Alaskan waters increased from about 27,000 mt to about 2.1 million metric tons (mmt). The fishing fleets of Japan and the Soviet Union were the first to exploit the region's groundfish resources in the 1950s, targeting Pacific ocean perch and yellowfin sole. By the early 1960s, trawl fisheries for walleye pollock and Pacific cod were established. By the late 1970s, American catcher boats had formed joint ventures with foreign processing vessels, beginning the domestication of Alaska groundfish fishing. Growth of the fishery and decline of the sea lion coincided in time and space, and the two overlapped in target (or prey) species. The following chronology describes management efforts taken to protect Steller sea lions, and to evaluate and mitigate the potential for competition between the sea lion and fisheries in the BSAI and GOA.

1990 --- On April 5, 1990, NMFS issued an emergency interim rule (55 FR 12645) to list the Steller sea lion as a threatened species under the ESA and established emergency interim measures to begin the population recovery process. NMFS implemented the following emergency conservation measures:

1. Monitoring of incidental take and monthly estimates of the level of incidental kill of Steller sea lions in observed fisheries.

2. Aggressive enforcement of protective regulations, especially as they relate to intentional, lethal takes of Steller sea lions.

3. Establishment of a Recovery Team to provide recommendations on further conservation measures.

4. Prohibition of shooting at or within 100 yds of Steller sea lions (this did not apply to Alaska native subsistence hunting).

5. Establishment of 3 nm “no-approach” buffer zones around the principle Steller sea lion rookeries in the GOA and AI.

6. Reduction of incidental kill quota from 1,350 to no more than 675 Steller sea lions.

Fritz et al. (1995) summarized the rationale supporting these actions and reviewed their impact on the groundfish fishing industry. NMFS issued the final rule for the Steller sea lion listing as threatened under the ESA and for the above actions on November 26, 1990 (55 FR 49204). NMFS also appointed a Recovery Team in 1990.

1991 --- On January 7, 1991, NMFS issued a final rule to implement regulations for BSAI/GOA FMP amendments 14/19 that limited pollock roe-stripping and seasonally allocated the pollock TAC in the BSAI and GOA (56 FR 492). For BSAI fisheries, the pollock TAC was divided between an A (roe) season and a B season (summer-fall). In the GOA fisheries, the pollock TAC for the Central and Western (C/W) Regulatory Areas was divided into 4 equal seasons. NMFS noted in the proposed rule (55 FR 37907, September 14, 1990) that "shifting fishing effort to later in the year may reduce competition for pollock between the fishery and Steller sea lions whose populations have been declining in recent years". Also, given the recent listing of Steller sea lions as threatened under the ESA, a conservative course of action seemed prudent.

The listing of the Steller sea lion also prompted NMFS to initiate section 7 consultation on the GOA and BSAI FMPs. On April 5, 1991, NMFS issued biological opinions to evaluate the potential impacts of the pertinent fisheries on endangered and threatened species, including the Steller sea lion. The potential adverse effects to Steller sea lions of the GOA and BSAI groundfish fisheries include: 1) reduction of food availability (quantity and/or quality) due to harvest; 2) unintentional entanglement of marine mammals in fishing gear; 3) intentional harassment (including killing and wounding) of animals by fishermen; and 4) disturbance by vessels and fishing operations. Both biological opinions concluded that the fishery was not likely to jeopardize the continued existence and recovery of the Steller sea lion. The following conservation recommendations were made:

1. NMFS should expand its research effort and initiate projects specifically designed to assess the effects of fisheries on Steller sea lion, their prey, and their feeding efficiency.

2. Law enforcement efforts should be increased to ensure compliance with Steller sea lion rookery buffer zones and shooting prohibitions.

3. NMFS should continue the Steller sea lion public relations and fishery information effort to maintain awareness of the Steller sea lion decline and conservation prohibitions in place.

4. NMFS should work with the State of Alaska to obtain more accurate estimates of the subsistence take of Steller sea lions.

5. NMFS and the State of Alaska should initiate an outreach program to facilitate efficient taking, as well as to obtain biological data from harvested animals.

On June 5, 1991, NMFS issued a biological opinion that focused on the potential effects of the GOA pollock fishery, as specified in the 1991 TAC specification, on food availability to Steller sea lions. Although the opinion concluded that the GOA 1991 pollock TAC specification was not likely to jeopardize the continued existence of any endangered or threatened species under NMFS' jurisdiction, the opinion noted that changes in the temporal and spatial distribution of the pollock fishery may have contributed to the Steller sea lion decline. Specifically, the fishery operated more in fall and winter, caught the quota in less time, and fished more often in areas later designated (in 1993) as Steller sea lion critical habitat under the ESA (Fritz *et al*. 1995).

On June 19, 1991, NMFS issued an emergency interim rule (effective through September 17, 1991) to ensure that pollock fishing did not jeopardize the continued existence or recovery of the threatened Steller sea lion (56 FR 28112). The preamble to this rule referenced the April 19 and June 5, 1991 biological opinions. The rule contained measures to protect the Steller sea lion by:

1. allocating the pollock TAC for the combined W/C Regulatory Areas equally between two subareas located east and west of 154°W,

2. limiting the amount of unharvested pollock TAC that may be rolled over to subsequent quarters in a fishing year, and

3. prohibiting fishing with trawl gear in the EEZ within 10 nm of 14 Steller sea lion rookeries.

On September 19, 1991, NMFS extended the above measures through December 16, 1991 (56 FR 47425).

NMFS reinitiated Section 7 consultation on the GOA pollock fishery because the 1991 3rd quarter pollock TAC was exceeded by 26%. On September 20, 1991, NMFS concluded that because of the small size of the 4th quarter harvest (27,000 mt), a fishery-caused reduction in local abundance of pollock, and thus, availability to Steller sea lions, does not appear likely. This opinion concluded that the proposed 1991 4th quarter pollock harvest was not likely to jeopardize the continued existence or recovery of Steller sea lions.

Since 1991, NMFS has conducted numerous section 7 informal consultations on the effects of various GOA and/or BSAI groundfish fishery management actions on Steller sea lions. In these instances, NMFS determined that the action was not likely to affect listed species under NMFS' jurisdiction in a way that was not already considered in previous biological opinions, therefore, section 7 formal consultation was not required.

Section 4(f) of the ESA requires NMFS to develop and implement plans for the conservation and survival of endangered and threatened species. NMFS had appointed a Steller Sea Lion Recovery Team to draft a Recovery Plan, and the draft Recovery Plan was released for public review and comment on March 15, 1991.

1992 --- On January 21, 1992, NMFS issued a biological opinion that evaluated the potential adverse effects of the 1992 BSAI fishery on Steller sea lions and concluded that the 1992 TAC specifications and the BSAI groundfish fishery were not likely to jeopardize their continued existence and recovery. The biological opinion also included the following discretionary conservation recommendation:

> "NMFS should amend the BSAI FMP to provide a mechanism to spatially allocate TACs in the Aleutian Islands in the future. For example, Atka mackerel are abundant in shelf waters near AI Steller sea lion rookeries and are eaten by Steller sea lions. Presently, the Atka mackerel harvest is only a minor component of the exploitable biomass and spatial and/or temporal concentration of the fishery is not expected to have any biological significance. However, if yearly TACs

increase, as appears likely, spatial distribution of the harvest may be warranted to prevent local depletion of fish stocks."

On January 23, 1992, NMFS issued a final rule to implement amendments 20/25 to the BSAI and GOA FMPs (57 FR 2683). The amendments authorized regulations to protect marine mammal populations as follows:

1. prohibited trawling year-round within 10 nm of 37 Steller sea lion rookeries in the GOA and BSAI;

2. expanded the prohibited zone to 20 nm for 5 of these rookeries from January 1 through April 15 each year;

3. established 3 GOA pollock management districts; and

4. imposed a limit on the amount of an excess pollock seasonal harvest that may be taken in a quarter in each district.

On March 4, 1992, NMFS issued a biological opinion that evaluated the likely effects of the proposed BSAI FMP amendment 18 to proportionately allocate the yearly available harvest of pollock to inshore, offshore, and western Alaska community sectors of the BSAI fishing industry. This biological opinion concluded that based on the available data and management measures currently in place, that adoption of the proposed FMP amendment was not likely to jeopardize the continued existence and recovery of Steller sea lions. The biological opinion continued that "However, since the southeastern Bering Sea shelf is considered to be an important foraging habitat for Steller sea lions, concerns regarding fishery removals from this area remain. Therefore, NMFS will continue to evaluate the suitability of existing management measures for the BSAI fishery to ensure adequate protection of Steller sea lions and their essential habitats. Since knowledge regarding the relationship between Steller sea lions and the commercial fishery remains very limited, it is essential that results from 1992 fisheries and Steller sea lion research efforts be factored into this analysis.

Additional management measures for the southeastern Bering Sea shelf fishery that will be evaluated during 1992 include: (1) limits on total harvest from the southeastern Bering Sea shelf; (2) modification of Steller sea lion rookery buffer zones; and (3) limits on available pollock TAC in the "A" season. Evaluation and selection of an appropriate management regime will be conducted in consultation with the Council and the concerned public, and be completed prior to the start of the 1993 fishery."

1993 --- NMFS provided notice on January 7, 1993 that the final Recovery Plan for the Steller sea lion was available (58 FR 3008).

On March 12, 1993, NMFS issued a final rule to implement an expanded no-trawl zone around the Ugamak Island Steller sea lion rookery in the eastern Aleutian Islands during the pollock roe fishery season in the BSAI (58 FR 13561). The expanded zone was expected to better encompass Steller sea lion winter habitats and juvenile foraging areas in this portion of the southeastern Bering Sea shelf during the BSAI winter pollock fishery.

On April 28, 1993, NMFS issued a biological opinion that evaluated the potential effects on Steller sea lions of delaying the start of the BSAI pollock fishery "B" season from June 1 to August 15. NMFS concluded that it would take appropriate steps to ensure that delaying the BSAI "B" season would not result in a concentration of the BSAI fishery into the winter months and the southeastern Bering Sea shelf. Therefore, the proposed action was not likely to jeopardize the continued existence and recovery of Steller sea lions. Possible management measures to mitigate any significant increase in the winter fishery could include: 1) establishing a directed pollock fishery closure date of November 1 to ensure no increase in winter harvests, or 2) seasonally expanding rookery trawl closure zones until the entire “B” season TAC has been harvested to provide additional protection to Steller sea lion foraging areas.

On July 13, 1993, NMFS issued a final rule to implement regulations (BSAI FMP amendment 28) that subdivided the Aleutian Islands subdistrict into three subareas (areas 541, 542, 543) (58 FR 37660). This rule was implemented because of concerns that the concentration of fishery removals, particularly Atka mackerel, in the eastern Aleutian Islands could cause localized depletion of groundfish stocks. While dispersal of the Atka mackerel TAC was initiated to conserve fish, it was also consistent with the objectives of the fishery management measures enacted for Steller sea lion recovery.

On August 27, 1993, pursuant to the ESA, NMFS designated critical habitat for the Steller sea lion (58 FR 45269). The primary benefit of the designation is that it provides notice to Federal agencies that a listed species is dependent on these areas (and their features) for its continued existence and that any Federal action that may affect these areas (and their features) is subject to the consultation requirements of section 7 of the ESA.

On November 1, 1993, NMFS initiated a status review of the Steller sea lion to determine whether a change in classification to endangered is warranted (58 FR 58318). NMFS solicited comments and biological information concerning the status of the Steller sea lion to be used for consideration in its comprehensive review.

1994 --- On November 29-30, 1994, NMFS convened the Steller Sea Lion Recovery Team specifically to consider the appropriate ESA listing status for the Steller sea lion and to evaluate the adequacy of ongoing research and management programs. The Recovery Team recommended that NMFS list the Steller sea lion as two separate population segments, split to the east and west of 144°W. The Recovery Team also recommended that the western population segment be listed as endangered and the eastern population segment be listed as threatened.

1995 --- On February 22, 1995, NMFS Alaska Region (AKR) and the Alaska Fisheries Science Center AFSC) recommended to NMFS Headquarters that: 1) the U.S. Steller sea lion population should be managed as two distinct population segments under the ESA, split to the east and west of 144°W, and 2) that the listing status of the western population should be changed to endangered. The AKR/AFSC recommendation was supported by a draft proposed rule and a draft status review document.

1996 --- On January 26, 1996, NMFS reinitiated a section 7 formal consultation on the effects of the BSAI and GOA FMPs and the 1996 TAC specifications on the Steller sea lion. Although NMFS had evaluated the effects of proposed changes to both the BSAI groundfish fishery the GOA groundfish fishery since 1991, it had been over 4 years since the last formal consultation on either fishery. During this period, the Steller sea lion population had continued to decline. Furthermore, NMFS had also collected additional data on Steller sea lions and the GOA and BSAI groundfish fisheries.

NMFS concluded that the BSAI and GOA FMPs, fisheries, and harvests under the proposed 1996 TAC specifications were not likely to jeopardize the continued existence of Steller sea lions or to result in the destruction or adverse modification of their critical habitat. NMFS noted that “the reasons for the decline of Steller sea lion populations and the possible role of the fisheries in the decline remain poorly understood.

The biological opinion included the following conservation recommendations: (1) In consultation with the Steller Sea Lion Recovery Team, the Council, and other affected parties, NMFS should review the adequacy of existing buffer zones around Steller sea lion rookeries and the ecological consequences of various harvest strategies for groundfish; (2) In cooperation with the state of Alaska, NMFS should review the location, duration, and effects of state-managed herring and salmon fisheries; (3) NMFS should fund and/or undertake research to determine the local effects of fishing on sea lion prey resources.

The biological opinion also included an incidental take statement, in which NMFS specified an annual incidental take level of 15 sea lions for the GOA groundfish fishery and 30 for the BSAI groundfish fishery. NMFS also identified a (non-discretionary) reasonable and prudent measure necessary to minimize the impact of the incidental take: For both BSAI and GOA, NMFS must ensure that observers monitor the take of Steller sea lions incidental to the groundfish fisheries.

On March 12, 1996, NMFS issued a final rule to implement GOA FMP amendment 45 that combines the 3rd and 4th quarterly allowances for pollock in the 3 statistical areas of the combined W/C Regulatory Area into single seasonal allowances that will become available on September 1 of each fishing year (61 FR 9972).

1997 --- On January 17, 1997, NMFS issued a Decision Memorandum on the BSAI and GOA 1997 TAC Specifications with respect to Steller sea lion section 7 consultations. Based on available information on the fishery and Steller sea lions, NMFS determined that the GOA and the BSAI groundfish fisheries were not likely to affect Steller sea lions in a way or to an extent not already considered in previous section 7 consultations on these fisheries. Therefore, reinitiation of consultation under the ESA was not required.

On May 5, 1997, NMFS reclassified Steller sea lions as 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.

1998 --- On February 26, 1998, NMFS noted a) the conclusion of the 1996 opinion that the BSAI groundfish fishery was not likely to jeopardize the continued existence of Steller sea lions or destroy or adversely modify their critical habitat, and b) NMFS had previously determined that reinitiation of consultation was not required for the 1997 fishery because none of the elements that would trigger reinitiation had occurred. NMFS also noted that the 1996 biological opinion remained valid for the 1998 BSAI groundfish fishery.

On March 2, 1998, NMFS issued a biological opinion that evaluated the effects of the GOA FMP and the 1998 pollock TAC specifications on the Steller sea lion. NMFS concluded that the 1998 GOA fishery was not likely to jeopardize the continued existence and recovery of Steller sea lions or to adversely modify critical habitat. NMFS noted that the biological opinion only addressed the 1998 fishery, not the continued implementation of the GOA FMP beyond 1998. The Alaska Region would need to reinitiate Section 7 consultation for the fishery in 1999 and beyond.

The March 2, 1998 opinion authorized the same incidental take level that was authorized in the 1996 opinion (15 Steller sea lions for the GOA). The authorization would be re-evaluated when additional data become available on the number of sea lions injured or killed annually by gear associated with this fishery. No reasonable and prudent measures were identified.

NMFS included the following conservation recommendations in this biological opinion: (1) Fritz and Ferrero (1998), in an analysis of options in Steller sea lion recovery and groundfish fishery management, suggest three general categories of management measures that could be employed to minimize the effects of fishing on Steller sea lion recovery: (a) gear modifications or restrictions, (b) reductions in total catch, and (c) further temporal and spatial distribution of the fisheries. NMFS should carefully analyze and consider the potential benefits of these options; (2) Initiate studies of the efficacy of buffer zones as soon as possible; (3) Continue studies to determine the foraging range of young-of-the-year Steller sea lions; (4) Continue to educate the fishing community about Steller sea lions and techniques to reduce or eliminate incidental take of the species; (5) Conduct studies of the site-by-site relation between fishing effort and trends in juvenile survival or counts at nearby rookeries.

On March 17, 1998, NMFS issued regulations for amendments 36/39 to the BSAI and GOA FMPs (63 FR 13009). This action created a forage fish species category in FMPs and implemented associated management measures. Directed fishing for forage fish would be prohibited at all times in the Federal waters of the BSAI and GOA. The intended effect of this action was to prevent the development of a commercial directed fishery for forage fish, a critical food source for many marine mammal, seabird, and fish species. The proposed rule (62 FR 65402, December 12, 1997) stated that a) forage fish are important prey for marine mammals, seabirds, and commercially important groundfish species, and b) decreases in the abundance of these predators may be related to declines in forage fish.

On June 11, 1998, NMFS issued a final rule to change the seasonal apportionment of the pollock TAC in the W/C Regulatory Areas of the GOA by moving 10% of the TAC from the 3rd fishing season (starting September 1) to the 2nd fishing season (starting June 1; 63 FR 31939). This seasonal shift of TAC was a precautionary measure intended to reduce the potential impacts of pollock fishing on Steller sea lions by reducing the percentage of the pollock TAC that is available to the fishery during the fall and winter months.

At its June 1998 meeting, the Council adopted a precautionary approach by approving a regulatory amendment to reduce the probability of localized depletion of Atka mackerel in critical habitat for Steller sea lions. The Council recommended both spatial and temporal redistribution of the BSAI Atka mackerel TAC as a further sea lion protective measure.

On December 3, 1998, NMFS issued a biological opinion on the authorization of the BSAI Atka mackerel fishery (1999-2002) and the BSAI and GOA pollock fisheries (1999-2002) under the respective fishery management plans (NMFS 1998a). The opinion concluded that the BSAI and GOA pollock fisheries are likely to jeopardize the continued existence of the western population of Steller sea lions and adversely modify its designated critical habitat. The finding of jeopardy and adverse modification was based on 1) the major role of pollock in the diet of Steller sea lions, 2) the evidence that Steller sea lions are prey-limited, 3) the overlapping distributions of fishing and foraging by Steller sea lions, 4) the concentration of fishing effort in space (Steller sea lion critical habitat) and time (including during the winter period when sea lions may be more sensitive to competition for prey), and 5) the evidence of excessive local harvest rates in sea lion critical habitat in contrast to stock-wide harvest rates. Principles for a reasonable and prudent alternative and an example reasonable and prudent alternative were included in the December 3, 1998 opinion. The Council was asked to develop conservation measures to satisfy the principles of the reasonable and prudent alternative, and passed a motion consisting of a set of such conservation measures. NMFS incorporated that recommendation into the RPAs of the Biological

Opinion (with some modification, NMFS 1998b), and the resulting management measures were incorporated into an emergency rule to manage the pollock fisheries in the first half of 1999.

1999 --- In June 1999, NMFS returned to the Council for additional recommendations regarding management measure for the latter half of 1999 (an extension of the emergency rule) and for 2000 and beyond (a permanent rule). Again, the Council recommended a number of measures for avoiding jeopardy and adverse modification.

On July 9, 1999, United States District Court for the Western District of Washington ruled that the RPAs developed in December 1998 were arbitrary and capricious for lack of sufficient explanation. The Court remanded the RPAs back to NMFS for preparation of Revised Final Reasonable and Prudent Alternatives (RFRPAs), which were issued on October 15, 1999, and submitted to the Court on October 18, 1999. Those RFRPAs have been further challenged by both Plaintiffs and Defendant-Interveners, and remain the basis for ongoing litigation.

2000 --- On January 25, 2000, the Court denied a move by NMFS to dismiss the claim or need for a temporary stay of litigation pending completion and issuance of a comprehensive "groundfish consultation". In doing so the Court supported Plaintiff's claim that the BSAI and GOA FMPs in their entirety constitute on-going agency action under the ESA and that NMFS must prepare a biological opinion equal in scope to the FMPs. The Court determined that" until such time as a comprehensive opinion is in place, this court retains the authority to determine whether any continuing action violates the ESA and can provide effective relief by enjoining it or remedying its effects"

On July 20, 2000, the Court concluded that Plaintiffs have proven that continued trawl fishing in critical habitat "poses a reasonably certain threat of imminent harm" to Steller sea lions and their critical habitat. Accordingly, the Court granted Plaintiffs motion for partial injunction of the groundfish fisheries and enjoined all groundfish trawl fishing within Steller sea lion critical habitat in the BSAI and GOA west of 144 w. longitude until further order of this Court. The injunction went into effect on August 8, 2000.

2.2.2 Management Framework Specific to Formulating the Alternatives for this Federal Action

NMFS established a framework approach to avoiding jeopardy and adverse modification of habitat in the 1998 and 1999 biological opinions on the pollock fisheries that allowed input by the Council and the public. NMFS's 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. NMFS used these three principles as the foundation for its 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.

This framework was used to initially evaluate the potential for competition between the Pacific cod fisheries and Steller sea lions. The initial analysis was provided to the Council at it's April 2000 meeting as a discussion paper. In that document NMFS identified issues of concern with respect to the GOA and BSAI Pacific cod fisheries, and their potential effects on the western population of Steller sea lions. The information available indicated that (1) Pacific cod are a common prey of Steller sea lions, particularly in the winter, (2) relatively large portions of the fisheries occur in Steller sea lion critical habitat, (3) the fisheries occur at relatively shallow depths well within the range of Steller sea lions, and (4) portions of the fisheries are temporally concentrated in the late winter/spring period when sea lions may be particularly sensitive to reductions in availability of prey. However, the information available was not sufficient to determine if competition occurs to an extent that would appreciably reduce the likelihood of survival and recovery of the Steller sea lion in the wild or diminish the value their critical habitat.

The recommendation from the Council was that NMFS conduct further analyses to better evaluate the potential for competition between the Pacific cod fisheries and Steller sea lions. At the June 2000 meeting, it was recognized by the Council that the evidence was sufficient enough to suggest precautionary adjustments to the Pacific cod fisheries, and that NMFS should prepare an environmental assessment with a range of alternatives and their potential impacts. The Council also scheduled a special meeting in September in Anchorage, Alaska, to address this issue and make management recommendations, as appropriate, which would be implemented prior to the beginning of the 2001 Pacific cod fishery. In general, such management recommendations may be similar, but are not limited to those sought in the pollock and Atka mackerel fisheries. That is, they may focus on general principles of spatial and temporal dispersion, and protection of prey resources around rookeries and haulouts.

2.3 Detailed Description of Alternatives

The alternatives range from the status quo, which is likely to compete with Steller sea lions for prey resources, to Alternative 3 which, if adopted, would prohibit all fishing for Pacific cod in critical habitat. The main difference between each of the alternatives is the level of Pacific cod allowed to be taken inside critical habitat. Furthermore, under alternatives 2 and 3, catch is dispersed temporally to provide additional protection for Steller sea lions by maintaining a prey field which would allow for successful foraging.

The alternatives will be discussed and evaluated relative to the framework principles previously employed by NMFS, i.e., how does each alternative provide protection around rookeries and important haoulouts, and avoid competition in certain key time periods and foraging areas outside of critical habitat. Discussion of the overlap in niche between the Pacific cod fishery and Steller sea lions is detailed in section 3.2 of this document. The following provides for a simplified overview only, highlighting NMFS' major concerns and expected impacts under each alternative regime.

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2.3.1 Alternative 1: Status Quo

The Pacific cod fishery is the second largest Alaskan groundfish fishery. Catches in both the BSAI and the GOA have increased relatively steadily (more so in the BSAI fishery) since the late 1970s. In 1999, the TACs for Pacific cod constituted 9% of combined groundfish TAC in the BSAI and 22% of the combined TAC in the GOA. The fishery for Pacific cod is conducted with bottom trawl, longline, pot, and jig gear, generally at depths less than 150m. In the BSAI, 47% of the TAC is allocated to trawl fishing, 51% to longline and pot fishing combined, and 2% to jig fishing. In the GOA, Pacific cod is allocated between the processing components, 90% to inshore and 10% to offshore. In both the BSAI and the GOA, the observed changes in catch and harvest parallel a shift in the nature of the fisheries from foreign in the 1970s to joint venture in the 1980s and then domestic in the 1990s.

The trawl fishery is typically concentrated during the first few months of the year, whereas fixed-gear fisheries tend to occur in all months except the summer. 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. For all gear types combined, the catch from Steller sea lion critical habitat in the BSAI has approached and exceeded 120,000 mt and constitutes approximately half of the total catch of Pacific cod in all BSAI areas. In the GOA, the trawl fishery has centers of activity around the Shumagin Islands and south and east of Kodiak Island, while the longline fishery is located primarily in the vicinity of the Shumagin Islands. For all gear types combined, the catch from Steller sea lion critical habitat in the GOA has been around 40,000 mt or more in recent years and constitutes approximately 60% to 70% of the total catch of Pacific cod in all GOA areas.

The allocation of BSAI and GOA Pacific cod catch under the status quo alternative is as follows:

BSAI

These gear allocations should take effect in September 2000.

- CDQ: 7.5%
- The remainder is divided as follows:
  - Trawl: 47%
  - Jig: 2%
  - Hook-and-line or Pot: 51 %
    - After deduction of incidental catch in groundfish H&L and pot gear fisheries, the remainder would be divided as follows:
    - Freezer longliners: 80%
    - Pot: 18%
    - Catcher vessels less than 60 ft LOA: 1.4%
    - Catcher vessels using hook-and-line gear: 0.3%

NMFS, after consultation with the Council, may divide the directed fishing allowances allocated to vessels using hook-and-line or pot gear among the following three periods: January 1 through April 30, May 1 through August 31, and September 1 through December 31.

GOA

- 90% Inshore
- 10% Offshore

Seasons in the BSAI and GOA Pacific cod fisheries may be further adjusted annually through seasonal apportionments of Pacific halibut bycatch allowances. These seasonal apportionments of bycatch allowances are recommended annually by the Council as part of the annual harvest specifications process and based on determinations that provide for optimizing the amount of Pacific cod harvested under established bycatch restrictions.

Using the three principles in avoiding competition, protection of key areas, spatial, and temporal dispersion of fisheries, the status quo could be evaluated as follows:

Protection of key areas (rookeries and important haulouts): the Pacific cod fishery is significantly concentrated in areas critical to the foraging success of Steller sea lions.

Spatial dispersion: the Pacific cod fishery is significantly concentrated in Steller sea lion critical habitat.

Temporal dispersion: the Pacific cod fishery occurs primarily in the late winter/early spring, a time period recognized to be pivotal to the survival of juvenile Steller sea lions and nursing females. It is this time period that they are the most sensitive to anthropogenic changes to the Pacific cod resource.

2.3.2 Alternative 2

Under alternative 2 the harvestable amount of Pacific cod would be temporally allocated into 2 seasons: an A season during which only 40 percent of annual TAC could be taken, and a B season in which the remaining 60% could be harvested. Furthermore, TAC would be distributed by area in relation to biomass where known. Additionally, the BSAI would be split into two management areas each with its own TAC (Bering Sea and Aleutian Islands).

Using the three principles in avoiding competition, protection of key areas, spatial, and temporal dispersion of fisheries, Alternative 2 could be evaluated as follows:

Protection of key areas (rookeries and important haulouts): rookeries and important haoulouts would be protected to 20 nm in the EBS, and to 10 nm in the AI and GOA.

Spatial dispersion: the BSAI would be split into two distinct areas further protecting against disproportionate harvest rates, and harvest in critical habitat would be limited to the amount of Pacific cod biomass estimated to occur there. Where critical habitat biomass is not known, a proxy value will be used until such time as improved analytical methods can be developed or surveys can be conducted to estimate the value.

Temporal dispersion: the Pacific cod fishery would be dispersed evenly over two seasons limiting the opportunity for localized depletions to occur, especially in areas known to experience intense fishing pressure.

Compared to Alternative 1, this approach provides an increased level of protection for foraging Steller sea lions by reducing the likelihood of competition for prey resources with the Pacific cod fishery. Key areas would be protected from fishing, allowing for an undisturbed prey field, and foraging areas outside of this core area would be protected from localized depletions by reducing the level of fishing effort both spatially and temporally. This type of fishing regime has been previously employed for pollock and has resulted in diminished intensity of fishery removals of pollock in both time and space (see maps of fishing effort on NMFS web site at http://www.refm.noaa.gov/stocks/CPUE/ebharvests.html).

BSAI - Create a separate Aleutian Islands management area for Pacific cod with a separate TAC

<u>Bering Sea Subarea</u>

	Seasonal % of Annual TAC	
Area	**A** (Jan. 20 - April 30)	**B** (May 1 - Nov. 1)
Bering Sea harvest amount	**40%**	**60%**
Limit within Bogoslof Foraging Area (critical habitat within the Sea Lion Conservation Area [SCA])	**20%**	Based on avg survey biomass in SCA (1995-99) 6%. **Limit** = (6%*60%) = **3.6%**

Close rookeries and important haulouts to fishing for Pacific cod (same sites as previously considered for pollock trawl exclusion zones under the December 1998 biological opinion; see Table 1)

Options:
- Use CPUE relative biomass estimate in critical habitat for the winter limit
- Consider Jan. 1 fixed gear start date
- Consider later start date for B season
- Separate gear allocations of the CH limit
- Consider using the SCA management area instead of CH in the Bering Sea
- Consider no B season CH limit (closure around rookery and haulout sites only)

Aleutian Islands Area

	Seasonal % of Annual TAC	
Area	**A** (Jan. 20 - April 30)	**B** (May - Nov. 1)
Aleutian Islands harvest amount	**40%**	**60%**
Limit within critical habitat	**20%**	Based on survey biomass in CH (1997) 80.5% **Limit** = (80.5%*60%) = **48.3%**

Close rookeries and important haulouts to fishing for Pacific cod (same sites as previously considered for pollock trawl exclusion zones under the December 1998 biological opinion with additional sites for the Aleutians Islands Area; see Table 1)

Options:
- Close the Aleutian Islands to fishing for Pacific cod

GOA

		Seasonal % of Annual TAC	
Area	**A** (Jan. 20 - April 30)	**B** (May 1 - Nov. 1)	
GOA harvest amount	**40%**	**60%**	
Limit within critical habitat	**20%**	Based on survey biomass in CH (1999) = 53% **Limit =** (53%*60%) **= 31.8%**	
		Western Limit	*Central Limit*
		Biomass = 66% Limit = (66%*60%) = **39.6%**	Biomass = 45% Limit = (45%*60%) = **27%**

Close rookeries and important haulouts to fishing for Pacific cod (same sites as previously considered for pollock trawl exclusion zones under the December 1998 biological opinion; see Table 1)

Continue Western/Central TAC apportionments

Options:
- Consider no B season CH limit (closure around rookery and haulout sites only)
- July 1 B season start date

Alaska State Fishery: to be considered for parallel action by the State of Alaska (not part of this action)
- Close rookery and important haulouts to fishing for Pacific cod (Table 1)
- Two fishery seasons

2.3.3 Alternative 3

Under Alternative 3, all of Steller sea lion critical habitat would be closed to fishing for Pacific cod for all gear types. Additionally, fishing outside of critical habitat would be dispersed into three seasons.

Using the three principles in avoiding competition, protection of key areas, spatial, and temporal dispersion of fisheries, Alternative 3 could be evaluated as follows:

Protection of key areas (rookeries and important haulouts): rookeries and important haulouts would be protected to 20 nm in all areas. Additional haulout sites which haven't been used extensively in recent years would also be protected.

Spatial dispersion: The BSAI would be split into two distinct areas further protecting against disproportionate harvest rates. Critical habitat would be protected from directed fishing for Pacific cod. With no reduction in TAC, harvest rates outside of critical habitat would be proportionally higher than Alternative 2.

Temporal dispersion: the Pacific cod fishery would be dispersed over three seasons limiting the opportunity for localized depletions to occur, especially in areas known to experience intense fishing pressure.

Compared to Alternatives 1 and 2, this approach provides an increased level of protection for foraging Steller sea lions by minimizing competition for prey resources with the Pacific cod fishery. All of critical habitat would be protected from fishing, allowing for a large area with an undisturbed prey field, and foraging areas outside of this core area would be protected from localized depletions by reducing the level of fishing effort both spatially and temporally. This scenario is much more restrictive than the two previous actions taken for pollock and Atka mackerel.

BSAI: Create a separate Aleutian Islands management area for Pacific cod with a separate TAC

Close all of Steller sea lion critical habitat (CH) west of 144 degrees west longitude to directed fishing for Pacific cod (listed under 50 CFR part 223.202).

<u>Bering Sea subarea</u>

Season	Dates	Percent of annual TAC outside CH
A	Jan. 20 - April. 30	40%
B	May 1 - August 31	30%
C	Sept. 1 - Nov. 1	30%

Aleutian Islands Area

Season	Dates	Percent of annual TAC outside CH
A	Jan. 20 - April. 30	40%
B	May 1 - August 31	30%
C	Sept. 1 - Nov. 1	30%

Options:
- Close Pacific cod fishing in the Aleutian Islands

GOA

Season	Dates	Percent of annual TAC outside CH
A	Jan. 20 - April. 30	40%
B	May 1 - August 31	30%
C	Sept. 1 - Nov. 1	30%

3.0 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

3.1 Effects on Pacific cod in the BSAI

The purpose of this section of the document is to describe the Pacific cod fishery and display the impacts on the Pacific cod stock itself that could occur under the various alternatives presented.

3.1.1 Stock Description and Life History

Pacific cod (*Gadus macrocephalus*) is a demersal species that occurs on the continental shelf and upper slope from Santa Monica Bay, California through the Gulf of Alaska, Aleutian Islands, and eastern Bering Sea to Norton Sound (Bakkala 1984). The Bering Sea represents the center of greatest abundance, although Pacific cod are also abundant in the Gulf of Alaska and Aleutian Islands. Bering Sea, Aleutian Islands, and Gulf of Alaska cod stocks are genetically indistinguishable (Grant et al. 1987), and tagging studies show that Pacific cod migrate seasonally over large areas (Shimada and Kimura 1994).

Spawning takes place between January and May in the sublittoral-bathyal zone (40-290 m) near bottom as Pacific cod converge in large spawning masses. Major aggregations occur between Unalaska and Unimak Islands, southwest of the Pribilof Islands and near the Shumagin group in the western Gulf of Alaska (Shimada and Kimura 1994). Eggs sink to the bottom after fertilization and are somewhat adhesive (Hirschberger and Smith 1983). Optimal temperature for incubation is 3-6° C, optimal salinity is 13-23 ppt, and optimal oxygen concentration is from 2-3 ppm to saturation. Little is known about the optimal substrate type for egg incubation. Eggs hatch in about 15-20 days. Larvae undergo metamorphosis at about 25-35 mm. Little is known about the distribution of Pacific cod larvae, although a small number of observations from the Gulf of Alaska indicate that larvae may be pelagic, occurring in the upper 45 m of the water column. Juvenile Pacific cod are demersal. Juveniles start appearing in trawl surveys at a fairly small size, as small as 10 cm. Juvenile distribution is concentrated over the inner to mid-continental shelf, at depths of 60-150 m. During the non-spawning season, adults are distributed broadly across the continental shelf, and are occasionally found on the upper slope as well. Preferred substrate is soft sediment, from mud and clay to sand.

Adults can grow to be more than a meter in length, with weights in excess of 15 kg. Length-at-age schedules are compared for the Bering Sea and Gulf of Alaska areas in Figure 1, and weight-at-age schedules are compared for the same two areas in Figure 1 (area-specific schedules for the Aleutian Islands have not been computed).

The maximum recorded age of a Pacific cod from the Bering Sea, Aleutian Islands, or Gulf of Alaska is 19 years. Estimates of natural mortality for this species vary widely and range from 0.29 (an estimate obtained for the eastern Bering Sea stock by Thompson and Shimada 1990) to 0.83-0.99 (an estimate obtained for the Canadian stock by Ketchen 1964). For stock assessment purposes, a value of 0.37 is used in both the BSAI and the GOA.

The maturity-at-length schedule for the Bering Sea stock is shown in Figure 1, indicating that 50% of Pacific cod are estimated to reach maturity by the time they reach 67 cm in length, or about 6 years of age. Lacking area-specific information, the same maturity-at-length schedule is assumed to apply in the Aleutian Islands and Gulf of Alaska.

Migratory patterns of Pacific cod are not fully understood. Shimada and Kimura (1994) analyzed 353 recoveries of fish tagged (mostly in the Bering Sea) during the period 1982-1990. These fish were shown to undergo an annual cyclic migration as follows: beginning from summer feeding grounds inside Bristol Bay, the fish moved onto the shelf edge in the fall, then onto spawning grounds (described above) in the winter, followed by a return to the summer feeding grounds. It was clear that some fish from the Bering Sea moved into the Gulf of Alaska. However, the locations of tag releases and the number of tag recoveries made it difficult to quantify migration rates, to demonstrate migration from the Gulf of Alaska into the Bering Sea, or to determine migration patterns on finer scales.

3.1.2 Trophic Interactions

Pacific cod are omnivorous and are primarily benthic feeders that consume both invertebrates and fish. Livingston (1991) characterized the diet of Pacific cod in the Bering Sea as having polychaetes, amphipods, and crangonid shrimp as the most frequently occurring items in the stomach contents. In terms of numbers of individual organisms consumed, the most important items were euphausiids, miscellaneous fishes, and amphipods; and in terms of weight of organisms consumed, the most important items were pollock, fishery offal, and yellowfin sole. Small Pacific cod were found to feed mostly on invertebrates, while large Pacific cod (< 60 cm) were mainly piscivorous, although the proportion of fish in the diet varied by year. Pollock is the dominant fish prey of large cod in the eastern Bering Sea. During summer, it is consumed by Pacific cod across large parts of the middle and outer shelf and slope areas (Livingston and deReynier 1996, Lang and Livingston 1996). Limited observations on seasonal changes in Bering Sea Pacific cod diet show a higher proportion of pollock in the diet of larger Pacific cod than in other seasons. Prey size generally increases with size of Pacific cod. For example, Pacific cod 30-59 cm in length consume pollock ranging in length from about 5-30 cm while larger Pacific cod consume pollock of about 5-50 cm in length. Dominant size groups in the diet vary by year and depend on Pacific cod prey size preferences relative to pollock size composition in different years.

In the Aleutian Islands, summer diet of Pacific cod consists of Atka mackerel, walleye pollock, miscellaneous fish, crab, shrimp, amphipods, cephalopods (squid and small octopods), and miscellaneous invertebrates (Yang 1996). As in other areas, Pacific cod become more piscivorous with size. Atka mackerel is the dominant fish prey, followed by walleye pollock in this area. Sizes of Atka mackerel consumed by Pacific cod range from 10-34 cm in length. In 1991, Pacific cod consumed Atka mackerel mainly in the western Aleutian Islands while pollock was consumed through most of the Aleutian shelf region. Pacific cod diet in other seasons is not well known in this region.

In the Gulf of Alaska, summer diet of Pacific cod has been described for 1990, 1993, and 1996 (Yang and Nelson 2000). Polychaetes, small octopods, shrimp, crab, and fish are the dominant prey items by weight in this area. Pollock is the dominant prey fish but does not completely dominate the diet of large Pacific cod as it does in the Bering Sea. Shrimp and crab are important to smaller Pacific cod while a combination of pollock, shrimp, and crab are important to larger (>60 cm) Pacific cod. Other fish consumed by Pacific cod in this region include eelpouts, Atka mackerel, sculpins, Pacific sandfish, arrowtooth flounder, capelin, and herring. Each of these may constitute less than 5% of the diet by weight in any given year. Pollock is consumed broadly throughout the shelf area and prey pollock sizes consumed by Pacific cod range from 5-50 cm for large (>60cm) Pacific cod. In an inshore area (Pavlov Bay) of the Gulf of Alaska, Pacific cod diet in the early 1980's had both pollock and capelin as large components during summer (over 20% of the diet by weight for each of these prey items (Albers and Anderson 1985).

Pacific cod share common prey with many other species. In the Bering Sea, pollock is an important prey item of many groundfish, bird, and mammal species (Hunt et al. 1981, Kajimura and Fowler, 1984, Frost and Lowry 1986, Springer 1992, Livingston 1993), including Pacific cod, walleye pollock, arrowtooth flounder, flathead sole, Pacific halibut, skates, Greenland turbot, kittiwakes and murres, and numerous marine mammals such as northern fur seal, Steller sea lions and other pinnipeds. In the Gulf of Alaska, Pacific halibut, arrowtooth flounder, sablefish, tufted puffins, Steller sea lions and harbor seals consume pollock (Pitcher 1980 and 1981, Yang and Nelson 2000, Hatch and Sanger 1992). In the Aleutian Islands, Atka mackerel is an important prey not only of Pacific cod but of Pacific halibut, arrowtooth flounder, Steller sea lions, harbor seals, sea otters, and a variety of whales (see review by Yang 1998).

Predators of Pacific cod include halibut, salmon shark (*Lamna ditropis*), northern fur seals, Steller sea lions, harbor porpoises (*Phocoena phocoena*), various whale species, and tufted puffin (Westrheim 1996). Pacific cod is generally not a dominant prey item of groundfish although it is found sporadically in the diets of groundfish such as Greenland turbot, Pacific cod, Pacific halibut, skates, and walleye pollock in the Bering Sea (Livingston and deReynier, 1996); arrowtooth flounder, Pacific halibut, and walleye pollock in the Gulf of Alaska (Yang and Nelson 2000); and arrowtooth flounder, Pacific halibut, Pacific cod, and walleye pollock in the Aleutian Islands (Yang 1996).

Thus, Pacific cod is not only a prey of Steller sea lions but it is also a competitor with sea lions for common prey, particularly Atka mackerel and walleye pollock. Prey sizes of pollock consumed by both are similar. Most pollock measured from Steller sea lion scats are >30cm (NMML data) and most of the pollock biomass consumed by large Pacific cod (>60cm) mainly consists of pollock >30cm (e.g., p. 85 in Livingston and deReynier, 1996) . Although the two predators share other prey such as herring, arrowtooth flounder, and cephalopods, these prey are neither as dominant in the diet of the predators nor consistently found in the diets of the two predators in similar geographic areas of the BSAI or GOA. Also, there may not be size overlap of certain prey consumed by the two predators, e.g. cephalopod prey consumed by Pacific cod are small relative to those consumed by Steller sea lions (Mei-Sun Yang and Beth Sinclair Alaska Fisheries Science Center, personal communication).

From an annual perspective on prey removal over a broad geographic area, an individual large Pacific cod >60 cm has the potential to consume up to 2.5 times its body weight per year, based on the daily ration of 0.7% body weight per day (BWD) assumed by Livingston and deReynier (1991). Given that a large proportion of the diet of large Pacific cod in some seasons may consist of prey they have in common with Steller sea lions and the estimation that Pacific cod eat more than their own body weight per year, the question could be asked whether fishery removals of these large Pacific cod would potentially result in a no net loss of Steller sea lion prey on an annual basis in the BSAI and GOA. However, it is unknown if the prey released on these time and space scales would result in a benefit to Steller sea lions for which the greatest concern expressed has been about the availability of prey during winter. Also, as mentioned above, Pacific cod has many other competitors and Steller sea lions would not be the only competitors that benefit from Pacific cod removals.

If the areas and times of greatest concern for Steller sea lions are used in deriving the amount of prey removed per unit Pacific cod, the possibility of no net prey loss to Steller sea lions becomes lower. For example, if the analysis was restricted to winter, which is the time period thought to be most important for sea lions to obtain sufficient prey, a less optimistic result might be obtained. Pacific cod daily ration in winter is likely about half its annualized daily ration of 0.7 % (BWD) and is approximately 0.3-0.4% body weight per day based on seasonal bioenergetic information from another gadid, walleye pollock (Buckley and Livingston, 1994) and knowledge about turnover rates of Atlantic Pacific cod stomach contents at different temperatures (Waiwood et al., 1991). These lower values are also used for Pacific cod winter ration in a multispecies virtual population analysis model of the eastern Bering Sea (Livingston and Jurado-Molina, 2000). An individual large Pacific cod during the 91 day winter season could potentially consume about one-third of its body weight during this period. Even if 100% of the prey were sea lion prey, this would not result in a no net loss of prey from a sea lion perspective during that season and area if the Pacific cod were removed by a fishery.

Multi-species modeling provides information on competitors that might benefit when prey are released due to decline of a predator or competitors that might not get as much of a certain prey when another predator increases in abundance. Age-structured multispecies modeling of the eastern Bering Sea indicates that in the long-term, the predators that benefit most when prey are released are those that consume the youngest prey of a certain species (Jurado-Molina and Livingston, 2000; J. Jurado-Molina, University of Washington, pers. communication). Thus, if more pollock were released due to increased removal of its Pacific cod predators, then animals such as walleye pollock, northern fur seal, and arrowtooth flounder that consume age 0-2 pollock appear to benefit the most in the long term while animals such as Greenland turbot that consume more older pollock, do not appear to realize an increase in their consumption of pollock prey. Although the model does not include Steller sea lions, we infer that since they consume large pollock that they would not realize an increase in their consumption of older pollock if there is increased removal of Pacific cod predators. Presumably this occurs because these predators are last in line in the gauntlet of predators that a pollock encounters throughout its life.

The multi-species modeling experiments further indicate that these estimated changes in amount of prey per individual predator when Pacific cod are fished (and none of its competitors are fished) or when Pacific cod is unfished (and all of its competitors are fished) are quite small, increases or decreases of only around 2% of the per capita consumption that predator would otherwise have had. Thus, at our present level of fishing for Pacific cod, other species do not appear to realize much change in their prey base in either a positive or negative direction.

More detailed spatial modeling of short and long term implications to predators of changing prey availability would provide more insights into this process.

3.1.3 Stock Assessment and Fishing Mortality

3.1.3.1 Methodology and Data

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 Bering Sea and Gulf of Alaska are modeled separately, the model structures in recent years have been identical (Thompson and Dorn 1999, Thompson et al. 1999). No formal assessment model exists for the Aleutian Islands portion of the BSAI stock. Instead, results from the Bering Sea assessment are inflated proportionately to account for Aleutian Islands fish.

Annual trawl surveys in the Bering Sea and triennial bottom trawl surveys in the Aleutian Islands and Gulf of Alaska are the primary fishery-independent sources of data for Pacific cod stock assessments (Thompson and Dorn 1999, Thompson et al. 1999). The Bering Sea survey has been conducted annually since 1979, the Aleutian Islands survey has been conducted every three years since 1980 with the exception of a five-year hiatus between 1986 and 1991, and the Gulf of Alaska survey has been conducted every three years since 1984. Matching results from the surveys to NPFMC management areas poses a slight nomenclatural problem in that the NPFMC's Bering Sea management area includes waters that are not covered by the Bering Sea survey but are covered by the Aleutian Islands survey. Thus, results from the Aleutian Islands survey are typically partitioned according to waters contained within the Aleutian Islands management area and a “southern Bering Sea” subarea (corresponding to statistical areas 518 and 519) that falls within the Bering Sea management area. To avoid confusion, this section will try to use the following terms consistently:

Term	Refers to
Bering Sea	NPFMC Bering Sea management area
Bering Sea survey	NMFS’ bottom trawl survey of the eastern Bering Sea shelf (a subset of the NPFMC Bering Sea management area)
Aleutian Islands	NPFMC Aleutian Islands management area
Aleutian Islands survey	NMFS’ bottom trawl survey of the Aleutian Islands shelf and southern Bering Sea shelf (the latter a subset of the NPFMC Bering Sea management area)

The entire time series of biomass estimates for the Bering Sea survey, Aleutian Islands survey, and Gulf of Alaska survey are shown in Table 2 and Figure 2. Standard errors are shown for all years in the Bering Sea survey and Gulf of Alaska survey, but only for the three most recent years in the Aleutian Islands survey (standard errors for earlier Aleutian Islands survey estimates are being recalculated and are not currently available).

Figure 3 shows size compositions for the three most recent years in each survey. For the Bering Sea survey, the data are further partitioned into three subareas: east of 170°W, west of 170°W, and the sea lion conservation area.

For the most recent assessments, fishery size compositions were available, by gear, for the years 1978 through the first part of 1999. 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 Bering Sea 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). However, it does not match exactly the current pattern of seasonal releases of the TAC. 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 models. All components were weighted equally.

3.1.3.2 Results from Current Stock Assessments

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 and full-selection fishing mortality rates in each year of the time series. Given these quantities, plus parameters (estimated outside of the stock assessment) 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). Table 3 shows the time series of age 3+ biomass, spawning biomass, and "survey" biomass estimates for the Bering Sea and Gulf of Alaska from the current assessments (the "survey" biomass estimate is the model's prediction of what the survey should have observed). Because the model's age 3+ biomass estimates account for incomplete selection of some age groups by the surveys, they tend to be higher than either the model's "survey" biomass estimates or the actual survey biomass estimates shown in Table 2. Table 4 shows the time series of full-selection fishing mortality rates for the Bering Sea and Gulf of Alaska from the current assessments.

Other outputs of the assessments include projections of biomass and harvest under a variety of reference fishing mortality rates. Based on these projections, a pair of ABC values are recommended (one value for the BSAI and one for the GOA). For 2000, these values were 193,000 mt in the BSAI and 76,400 mt in the GOA. Pacific cod is currently managed under Tier 3 of the Council's ABC and OFL definitions (Amendment 56 to each of the respective FMPs). Management under Tier 3 requires reliable estimates of projected biomass, $B_{40\%}$, $F_{40\%}$ (for ABC), and $F_{35\%}$ (for OFL). For the past several years, the ABC recommendations for Pacific cod in the BSAI and GOA have been based on a decision-theoretic analysis that attempts to account for certain aspects of model uncertainty (specifically, uncertainty surrounding the true values of the natural mortality rate and survey catchability coefficient) in a risk-averse manner. This has resulted in recommended ABCs somewhat lower than the maximum levels allowed under Amendment 56. Pacific cod is not overfished in either the BSAI or GOA.

Historic catch amounts are displayed in Table 5. Since 1978, catch in the BSAI has ranged from about 30,000 mt to over 250,000 mt. In the GOA, catch has ranged from about 12,000 mt to just over 80,000.

3.1.3.3 Splitting the BSAI TAC into separate BS and AI components

It does not appear that the Pacific cod inhabiting the Aleutian Islands area form a single, discrete stock (Grant et al. 1987, Shimada and Kimura 1994). However, setting separate Aleutian Islands and Bering Sea TACs may still offer advantages relative to a combined BSAI TAC. First, in the event that there are any (hitherto unidentified) small substocks that inhabit the Aleutian Islands area, a separate Aleutian Islands TAC may afford them greater protection. Second, a separate Aleutian Islands TAC would allow greater management flexibility in that the Aleutian Islands management area would not be affected by closures in the Bering Sea management area, and vice-versa. All other things being equal, a precautionary approach to management of this stock might reasonably include measures designed to match the geographic distribution of the catch with that of the biomass.

Establishing area-specific TACs for the purpose of distributing catch approximately in proportion to biomass presumes the existence of area-specific estimates of biomass. In the case of the Bering Sea portion of the Pacific cod stock, such estimates exist in two forms: estimates from annual bottom trawl surveys and estimates from the stock assessment model. In one sense, the estimates from the stock assessment model might be preferable in that (unlike the survey estimates) they adjust for differential selectivity at age. Unfortunately, in the case of the Aleutian Islands portion of the Pacific cod stock, the only available estimates of biomass are those from the triennial bottom trawl survey. In order to make the biomass estimates from the Bering Sea and Aleutian Islands most comparable, then, it is appropriate to use bottom trawl survey estimates in both cases. Table 6 compares the biomass estimates from the Aleutian Islands surveys to the biomass estimates from the corresponding eastern Bering Sea surveys. By computing the average biomass from the Bering Sea management area during "triennial" survey years and comparing it to the average biomass from the aggregate BSAI management area during those same years, an estimate of the average proportion of the overall biomass contained in the Bering Sea management area can be obtained. For the current time series (1980-1997), this value turns out to be about 89%, leaving about 11% on average in the Aleutian Islands management area. It should be noted that the average could change somewhat when results from the current Aleutian Islands and Bering Sea surveys become available.

Table 7 shows the impacts that an 89:11 split of previous TACs would have imposed on previous catches, both in the Bering Sea and Aleutian Islands management areas. From 1980 through 1987, the Bering Sea catch would not have been constrained by an area-specific TAC equal to 89% of the total. However, from 1988 through 1999 (a 12-year period), Bering Sea catches would have been constrained in five years (1988, 1991-1992, and 1994-1995). In those five years, catches would have been reduced by an average of about 4% (8,400 t). From 1980 through 1991, the Aleutian Islands catch would not have been constrained by an area-specific TAC equal to 11% of the total. However, from 1992 through 1999 (an 8-year period), Aleutian Islands catches would have been constrained in six years (1992-1994, 1996, and 1998-1999). In those six years, catches would have been reduced by an average of about 29% (10,400 t).

In the event that an 89:11 TAC apportionment results in a redistribution of catch from one management area to the other, the overall size composition of the catch could change as well. As shown in Figure 4, Pacific cod harvested in the Aleutian Islands management area tend to be larger than those harvested in the Bering Sea management area. The median sizes in the commercial catch are shown below, broken down by year, management area, and gear type. Note that median sizes in the Aleutian Islands are greater (for all three gears in each of the last three years) than median sizes in the Bering Sea.

Year	**Median Size (cm) in the Aleutian**			**Median Size (cm) in the Bering Sea**		
	Trawl	Pot	Longline	Trawl	Pot	Longline
1997	88	85	75	64	67	65
1998	82	77	72	69	68	66
1999	81	76	73	67	69	63

3.1.3.4 Assessment of Biomass in Critical Habitat

Table 8 shows how some recent survey estimates of Pacific cod biomass are distributed relative to Steller sea lion critical habitat. In the case of the Bering Sea survey, partitioning biomass estimates along these lines is a relatively straightforward exercise. In the cases of the Aleutian Islands survey and Gulf of Alaska survey, however, the statistical design of the surveys is much less amenable to this type of analysis. For the Aleutian Islands survey and Gulf of Alaska survey, the estimates shown in Table 8 are based on the assumption that Pacific cod biomass is distributed evenly within each survey stratum. Surveys designed to estimate biomass in critical habitat are needed to better evaluate biomass and therefore the harvestable amount of Pacific cod by area.

Use of Fishery CPUE to Estimate Relative Abundance Inside/Outside of Critical Habitat in the Bering Sea

If commercial fishing effort is homogeneous and is sampled at a high density throughout an area, it should be a straightforward exercise to use catch per unit effort (CPUE) data from the fishery to determine the relative biomasses within subareas. The need for this type of analysis seems especially great in the case of the Bering Sea stock of Pacific cod, where the last three summer trawl surveys indicate, on average, that only about 13% (Table 8) of the cod biomass resides inside sea lion critical habitat during the summer but conventional wisdom holds that the *winter* proportion is significantly higher.

Of course, the conditions listed above (homogeneous effort, sampled at a high density throughout the area) are not satisfied exactly. First, trawl effort is not completely homogeneous. Heterogeneity in vessel size, vessel horsepower, vessel type (catcher, catcher/processor), skipper skill level, and target species could all lead to heterogeneity of fishing effort measured simply as haul duration. Second, trawl effort is not sampled at a high density throughout the Bering Sea. In January, for example, sampled trawl effort tends to be clustered almost entirely in the district bracketed by 57° latitude on the north and 162°W longitude and 170°W longitude on the east and west, respectively. By April, sampled trawl effort typically spreads northward on the central shelf to some extent and up along the shelf edge, but large areas (e.g., inner Bristol Bay and most waters north of 57° latitude except along the shelf edge) remain almost entirely unsampled.

The important question, however, is not whether the conditions listed above are satisfied exactly, but whether they are satisfied sufficiently that winter fishery CPUE data would be expected to provide better estimates of relative cod biomass inside and outside of sea lion critical habitat during winter than the estimates provided by the summer trawl survey. The estimates provided by the survey benefit from the facts that, unlike in the commercial trawl fishery, survey effort is standardized and a very large portion of the Bering Sea is sampled in a systematic fashion. On the other hand, one factor arguing in favor of using fishery CPUE data in some fashion is that information can be obtained from the relevant time period (i.e., the first few months of the year). Another such factor is the comparatively large number of sampled hauls overall. By April of each year, for example, the number of sampled trawl hauls both inside and outside of critical habitat is typically well into the thousands, whereas the number of survey stations inside and outside of critical habitat is only 42 and 314, respectively. The table below shows the number of sampled trawl fishery hauls inside and outside of sea lion critical habitat, by year and months:

Year	Months	Sampled Hauls Inside CH	Sampled Hauls Outside CH
1998	January only	176	556
1998	January-February	657	1,845
1998	January-March	2,228	3,504
1998	January-April	3,184	4,320
1999	January only	373	323
1999	January-February	1,119	1,512
1999	January-March	2,523	2,651
1999	January-April	3,147	3,945
2000	January only	277	116
2000	January-February	1,132	444
2000	January-March	1,571	1,058
2000	January-April	2,413	1,608

Thus, it seems prudent at least to consider the possibility that fishery CPUE data can provide a usable estimate of the relative biomass of Pacific cod inside and outside of sea lion critical habitat. This can be accomplished in the following steps: First, estimate the size of the areas covered by the sampled hauls inside and outside of critical habitat; second, determine an appropriate weighting of CPUE data from the areas that are sampled; third, determine an appropriate method for extrapolating estimates of relative abundance for the areas that are not sampled; and fourth, compute relative abundance inside and outside of critical habitat.

Figure 5a shows the eastern Bering Sea divided into blocks defined by half degrees of latitude and whole degrees of longitude (“half-by-one” blocks). Each column label corresponds to the longitude (W) at the right-hand boundary of the blocks in that column. Each row label corresponds to the latitude at the lower boundary of the blocks in that row. The suffix "A" in a row label indicates the first half of the respective degree latitude, while the suffix "B" indicates the second half (e.g., row 55A covers waters between 55°00' and 55°30' latitude, while row 55B covers waters between 55°30' and 56°00' latitude). The large polygons correspond, approximately, to the six large strata used by the Bering Sea summer trawl survey. The areas shown in black correspond, approximately, either to major land masses or to waters outside the Bering Sea management area. The area shown in grey corresponds, approximately, to the Bogoslof sea lion foraging area.

Using these half-by-one blocks, it is possible to obtain a rough estimate of the relative size of the areas covered by the sampled hauls inside and outside of critical habitat. This was done for the years 1998-2000, using four sampling periods within each year (January only, January-February, January-March, and January-April). For example, Figures 5b and 5c show the number of sampled trawl hauls in each half-by-one block inside and outside of critical habitat for the months January-April in 1998. Figures 5d and 5e show the average trawl CPUE in each sampled half-by-one block inside and outside of critical habitat for the same time period. Note that, due to the coarseness of the half-by-one grid, some blocks contain both “inside critical habitat” and “outside critical habitat” data (e.g., 56A169). For the same reason, Figure 5b shows that block 54A164 contains a haul, even though Figure 5a indicates that this block is outside of the Bering Sea management area.

By comparing the last three years, it appears that critical habitat (especially that portion of critical habitat assessed by the summer trawl survey) tends to be fairly well sampled by the commercial fishery before the end of the first trimester each year. However, fishery coverage of the area outside critical habitat tends to be far less complete. The table below shows the number of half-by-one block that contain CPUE data (“yes”) and that are missing CPUE data (“no”) in each survey stratum, exclusive of the Bogoslof sea lion foraging area.

		Stratum 1		**Stratum 2**		**Stratum 3**		**Stratum 4**		**Stratum 5**		**Stratum 6**	
Year	Months	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1998	January only	0	27	0	15	14	15	1	35	0	8	0	37
1998	January-February	0	27	0	15	14	15	1	35	2	6	0	37
1998	January-March	0	27	0	15	20	9	1	35	7	1	19	18
1998	January-April	12	15	1	14	21	8	1	35	7	1	19	18
1999	January only	0	27	0	15	16	13	0	36	2	6	0	37
1999	January-February	0	27	0	15	17	12	0	36	2	6	0	37
1999	January-March	0	27	0	15	19	10	0	36	7	1	8	29
1999	January-April	1	26	2	13	22	7	4	32	7	1	11	26
2000	January only	0	27	0	15	3	26	0	36	0	8	0	37
2000	January-February	0	27	0	15	7	22	0	36	3	5	0	37
2000	January-March	0	27	0	15	21	8	0	36	8	0	8	29
2000	January-April	2	25	0	15	22	7	3	33	8	0	14	23

One issue, then, concerns the best method to deal with the half-by-one blocks that contain no data. Two possible extremes might serve to bracket the solution. At one extreme, it might be imagined that blocks containing no data do so simply by random chance or for other reasons having nothing to do with the density of cod there, in which case it would be appropriate to assume some sort of "average" CPUE for those blocks. At the other extreme, it might be imagined that blocks containing no data do so because there are no cod there, in which case it would be appropriate to assume a zero CPUE for those blocks. These two methods will be labeled the "missing=mean" and "missing=zero" methods, respectively.

More precisely, for each year (1998, 1999, 2000) and range of months (January only, January-February, January-March, January-April) the analysis proceeded by computing a relative biomass index for the area inside critical habitat and two relative biomass indices (one for each of the above methods) for the area outside critical habitat. Computation of the relative biomass index for the area inside critical habitat was fairly straightforward, and was accomplished as follows: First, compute the mean CPUE inside critical habitat. Second, multiply this number by the amount of area inside critical habitat.

Computation of the relative biomass index outside critical habitat under the "missing=mean" method was accomplished by a procedure analogous to that used for the relative biomass index inside critical habitat. Computation under the "missing=zero" method was somewhat more complicated, and was accomplished as follows: First, compute the number of blocks containing data in each stratum. Second, compute the mean CPUE of the sampled hauls in each stratum. Third, multiply these two numbers for each stratum. Fourth, sum this product across all strata. Fifth, divide this sum by the total number of blocks in the Bering Sea survey area exclusive of the Bogoslof foraging area (the Bogoslof foraging area being the only portion of critical habitat whose boundaries coincide exactly with those of the corresponding half-by-one blocks). Sixth, multiply this quotient by the amount of area outside critical habitat but within the Bering Sea trawl survey area.

Resulting estimates of the winter proportion of Pacific cod biomass within sea lion critical habitat are summarized in the table below (the last column averages the results across both methods and all three years) and illustrated in Figure 6:

	"Missing=Mean" Method			**"Missing=Zero" Method**			
Months	1998	1999	2000	1998	1999	2000	Average
January only	0.33	0.20	0.19	0.84	0.70	0.92	0.53
January-February	0.32	0.23	0.17	0.83	0.75	0.75	0.51
January-March	0.27	0.21	0.11	0.42	0.27	0.24	0.25
January-April	0.25	0.20	0.12	0.38	0.24	0.26	0.24

Looking at the two methods one at a time, it appears that the "missing=mean" method tends to give roughly similar results between years (although a time trend seems to be evident), and even more so between different ranges of months within a given year. While the "missing=zero" method also tends to give roughly similar results between years, a marked difference can be seen between results obtained using either January or January-February data and those obtained using either January-March or January-April data. This is because the number of blocks containing no data decreases dramatically after February.

The two methods give quite different results from one another when using either January or January-February data, but fairly similar results when using either January-March or January-April data. The standard deviation of the results (across methods and years) is 0.30-0.33 using January-February or

January data respectively, but only 0.09-0.10 using January-April or January-March data respectively. For January-March data, if the low and high values are omitted, the estimates from the two methods range from 0.21 to 0.27. For January-April data, if the low and high values are omitted, the estimates from the two methods range from 0.20 to 0.26.

If a single estimate is to be chosen on the basis of this study, 25% is a relatively robust and precautionary estimate of the winter proportion of Pacific cod biomass inside sea lion critical habitat. An estimate of 25% is not far from the average value obtained by either method using January-March or January-April data, or from the average value under the "missing=mean" method using January or January-February data. However, a value of 25% would be a drastic under-estimate if the "missing=zero" method using January or January-February data turned out to give more accurate results.

Using data from January-March or January-April greatly increases both the number of sampled hauls and the number of sampled half-by-one blocks relative to the amount of data available from January-February. However, if the half-by-one blocks that are newly sampled during the March-April period are fished predominately by vessels with characteristics substantially different from the fleet average, the results obtained from the March-April data could be misleading. For example, many of the blocks that are first sampled in March or April are contained in Stratum 6, which is near the shelf edge and far from shore. If this stratum is fished predominately by vessels with much greater horsepower than the fleet average, the CPUEs from that stratum could give a misleading estimate of the relative biomass in that stratum.

It should also be emphasized that there are many ways to use CPUE data to estimate relative biomass between areas, whereas this analysis considered only two. Other methods, such as averaging CPUEs across block-wide means rather than across individual hauls, using "nearest neighbor" algorithms to fill in missing blocks, or developing a standardized effort calibration based on vessel characteristics, could also be explored.

3.1.4 Effects of Historic Spatial and Temporal Fishing Patterns for P. cod

The fishery for Pacific cod is conducted with bottom trawl, longline, pot, and jig gear. In the BSAI, 47% of the TAC is allocated to trawl fishing, 51% to longline and pot fishing combined, and 2% to jig fishing. For 2000, NMFS expects to implement further gear modifications as described under the status quo Alternative 1. In the GOA, Pacific cod is allocated between the processing components, 90% to inshore and 10% to offshore. Seasons in the BSAI and GOA Pacific cod fisheries may be further adjusted annually through seasonal apportionments of Pacific halibut bycatch allowances. These seasonal apportionments of bycatch allowances are recommended annually by the Council as part of the annual harvest specifications process and based on determinations that provide for optimizing the amount of Pacific cod harvested under established bycatch restrictions.

Depth of the fishery

The depth of the Pacific cod fishery is displayed in Figure 7. In the Bering Sea, the catch occurs between 50-225 meters, with the highest concentration being in the 100-125 m depth range. The longline fishery occurs at deeper depths than both the trawl and pot fisheries. The fishery in the Aleutian Islands is slightly deeper than the Bering Sea (75-225m), with most of the catch occurring around the 125-150 depth range. Pot gear is more heavily weighted to the shallower depths than trawl and longline. In the GOA, the fishery occurs at generally lower depths overall than the BS or AI, with a range from 25-225m. Longline tends to be slightly deeper than pot and trawl in the GOA.

Size of Pacific cod harvested by the fishery

The size of Pacific cod harvested in the fishery for the BS, AI, and GOA areas is displayed in Figure 4. In the BS, the mean size is about 65-70 cm with a range from about 30 to 110 cm. The survey distributions are displayed in Figure 3. For the AI, the size of Pacific cod are noticeably larger, with a mean of about 80 cm with a range from 40 to 115 cm. In the GOA, the distribution is very similar to the BS, with a mean about 65-70 cm and a range from 30 to 95 cm. Comparing these to the survey size distributions (Figure 3), it appears that all areas of the fishery are selecting for larger fish than the survey.

3.1.4.1 Bering Sea and Aleutian Islands Area

3.1.4.1.1 Fishery Overview

Trawl Gear

In the BSAI Pacific cod fisheries there are a broad group of participants. Small catcher vessels as well as large catcher/processors target Pacific cod with a variety of gear types. In 1999, 26 trawl catcher/processors and 81 trawl catcher vessels harvested Pacific cod in the BSAI. Under regulations at §679.20(b)(1)(iii) 7.5% of the annual Pacific cod TAC is allocated to the CDQ fishery.

The non-CDQ Pacific cod TAC is split into three gear type allocations; trawl, fixed gear (hook and line and pots), and jig. Regulations at §679.20 (a)(7)(i) allocate 47% to trawl gear (split 50:50 between catcher vessels and catcher/processors), 51% to fixed gear, and 2% to jig gear. 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.

The trawl fishery opens by regulation on January 20 [(§679.23(c)] and closes when either the Pacific cod TAC or the halibut mortality cap for the trawl fishery is reached.   In 1999 initial participation was limited to approximately 2 or 3 catcher/processors and 7 or 8 catcher vessels. After the pollock A2 season finished in March numerous vessels switched over to the cod fishery. The catcher vessel sector closed April 11 and the catcher/processor sector closed May 6. Both sectors were reopened for a clean-up fishery on October 1. The majority of the Pacific cod harvested by trawl gear is taken in shallow waters on the eastern Bering Sea shelf.

The AFA established limits on the amount of species other than pollock that vessels (who participate in the cooperatives established under the AFA) are allowed to harvest. Under these “sideboard caps” these vessels, as a group, are required to limit their harvest of other species in the BSAI based on historical levels. Pacific cod is one of the more valuable commercial species that is limited to the these vessels. Non-cooperative trawl vessels are not subject to the Pacific cod sideboard cap and are allowed to target Pacific cod until the annual TAC is harvested and the fishery is closed. The effects of the AFA on trawl fisheries for Pacific cod (and other species) is still largely unknown.

Trawl gear fishing effort for 1996-1999 is displayed in Figure 8.

Fixed Gear

In 1999, 39 catcher vessels and 38 catcher/processors targeted Pacific cod with hook and line gear. In addition 89 catcher vessels and 13 Catcher/processors used pot gear to target Pacific cod. Under regulations at §679.20(b)(1)(iii), 7.5% of the annual Pacific cod TAC is allocated to the CDQ fishery.

The Pacific cod TAC is split into three gear type allocations; trawl, fixed gear (hook and line and pots), and jig. Regulations at §679.20 (a)(7)(i) allocate 47% to trawl gear (split 50:50 between catcher vessels and catcher/processors), 51% to fixed gear, and 2% to jig gear. 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.

Regulations at §679.20 (a)(7)(iv) split the fixed gear cod TAC into three seasonal allocations; January 1, May 1, and September 1. The first season opened January 1 and a total of 34 hook and line and 13 pot catcher/processors participated. The first trimester fishery closed April 17.

The second season fishery on May 1 was open only to pot vessels (hook and line vessels were excluded). A total of 13 catcher/processor pot vessels participated and the second season closed June 6. Note that in 2000 the Council recommended a zero allocation of Pacific cod TAC to the second trimester fishery so no fixed gear fishery will take place in the summer of 2000.

The third season opened to pot vessels September 1 and to hook and line vessels September 15. Thirty four hook and line and 6 pot catcher/processors participated. The fixed gear fishery closed October 19 and a clean-up fishery reopened on December 6.

The jig fishery for Pacific cod opened January 1 and remained open throughout 1999. A total of 169 mt of Pacific cod was harvested by jig gear in 1999.

Hook and line harvested cod are mostly taken along the slope of the continental shelf break and along the Aleutian Islands. Pacific cod harvested by pot gear is taken along the slope as well as north and west of Unimak Island and also adjacent to the Aleutian Island chain.

A BSAI FMP amendment splitting the fixed gear Pacific cod allocation into discrete hook and line and pot quotas was approved by the Council and will likely be implemented in the year 2000. The amendment would split the 51% fixed gear TAC as follows:

- 80%: hook and line catcher/processors
- 0.3%: hook and line catcher vessels
- 18.3%: pot vessels
- 1.4%: pot or hook and line vessels less than 60 feet

In addition, the license limitation regulations implemented in 2000 are scheduled to be amended in 2001 or 2002. As proposed they would further limit the number of vessels allowed to fish for Pacific cod in the BSAI by adding a minimum landings provision.

Pot gear fishing effort for 1996-1999 is displayed in Figure 9, and longline effort is displayed in Figure 10.

3.1.4.1.2 Spatial and Temporal Fishery Patterns

The principle concern with the Pacific cod fishery is the possible competitive interaction with the endangered western population of Steller sea lions. Over the last 20 years, there has been a significant increase in the amount and relative percentage of Pacific cod removed by the fishery from designated critical habitat in the BSAI (Figure 11). This has been previously noted in two prior biological opinions on the groundfish fisheries (NMFS 1998x and 1999x). This section of the document will display the temporal and spatial removals of Pacific cod in the BSAI from the perspective of compression of the catch in the winter and inside critical habitat areas. All sectors have been combined in order to show the cumulative effect of all harvests. However, additional information has been displayed to show the relative effects of each gear type.

For purposes of analysis NMFS has split the calender year into three portions and will use the following defined seasons: (1) winter; January - April, (2) summer; May - August, and (3) fall; September - December.

In the BSAI, the harvest has occurred primarily in the winter period, and is especially true in the AI (Figure 12). Daily catch amounts in Figure 13 indicate a fishing season roughly from February to mid-April. This is mostly due to the large trawl gear pulse which is almost entirely within critical habitat. The longline fishery occurs relatively dispersed throughout the winter and fall, mostly outside of critical habitat, with little catch occurring during the summer due to bycatch restrictions on the fishery.

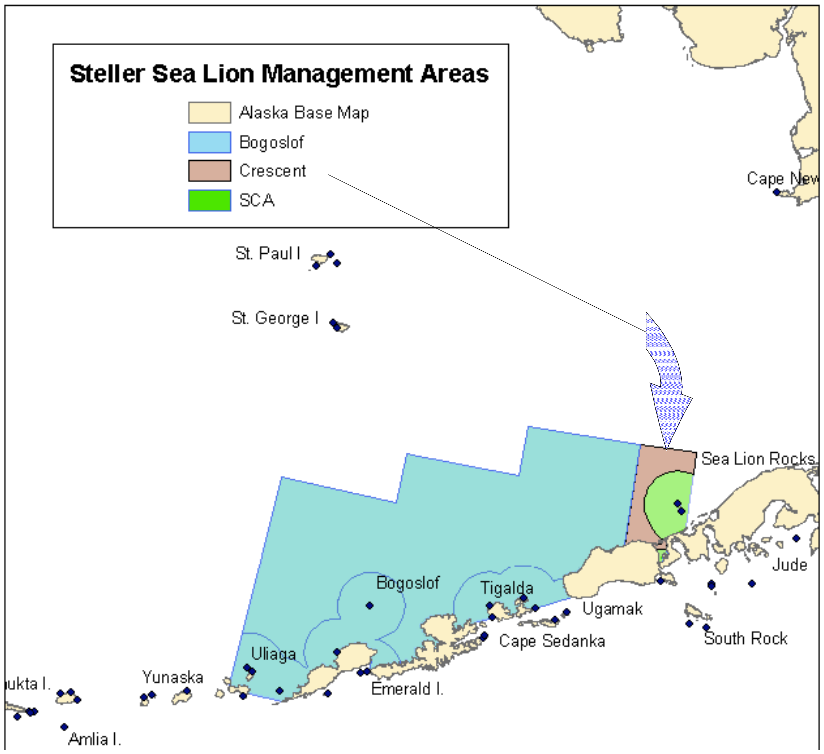
In the BSAI, over the last four years, about 55% of the annual catch has been taken in critical habitat (Figure 11). For purposes of this analysis, the BSAI has been further split into two distinct areas (BS and AI) as noted in section 3.1.3.3. For the BS, between 42 and 46% of the annual catch is taken inside critical habitat (Table 9). Of this about 35 to 36% has been taken in the winter period inside critical habitat, with little being taken in each of the other seasons (Figure 14). In the AI, between 80 and 95% of the catch is taken in critical habitat, of which about 60 to 75% is harvested inside critical habitat in the winter. Within critical habitat, about 30-40% of the catch (Table 10) by gear type and area was taken inside 10 nm of rookeries and important haulouts listed in Table 1.

Looking at the fishery by individual gear types, the trawl sector accounts for the most significant removals of Pacific cod from critical habitat in the BS (Figure 15). Both pot gear and trawl harvest more of their catch from critical habitat than from areas outside, and for the trawl sector this occurs in the winter period. Longline catch is taken more outside of critical habitat and occurs mostly in winter and fall, with some limited catch in the later summer (Figures 13 and 15). These patterns are obvious in Figure 16, which displays the seasonal and annual percentages of each sector's catch inside critical habitat. The trawl and pot sectors average about 80% inside, while the longline sector only takes about 20% of it's catch inside.

In the AI, all sectors remove the vast majority of their catch from critical habitat (Figure 17), with trawl and longline gear accounting for most of the removals by weight. The rate of catch inside critical habitat is high for all sectors as shown in Figure 18, about 80 to 100% of the catch is taken in critical habitat.

Harvest rates are shown in Table 11 by area for the summer season only. Harvest rates were highest inside the SCA (between 6 and 13%) and much lower outside the SCA (about 1% both east and west of 170 degrees w. longitude). Annual harvest rates from 1978 to 1998 are shown in Figure 19. Weekly harvest rates for the BSAI by gear type are shown in Figure 20.

The Sea Lion Conservation Area (SCA)



The SCA is an existing management area which is used to limit pollock fishing in critical habitat in the BS. It was implemented in 1999 and originally termed the CH/CVOA (combined Bogoslof foraging area critical habitat and the portion of the catcher vessel operational area east of it). A detailed discussion on the SCA and its significance can be found in the biological opinion dated December 3, 1998.

A critical habitat limit for Pacific cod (as described in Alternatives 2 and 3) would not include a crescent shaped area east of the Bogoslof foraging area and west of a 20 nm closure zone around the rookery at Sea Lion Rocks. Given the intense historical fishing pressure in critical habitat, it is likely that reductions in critical habitat harvestable amounts would force fishermen to prosecute this crescent shaped zone to a greater extent than previously observed. Our concern is that there would be an edge effect, that localized depletions would be occurring in the crescent area and that fish would migrate out of critical habitat to fill this void. This could result in a reduction of biomass in critical habitat. How significant is this issue? Table 12 displays the historical catch in the crescent area outside critical habitat, the amount in the SCA, and the overall catch in the Bering Sea. The trawl and pot sectors appear to utilize this area at about the same rate. Since these two sectors take much of their catch inside the SCA, the ratio of catch of the crescent area to the SCA and the total catch by sector is about the same, 5-7% on average. For the longline sector, about 22% of the catch which occurs in the SCA was taken in the crescent area. However, because the longline sector catches most of its Pacific cod outside of the SCA, the crescent area only amounts to about 4% of their overall catch. Generally, for all sectors, the crescent area is about 5% of the total catch in the Bering Sea.

Unfortunately, we don't have a way to determine the localized depletion effects possible if 5% of the annual Pacific cod catch was taken in this small area and if the critical habitat areas around it were closed. However, given that the relative area is very small compared to the area of the entire Bering Sea that is used to determine biomass amounts, the chance for localized depletions, especially if effort increases, is possible, although unquantifiable.

3.1.4.2 Gulf of Alaska

3.1.4.2.1 Fishery Overview

Trawl Gear

Pacific cod is the second largest volume fishery in the GOA after pollock. In 1999, vessels using bottom trawl gear harvested 33,466 mt in the directed fishery and 3,242 mt as incidental catch in other directed fisheries for a total of 36,708 mt which was 53.5% of the total federal TACs for Pacific cod in the GOA. The percentage of the total TACs for Pacific cod harvested by trawl gear in the GOA has declined in recent years as additional vessels using fixed gear have entered the fishery, because the Federal Pacific cod TACs are not allocated by gear type in the GOA, harvests by all gear types are deducted from a shared TAC established for each management area.

The federal Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in state waters. Since the beginning of a separate Pacific cod fishery managed by the State of Alaska in 1997, the federally managed TACs have been adjusted downward from ABC levels by the amount of guideline harvest levels (GHLs) established by the State. Trawl vessels of all sizes target Pacific cod, and the fishery attracts the greatest number of trawl vessels (115 vessels in 1999, down from 157 vessels in 1995) participating in the groundfish fisheries. In recent years 20 % of the annual TACs have been held in reserve until after the principal directed fisheries close as a management buffer to prevent exceeding the annual TACs and to provide greater assurance that incidental catch of Pacific cod may be retained up to MRB amounts throughout the fishing year. In the GOA the Pacific cod TACs are allocated 90% to vessels targeting Pacific cod for processing by the inshore component and 10% to vessels targeting Pacific cod for processing by the offshore component. Pacific cod is also included in the improved retention and utilization regulations at § 679.27. The most common primary products are skinless boneless fillets, and for processors without fillet machinery headed and gutted fish. A wide variety of ancillary products may also be produced including; roe, milt, surimi, collars, stomachs, heads, fish meal and oil. The Pacific cod fishery has the highest prohibited species catch of halibut and C. bairdi of the trawl fisheries in the GOA. In 1999 this amounted to 1,234 mt of halibut mortality and 22,451 individual crabs.

Trawl gear fishing effort for 1996-1999 is displayed in Figure 8.

Hook and Line Gear

Second in volume and value for hook-and-line gear in the GOA is the Pacific cod fishery. In 1999, the hook-and-line gear harvest was 11,938 mt in the directed fishery and 424 mt as incidental catch in other directed groundfish fishes for a total of 12,362 mt which was 18% of the total harvest of Pacific cod in the federally managed fisheries in the GOA. In recent years the number of vessels targeting Pacific cod using hook-and-line gear has remained fairly constant from 1995 to 1999. The Pacific cod TACs are not allocated by gear type in the GOA, harvests by all gear types are deducted from a shared TAC established for each management area. The Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in 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 16,660 mt in 2000 (65 FR 8298, February 18, 2000). Hook-and-line vessels of all sizes target Pacific cod, and the fishery attracts the greatest number of vessels after sablefish, with 420 participating in the groundfish fisheries in 1999.

In recent years 20 % of the annual TACs have been held in reserve until after the principal directed fisheries close as a management buffer to prevent exceeding the annual TACs and to provide greater assurance that incidental catch of Pacific cod may be retained up to MRB amounts throughout the fishing year. Pacific cod is also included in the improved retention and utilization regulations at §679.27. The most common primary products are skinless boneless fillets, and for processors without fillet machinery headed and gutted fish. A wide variety of ancillary products may also be produced including; roe, milt, trimmings can be processed into surimi, collars, stomachs, heads, fish meal and oil. Almost the entire amount of annual halibut mortality allowance established in the final GOA annual harvest specifications for groundfish for other hook-and-line fisheries in recent years has been taken in the directed hook-and-line Pacific cod fishery.

Longline fishing effort for 1996-1999 is displayed in Figure 10.

Pot Gear

In the GOA fishing for groundfish using pot gear is almost entirely limited to targeting Pacific cod. In 1999 the pot gear harvest was 19,015 mt in the directed fishery which was 27.7% of the total harvest of Pacific cod in the federally managed fishery. Following the implementation of the moratorium program in 1995, the establishment of a state waters Pacific cod fishery in 1998, and the LLP in 2000 most of new entrants are limited to fishing within state waters during both the federal and subsequent state water openings. In 1999 211 vessels targeted Pacific cod with pot gear in the federally managed fishery, and 234 targeted Pacific cod in the state manage fishery in the GOA, with many of the larger sized vessels participating in both fisheries.

The federal Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in 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. In the state waters fisheries in the GOA the Pacific cod GHLs are allocated by gear type (between pot and jig) and vessel size (5 AAC 28.276, .367, .467, .537, and .577). For 1999, it is estimated that pot gear harvested an additional 12,378 mt of Pacific cod in the state waters of the GOA.

The net effect is that the amount of Pacific cod harvested by vessels using pot gear has increased in recent years. Pot gear vessels of all sizes target Pacific cod. The most common primary products are skinless boneless fillets, and for processors without fillet machinery headed and gutted fish. A wide variety of ancillary products may also be produced including; roe, milt, trimmings can be processed into surimi, collars, stomachs, heads, fish meal and oil. Incidental catch of other groundfish species is very low for pot gear targeting Pacific cod, most of the incidenal catch of groundfish is octopus from the “other” species assemblage. By regulation (§679.2) the circumference of the tunnel entrance is limited to 36 inches and a biodegradable panel must be installed to reduce bycatch. In recent years incidental catch of halibut has been low (41 mt in 1999) and pot gear has been exempted in the GOA from halibut prohibited species catch limitations. Pot gear has the highest incidental catch of crab in the GOA. In 1999, pot gear incidental catch of *C. bairdi* crab in the GOA Pacific cod fishery was 51,123 animals.

Pot gear fishing effort for 1996-1999 is displayed in Figure 9.

Jig Gear

In the GOA jig gear is used to target primarily Pacific cod and rockfish. Catches of Pacific cod by vessels using jig gear in the federally managed fishery, 58 mt in 1999, are less than 0.1% of the total federally managed TACs of Pacific cod in the GOA. Most of the incidental catch of rockfish of dusky rockfish (included in the pelagic shelf rockfish assemblage) is taken incidentally in directed fisheries in state waters managed fisheries targeting Pacific cod and black rockfish. The above discussion above of the state waters Pacific cod fishery and allocations between pot and jig gear is applicable here. Vessels using jigging gear are more active in the State of Alaska managed Pacific cod and black rockfish fisheries than in the federally managed fisheries. In the state waters Pacific cod fisheries allocations of the GHLs have been made to vessels using jig gear, however these allocations have not yet been fully utilized. In 1999 vessels using jig gear harvested 1,531 mt of Pacific cod in the state waters fishery. In 1999 approximately 180 vessels using jig gear participated in the state waters fishery. The amount of effort by vessels using jig gear is increasing in the GOA. The use of jig gear is especially attractive to owners of small sized vessels. The cost of the gear is relatively inexpensive and can fished from small vessels with minimum crew. Primary and ancillary products from jig caught Pacific cod are the same as from catches by other gear types. Prohibited species catch information is not available, the vast majority of vessels using jig gear are under 60 feet LOA and are exempt from federal observer and record keeping and reporting requirements. In recent years jig gear along with pot gear in the GOA have been exempted from halibut prohibited species catch limitations. While the amount of incidental catch of halibut by vessels using jig gear is unknown, it is assumed to be low and that bycatch rates and attendant mortality rates are also relatively low.

3.1.4.2.2 Spatial and Temporal Fishing Patterns

The principle concern with the Pacific cod fishery in the GOA is the possible competitive interaction with the endangered western population of Steller sea lions. Over the last 20 years, there has been a significant increase in the amount and relative percentage of Pacific cod removed by the fishery from designated critical habitat in the GOA (Figure 21). This has been previously noted in two prior biological opinions on the groundfish fisheries (NMFS 1998x and 1999x). This section of the document will display the temporal and spatial removals of Pacific cod in the GOA from the perspective of looking at compression of the catch in the winter and inside critical habitat areas. All sectors have been combined in order to show the cumulative effect of all harvests and management areas 610, 620, and 630 have been separated out to show regional effects. However, additional information has been displayed to show the relative effects of each gear type. Of special concern in the GOA is the cumulative effects of the State managed Pacific cod fishery which will be discussed further in section 3.1.4.2.3.

For purposes of analysis NMFS has split the calender year into three portions and will use the following defined seasons: (1) winter; January - April, (2) summer; May - August, and (3) fall; September - December

For the GOA, annual catch amounts and harvest rates from 1978 to 1998 are shown in Figure 19. Recently, the harvest has occurred primarily in the winter period (Figure 12). Daily catch amounts in Figure 22 indicate a fishing season roughly from February to mid-March with some fishing occurring outside critical habitat in the summer and fall.

In the GOA, over the last four years, between 40 and 70% of the annual catch has been taken in critical habitat (Figure 21). For purposes of this analysis, the GOA has been further split into the three management areas (610, 620, and 630). Catch by area is displayed in Figure 23, with total catch on top and the amount in critical habitat on the bottom. Most of the catch occurs in the winter for all areas, with the highest amounts being taken from areas 610 and 630. The same pattern is seen in critical habitat for all areas of the GOA.

For the GOA, between 55 and 73% of the annual catch is taken inside critical habitat (Table 9). Of this about 47 to 68% has been taken in the winter period inside critical habitat, with little being taken in each of the other seasons (Figure 14). In area 610, between 80 and 90% of the catch is taken in critical habitat (Table 9). In the winter period the catch in critical habitat amounts to between 70 and 90% of the total annual catch in area 610 (Figure 24). In area 620, between 40 and 90% of the catch is taken in critical habitat (Table). In the winter period the catch in critical habitat amounts to between 25 and 80% of the total annual catch in area 620 (Figure 24). In area 630, between 40 and 64% of the catch is taken in critical habitat (Table 9). In the winter period the catch in critical habitat amounts to between 33 and 62% of the total annual catch in area 630 (Figure 24). Within critical habitat, about 10-60% of the catch (Table 10) by gear type and area was taken inside 10 nm of rookeries and important haulouts listed in Table 1.

Looking at the fishery by individual gear types, the trawl sector accounts for the most significant removals of Pacific cod from critical habitat in the GOA (Figure 23). Trawl averages about 50 to 70% from critical habitat overall in the GOA (Figure 25). By area, trawl harvests about 90% in critical habitat in area 610, between 10 and 90% in area 620, and about 30 to 40% in area 630 (Figure 25). For pot gear, about 60% of the annual catch is from critical habitat. Similar to trawl gear, about 90 to 100% is in critical habitat in area 610, between 60 and 100% in area 620, and 40 to 60% in area 630 (Figure 25). Longline catch is about 70% from critical habitat overall. In area 610, longline harvest is between 40 and 90% from critical habitat, between 10 and 50% in area 620, and between 80 and 100% in area 630 (Figure 25).

In the GOA, during the Federal fishery (when directed fishing for Pacific cod is open) the State opens a "parallel fishery." NMFS counts all of the catch which occurs in the parallel fishery against the Federal TAC, and is considered an extension of the Federal action being analyzed here. In this fishery we see that on average about 97% of the catch occurs inside critical habitat, and about 72% of the catch occurs inside 10 nm from rookeries and haulouts that were closed to pollock fishing under the RFRPAs for Steller sea lion concerns (Table 13). On average, the amount taken in State waters during the parallel fishery is approximately 12,000 mt, or about 18% of the total Federal catch in 1999 (Table 5).

3.1.4.2.3 State Managed Pacific Cod Fishery

The federal Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in state waters. Since the beginning of a separately managed Pacific cod fishery by the State of Alaska in 1997, the federally managed TACs have been adjusted downward from ABC levels by the amount of guideline harvest levels (GHLs) established by the State. In recent years about 20 % of the annual TACs have been held in reserve until after the principal directed fisheries close as a management buffer to prevent exceeding the annual TACs. In 1999, the State took 16,565 mt (the Federal TAC was reduce

State, Federal, and combined catches are compared in Figure 26 and Table 14. In 1998 and 1999 the State fishery occurred mostly in the winter and of that about 95% of the catch was in critical habitat. That is not surprising because the State fishery is limited to within 3 nm of land, and critical habitat is extended to 20 nm from rookeries and haulouts. The net effect, when you combine the two fisheries together, is that the overall Pacific cod fishery (available under the specified ABC amount) becomes a little more concentrated in critical habitat, about 3-5% more depending on the area and the season.

3.1.5 Effects of Existing Closure Areas

Year-round Closures - Year-round closure have been established to protect habitat, reduce bycatch, and reduce competition with marine mammals.

- The nearshore Bristol Bay Closure Area encompasses 19,000 square nautical miles (BSAI Amendment 37). It is important ecologically (structure is necessary for young-of-the-year red king crab survival (McMurrey et al. 1984, Rounds et al. 1989, Rodin 1990), and it is a habitat type thought to be vulnerable and highly sensitive to fishing gear damage (Auster and Langton 1999). The closure also encompasses areas where red king crab pod, a behavior that occurs when the crabs grow and move away from the epifaunal structure (Dew 1990).

- The Pribilof Islands Habitat Conservation Area encompasses 7,000 square nautical miles (BSAI Amendment 21a). It is important ecologically (needed for juvenile blue king crab survival (Armstrong et al. 1985)), and it is vulnerable and sensitive to fishing gear damage via crushing, burying, and siltation. Other gear types probably do not significantly alter or impact this habitat.

- The Red King Crab Savings Area covers 4,000 square nautical miles (BSAI Amendment 37). The area contains a known concentration of adult red king crab.

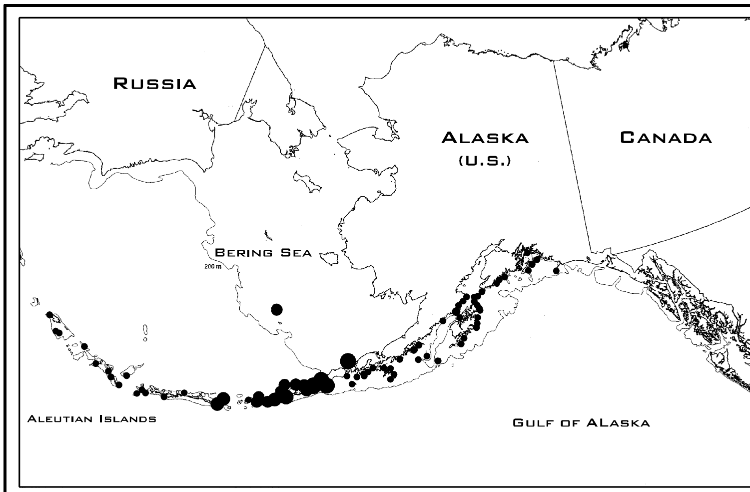
- The Southeast Alaska no-trawl area covers about 52,600 nautical miles. This area contains a vast amount of deepwater living substrates including red tree coral. This closure was adopted as part of the license limitation program (GOA Amendment 41).

- The Sitka Pinnacles Marine Reserve covers about 2.5 square nautical miles (GOA Amendment 59). It contains deepwater living substrates such as corals and anemones. No groundfish fishing is allowed there, to protect the habitat and provide for a sanctuary for spawning lingcod and juvenile rockfish.

- The Cook Inlet area has been proposed as a no-trawl area to control crab bycatch mortality as well as protect crab habitat. It covers about 7,000 nautical miles including state waters.

- The red king crab protection zones around Kodiak Island were established under GOA Amendment 26 to reduce crab bycatch and unobserved crab mortality and to a lesser extent provide habitat protection. Trawling is prohibited in some areas year round, whereas other areas are closed on a seasonal basis. The year-round areas encompass about 1,000 nm^2.

- Year-round trawl closures to pollock trawling, extending out to 10 nm have been implemented around 71 Steller sea lion rookeries and



Location of the zones around Steller sea lion rookeries and haulouts where pollock trawling is prohibited to reduce competition for prey.

haulouts (46 in the GOA, and 25 in the BSAI). If it is assumed that one half of the total area of the circle is comprised of land, on average, for the total closures, then approximately 22,000 nm^2 are closed. These closures were implemented by regulatory amendments authorized under BSAI Amendment 20 and GOA Amendment 25.

- The entire Aleutian Islands management area is closed to pollock fishing year-round to reduce interactions of Steller sea lions and trawl fisheries targeting pollock.

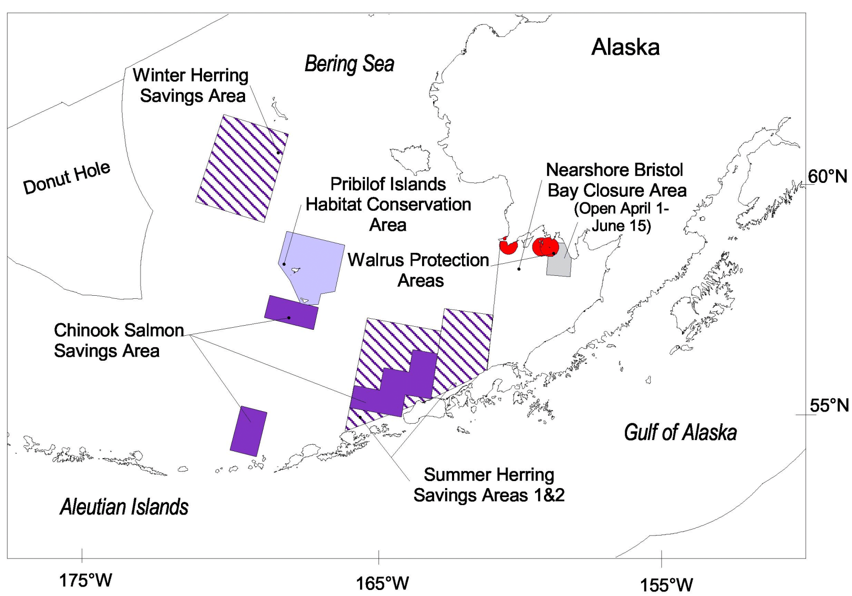
<u>Seasonal Closures</u> - Seasonal closures have been widely adopted to reduce impacts of fisheries on prohibited species and marine mammals. Furthermore, because fishing effort is reduced, seasonal time/area closures provide some added protection to the habitat within the closure area.

- The chum salmon savings area was established to limit the amount of chum salmon that can be taken incidentally by trawl gear (BSAI Amendment 35). This hotspot area is closed during the month of August, and remains closed if a trigger is reached. The area encompasses about 5,000 nm^2.

- The chinook salmon savings areas were designated based on high bycatch rates of chinook salmon taken in trawl fisheries (the pollock fishery in particular). The total area encompasses about 9,000 nm^2. The areas were first established in 1995 (BSAI Amendment 21b), then later modified when the bycatch limit was reduced in 1999 (BSAI Amendment 58). The trigger limit is scheduled to be reduced as follows: 48,000 salmon (current 1999), 41,000 in 2000, 37,000 in 2001, 33,000 in 2002, and 29,000 in 2003. Accounting for the cap begins January 1 and continues year-round. Non-pollock fisheries are exempt from the closure, and those fisheries' chinook PSC bycatch are not counted toward the cap.

- The three Herring Savings Areas were established to limit the amount of herring taken as bycatch in trawl fisheries (BSAI Amendment 16a). There are two areas that would close in summer months, and one in the winter. These areas were established based on seasonal abundance of herring in given areas. Together, the herring savings areas encompass about 30,000 nm^2.

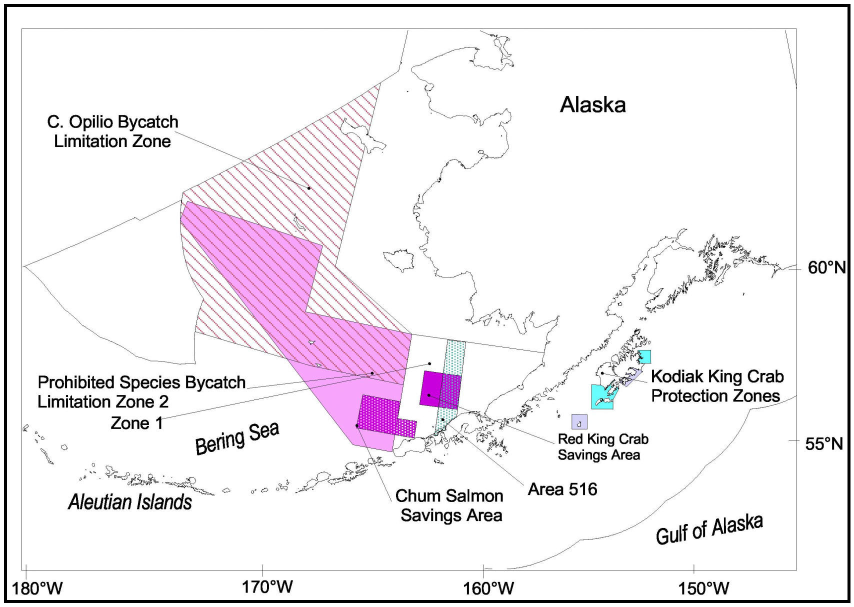
- There are two bycatch limitation zones to limit the amount of Tanner crab taken incidentally in trawl fisheries. These zones were first established under BSAI Amendment 10, then modified under Amendment 12a. Each zone is closed to trawling for target



fisheries when a specified amount is taken in designated trawl fisheries. Tanner crab bycatch zones encompass about 80,000 nm^2.

- The year-round closure of area 512 (BSAI Amendment 10, 1987) was extended to Area 516 with a seasonal closure (BSAI Amendment 12a, 1989) in order to protect red king crabs from trawls when the crabs are molting. Area 516 encompasses about 4,000 nm^2.

- The snow crab bycatch limitation zone is closed when a limited amount of C. opilio is taken incidentally in specified trawl fisheries (BSAI Amendment 40). This area encompasses about 90,000 nm^2.



- Seasonal extensions to Steller sea lion rookeries reduce the interactions of pollock fisheries and sea lions (regulatory amendments).

- During the summer months, all fishing vessels are prohibited within 12 nm of the three major Pacific walrus haulouts in Bristol Bay (BSAI Amendment 17).

Summary of existing closure areas in the Bering Sea /Aleutian Islands and Gulf of Alaska

Bering Sea/Aleutian Islands

Location	Season	Area size	Notes
Area 512	year-round	8,000 nm^2	closure in place
Pribilofs	year-round	7,000 nm^2	established in 1995
RKCSA	year round	4,000 nm^2	established in 1995; pelagic trawling allowed
NSBB	year round	19,000 nm^2	expands the 512 closure
SSL Rookeries	year round	5,800 nm^2	10 mile no-trawl zones around 27 rookeries
Area 516	3/15-6/15	4,000 nm^2	closure in place since 1987 for crab protection
Walrus Islands	5/1-9/30	900 nm^2	12 mile no-fishing zones around 3 haul outs
CSSA	8/1-8/31	5,000 nm^2	re-closed if 42,000 chum salmon bycaught
CHSSA	trigger	9,000 nm^2	closed if 48,000 chinook salmon bycaught
HSA	trigger	30,000 nm^2	closed to specific fisheries when trigger reached
Zone 1	trigger	30,000 nm^2	closed to specific fisheries when trigger reached
Zone 2	trigger	50,000 nm^2	closed to specific fisheries when trigger reached
COBLZ	trigger	90,000 nm^2	closed to specific fisheries when trigger reached
SSL Rookeries	seasonal	5,100 nm^2	20 mile extensions around 8 rookeries

Bogosloff FA-CH	rest of year	23,800 nm^2	closed to all trawling Aug 8, 2000
Sequam Pass FA-CH	rest of year	2,200 nm^2	closed to all trawling Aug 8, 2000

Gulf of Alaska

Location	Season	Area size	Notes
Kodiak	year-round	1,000 nm^2	to protect RKC stocks
Kodiak	2/15-6/15	500 nm^2	to protect RKC seasonally lifestages
SSL Rookeries	year round	3,000 nm^2	10 mile no-trawl zones around 14 rookeries
SSL Rookeries	seasonal	1,900 nm^2	20 mile extensions around 3 rookeries
Southeast AK	year round	52,600 nm^2	adopted as part of the LLP
Sitka Pinnacles	year round	2.5 nm^2	to protect habitat: salmon trolling can occur
Shelikof Strait FA-CH	rest of year	10,950 nm^2	closed to all trawling Aug 8, 2000

CHSSA= chinook salmon savings area
COBLZ= C. opilio bycatch limitation zone
CSSA= chum salmon savings area
FA-CH=Foraging Area-Critical Habitat
HSA= herring savings area
LLP= license limitation program
NSBB= Near shore Bristol Bay
SSL= stellar sea lion buffer zones

3.1.6 Possible Fishery Induced Localized Depletions of Pacific Cod in the Bering Sea

See Appendix 1 for a detailed preliminary analysis of possible localized depletions of Pacific cod in the Bering Sea. This report was the result of a project funded by contract from NMFS in order to determine whether the CPUE declines observed in the Bering Sea in the winter were due to localized depletions or were due to migration and dispersion of Pacific cod after spawning.

The preliminary analysis was not able to definitively relate declining CPUE in the Bering Sea to either localized depletions or the annual migration, or dispersion of Pacific cod. However, the analysis points out that localized depletions are likely to be occurring, "overall...results... are consistent with localized depletions of Pacific cod," and continues to say that "spatially explicit analyses do not strongly indicate that CPUE declines inside the Sea Lion Conservation Area are due to dispersal, i.e. fish migrations into other fishing grounds." Therefore, given the intense fishing pressure in critical habitat during the winter, and the preliminary analysis at hand, NMFS believes that localized depletions, resulting from fishing, are likely to be occurring. It is impossible, however, to determine to what extent they occur and if they are significant in relation to the migration or dispersion of Pacific cod to areas outside of critical habitat. Presently, a preliminary estimate for biomass in critical habitat in the winter is between 19% and 29% of the stock (section 3.1.3.4), during the summer 13% of the stock is observed in critical habitat (from survey estimates). This represents a change of approximately 6 to 16% of the total biomass. From the information currently available, it does not appear that there is a massive migration of the species. Therefore, what causes the observed CPUE declines in the trawl fishery? It is possible that dispersion, (rather than post-spawning migration), and fishery removals (localized depletions), account for the reduced CPUE in the trawl sector.

3.1.7 Effects of the Alternatives

Overall, the Pacific cod stock is considered to be healthy and is not overfished (see section 3.1.3). However, the concern is not with the overall mortality rate, it lies instead with the possible effects of the fisheries on localized regions as discussed below.

Tables 15, 16, and 17 outline the expected catch amounts in the aggregate under each alternative, while Tables 18, 19, and 20 provide a detailed description of the impacts for each sector and sub-sector

3.1.7.1 Bering Sea and Aleutian Islands Area

Alternative 1

In the Bering Sea, the fishery has historically harvested 69% of the annual catch in the winter season, and about 35% of the annual catch was inside critical habitat in the winter (Table 15). Only about 9% of the catch was taken in the summer, and 22% in the fall. In the Aleutian Islands Area 84% of the catch was taken in the winter and approximately 70% was taken inside critical habitat in the winter with little being taken in each of the summer and fall seasons. Additionally, from 1992 through 1999 (an 8-year period), Aleutian Islands catches would have been constrained in six years if there had been a separate TAC allocated for the Aleutian Islands Area (1992-1994, 1996, and 1998-1999). In those six years, catches would have been reduced by an average of about 29% (10,400 mt) (see section 3.1.3.3).

Alternative 2

Under Alternative 2 in the Bering Sea and Aleutian Islands, the annual TAC would be divided into two seasons (A season = 40%, B season = 60%) with a critical habitat limit by season relative to biomass where known (Table 16). Comparing this to the status quo in the Bering Sea, would result in a 15% reduction of the annual catch being taken from critical habitat in the winter and about a 6% reduction in the summer. Annually, the catch in critical habitat would be reduced from 44% to 23.6%, about a 21% reduction (in terms of the annual catch). In the Aleutian Islands, Alternative 2 would result in a reduction of 50% of the catch taken out of critical habitat in the winter. However, this would be offset somewhat by a possible increase in fishing in critical habitat in the summer. This is due to moving a large amount of the fishing effort from the winter to the summer and fall coupled with the relatively high concentration of Steller sea lion biomass in critical habitat. Overall in the Aleutian Islands the catch in critical habitat would be reduced by approximately 17.4% of the annual catch.

<u>Alternative 2 also includes a number of options</u>

Use CPUE relative biomass estimate in critical habitat for the winter limit

This preliminary analysis is undergoing NMFS review. It is likely that variations on this analysis will be presented at the Council meeting in September. Further information will be provided which describes the assumptions and level of uncertainty which surround the estimates provided.

Consider January 1 fixed gear start date

This would allow fishing in the first 20 days of the year during a time period that NMFS has stated as being important to Steller sea lions, and that fishing for pollock and Atka mackerel should not be allowed.

Separate gear allocations of the CH limit

In the case of pollock, the Council allocated different percentages of the critical habitat limit to various sectors. That is consistent with the overall goal of this alternative as long as the total of all sectors do not violate any of the critical habitat or seasonal limitations.

Consider later start date for B season

Industry has asked for the option of a later B season start date. A later start date (by a month or two) would not significantly change the seasonal split and cause temporal concentration of the fishery.

Consider using the SCA management area instead of CH in the Bering Sea

The SCA is discussed in section 3.1.4.1.2. Management of a critical habitat limit using the SCA would further reduce the industry about 5% of their historical catch out of the crescent area which is not critical habitat, however, allowing the crescent area to stay open could result in increase fishing in this small area which is nearly surrounded by critical habitat. The possible effects are unknown given possible behavior of the fishery.

Consider no B season CH limit (closure around rookery and haulout sites only)

In the Bering Sea only about 6% of the Pacific cod biomass is in critical habitat in the summer. Because the alternative moves a large portion of the TAC to this time of the year, consideration of no CH limit given the fishery's recent performance would be contrary to the goals of this alternative and the three principles.

Closure of the Aleutian Islands to directed fishing for Pacific cod

Most of the fishing occurs in critical habitat in the winter. Estimates from the summer survey results in about 80.5% of the biomass is in critical habitat in that season. Little is known about the biomass distribution in the winter. Given that nearly the entire Aleutian Islands fishery occurs in critical habitat, and that only about 30% of the fishery occurs in the 10 nm zone specified for the rookery and important haulouts (which would be closed under this alternative), a closure of the Aleutian Islands (or reduction in TAC) is a reasonable option to consider from the standpoint of protecting prey in critical habitat for Steller sea lions.

Alternative 3

Under Alternative 3 in the Bering Sea and Aleutian Islands, the annual TAC would be divided into three seasons (ratio of 40:30:30) with no directed fishing in critical habitat (Table 17). Comparing this to the status quo in the Bering Sea, would result in a 35% reduction of the annual catch being taken from critical habitat in the winter and about a 9% reduction in the summer and fall seasons combined. Annually, the catch in critical habitat would be reduced by 44%. In the Aleutian Islands, Alternative 3 would result in a reduction of 70% of the catch taken out of critical habitat in the winter, and about 14% in the summer and fall seasons combined. Overall in the Aleutian Islands the catch in critical habitat would be reduced by approximately 86% of the annual catch.

This alternative would result in fishing rates much higher outside of critical habitat than would be predicted under Alternative 2 where the goal is to fish according to biomass abundance.

3.1.7.2 GOA

Alternative 1

In the GOA, the fishery has historically harvested 84% of the annual catch in the winter season, and about 60% of the annual catch was inside critical habitat in the winter (Table 15). Only about 8% of the catch was taken in the summer, and 8% in the fall. In area 610, 93% of the annual catch was taken in the winter season, and about 80% of the annual catch in 610 was inside critical habitat in the winter. In area 620, 77% of the annual catch was taken in the winter season, and about 63% of the annual catch in 620 was inside critical habitat in the winter. In area 630, 80% of the annual catch was taken in the winter season, and about 45% of the annual catch in 630 was inside critical habitat in the winter.

Alternative 2

Under Alternative 2 in the GOA, the annual TAC would be divided into two seasons (A season = 40%, B season = 60%) with a critical habitat limit by season relative to biomass where known (Table 16). Comparing this to the status quo in the GOA, would result in a 39.8% reduction of the annual catch being taken from critical habitat in the winter. Annually, the catch in critical habitat would be reduced from 65% to 52%, about a 13% reduction (in terms of the annual catch). In area 610, Alternative 2 would result in a 60% reduction of catch in critical habitat in the winter. In area 620, there would be a 43% reduction of catch in critical habitat in the winter, and in area 630, there would be a 25% reduction of catch in critical habitat in the winter.

Alternative 2 also includes a number of options

Consider later start date for B season

Industry has asked for the option of a later B season start date. A later start date (by a month or two) would not significantly change the seasonal split and cause temporal concentration of the fishery.

Consider no B season CH limit (closure around rookery and haulout sites only)

In the GOA, catch in the summer and fall has historically been low and therefore, catch in critical habitat has also been low. This alternative would force the fishery to operate in this period which they have not traditionally fished. Biomass estimates for critical habitat are about 53%. On average, the GOA fishery has taken about 60-70% of its catch from critical habitat, which is about 10-20% higher than the amount of biomass expected in the summer inside critical habitat. Therefore, it is reasonable to require a B season critical habitat limit.

Alternative 3

Under Alternative 3 in the GOA, the annual TAC would be divided into three seasons (40:30:30 split) with no directed fishing in critical habitat (Table 17). Comparing this to the status quo in the GOA, would result in a 60% reduction of the annual catch being taken from critical habitat in the winter and about a 6% reduction in the summer and fall seasons combined. Annually, the catch in critical habitat would be reduced by 65%. In area 610, Alternative 3 would result in an 80% reduction of catch in critical habitat in the winter. In area 620, there would be a 63% reduction of catch in critical habitat in the winter, and in area 630, there would be a 45% reduction of catch in critical habitat in the winter.

This alternative would result in fishing rates much higher outside of critical habitat than would be predicted under Alternative 2 where the goal is to fish according to biomass abundance.

3.2 Effects on Marine Mammals

3.2.1 Steller Sea Lion

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

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

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

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

Compared to other pinnipeds, Steller sea lions tend to make relatively shallow dives, with few dives recorded to depths greater than 250 m. Maximum depths recorded for individual adult females in summer are in the range from 100 to 250 m; maximum depth in winter is greater than 250 m. The maximum depth measured for yearlings in winter was 72 m (Merrick and Loughlin 1997; Swain and Calkins 1997)

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

The count of adult and juvenile Steller sea lions in Alaska during 1996/98 was 40,565 (Alaskan western stock = 29,658), with a total for the state of 52,602 if pups are included (Sease and Loughlin 1999). In the late 1950s and early 1960s, the total population in the North Pacific was estimated to be about 240,000 to 300,000 (Kenyon and Rice 1961). Steller sea lions are currently managed as two distinct stocks (i.e., eastern and western) (Loughlin 1997). Abundance of the U.S. eastern stock remained relatively stable from the 1960s to 1985 at around 13-15,000 nonpups, and has since increased to nearly 19,000 nonpups. The U.S. western stocks on the other hand have declined continuously since the 1960s, from around 177,000 nonpups in the 1960s to 33,600 nonpups in 1994 (Figure 27). In the 1960s, the western stock included 92 percent of the U.S. population, but by 1994 this proportion had declined to 64 percent (Loughlin *et al.* 1992, Merrick *et al.* 1987).

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

The NMFS observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. The minimum estimated mortality rate incidental to commercial fisheries is 30 Steller sea lions per year, based on observer data (23.7) and self-reported fisheries information (5.7) or stranding data (0.2) where observer data were not available. No Steller sea lion mortality was observed by NMFS in either pot fishery (Hill and DeMaster 1999).

The NMFS has implemented several management measures for Steller sea lions. In 1990, coincident with the ESA listing of Steller sea lions, NMFS: (1) prohibited entry within three nautical miles of listed Steller sea lion rookeries west of 150°W; (2) prohibited shooting at or near Steller sea lions; and (3) reduced the allowable level of take incidental to commercial fisheries in Alaskan waters (50 CFR 227.12) (Fritz *et al.* 1995). As a result of ESA Section 7 consultations on the effects of the North Pacific federally-managed groundfish fisheries, NMFS implemented additional protective measures in 1991, 1992, and 1993 to reduce the effects of certain commercial groundfish fisheries on Steller sea lion foraging [50 CFR 679.20(a)(5)(ii), 679.22(a)(7) and (a)(8), and 679.22(b)(2))(1994)]. No additional management actions accompanied the 1997 change in ESA listing. However, since 1998 several additional management measures have been implemented in Alaskan groundfish fisheries. The Atka mackerel fishery in the Aleutian Islands was modified to restrict removals from inside critical habitat and seasonal apportionments were established. In December 1998, NMFS developed a set of management actions for the BSAI and GOA pollock fisheries after reaching a jeopardy finding under the ESA. The actions included further temporal/spatial distribution of the fisheries, establishment of additional pollock trawl closure zones around haulouts and closure of the Aleutian Islands to pollock trawling.

3.2.1.1 Prey Composition in Steller Sea Lion Diet

Overview

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

The total estimated annual food consumption by the Steller sea lion population in the EBS is 185.2 x 10^3 mt, of which 140.7 x 10^3 mt (76 percent) is fish. Of the total annual fish consumption, commercial groundfish comprise 69 percent. The groundfish consumption by Steller sea lions represents 0.4 percent of the standing biomass consumed annually by all predators combined in the EBS (Perez and McAlister 1993).

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

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

Recent Diet Analyses: 1990-1998

The primary method of identifying prey species consumed by Steller sea lions is through analysis of bony remains in scat (fecal) 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.

Historically, prey remains from predator stomachs were considered the best source of information for diet studies. However a recent analysis of prey remains from stomachs and colons of northern fur seals (Sinclair, et al. 2000) illustrates the potential bias in basing diet studies on either stomachs or scats alone. 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. The scat remains from that same animal however, typically represent meals eaten 12 - 72 hours prior and tend to under represent the size of prey consumed since small items pass through the digestive tract much more readily than large items. Thus, bias in interpretation of prey species, prey size and age estimates, prey number or volume consumed occurs when based on any single method. Diet studies based on scat are specifically limited in terms of providing prey number, and thus volume and biomass estimates of prey consumed. Nonetheless scat is a reliable tool for monitoring seasonal and temporal trends in predator diets and eliminates the need to euthenize the animal.

A recent analysis of ten years (1990-1998) of Steller sea lion scat material collected from rookeries and haul-outs in the Gulf of Alaska, Aleutian Islands, and southern Bering Sea confirms that Pacific cod (*Gadus macrocephalus*) is among the top prey of Steller sea lions with highest occurrences during winter months (Table 21 and Figure 28, NMML, unpub. data). The study also found a mean size of Pacific cod of about 50 cm in Steller sea lion diet, which overlaps with the size of Pacific cod targeted in commercial fishery catches. The discussion below addresses the methodology and interpretation of data used to identify and quantify the size of Pacific cod consumed by Steller sea lions.

Methods

Scat has been collected from Steller sea lion rookeries and haulout sites from the Gulf of Alaska and Aleutian Islands since 1990, and twice yearly for seasonal comparisons since 1995. The relative "importance" of an individual prey species in the diet of Steller sea lions is based on the number of scats that contain that prey species and is referred to as "percent frequency of occurrence" (%FO), or "percent occurrence".

The most useful bony remains for identifying and quantifying the size of fish consumed by a marine mammal are the sagittal otoliths (ear bones). Species specific regression formulae that allow estimation of fish length from otolith length have been identified for many species including Pacific cod. Unfortunately, otoliths rarely occur in scat from Steller sea lions because of the strong mechanical and enzymatic processes by which they digest their food. Other bones such as gill rakers occur in scat in good condition and are used in the absence of otoliths to identify fish prey to species, *but cannot be used to determine fish size*. A single fish typically has up to 300 gill rakers, one or two of which will survive the Steller sea lion digestive process to be recovered in scat remains. Since gill rakers from any one fish are highly variable in shape and size, their potential for quantifying the number or size of fish consumed is limited. Instead, fish size can only be approximated (i.e. "small", "very large") by visual comparison of the gill rakers with those of a size-stratified series from known age/length fish collected for this study. This method of visual assessment is useful on a broad scale, but does not allow quantitative treatment of the data. Therefore, the next step in this study was to identify specific bones other than gill rakers that might be used to quantify prey lengths.

Regression formulae were developed based on cranial and post-cranial bones from a size stratified series of known age/length Pacific cod. Ultimately, five measurable bone types (dentary, epi- and hypobranchial, quadrate, premaxilla, and epihyal) that provided a high degree of correlation with total fish length (r-squared values ranging 0.966 - 0.990) were selected. Because of the predominance of gill rakers in the prey remains, these five bone types had previously been used only as a secondary means of identifying Pacific cod from Steller sea lion scats. They are also more likely to be eroded by digestion than gill rakers. However, each of the five bones occurs frequently in scat material and can be used to identify prey remains to the species level. Therefore, the 10 year database was reanalyzed with application of this new technique allowing for quantification of the size of Pacific cod consumed by Steller sea lions.

Results

Pacific cod is among the top prey of Steller sea lions (Table 21), particularly during December - March, when it occurs in up to 62% of scats that contain prey parts (Figure 29). Highest occurrences of Pacific cod during winter months are from scats collected on rookeries in the Gulf of Alaska (Figure 29). Pacific cod also occurs in the diet of Steller sea lions during summer months, but at lower frequencies overall (Figure 30). In terms of percent occurrence, Pacific cod was ranked as the fourth most common prey overall, but was the second most common prey item in the winter behind pollock (Figure 28). In the summer, Pacific cod drops down to the sixth position being found in only about 8% of the scat samples analyzed. It is important to note that the values presented in Figure 28 are overall averages and don't necessarily reflect what occurs at any particular rookery or haulout. Figures 29 and 30 present the range of values found at individual sites.

In previous analyses to determine the size of Pacific cod eaten by Steller sea lions, researchers used gill rakers to approximate size into subjective size categories as described above (see June 6 Pacific cod discussion paper). In that analysis, approximately 80% of the Pacific cod remains recovered from Steller sea lion scat during summer and winter months were from "very large" fish up to 80 cm in total length. This category was too broad to determine the degree if size overlap with the fishery. In response to this challenge, NMFS biologists made direct measurements of five selected bones (see above description of cranial and post-cranial bones) occurring in scat samples containing "very large" Pacific cod. This yielded a total length range of 30-75 cm with a mean of 50 cm once erosion is taken into account (Figure 31). Therefore, on average, 80% of the Pacific cod eaten by Steller sea lions were approximately 50 cm in length.

This study is being expanded to develop a technique for direct measurement of gill rakers. It is expected that quantifying total length from gill raker measurements will result in increased sample sizes, a stronger representation of 50-80 cm Pacific cod as indicated in subjective estimates, and an increase in the estimate of mean size of Pacific cod consumed by Steller sea lions.

3.2.1.2 Possible Fishery/Steller Sea Lion Interactions

Ecological interactions between marine mammals and commercial fisheries are difficult to identify in most cases. Examples of observable interactions are generally restricted to direct mortality in fishing gear. Even then, the ecological significance of the interaction is related to the number of animals killed and subsequent population level responses. None of the marine mammal incidental mortality estimates for Alaskan groundfish fisheries exceed the potential biological removals (PBRs) (Hill and DeMaster 1999); therefore, those interactions are not expected to have large consequences for Steller sea lions.

More difficult to identify and potentially more serious are interactions resulting indirectly, from competition for resources that represent both marine mammal prey and commercial fisheries targets. Such interactions may limit foraging success through localized depletion, dis-aggregation of prey, or disturbance of the predator itself. Compounding the problem of identifying competitive interactions is the fact that biological effects of fisheries may be indistinguishable from changes in community structure or prey availability that might occur naturally. Lowry (1982) developed qualitative criteria for determining the likelihood and severity of biological interactions between fisheries and marine mammal species in the Bering Sea. Based on his Bering Sea assessment, three pinniped species (northern fur seal, harbor seal, and Steller sea lion) had the greatest potential for adverse ecological interactions with commercial fisheries. Noticable declines in abundance of these three species has occurred over the past 30 years (Loughlin *et al.* 1992, NMFS 1993, Pitcher 1990).

The relative impact of fisheries perturbations compared to broad, regional events such as climatic shifts are uncertain, but given the potential importance of localized prey availability for foraging marine mammals and the continuing decline of Steller sea lions it is possible that changes in the prey field available to Steller sea lions is continuing to negatively effect their foraging success. 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 juveniles because they forage mostly in the upper water column close to land, may make them more vulnerable to changes in prey availability. They further reasoned that because of the behavior of juveniles and nursing females, that 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).

3.2.1.3 Previous Actions to Protect Steller Sea Lion Prey Availability

<u>Atka mackerel</u>

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 estimates of total Atka mackerel biomass in the Aleutian Islands region, fishery harvest rates in localized areas may have been high enough to affect prey availability of 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 populations in the Aleutian Islands 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, 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 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:

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%

Pollock

As a result of the RFRPAs, an additional 83,080 km^2 (21%) of critical habitat in the Aleutian Islands was closed to pollock fishing along with 43,170 km^2 (11%) around sea lion haulouts in the GOA and eastern Bering Sea. Consequently, after the RFRPAs were implemented, a total of 210,350 km^2 (54%) of critical habitat was closed to the pollock fishery. The portion of critical habitat that remained open to the pollock fishery consisted primarily of the area between 10 and 20 nm from rookeries and haulouts in the GOA and parts of the eastern Bering Sea foraging area.

The Bering Sea and Aleutian Islands pollock fishery was also subject to changes in total catch and catch distribution. Disentangling the specific changes in the temporal and spatial dispersion of the EBS pollock fishery resulting from the sea lion management measures from those resulting from implementation of the American Fisheries Act (AFA) is difficult. The AFA reduced the capacity of the catcher/processor fleet and permitted the formation of cooperatives in each industry sector by 2000. Both of these changes would be expected to reduce the rate at which the catcher processor sector (allocated 36% of the EBS pollock TAC) caught pollock beginning in 1999, and the fleet as a whole in 2000. Because of some of its provisions, the AFA gave the industry the ability to respond efficiently to changes mandated for sea lion conservation that otherwise could have been more disruptive to the industry.

Reductions in pollock catches from BSAI sea lion critical habitat were realized by closing the entire Aleutian Islands region to pollock fishing and by phased-in reductions in the proportions of seasonal TAC that could be caught from the Sea Lion Conservation Area, an area which overlaps considerably with sea lion critical habitat. In 1998, over 22,000 mt of pollock was caught in the Aleutian Island regions, with over 17,000 mt caught in AI critical habitat; pollock fishery removals of pollock from the Aleutian Islands in 1999 and 2000 to date have been 0.

On the eastern Bering Sea shelf, both the catches of pollock and the proportion of the total catch caught in critical habitat have been reduced significantly since 1998 as a result of the RFRPAs.

3.2.1.4 Effects of the Alternatives on Steller Sea Lions

Although the exact relationships between commercial fisheries and Steller sea lions cannot be quantified, we intend to explore the possible interaction based on the degree of competition for resources (niche overlap) and spatial and temporal fishery removals which would either positively or negatively affect the prey field available to Steller sea lions.

Assessing competition

Competition occurs when two potential competitors use the same resource, the use of the resource by one potential competitor limits the availability or use by a second competitor, and the restriction in availability or use of the resource constrains or limits the second competitor in some manner.

Three questions must be addressed for each alternative to evaluate the potential for competition:

(1) Are Steller sea lions food-limited?

This first question can be answered for all of the alternatives. This question was addressed by NMFS in its December 8, 1998 Biological Opinion on the pollock and Atka mackerel fisheries. In that document, NMFS examined the evidence that Steller sea lions are food-limited. The best available evidence indicates food limitation remains the primary hypothesis for the ongoing decline of the species. The following is an excerpt from the December 1999 Biological Opinion on the 2000 BSAI and GOA groundfish fisheries:

> *"The available evidence suggests that a significant part of the problem* [declining population] *is lack of available prey. Studies of animals collected in the GOA in 1975-1978 and 1985-1986 indicate that animals in the latter collection were smaller, took longer to reach reproductive maturity, produced fewer offspring, tended to be older, and exhibited signs of anemia --- all observations consistent with the hypothesis of nutritional stress (Calkins and Goodwin 1988, Pitcher et al. in review, York 1994). In addition, survival of juvenile animals appeared to have dropped in both the eastern Aleutian Islands (Ugamak Island; Merrick et al. 1987) and the GOA (Marmot Island; Chumbley et al. 1997). These results, the evidence of substantial changes in the physical and biological features of the BSAI and GOA ecosystems, and the expansion of fisheries in these regions all support the contention that lack of available prey has contributed significantly to the past decline of the western population, and may still be contributing."*

(2) Do Steller sea lions and the Pacific cod fisheries utilize the same resource?

- Selection of prey by size,
- Selection of prey by depth,
- Temporal selection of prey,
- Spatial selection of prey

Four questions outlined above have been previously used by NMFS in its biological opinions to determine if Steller sea lions and the fisheries are competing for prey resources. Each of these factors will be examined for each alternative to determine the possible competitive interaction which might result from the adoption of each alternative.

(3) Do fishery removals of Pacific cod affect the foraging success of Steller sea lions?

At what level of competition (from number 2 above) are Steller sea lions negatively affected so that the overall foraging success declines? Attempts to isolate correlations from this complex situation have been severely confounded by measurement error, multiple varying factors, and time lags between the original action such as fishery removal of prey and a decreased population of Steller sea lions. The fact that the situation is very complex does not mean that competition is not possible, it simply means that the effects of competition may not be separable from the effects of additional factors, such as environmental change, particularly given the data at hand.

In essence, the absolute level of competition between Steller sea lions and the Pacific cod fisheries cannot (at this time) be assessed using direct or simple correlative approaches. Such assessments will be possible only when data are available to describe the foraging distribution of Steller sea lions, the availability of prey within that distribution, and the effects of fisheries on the availability of prey in those regions.

Therefore, this analysis will attempt to demonstrate the relative probability of competition (negative interactions) of the three alternatives presented. Practically, for each alternative, we will attempt to combine all of the possible effects from paragraph (2) above in a qualitative assessment of the possibility for reducing the foraging success of Steller sea lions.

3.2.1.2.1 Alternative 1

Selection of prey by size

Prey size selected by trawl surveys and the commercial fishery are displayed in Figures 3 and 4 and discussed in sections 3.1.3 and 3.1.4. Prey size selected by Steller sea lions is presented in 3.2.1.1 and in Figure 30. Analysis of Steller sea lion scats, as represented in the scat samples from 1990-1998, estimated that about 80% of the Pacific cod found were 50 cm in length (range 30-75cm). The size of Pacific cod in the trawl survey tends to be smaller than those harvested in the commercial fishery. In the commercial fishery, the size of Pacific cod tend to be larger in the Aleutian Islands than in the Bering Sea or Gulf of Alaska (see section 3.1.3.3). The median size in the Bering Sea is about 65 cm, and about 80 cm in the Aleutian Islands.

The size of Pacific cod in the diet of Steller sea lions overlap with the size harvested by the fishery. Most of the fish eaten by Steller sea lions were between 30-60 cm (Figure 30), which represents about the lower half of the size distribution harvested by the fishery (Figure 4). Section 3.2.1.1 describes that estimates of prey size are likely an underestimate given that some fish aren't consumed whole and that erosion of bony parts can be 30% or more. Therefore, it is reasonable to conclude that under Alternative 1, the fishery and Steller sea lions compete for Pacific cod, especially for sizes less than 80 cm. In the Aleutian Islands, given the larger size distribution of Pacific cod, the overlap is slightly less than in the Bering Sea and GOA.

Selection of prey by depth

The depth of Pacific cod removed by the fishery is described in section 3.1.4 and Figure 7. Removals range from 50-200 m, with most of the fishing between 75-150 m. As noted above in section 3.2.1, Steller sea lions have been observed foraging at depths in the range of 75-250 m year-round. Therefore, under Alternative 1, the commercial fishery and Steller sea lions utilize Pacific cod in the same depth ranges.

Temporal selection of prey

Temporal concentration of the fishery is summarized in section 3.1.7.1 and described in detail in section 3.1.4. For all areas, between 70-86% of the annual catch is harvested in the winter, a time period which is believed to be crucial to foraging Steller sea lions. This represents intense temporal concentration and is likely to result in localized depletions (see section 3.1.6) which could reduce the foraging success of nursing females and juvenile Steller sea lions.

Spatial selection of prey

The area of greatest concern for foraging Steller sea lions is critical habitat. These areas are used extensively by nursing females and juveniles who do not have the ability to travel to areas outside this zone in certain times of the year, primarily winter. However, Steller sea lions have been observed foraging over much of the BSAI and GOA, and can travel hundreds of kilometers in a single foraging trip, especially large males (section 3.2.1).

Fishery harvests have recently been concentrated in critical habitat (see section 3.1.7), especially at times of year considered critical to Steller sea lions (see above). Given our best estimation of biomass in critical habitat by season (section 3.1.3.4), the fishery removes a disproportionate amount from critical habitat than from areas outside critical habitat.

Do fishery removals of Pacific cod affect the foraging success of Steller sea lions?

It is NMFS opinion that the Pacific cod fishery under Alternative 1 is compressed in the winter season, and removes excessive amounts of Pacific cod from Steller sea lion critical habitat.

3.2.1.2.2 Alternative 2

Selection of prey by size

Under Alternative 2 we would expect no change from the status quo in the size of Pacific cod harvested by the fishery or eaten by Steller sea lions.

Selection of prey by depth

Under Alternative 2 we would expect no change from the status quo in the depth of Pacific cod harvested by the fishery or eaten by Steller sea lions.

Temporal selection of prey

Temporal patterns in the fishery expected under Alternative 2 are summarized in section 3.1.7.1. Under the status quo, between 70-86% of the annual catch has been harvested in the winter. For Alternative 2, this would be reduced to 40% of the annual TAC, about a 50% reduction in catch in the winter when Steller sea lions are most vulnerable to localized depletions in prey. This action would be a significant change from the status quo and is very similar to the temporal dispersion methods used for Atka mackerel and pollock.

Spatial selection of prey

Spatial patterns in the fishery expected under Alternative 2 are summarized in section 3.1.7.1. Under the status quo, between 35-80% of the annual catch has been harvested in critical habitat in the winter by area. For Alternative 2, this would be reduced to 20% of the annual TAC, about a 15-60% reduction in catch in critical habitat where Steller sea lions are most vulnerable to localized depletions in prey. NMFS will use the estimated biomass of Pacific cod in critical habitat to proportion the amount of catch that would be allowed in any given season.

Additionally, directed fishing for Pacific cod would be prohibited inside 10-20 nm of rookeries and important haulouts, historically, about 30-40% of the catch occurred in these areas (Table 10). This would provide the maximum level of protection in these areas which are believed to be very important to nursing female and juvenile Steller sea lions.

This action would be a significant change from the status quo and is very similar to the spatial dispersion methods used for Atka mackerel and pollock.

Would fishery removals of Pacific cod under Alternative 2 affect the foraging success of Steller sea lions?

It is NMFS opinion that the Pacific cod fishery under Alternative 2 is dispersed between areas outside and inside of critical habitat according to biomass estimates where known, protects Steller sea lion rookeries and important haulouts from directed fishing for Pacific cod, and temporally disperses the fishery into two seasons.

It is NMFS opinion that the Pacific cod fishery under Alternative 2 would successfully reduce competition with Steller sea lions to an extent that would be reasonably likely not to cause intense localized depletions that would reduce the foraging success of Steller sea lions to a point that would cause them irreparable harm.

3.2.1.2.3 Alternative 3

Selection of prey by size

Under Alternative 3 we would expect no change from the status quo in the size of Pacific cod harvested by the fishery or eaten by Steller sea lions.

Selection of prey by depth

Under Alternative 3 we would expect no change from the status quo in the depth of Pacific cod harvested by the fishery or eaten by Steller sea lions.

Temporal selection of prey

Temporal patterns in the fishery expected under Alternative 3 are summarized in section 3.1.7.1. Under the status quo, between 70-86% of the annual catch has been harvested in the winter. For Alternative 2, this would be reduced to 40% of the annual TAC, about a 50% reduction in catch in the winter when Steller sea lions are most vulnerable to localized depletions in prey. Additionally, catch would be dispersed into a summer and a fall season (30:30). This action would be a significant change from the status quo, and would have more temporal dispersion than what was required for Atka mackerel and pollock.

Spatial selection of prey

Spatial patterns in the fishery expected under Alternative 3 are summarized in section 3.1.7.1. Under the status quo, between 35-80% of the annual catch has been harvested in critical habitat in the winter by area. For Alternative 3, all catch in critical habitat would be reduced to 0% of the annual TAC. This is the maximum level of protection possible for critical habitat in areas where Steller sea lions are known to use extensively for foraging.

This action would be a significant change from the status quo and would protect about 386,770 km^2 of ocean surface (about 12% of the fishery management regions) from competition with the commercial fishery.

Would fishery removals of Pacific cod under Alternative 3 affect the foraging success of Steller sea lions?

It is NMFS opinion that the Pacific cod fishery under Alternative 3 would eliminate competition between Steller sea lions and the Pacific cod fishery inside of critical habitat because of a closure to directed fishing. Areas outside of critical habitat would be protected against localized depletions by a regime of three seasons which would not allow harvest rates to occur at a level which would cause depletions.

3.2.2 Northern Fur seal

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

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

Studies on northern fur seal diets began with the work of Lucas (1899). The most extensive research was based on the pelagic sampling of over 18,000 fur seals between 1958 and 1974 (Perez and Bigg 1986). Of the fur seal stomachs collected, 7,373 contained food and an additional 3,326 had trace remains of food. Their diet consists of 67 percent fish (34 percent pollock, 16 percent capelin, 6 percent Pacific herring, 4 percent deep-sea smelts and lanternfishes, 2 percent salmon, 2 percent Atka mackerel, and $\leq$1 percent of eulachon, Pacific cod, rockfishes, sablefish, sculpins, Pacific sand lance, flatfishes and other fish) and 33 percent squid (Perez 1990). These data showed marked seasonal and geographic variation in the species consumed. In the EBS, pollock, squid, and capelin accounted for about 70 percent of the energy intake. In contrast, sand lance, capelin, and herring were the most important prey in the GOA.

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

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

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

Abundance varies by season. During the breeding season, approximately 74 percent of the worldwide population is found on the Pribilof Islands with the remaining animals spread throughout the North Pacific Ocean. Of the seals in U.S. waters outside of the Pribilof Islands, approximately one percent of the population is found on Bogoslof Island in the southern Bering Sea and San Miguel Island off southern California (Lloyd *et al.* 1981, NMFS 1993a). Two separate stocks of northern fur seals are recognized within U.S. waters: An eastern Pacific stock and a San Miguel Island stock. The most recent estimate for the number of fur seals in the eastern Pacific stock is approximately 1,019,192 (Hill and DeMaster 1999).

Northern fur seals were listed as depleted under the Marine Mammal Protection Act (MMPA) in 1988 because population levels had declined to less than 50 percent of levels observed in the late 1950s and no compelling evidence existed that carrying capacity had changed substantially since that time (NMFS 1993a). Under the MMPA, this stock remains listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60 percent of carrying capacity).

A conservation plan for the northern fur seal was written to delineate reasonable actions to protect the species (NMFS 1993a). Following that, fisheries regulations were implemented in 1994 (50 CFR 679.22(a)(6)) to create a Pribilof Islands Area Habitat Conservation Zone, in part, to protect the northern fur seals.

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

Declines of otariid populations in the Bering Sea and North Pacific Oceans are currently attributed to this reduction in diet diversity and may be indirectly related to anthropogenic factors such as commercial fishing and historical whaling operations. However, the extent to which fisheries removals might contribute to reduced northern fur seal foraging success has not been determined.

3.2.3 Harbor Seal

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

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

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

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

Three separate stocks of harbor seals are recognized in Alaska waters: (1) The southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, (2) the GOA stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and (3) the Bering Sea stock - including all waters north of Unimak Pass (Hill and DeMaster 1999). Population sizes and mortality rates in fisheries are calculated separately.

The most recent comprehensive aerial surveys of the southeast Alaska stock were conducted during the autumn molt in 1997 and 1998. Uncorrected (for animals not present during assessment surveys) counts for the northern southeast Alaska region, in 1997 (from Kayak Island to Frederick Sound) yielded 18,933 seals. Uncorrected counts for the southern southeast Alaska region (from Federick Sound to the US/Canada border), in 1998, was 26,106 animals. Utilizing a correction factor to account for harbor seals in the water (i.e., not accounted for in aerial photographs), the combined population estimate for southeast Alaska is 77,917. This apparent increase from the previous Stock Assessment Review (SAR) estimate (37,450) Hill and DeMaster 1999) should be interpreted as a result of improved and refined assessment procedures and not a population explosion. The NMFS observers monitored harbor seal incidental take in the GOA groundfish trawl, longline, and pot fisheries during 1990-1996. Incidental takes within the range of the southeast Alaska stock of harbor seals occurred only in the longline fishery, with annual mortality estimated to be 4.0 seals (Hill and DeMaster 1999).

The GOA stock was assessed in sections with photographic aerial surveys during the autumn molt in 1994 and 1996. Utilizing a correction factor to account for harbor seals in the water (i.e., not accounted for in aerial photographs) the estimate was 29, 175 (Hill and DeMaster 1999). The NMFS observers monitored incidental take in the GOA groundfish trawl, longline, and pot fisheries, and the Prince William Sound and Alaska Peninsula/Aleutian Islands salmon drift gillnet fisheries. The mean annual (total) mortality from fisheries with observers was estimated to be 24.6 harbor seals (Hill and DeMaster 1999).

The Bering Sea stock was surveyed during the autumn molt of 1995 throughout northern Bristol Bay and along the north side of the Alaska Peninsula (Withrow and Loughlin 1996). The estimated abundance, corrected for animals in the water, is 13,312 (Hill and DeMaster 1999). The NMFS observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries. The mean annual (total) mortality was 2.2 for the BSAI groundfish trawl fishery, 0.6 for the BSAI longline fishery, and 1.2 for the BSAI pot fishery, a total of 4 harbor seals (Hill and DeMaster 1999).

Spatial partitioning of offshore commercial harvests and inshore feeding harbor seals may limit the degree of potential competition, but the foraging range of harbor seals may still overlap commercial fishing grounds. Thus, this overlap applies to the western and GOA harbor seal stocks, while the southeast Alaska stock of harbor seals are distributed such that overlap with federally managed commercial groundfish fisheries is minimal, and the potential for adverse fishery impacts there is low.

3.2.4 Other Pinnipeds

The “other pinnipeds” group includes spotted seals, bearded seals, ringed seals, and ribbon seals. Ecological interactions between these species and commercial fisheries are generally limited by both spatial separation and differences between commercial harvest targets and the species food habits.

The distributions of the “other pinnipeds” tend toward seasonally or permanently ice covered waters of the Beaufort, Chuckchi, Bering and Okhotsk Seas, generally north of most areas commercially fished for groundfish, although individuals of each species can be found further south in the Bering Sea. In particular, spotted seals also occur in coastal waters of Bristol Bay, on the Pribilof Islands and to a lesser extent, in the eastern Aleutian Islands.

With the exception of spotted seals, the food habits of these species do not overlap significantly with commercial fisheries targets. Bearded seals consume primarily benthic prey including crabs and clams as well as shrimps and Arctic cod (Kosygin 1966; Kosygin 1971; Lowry and Frost 1981). Ringed seals eat Arctic cod, saffron cod, smelt, herring, shrimps, amphipods and euphausiids (Fedoseev 1984; Johnson 1966; Lowry 1980; McLaren 1985). Ribbon seal diet has been characterized as intermediate between ringed and bearded seals (Shustov 1965). Spotted seals include pollock in their diet when feeding in the central Bering Sea (Bukhtiyarov *et al.* 1984), but their use of that resource in the eastern Bering Sea and Aleutian Islands in unknown. Spotted seal diet in Bristol Bay, the Priblof Islands and the eastern Aleutians is likewise unknown, but if similar to harbor seals in those areas, it is likely to be diverse and may include a small percentage of commercially important species. Thus, no adverse impacts are expected under any of the proposed alternatives.

3.2.5 Pacific Walrus

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

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

Determining Pacific walrus population size is complicated by sampling problems and interpretation of survey results. The total initial estimate of 270,000-290,000 animals in 1980 (Johnson *et al.* 1982) was later adjusted to about 250,000 (Fay *et al.* 1984, Fedoseev 1984). Nonetheless, a dramatic increase in the size of the walrus population up to 1980 has been indicated by the survey results, and by range expansion (Fay *et al.* 1984, Sease 1986).

The species is not listed under the ESA and has no special status under the MMPA. Round Island, one of the most important terrestrial haulouts in the United States, is a State of Alaska preserve and federal regulations prohibit entry of fishing vessels inside 12 miles (672.22(a)(4)).

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

The fishery would have little or no impact on the Pacific walrus population under any of the proposed alternatives.

3.2.6 Killer Whale

Killer whales (*Orcinus orca*) have been observed in all oceans and seas of the world (Leatherwood *et al.* 1982). In Alaska waters, killer whales occur along the coast from the Chukchi Sea, into the Bering Sea, along the Aleutian Islands, GOA, and into southeast Alaska (Braham and Dahlheim 1982). They occur primarily in coastal waters, although they have been sighted well offshore (Heyning and Dahlheim 1988). Seasonal movements in polar regions may be influenced by ice cover and in other areas primarily by availability of food. Prey include marine mammals, birds, fish, and squid (Jefferson *et al.* 1991). The total estimated annual prey consumption by the population in the EBS is 16.1 x 10^3 mt, of which 10.5 x 10^3 mt (65 percent) is fish (Perez and McAlister 1993). Interactions with commercial longline fisheries are well-documented throughout the BSAI. Depredation rates of bottomfish by killer whales on longline catches, based on four different methods of calculation, suggested that whales took 14-60 percent of the sablefish, 39-69 percent of the Greenland turbot, and 6-42 percent of the arrowtooth flounder caught in commercial gear (Yano and Dahlheim 1995).

Four killer whale stocks are recognized along the west coast of North America from California to Alaska. Two of them occur in Alaska, the Eastern North Pacific Northern Resident stock and the Eastern North Pacific Transient stock (Hill and DeMaster 1999). The combined counts of resident and transient killer whales are 717 and 336, respectively (Dahlheim 1994, Dahlheim *et al.* 1996, Dahlheim and Waite 1993). Reliable data on trends in population abundance for either stock are not available (Hill and DeMaster 1999).

The NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1998. Observed incidental mortality of killer whale occurred in the BSAI groundfish trawl and longline fisheries with a mean annual (total) mortality of 1.0 for BSAI trawl and 0.4 for BSAI longline. No killer whale mortality was observed in the pot fisheries (Hill and DeMaster 1999). Killer whales interact with longline fisheries in the southeastern Bering Sea where predation on catch, especially sablefish and Greenland turbot, occurs periodically as gear is being retrieved (Dahlheim *et al.* 1996). Fishermen within the fixed gear Pacific halibut and sablefish fisheries are allowed to use longline pot gear to reduce interactions with killer whales (61 FR 49076, September 18, 1996).

Nishiwaki and Handa (1958) examined killer whale stomach contents from the North Pacific Ocean and found squid, fish, and marine mammals, in order of abundance. Whether these findings are consistent with killer whale foraging patterns in either the BSAI or GOA groundfish management areas is uncertain, but there is no evidence to suggest exclusive reliance on commercially important groundfish species. Thus, the grounds for suggesting competition for forage, despite broad distributional overlaps between the species and commercial fisheries is weak.

3.2.7 Other Toothed Whales

The “other toothed whales” occurring in Alaskan waters include beluga whales, Pacific white-sided dolphins, harbor porpoise, Dall’s porpoise, sperm whales and beaked whales. The impacts of any alternative considered in this document on these species would be minimal. While each of these species, except for beluga whale frequents areas used by the groundfish fishery, their ecological interactions with commercial fisheries are limited by differences between their prey and the fisheries harvest targets.

The beluga whale stocks along the western coast of Alaska from Bristol Bay north, and the one in Cook Inlet are generally restricted to shallow coastal and estuarine habitats not used by commercial groundfish fisheries. Their diet is predominantly salmonids and small schooling fishes such as eulachon and capelin. Thus, little grounds for groundfish fishery interactions exists for this species.

Similarly, Pacific white-sided dolphins are not commonly observed north of the Aleutian Islands, and appear to be seasonal visitors in parts of the Gulf of Alaska and Southeast Alaska, thus the main body of their population is more commonly found in the central North Pacific Ocean. With regard to diet, they, like Dall’s porpoise feed mainly on cephalopods and small schooling fishes such as myctophids.

The remaining species consume a wide variety of both fish and invertebrate species, but overlap with commercially important species is limited in most cases. Beaked whales, a diverse group unto itself, are poorly known, but available information suggests that they prey on benthic and epibenthic species including squid, skates, rattails, rockfish, and octopus. Harbor porpoise diet in Alaskan waters is also poorly understood, although forage consumed by stocks in the Pacific Northwest and their tendency toward near shore distribution suggest that they probably consume a variety of coastal species.

Sperm whale diet overlaps with commercial fisheries targets more than any other species in this group, but the degree of overlap is at least partly due to direct interactions with longline gear. In addition to consuming primarily medium to large sized squids, they also consume salmonids, rockfish, lingcod and skates, and in the Gulf of Alaska they have been observed feeding off longline gear targeting sablefish and halibut. The interactions with commercial longline gear does not appear to have an adverse impact on sperm whales, much to the contrary, the whales appear to have become more attracted to these vessels in recent years.

3.2.8 Baleen Whales

The baleen whales present in Alaskan waters include the gray, humpback, fin, minke, northern right, bowhead, blue and sei whales. Ecological interactions between commercial fisheries and these species are well partitioned on the basis of major differences between the whale's diets and commercially important target species. Several whale species such as blue, fin, sei, and northern right whale feed primarily on copepods, euphausiids, and amphipods. Gray whales feed mostly on epibenthic and benthic invertebrates, while humpbacks have a more diverse diet including euphausiids, mackerel, sand lance, herring and capelin. None of these are commercially important target species.

With regard to distributional overlaps, one or more of these whale species, with the probable exception of the bowhead whale, are likely to occur in groundfish harvesting areas. The effect of commercial fishing activity on baleen whale prey aggregations is unknown. However, these prey species, like the whales themselves, are broadly distributed both inside and outside of areas commercially fished so that reliance on localized prey, should it be temporarily disrupted by fishery activities, is unlikely to adversely impact overall foraging success or the status and trends of the population at large.

3.2.9 Sea Otter

Sea otter distribution is generally inshore, in depths less than 34 m, although large groups were observed 30 km north of Unimak Island in the Bering Sea during the late 1960s (Kenyon 1969). Sea otter prey is highly diverse, consisting of over 80% benthic invertebrates, including sea urchins, abalone, numerous bivalve species, crabs, snails, squid and octopus. Of the remaining 20% fish, lumpsuckers, sculpins and greenlings are most common, and none of these are commercially important in the groundfish fisheries. Less than 1% of the sea otter diet is comprised of commercially exploited species, including Atka mackerel, rockfishes, sablefish Pacific cod and pollock (Perez 1990). Given such minor occurrence of commercially exploited groundfish in the sea otter diet and their otherwise broad utilization of benthic resources, the availability of groundfish would be expected to have little, if any, impact on sea otter foraging.

3.3 Effects on Seabirds

3.4.1 Short-tailed Albatross

The short-tailed albatross (*Phoebastria albatrus*) current range includes the Bering Sea and the Gulf of Alaska. Originally numbering in the millions, the worldwide population of breeding age birds is currently approximately 600 individuals and the worldwide total population is approximately 1300 individuals (the population was estimated at 400 in 1988, 700 in 1994). The population is increasing at an approximate annual rate of 7 to 8 percent, based on egg counts from 1980 to 1998. At the beginning of the 20th century, the species declined in population numbers to near extinction, primarily as a result of hunting at the breeding colonies in Japan. Breeding colonies are located on two islands in Japan, the primary colony being on Torishima Island (24.30°N, 154.00°E), 370 miles south of Tokyo, and a much smaller colony on Minami-kojima Island. As the population increases, the potential for interactions with commercial fisheries increases. Preliminary information from a population model indicates that the short-tailed albatross population could have realized a 0.2 percent higher survival rate if incidental takes in the fisheries had not occurred from 1980 to 1989.

The short-tailed albatross was originally designated as endangered under the Endangered Species Conservation Act of 1969 on the list of foreign-listed species. When the ESA replaced the 1969 Act in 1973, it was included as a foreign species but not as a native species, thus the current listing notes the short-tailed albatross as endangered except in the United States. The USFWS proposed to correct this administrative error by extending the endangered status for the short-tailed albatross to include the species' range within the United States (63 FR 58692, November 2, 1998). This proposal was finalized and the endangered status of the short-tailed albatross extended in a final rule published by the USFWS on July 31, 2000 (65 FR 46643).

Past observations indicate that adult short-tailed albatrosses are present in Alaska primarily during the summer and fall months along the shelf break from the Alaska Peninsula to the GOA, although 1- and 2-year old juveniles may be present at other times of the year. Consequently, these albatrosses generally would be exposed to fishery interactions most often during the summer and fall. Seven short-tailed albatross takes have been reported in the Alaskan fisheries from 1983 to 1999, 6 of these from vessels using hook-and-line gear. These occurred in the months of July, August, September (3), and October (2). Short-tailed albatross sightings in the BSAI and/or GOA have occurred in all months of the year. The first reported take of a short-tailed albatross in the Alaskan fisheries was in July 1983, north of St. Matthew Island (between 60°N, 180° and 58°.5' N, 175°W). The bird was found dead in a fish net. A second take occurred in October 1987, and was caught by a vessel fishing for halibut in the GOA (59° 27.7'N, 145° 53.3'W). A juvenile short-tailed albatross was taken in the western GOA IFQ sablefish hook-and-line fishery south of the Krenitzin Islands (53° 31'N, 165° 38'W) on August 28, 1995. NMFS issued regulations requiring operators of hook-and-line vessels fishing for groundfish in the GOA and the BSAI to conduct fishing operations in a certain manner and employ specified bird avoidance techniques to reduce seabird bycatch and incidental seabird mortality of short-tailed albatrosses and other seabird species in 1997 (62 FR 23176) and amended in 1998 (63 FR 11161).

The biological opinion on the effects of the BSAI and GOA groundfish fisheries on the short-tailed albatross required NMFS to develop a plan to evaluate the effectiveness of the seabird avoidance measures that were required in 1997. The biological opinion issued by USFWS in 1998 on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross required NMFS to test the effectiveness of seabird avoidance measures in the groundfish fisheries to the Pacific halibut fishery also. The plan must also be implemented and a final report on the evaluation of avoidance measures submitted to USFWS by December 31, 2000. NMFS completed and submitted to USFWS a *Test Plan to Evaluate Effectiveness of Seabird Avoidance Measures Required in Alaska's Hook-and-Line Groundfish and Halibut Fisheries*.

A two-year study evaluating the effectiveness of seabird avoidance measures was initiated in 1999. The goal of the research program is to develop methods to reduce the incidental capture of seabirds in Alaska longline fisheries without decrfeasing the target catch or increasing the bycatch of other species. In 1999, research was conducted on active fishing vessels in two Alaska longline fleets, the IFQ fishery targetting sablefish and the freezer-longliner fleet targetting Pacific cod. Once final research results are available in early 2001, NMFS and the Council can anticipate recommendations for regulatory changes intended to improve the effectiveness of the currently required seabird avoidance measures.

3.4.2 Eider

Spectacled Eider

Spectacled eiders (*Somateria fischeri*) are large diving sea ducks that spend most of the year in marine waters where they primarily feed on bottom-dwelling molluscs and crustaceans. Besides breeding and molting in some Alaska coastal areas, spectacled eiders congregate during the winter in exceedingly large and dense flocks in openings in the pack ice in the central Bering Sea between St. Lawrence and St. Matthew Islands. Spectacled eiders from all three known breeding areas (in Alaska and Russia) use this wintering area. While at sea, spectacled eiders appear to be primarily bottom feeders, eating molluscs and crustaceans at depths of up to 70 m in the wintering area. Between the 1970s and 1990s, spectacled eiders on the Yukon-Kuskokwim Delta (an Alaska breeding area) declined by 96 percent to fewer than 2,500 pairs in 1992. Based upon surveys conducted during the past few years, the Yukon-Kuskowkim Delta breeding population is estimated to be about 4,000 pairs. The current worldwide population estimate is 360,000 birds, which is derived from winter surveys in the Bering Sea and includes non-breeding birds.

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

The spectacled eider was listed as a threatened species throughout its range in Alaska and Russia in 1993. Critical habitat was proposed designation of critical habitat for the spectacled eider on February 8, 2000. The proposal includes: 1) nesting areas on Alaska's North Slope and Yukon-Kuskokwim Delta and adjacent marine waters, 2) molting areas on Norton Sound and Ledyard Bay, and 3) the only known wintering area in the Bering Sea between St. Lawrence and St. Matthew Islands.

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

Steller's Eider

Steller's eiders (*Polysticta stelleri)* spend the majority of the year in shallow, near-shore marine waters. Primary foods in marine areas include bivalves, crustaceans, polychaete worms, and molluscs. Three breeding populations of Steller's eiders are recognized, two in Arctic Russia and one in Alaska. After the nesting season, Steller's eiders return to marine habitats where they molt. During winter, most of the world's Steller's eiders concentrate along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet in shallow, near-shore marine waters. In spring, large numbers concentrate in Bristol Bay before migration. Along open coastline, Steller's eiders usually remain within about 400 m of shore normally in water less than 10 m deep but can be found well offshore in shallow bays and lagoons or near reefs. Whereas the Russian Atlantic population is believed to contain 30-50,000 individuals, and the Russian Atlantic population likely numbers 100-150,000, the threatened Alaska-breeding population is thought to include hundreds or low thousands on the Arctic Coastal Plain, and possibly tens or hundreds on the Yukon-Kuskokwim Delta.

The Alaska breeding population of the Steller's eider was listed as a threatened species in 1997. This determination was based upon a substantial decrease in the species' nesting range in Alaska, a reduction in the number of Steller's eiders nesting in Alaska, and the resulting increased vulnerability of the remaining breeding population to extirpation. Critical habitat was proposed on March 13, 2000. The proposal includes: 1) nesting areas on the Yukon-Kuskokwim Delta and the North Slope, and 2) molting, migration staging, and wintering areas that include marine waters. The primary constituent elements for Steller's eiders in marine habitat are waters up to 10 m (30 ft) deep and the underlying substrate, the associated invertebrate fauna in the water column and in and on the underlying substrate, and, where present, eelgrass beds and associated flora and fauna. Steller's eiders generally stay within "a quarter of a mile" (400 m) of shore and in waters less than 10 m (30 ft) deep. Specific marine areas include: 1) waters around Nunivak Island to a distance of 400 m offshore, 2) waters on the north side and south side of Kuskokwim Bay to a distance of 40 km (25 mi) offshore, 3) all marine waters within 400 m of mean high water of many areas in the eastern Aleutians, 4) all marine waters within 400 m of mean high water from the south side of the Alaska Peninsula, 5) specified marine waters of Kachemak Bay, and 5) all marine waters within 400 m of Kodiak and Afognak Islands.

3.4 Effects on Forage Species

The following species groups are included in the forage fish category established in 1998: Osmeridae (capelin, eulachon, and other smelts), Myctophidae (lanternfishes), Bathylagidae (deep-sea smelts), Ammodytidae (Pacific sand lance), Trichodontidae (Pacific sand fish), Pholidae (gunnels), Stichaeidae (pricklebacks, warbonnets, eelblennys, cockcombs, and shannys), Gonostomatidae (bristlemouths, lightfishes, and anglemouths), and the Order Euphausiacea (krill). Although other species such as herring and juvenile Pacific cod are considered important forage for marine mammals, birds, and fish, those groups are discussed in the sections that are specific to those species. Only the species included in the new forage fish category established in 1998 in amendments 36 and 39 to the BSAI and GOA FMPs are discussed in this section.

Incidental catch amounts of some of the forage species have been recorded in BSAI and GOA groundfish fisheries in previous years. Smelts have been recorded more regularly than some of the other groups, and no reporting previous to 1998 has been done for species such as Euphausiacea and Gonostomatidae. Forage species catch under status quo management is estimated in Tables 4-25 through 4-35 of the SEIS (NMFS 1998c) Data in rows under the target fishery heading "Pacific Cod" are applicable to the proposed management measures. NMFS assumes quantities of forage fish taken as bycatch in the Pacific cod harvest will remain the same under the status quo alternative and action alternatives.

3.5 Effects on Prohibited Species Bycatch

Bycatch tables for Alternatives 1-3 are provided in Tables 18, 19, and 20. These models are also available on the web at the NMFS home site (http://www.fakr.noaa.gov/protectedresources/stellers.htm).

The bycatch of major prohibited species groups by the various sectors were examined based on historic fishing patterns. The primary bycatch species groups included in this analysis were Pacific halibut (*Hippoglossus stenolepsis*), Pacific Salmon (*Onchorynchus spp*), king crab (*Paralithodes spp*), and Tanner crab (*Chionoecetes spp*). The data in tables providing bycatch rates and projected amounts are based on data supplied by the National Marine Fisheries Service Observer Program from the four years 1996 - 1999. Bycatch rates for each species and gear/area/season combination were calculated as the total observed bycatch across the four years, divided by the total sum of Pacific cod over the same time period. Projected bycatch amounts were calculated by multiplying these rates by the expected portion of the TAC allocated to each sub-sector. A Geographical Information System (GIS) was used to determine whether a haul was inside or outside of critical habitat.

It should be noted that the data are a representation of past sector allocations, bycatch limits, bycatch rates, and spatial and temporal fishing patterns. The data also represent observed vessels only. Vessels less than 60 ft in overall length are not required to carry an observer, and only 30% of the hauls by vessels between 60 and 125 ft require an observer. Thus the data provide a fair historical representation of bycatch patterns by larger vessels, and provide an indication of the types of rates experienced by medium vessels and any vessels fishing in patterns similar to those observed historically.

3.5.1 Bering Sea and Aleutian Islands Area

Pacific Halibut

The halibut bycatch mortality limit for the 1999 Pacific cod trawl fishery was 1,434 mt, and for hook and line fisheries was 598 mt after 150 mt was reapportioned to the other non-trawl fisheries. No Pacific cod fishery was constrained by halibut bycatch mortality in 1999, and there are no halibut bycatch mortality limits in the pot or jig fisheries. Two reasons that halibut bycatch mortality has not resulted in closures in Bering Sea Pacific cod fisheries are increased fleet awareness, and reduced Pacific cod TACs.

Alternative 1. (see Table 18)
In the BSAI as a whole under Alternative 1, halibut bycatch rates by sector were fairly similar inside and outside of critical habitat with the exception of trawl catcher vessels and pot vessels where the rates were double and four times as high inside when compared with outside critical habitat rates (BSAI Table Historic – ALT1-SQ). The highest rates (and lowest represented catch) were seen in the catcher-vessel long-line sector, and the smallest rates were seen in the pot sector with rates an order of magnitude lower than the other trawl and fixed gear rates.

The most notable change between the BSAI halibut bycatch rates and the rates based on catch and bycatch in the Bering Sea only was within the catcher-processor trawl sector inside of critical habitat. Halibut bycatch rates by catcher-processors tripled within critical habitat in the BS area alone when compared to the rates for the entire BSAI (BS Table Historic – ALT1-SQ). The reason for this is that a portion of the catcher-processor sector catch has historically been in the Aleutian Islands where trawl fisheries have experienced much lower halibut rates.

With the exception of the poorly represented longline catcher vessels less than 60 ft in length, there was little difference between the AI, BS and BSAI halibut bycatch rates in the fixed gear fisheries. And except for the catcher processor bycatch within critical habitat mentioned above, BS and BSAI rates were similar in the trawl fisheries whereas the rates were decreased dramatically in the AI.

Alternative 2. (see Table 19)
The historic information under Alternative 2 adds a seasonal component to the bycatch tables in Table Historic – ALT2 , and reports the catch and bycatch within the first four months of the year, and within the remainder of the year (remaining 8 months). With the exception of fisheries in which there was no data available (second season trawl catcher-vessel and first season long-line catcher-vessel), there was a tendency for halibut bycatch rates to increase in the second season (Table Historic – ALT2). Since the majority of the trawl catch occurred during the first four months of the year, these higher rates could be somewhat influenced by the small amount of data from later months.

One possible allocation of the overall TAC by season and inside and outside of critical habitat is provided in Table Goal Worksheet – ALT2 . The apportionment of a greater amount of the total TAC into the second season under this alternative tended to increase the projected bycatch of halibut due to the higher second season bycatch rates. Halibut bycatch mortality in the entire BSAI was projected to increase from 1,972 mt with no seasonal TAC apportionment (Alternative 1) to 3,873 mt with two seasons (Alternative 2). Since the rates were fairly similar inside and outside of critical habitat, the increase is largely attributable to the higher second season bycatch rates. Similarly, bycatch was projected to increase in the BS from 2,397 mt under Alternative 1 to 3,732 mt under Alternative 2, and in the AI from 97 mt under Alternative 1 to 193 mt under Alternative 2.

Alternative 3. (see Table 20)
Alternative 3 provides for both a division of the TAC into three separate seasons as well as a reallocation of effort out of critical habitat. In general, halibut bycatch rates are highest during the second of the three seasons (May – August, Table Historic ALT3). The projected bycatch in eliminating all Pacific cod catch within critical habitat in the BSAI and BS increases under Alternative 3, but to a lesser degree than seen under Alternative 2. Bycatch in the BSAI was projected to be 1,972 mt under Alternative 1 and was projected to be 3,527 mt under Alternative 3. Similarly in the BS, bycatch under Alternative 1 was 2,397 mt and was projected to be 3,080 mt under Alternative 3. The AI bycatch of halibut, on the other hand, was projected to increase dramatically from 97 mt under Alternative 1 to 790 mt under Alternative 3. This increase was due to the high halibut bycatch rates by the freezer long-line fleet during the second season outside of critical habitat in the AI.

Salmon

Alternative 1.
Salmon bycatch is typically distributed through the year so that most hauls encounter few or no salmon and a small number of hauls encounter occasional very high numbers. The information presented here is based on annual or seasonal rates. Previous analyses (e.g. NMFMC Amendment 21b) have shown that the majority of salmon bycatch is taken by the trawl fisheries for pollock. Since the rates in the Pacific cod fishery are generally lower, chinook salmon bycaught by the Pacific cod fishery, for example, are not included in the calculation of Chinook Salmon Savings Area closures. There are generally only a small number of non-chinook salmon bycaught in the Pacific cod trawl fisheries.

Salmon bycatch rates are minimal in the fixed gear fisheries, and this discussion will focus on bycatch in the trawl fisheries. Overall salmon bycatch rates in the BS and BSAI were similar (roughly .05 salmon per mt of Pacific cod) for catcher vessels fishing inside and outside of critical habitat and for catcher processors fishing within critical habitat (Table Historic – ALT1-SQ). The bycatch rates were approximately three times this amount for catcher processors fishing outside of critical habitat in the BS and BSAI. In the Aleutian Islands the rates were lower than approximately .05 salmon per mt for all trawl vessels other than catcher processors fishing inside critical habitat.

Alternative 2.
In the BS and BSAI, the highest salmon bycatch rate based on historic observer data was during the first season (January – April) by catcher processors fishing outside of critical habitat (Table Historic – ALT2). The primary salmon species bycaught during the winter months is chinook salmon, and Amendment 21b showed that chinook salmon can be taken along the 200 m depth contour (outside of critical habitat) during these months, although the majority of chinook salmon are bycaught in the vicinity of the horseshoe.

The proposed changes in fishing effort under Alternative 2 with a movement of effort out of critical habitat and away from the winter months results in a predicted decline in salmon bycatch. The historical projected bycatch amount from all Pacific cod fisheries under Alternative 1in the BSAI was 6,014 salmon, and the projected amount by the redirection of effort to the second season under Alternative 2 was 3,258 salmon (Table Goal Worksheet – ALT2). Similarly, for the BS alone, bycatch was projected to decline from 6,909 salmon to 3,256 salmon.

Alternative 3.
The exclusion of effort in critical habitat and the movement of effort to the summer and fall seasons under Alternative 3 lead to predicted reductions in salmon bycatch in the BSAI and BS-only from 6,104 and 6,909 salmon, respectively under Alternative 1 to 3,698 and 4,101 salmon, respectively under Alternative 3 (Table Goal Worksheet – ALT3).

King crab and Tanner crab

Alternative 1.
The bycatch rates of king crab are much higher outside of critical habitat than within critical habitat, and are higher in the fixed gear fisheries than in the trawl fisheries (Table Historic – ALT1 - SQ). Bycatch rates of king crab tend to be higher in the Aleutian Islands than in the Bering Sea. The bycatch rates of Tanner crab are higher in the trawl and pot fisheries than in the hook and line fisheries, and are much higher in the Bering Sea than in the Aleutian Islands.

Alternative 2.
The reallocation of catch outside of critical habitat and to the second season resulted in little change in bycatch numbers in the AI (Table Historic – ALT2). In the BSAI and BS-only, however, there were dramatic increases in crab bycatch due to the redistribution of effort under Alternative 2. The bycatch of king crab was predicted to approximately triple under Alternative 2, and the bycatch of Tanner crab was predicted to approximately double under this alternative (Table Goal Worksheet ALT2).

Alternative 3.
With the total exclusion of effort from critical habitat, the expected bycatch of king and Tanner crab was even more dramatic with an approximate quadrupling of projected king crab bycatch and an approximate tripling of Tanner crab bycatch (Table Goal Worksheet ALT3).

3.5.2 Gulf of Alaska

Pacific cod in the Gulf of Alaska is not allocated by gear sector as it is in the BSAI. These tables use gear sectors to provide as much information as possible but not to imply the allocation by gear sector.

Since the directed fishery for Pacific cod in the GOA for the years 1996 to 1999 took place predominately during January through March the prohibited species bycatch rates for later in the year may not be representative of actual rates. The lower prohibited species bycatch rates for the second and third seasons are most likely because of the limited fishing effort. This data may not accurately portray what the prohibited species bycatch will be for the second and third seasons if the Pacific cod TAC is apportioned to the later seasons.

Pacific cod is predominately a trawl catcher vessel and freezer long-liner fishery in the Western GOA and a trawl and pot fishery in the Central GOA. Historically, in the Western GOA most of the Pacific cod TAC was taken inside of critical habitat. In the Central GOA the Pacific cod catch is more balanced inside and outside of critical habitat except in the long-liner sector. Currently, salmon, king crab and tanner crab do not have bycatch limits that close a fishery when reached.

Pacific halibut

The halibut bycatch mortality limit for the trawl sector in the GOA is allocated to a species complex which includes the Pacific cod fishery. The hook-and-line halibut bycatch mortality limit is allocated to all hook-and-line fisheries except sablefish and demersal shelf rockfish in the Southeast District and in 1999 was 290 mt. There are no halibut bycatch mortality limits for pot and jig gear. In the past, most of the Pacific cod fisheries closed by reaching the quotas rather than by reaching their halibut bycatch mortality limits. Moving the fisheries outside of critical habitat where the halibut bycatch rates are higher may increase the halibut bycatch mortality to an amount that would cause the a gear sector to be closed to directed fishing for Pacific cod before the quota was taken.

Alternative 1.
Under Alternative 1, the halibut bycatch mortality rates are higher outside of critical habitat in the Western and Central GOA for all gear sectors. The highest rates (and the lowest represented catch) were seen in the catcher vessel long-line sector and the lowest rates were inside of critical habitat for the trawl and pot sectors.

Alternative 2.
The halibut bycatch mortality rates increase for the second season in both the Western and Central GOA. Limited fishing effort was historically experienced in the summer and fall since most of the Pacific cod fishery took place from January to March. The bycatch rates also increase outside of critical habitat with a few exceptions. In the Western GOA there is no data available for the trawl catcher vessel rate outside of critical habitat. The Central GOA trawl catcher vessel rate for the first season and the freezer long-liner rate for the second season are an order of magnitude higher inside of critical habitat. With these increases in the bycatch rates, halibut bycatch mortality for both the Western and Central GOA was projected to increase from 1,334 mt with no seasonal TAC apportionment (Alternative 1) to 2,743 mt with two season (Alternative 2).

Alternative 3.
These tables also show an increased halibut bycatch when the fishery occurs completely outside of critical habitat. The halibut bycatch mortality increases from 443 mt to 1,292 in the Western GOA and from 791 mt to1,860 mt in the Central GOA. The Western GOA halibut bycatch mortality is less than seen under Alternative 2 (1,911 mt).

Salmon

Alternative 1.
Salmon bycatch rates are minimal in the fixed gear fisheries, and this discussion will focus on bycatch in the trawl fisheries. The Central GOA accounts for 93% of the salmon taken in both the Western and Central GOA. The highest rate by more than triple any other rate is for the trawl catcher processor sector outside of critical habitat in the Central GOA.

Alternative 2.
Adding the seasonal component according to the bycatch tables is expected to decrease the salmon bycatch in the Western GOA from 103 to 24 salmon because there are no rates available for the second season. The salmon bycatch increases slightly from 1,379 to 1,456 salmon in the Central GOA because of the increased effort of the Pacific cod fishery to the second season when the salmon bycatch rates are higher.

Alternative 3.
There is no predictable bycatch of salmon in the Western GOA when the Pacific cod fishery is moved outside of critical habitat because there are no rates available. The salmon bycatch in the Central GOA decreases from that seen under Alternative 1 from 1,379 to 1,113 salmon because the fishery is moved outside of critical habitat where the trawl catcher vessel sector has lower salmon bycatch rates.

King Crab and Tanner Crab

Alternative 1.
The king crab bycatch is low overall and is spread out over the sectors with most showing up in the catcher vessel trawl sector inside of critical habitat in the Central GOA and in the pot sector outside of critical habitat in the Western GOA. The catcher vessel trawl sector which accounts for the largest amount of the Pacific cod fishery has very low king crab bycatch.in the Western GOA, but has substantial higher rates than the Central GOA. Tanner crab is also taken mostly with trawl and pot gear. In the Western GOA more Tanner crab is taken inside of critical habitat, but so is most of the Pacific cod. In the Central GOA almost twice as much Tanner crab, but only about half of the Pacific cod quota is taken inside of critical habitat.

Alternative 2.
The king crab bycatch decreases in the Central GOA when a higher percentage of the Pacific cod fishery is moved outside of critical habitat because there is little king crab bycatch outside of critical habitat. In the Western GOA, the king crab bycatch increases with the increase in the amount of Pacific cod taken by the pot sector outside of critical habitat in the first season. There is no king crab bycatch during the other seasons for the pot sector. Tanner crab bycatch doubles in the Western GOA with the movement of the catcher vessel trawl fishery to outside of critical habitat. The Central GOA decreases slightly with the Pacific cod fishery moving outside of critical habitat and to the second season.

Alternative 3.
The king crab bycatch in the Western GOA increases by 7 times than that seen under Alternative 1, mostly due to the increase from 164 to 1,126 crab in the pot sector outside of critical habitat. The king crab bycatch in the Central GOA decreases from 144 to 47 crab. Alternative 3 increases the Tanner crab bycatch in the Western GOA by four times as seen under Alternative 1 from 55,587 to 8,948 crab. In the Central GOA the bycatch is reduced by almost half because of the mostly lower rates outside of critical habitat.

3.6 Effects on Incidental Catch

This analysis is pending and is expected at the September Council meeting.

3.7 Effects on Habitat - Essential Fish Habitat (EFH)

Appendix 2 contains an EFH assessment of the proposed alternatives. The assessment concludes that the alternatives entail some potential for adverse localized effects to EFH. The action does not entail a change to the cod TAC. Therefore, to the extent that fishing is reduced in Steller sea lion critical habitat and SCA areas, the fishing effort can be expected to shift elsewhere. Fishing, and the effects of fishing on benthic habitat, will increase in some areas. Testimony from the fishing fleet is that cod will be much harder to find, especially in winter, outside the Steller sea lion management areas. To the extent this is true, and that CPUE is lower as a result of this action, more trawling may occur per ton of fish caught, and concomitantly more pressure on EFH in those areas. Furthermore, there could be cumulative effects from this action combined with other actions to protect Steller sea lions from competition with the Atka mackerel and pollock fishery (which, however, is entirely pelagic in the BSAI and mostly pelagic in the GOA). Without knowing in advance where the fishery will concentrate and whether CPUE will actually be effected, such effects are largely unpredictable. Beneficial effects to EFH can also be expected, in the areas where fishing is decreased.

3.8 Management Considerations

Alternative 1: Status quo.

No significant new management issues arise from this alternative. The current recordkeeping and reporting system and observer data collection provide the information needed to manage the Pacific cod allocations.

Alternative 2:

Under this alternative, separate Pacific cod TACs would be established for the Aleutian Islands and the Bering Sea sub-areas of the BSAI. Rookeries and important haulouts would be closed to directed fishing for Pacific cod. Separate harvest limits would be established inside critical habitat.

Quota Management. The current information collections are not adequate to manage separate quotas inside critical habitat if both inside and outside areas are concurrently open. Three ways to address the problem of monitoring separate quotas inside critical habitat without changing the recordkeeping and reporting system are:

1 Have separate openings for inside and outside critical habitat fisheries. This would separate the catch inside critical habitat from that outside by time. Pacific cod caught during an outside CH opening would count against the outside quota, and Pacific cod caught during an inside CH opening would count against the inside CH quota. Inseason management would be complicated by an increased number of fishery openings, and pulses of fishing inside CH would result.

2 Presume that all catch comes from inside CH so long as CH remains open to directed fishing. This approach might be appropriate for small-vessel fixed-gear fisheries where observer coverage or VMS would not be suitable and where the majority of the fishing is expected to come from nearshore CH

areas. It could be implemented for small vessels in conjunction with increased observer coverage or VMS for larger vessels.

3 Require 100 percent observer coverage for all vessels fishing for Pacific cod. Observer costs to the industry would increase, observer availability problems might result, and problems would arise accommodating observers on small vessels.

Another option for accounting for inside and outside critical habitat catch is to require Vessel Monitoring System (VMS) units. This would require changes in recordkeeping and reporting regulations, and additional computer programming to incorporate VMS data into the quota monitoring process. The cost of a basic VMS unit is estimated as $1,800, with daily operating costs of $5. Vessels carrying a VMS unit would be required to fish either inside CH or outside CH for an entire trip. The VMS positions of the vessel during the trip would be used to confirm the trip location. If the VMS indicated that the vessel fished inside CH during any part of the trip, the total catch for the trip would be counted as having come from inside CH. This system would likely work well for trawl vessels, because the VMS signature (pattern and speed) while fishing is distinct from that while the vessel is traveling to and from the grounds. The system might not work so well for fixed-gear vessels, as the vessel can set gear on the grounds and leave it, and reliable VMS fishing signatures for these gear types are not established.

Even with the availability of these monitoring methods, some of the quotas that result from the seasonal and inside/outside CH allocations may be too small to allow a directed fishery, or require extremely conservative quota management which can result in unharvested quota. The allocations of Pacific cod by seasons and CH under Alternative 2 create many relatively small quotas. Several quotas for the offshore component in the GOA could be less than 500 mt. The offshore component is allocated 10 percent of the Pacific cod quota (for 2000, 2,062 in the Western GOA and 3,408 for the Central GOA). In the BSAI, several of the fixed gear quotas may be too small to manage a directed fishery. If the directed fishing allowance is too small to support the amount of effort then a fishery may not even open for directed fishing. Also, small quotas can be more difficult to manage. If there is a high level of effort with a high catch rate then to prevent exceeding a small quota the fishery may be closed early in order to ensure that the quota is not exceeded.

Enforcement of areas closed to directed fishing. Another management issue that results from Alternative 2 is that of enforcing a directed fishing closure in the closed rookery and haulout areas when fishing for other species is open. Unobserved vessels could fish for Pacific cod inside the closed areas and claim that the catch was from outside the closed areas. Sighting a vessel inside the closed area would not indicate a violation of the directed fishing closure. Effective monitoring would require boarding the vessel while it is fishing and examining the logbook and retained catch.

Management workload. Under Alternative 2 the total number of non-CDQ Pacific cod quotas in the BSAI to manage is 56. Just a few years ago NMFS managed five – CV trawl, CP trawl, and three seasonal quotas for fixed gear. In the GOA, the number of Pacific cod quotas would be 16, compared with 4 currently. The total number of inseason fishery closures for all BSAI and GOA groundfish fisheries in recent years has been around 120-130. If Alternative 2 is implemented, the inseason management staff will need to be increased by at least one full-time position to handle the huge increase in fishery management workload.

Alternative 3:

Under this alternative, separate Pacific cod TACs would be established for the Aleutian Islands and the Bering Sea sub-areas of the BSAI. All critical habitat would be closed to directed fishing for Pacific cod.

The current recordkeeping and reporting system and observer data collection provides the information needed to manage GOA quotas and separate AI and BS sub-area quotas. Separate quotas for Pacific cod inside critical habitat would not be established.

The principal management issue that results from Alternative 3 is that of enforcing a directed fishing closure in critical habitat when fishing for other species in the critical habitat is open. Unobserved vessels could fish inside critical habitat and report their catch from areas outside critical habitat. Sighting a vessel inside critical habitat would not indicate a violation of the directed fishing closure. Effective monitoring would require boarding the vessel while it is fishing and examining the logbook and retained catch.

3.9 Endangered Species Act Considerations

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

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

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

Federal agencies have an affirmative mandate to conserve listed species (Rohlf 1989). One assurance of this is Federal actions, activities or authorizations (hereafter referred to as Federal action) must be in compliance with the provisions of the ESA. Section 7 of the Act provides a mechanism for consultation by the Federal action agency with the appropriate expert agency (NMFS or USFWS). Informal consultations, resulting in letters of concurrence, are conducted for Federal actions that have no adverse affects on the listed species. Formal consultations, resulting in biological opinions, are conducted for Federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made as to whether the proposed action poses "jeopardy" or "no jeopardy" of extinction to the listed species. If the determination is that the action proposed (or ongoing) will cause jeopardy, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction to the listed species. These reasonable and prudent alternatives must be incorporated into the Federal action if it is to proceed. A biological opinion with the conclusion of no jeopardy may contain a series of management measures intended to further reduce the negative impacts to the listed species. These management alternatives are advisory to the action agency [50 CFR. 402.24(j)]. If a likelihood exists of any taking[1] occurring during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action. An incidental take statement is not the equivalent of a permit to take.

Twenty-three species occurring in the GOA and/or BSAI groundfish management areas are currently listed as endangered or threatened under the ESA (Table 22). The group includes seven great whales, one pinniped, three Pacific salmon, two seabirds, and one albatross.

Table 22. Species currently listed as endangered or threatened under the ESA and occurring in the GOA and/or BSAI groundfish management areas.

Common Name	Scientific Name	ESA Status
Northern Right Whale	*Balaena glacialis*	Endangered
Bowhead Whale [1]	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Snake River Sockeye Salmon	*Onchorynchus nerka*	Endangered
Short-tailed Albatross	*Phoebaotria albatrus*	Endangered
Steller Sea Lion	*Eumetopias jubatus*	Endangered and Threatened [2]
Snake River Fall Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Snake River Spring/Summer Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Puget Sound Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Lower Columbia River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Willamette River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Columbia River Spring Chinook Salmon	*Onchorynchus tshawytscha*	Endangered
Upper Columbia River Steelhead	*Onchorynchus mykiss*	Endangered
Snake River Basin Steelhead	*Onchorynchus mykiss*	Threatened
Lower Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Upper Willamette River Steelhead	*Onchorynchus mykiss*	Threatened
Middle Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Spectacled Eider	*Somateria fishcheri*	Threatened
Steller Eider	*Polysticta stelleri*	Threatened

[1] The bowhead whale is present in the Bering Sea area only.
[2] Steller sea lion are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.

In summary, species listed under the ESA are present in the action area and, as detailed below, some are negatively affected by groundfish fishing. The NMFS is the expert agency for ESA listed marine mammals. The USFWS is the expert agency for ESA listed seabirds. The proposed action, promulgation of a permanent

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

rule to implement Steller sea lion reasonable and prudent alternatives necessary to remedy the pollock fishery from the likelihood of jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying its critical habitat, must be in compliance with the ESA.

Species listed under the ESA are present in the BSAI and, some are negatively affected by groundfish fishing. Section 7 consultations have been done for all the above listed species, some individually and some as groups. See section 3.8 of the SEIS for summaries of Section 7 consultations prior to December 15, 1998 (NMFS 1998b). Subsequent to those listed in the SEIS, Section 7 consultations were completed for the Total Allowable Catch specifications established for the years 1999 and 2000 for ESA listed marine mammals (NMFS 1998a, 1999d); for the Alaska Groundfish Fisheries take of ESA listed salmon species (NMFS 1999b); and by the U.S. Fish and Wildlife Service for the longline fisheries take of Short-tailed albatross (USFWS 1999).

3.10 Coastal Zone Management Act Considerations

Implementation of the either of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

3.11 Marine Mammal Protection Act Considerations

Under the Marine Mammal Protection Act, commercial fisheries are classified according to current and historical data on whether or not the fishery interacts with marine mammals. Two groups, takers and non-takers, are initially identified. For takers, further classification then proceeds on the basis of which marine mammal stocks interact with a given fishery. Fisheries that interact with a strategic stock at a level of take which has a potentially significant impact on that stock would be placed in Category I. Fisheries that interact with a strategic stock and whose level of take has an insignificant impact on that stock, or interacts with a non-strategic stock at a level of take which has a significant impact on that stock are placed in Category II. A fishery that interacts only with non-strategic stocks and whose level of take has an insignificant impact on the stocks is placed in Category III.

Species listed under the Endangered Species Act present in the management area are listed in Table 12. Marine mammals not listed under the ESA that may be present in the BSAI and GOA management area include cetaceans, [minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Dall's porpoise *(Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and the beaked whales (e.g., *Berardius bairdii* and *Mesoplodon spp*.)] as well as pinnipeds [Pacific harbor seal (*Phoca vitulina*), northern fur seal (*Callorhinus ursinus*), Pacific walrus (*Odobenus rosmarus*), spotted seal (*Phoca largha*), bearded seal (*Erignathus barbatus*), ringed sea (*Phoca hispida*) and ringed seal (*Phoca fasciata*)], and the sea otter (*Enhydra lutris*).

Take of the above listed marine mammals in groundfish fisheries has been monitored through observer programs. The subject fisheries (Gulf of Alaska groundfish, and Bering Sea and Aleutian Islands groundfish) are classified as Category III. Steller sea lion, harbor seal, northern elephant seal, Dall's porpoise were species recorded as taken incidentally in the Gulf of Alaska groundfish trawl fisheries according to records dating back to 1990 (Hill *et al.* 1997.) Steller sea lion, northern fur seal, harbor seal, spotted seal, bearded seal, ribbon seal, ringed seal, northern elephant seal, Dall's porpoise, harbor porpoise, Pacific white-sided dolphin, killer whale, sea otter, and walrus were recorded as taken incidentally in the Bering Sea and Aleutian Islands groundfish trawl fisheries according to records dating back to 1990 (Hill *et al.* 1997.)

4.0 ECONOMIC AND SOCIOECONOMIC CONSEQUENCES

4.1 Regulatory Impact Review

This section provides information about the economic and socioeconomic impacts of the alternatives including identification of the individuals or groups that may be affected by the action, the nature of these impacts, quantification of the economic impacts if possible, and discussion of the trade-offs between qualitative and quantitative benefits and costs.

The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following statement from the order:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

This section also addresses the requirements of E.O. 12866 to provide adequate information to determine whether an action is "significant" under E.O. 12866.

E. O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to have the following consequences:

> (1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;
>
> (2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
>
> (3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
>
> (4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

A regulatory program is "significant" if it is likely to result in the effects described above.

4.2 Problem Statement

The decline of the Steller sea lion began in the Aleutian Islands region and spread eastward and westward through the late 1970s and the early to mid-1980s, but was most severe in the mid-1980s. The Steller sea lion was listed as threatened in 1990. The listing followed severe declines of the species throughout the Gulf of Alaska and Aleutian Islands region, which was the center of its range in the North Pacific. In the 1990s, the Steller sea lion population has continued to decline and, since the late 1970s, counts of Steller sea lions have dropped more than 80%. In 1997, NMFS recognized that two genetically distinct populations of Steller sea lions existed. Steller sea lions were split into an eastern population and a western population, divided at the 144°W. long. line. The western population of Steller sea lions was reclassified as endangered in 1997.

A number of factors are either known to have contributed to the recent decline, or are suspected of having done so. The leading hypothesis has been that Steller sea lions have recently declined due to factors causing nutritional stress, which adversely affects the growth and conditions of animals, and their probabilities of reproduction and survival. Nutritional stress may result from a range of factors that could affect the availability of Steller sea lion prey. Changes in prey availability may occur through natural causes, such as changes in environmental or oceanographic conditions, or as a result of human activities such as commercial fisheries, or through some combination of these factors.

Pacific cod (P.cod) is among the top prey items for Steller sea lions during the winter period from December through March, occurring in 17% - 40% of scats that contain identifiable prey items. These data are consistent with results from earlier studies (NMFS 1995). Highest occurrences of P.cod are from scats collected in the GOA (approximately 40%). P.cod also occurs in the diet of Steller sea lions during summer months, but at lower frequencies. The fishery for P.cod is conducted with bottom trawl, longline, pot, and jig gear. Fishing generally occurs at depths of less than 150 meters. In the BSAI, 47% of the total allowable catch (TAC) is allocated to trawl fishing, 51% to longline and pot fishing combined, and 2% to jig fishing. In the GOA, P.cod is allocated between the processing components, 90% to inshore and 10% to offshore. The catch of Pacific occurs primarily in the winter months (January - April) in both the BSAI and the GOA.

4.3 Objectives of the Action

The objective of this action is to implement management measures that reduce or eliminate competition between the P.cod fisheries and Steller sea lions by precluding fisheries around rookeries and major haulouts and by dispersing the fishery over time and space to minimize the likelihood of locally depleting prey resources to foraging sea lions.

4.4 Measuring the Economic Value of Steller Sea Lions

While no market exists within which Steller sea lions are "traded" (in the traditional economic sense), they nonetheless have economic value. Indeed, the economic value of Steller sea lions may include both “use” (consumptive) value and "non-use" (non-consumptive) value elements.

In the former case, Alaska Native populations have a traditional "subsistence" harvest right to the Steller sea lion resource. To the extent that declining Steller populations (in this case, with respect specifically to the western Steller sea lion stocks) reduce or even preclude subsistence harvest of these marine mammals, the Alaska Native community will suffer a welfare loss. Or expressed alternatively, rebuilding depressed Steller sea lion populations would be expected to yield direct benefits to the Alaska Native subsistence community, by enhancing their traditional “use” of these marine mammal resources.

A second and potentially substantially larger aggregate economic value attributable to the Steller sea lion resource is associated with non-use/non-consumptive values. In general, it can be demonstrated that society places economic value on (relatively) unique environmental assets, even if those assets are never directly exploited. That is, for example, society places real (and measurable) economic value on simply “knowing” that, in this case, Steller sea lion populations are flourishing in their natural environment.

A substantial literature has developed which describes the nature of these non-use values to society. In fact, it has been demonstrated that these non-use economic values may include several dimensions, among which are "existence" value, "option" value, and "bequest" value. As the respective terms suggest, it can be shown that society places an economic "value" on, in this case, the continued *existence* of the Steller sea lion resource; society further "values" the *option* it retains through the continued existence of the resource for future access to Steller sea lion populations; and society places "value" on providing future generations the opportunity to enjoy and benefit from this resource. These estimates are additive and mutually exclusive measures of the value society places on these natural assets, and are typically calculated as “willingness-to-pay” or “willingness-to-accept” compensation (depending upon with whom the implicit ownership right resides) for non-marginal changes in the status or condition of the asset being valued.

Quantitatively measuring society’s non-use value for an environmental asset, e.g., the western stock of Steller sea lion, is a complex but technically feasible task. However, an empirical estimation of these values is unnecessary in the current context, because the Endangered Species Act (ESA) implicitly assumes that society automatically enjoys a *“net benefit”* from any action which protects threatened or endangered species (including the habitat they rely upon), and/or facilitates the recovery of populations of such species (or their habitat), i.e., benefits exceed costs. And, while the current FMP action is being taken under the auspices of the Magnuson-Stevens Fishery Conservation and Management Act, it is primarily motivated by ESA considerations. Therefore, it is sufficient to point out that these very real “use” and “non-use” values to society do exist and that actions undertaken to maintain and enhance the western Steller sea lion resource result, by definition, in a benefit stream to the Nation.

However, because the alternative mitigation actions under consideration do carry with them potential economic and social costs, it is appropriate to evaluate, to the extent practicable, the *trade-off* society is making in order to obtain these ‘net National benefits’.

As suggested, to the extent that the mitigation actions are effective in improving the state of the Steller sea lion population in western Alaska, and the habitat upon which they depend,[2] all of society collectively benefits. However, the potential attributable costs of the application of the mitigation action principles are distributed much more narrowly. Indeed, they accrue most obviously to those who directly exploit and depend upon the environmental resource base in the affected areas. In the present context, this is primarily the fishing industry operating in the Bering Sea, Aleutian Islands, and Gulf of Alaska which target P.cod and, by extension, the communities which support and depend upon those fisheries. The following discussion summarizes the economic and social impacts which might be expected to accompany adoption of the proposed amendment to the BSAI and GOA groundfish management plans to implement one or more of the alternative mitigation actions.

The *“mitigation principles,”* proposed by NMFS and set forth in the EA above, identify three fundamental elements in connection with management of the commercial P.cod fisheries in the eastern Bering Sea, western and central Gulf of Alaska, and Aleutian Islands management areas. These include: (1) temporal dispersion, (2) spatial dispersion, and (3) P.cod fishing exclusion zones. The economic implications of each of these mitigation elements for the primary subsectors of the eastern Bering Sea, Gulf of Alaska, and Aleutian Islands P.cod fisheries are treated in subsequent sections of this assessment. The management environment within which the mitigation actions must be integrated is described in the following section.

4.5 Historical management of the P.cod fisheries

[2] This is a crucial assumption, and one upon which the following analytical discussion relies.

The Gulf of Alaska (GOA) Groundfish Fishery Management Plan (FMP) was implemented on December 1, 1978 and the Bering Sea/Aleutian Islands (BSAI) Groundfish FMP was implemented on January 1, 1982. These FMPs have governed management of P.cod in the EEZ since then. Foreign fishing operations were important in the early years of these plans. The transition from foreign to domestic fisheries was an important focus of early management. Foreign fishing ended in the GOA in 1987, and in the BSAI in 1990.

This section provides a brief description of the P.cod fisheries and their management since foreign fishing ended. The status quo option will be based on the fishery in 1999 and will draw on the background provided here. The P.cod TAC is allocated among different fleet categories as outlined below, and the evaluation of the alternatives will be based to some extent on these categories. Also, as noted below, many of these operations carry observers. The extent of observer coverage among the vessel categories also has implications of the analysis of the status quo and other alternatives.

Table 4.5.1 summarizes P.cod harvests by gear type in the BSAI and in the GOA from 1995 to 1999. In the BSAI, longline and trawl harvests have been the largest followed by pot gear. In the GOA, trawl gear was the most important in terms of volume, followed by pot gear and longline gear. Jig gear, which is not summarized in the table, was the least important gear in both areas.

Table 4.5.1 P.cod catch off Alaska by area, catcher category, and gear, 1995-1999. (1,000 metric tons, round weight)

		Gulf of Alaska			Bering Sea and Aleutians			All Alaska		
Gear	Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Longline	1995	5	6	11	3	101	103	7	107	114
	1996	5	5	10	0	94	95	5	100	105
	1997	7	4	11	0	124	124	7	128	135
	1998	6	3	10	0	100	100	7	103	110
	1999	7	5	12	0	89	89	7	94	101
Pot	1995	15	0	16	16	5	20	31	5	36
	1996	12	-	12	24	8	33	36	8	45
	1997	9	-	9	17	5	22	26	5	31
	1998	-	-	-	10	4	14	-	-	-
	1999	14	4	19	13	3	16	27	7	35
Trawl	1995	38	4	42	52	69	122	90	74	163
	1996	40	6	46	61	52	113	101	58	159
	1997	46	2	48	63	48	111	109	50	160
	1998	36	5	41	40	42	82	76	47	123
	1999	35	2	37	36	32	68	71	35	105

Note: Includes Eastern, Central, and Western Gulf. Includes only catches counted against Federal TACs. A dash indicates that data are not available, either because there was no activity or to preserve confidentiality.

Source: Preliminary Table 4 of the 1999 Economic SAFE report.; Blend estimates, NMFS.

Table 4.5.2 summarizes data on annual ex-vessel prices for P.cod from 1993 to 1999.
The data are provided separately for the GOA and the BSAI and, within each management area, separately for fixed and trawl gear. Trawl gear ex-vessel prices are lower than fixed gear prices. Prices rose to fairly high levels in 1999 and are reported to remain at high levels in 2000. Various reasons have been given for this, including (1) lower harvests of cod and other whitefish, including lower harvests from the Barents Sea and from Russian waters and (2) strengthening Asian exchange rates as the Asian economies recover from the recent financial crises and recessions.[3]

Table 4.5.2 Nominal ex-vesselvessel prices for P.cod fisheries off of Alaska by area and gear, 1993-1999 ($/lb round weight)

Year	GOA fixed	GOA trawl	BSAI fixed	BSAI trawl	All Alaska - all gear
1993	0.236	0.153	0.310	0.163	0.220
1994	0.199	0.142	0.277	0.117	0.198
1995	0.242	0.190	0.249	0.148	0.208
1996	0.232	0.165	0.286	0.149	0.220
1997	0.243	0.184	0.351	0.157	0.259
1998	0.210	0.160	0.276	0.142	0.209
1999	0.315	0.267	0.323	0.227	0.287

Source: Economic SAFE documents; preliminary 1999 SAFE tables.

4.5.1 Sector allocation

Allocation of P.cod among gear types in the BSAI began in 1993. From 1997 through 1999, the allocations were governed by Amendment 46 to the BSAI groundfish FMP. Fixed gear (longline and pot vessels) received 51% of the TAC, trawl gear received 47%, and jig gear received 2%. The trawl gear allocation was further divided between catcher vessels and catcher processor vessels. Each of these vessel classes received 50% of the trawl allocation.

Effective in 2000, Amendment 64 to the BSAI groundfish FMP will elaborate on the allocations to fixed gears (longline and pot vessels). Allocations to the trawl and jig fisheries remained unchanged. However, under Amendment 64, 80% of the fixed gear portion of the TAC will be allocated to freezer-longline, 0.3% will be allocated to catcher-longline, 1.4% to pot or longline vessels under 60 feet, and 18.3% to pot vessels.

The federal P.cod TACs are not allocated by gear type in the GOA; harvests by all gear types are deducted from a shared TAC established for each management area. In the GOA 90% of the TAC in each of the three management areas is to processors designated as "inshore" and to the operations delivering to them, and 10%

[3] Ess, Charlie. "North Pacific: Cod. Short supply on Eastern Seaboard and in Europe bodes well in Alaska." *National Fisherman* "Ondeck" web site. Http://www.nationalfisherman.com/ondeck/market/may00mu.html . Dated May, 2000. Downloaded August 15, 2000; *BANR. Bill Atkinson's Market News Report*, #780, 12-16-98, page 4; *Pacific Fishing*, August 2000, page 10; Thorn Smith, pers. com. 8-15-00.

is allocated to processors designated as "offshore" and to the operations delivering to them. Inshore processors include shoreline processing plants, vessels less than 125 feet that process no more than 126 mt round weight of pollock and P.cod per week, and vessels that process pollock or cod and operate from a fixed location in Alaska waters during the year.

4.5.2 Seasonal allocations and in-season management

Each year, following consultations with the North Pacific Fisheries Management Council (NPFMC) and the public, NMFS specifies total allowable harvests for target and "other" species for that year. Additionally, NMFS specifies allocations of harvests between fleet sectors that may be defined in the fishery management plans (FMPs). The gear allocations described in section 4.5.1 above would be reflected in these specifications. The specifications may apportion a fleet sector's harvest allocation between fishing seasons.

Fishing gear used to target P.cod will also take bycatch of other species. Some of the bycatch is of prohibited species. The FMPs make provisions for prohibited species caps (PSCs), or bycatch quotas, for some of these species. These PSCs are then allocated to the different fleet sectors. PSC caps may be allocated by gear types, even when, as in the GOA, P.cod is not. PSC limits for halibut are set out in regulations, while PSC limits for herring and crab are specified annually based on abundance and spawning biomass. Fishing for targeted species must end when a fleet sector's PSC for a prohibited species has been reached.

During the year, NMFS in-season managers allow fleet sectors to fish, or require them to stop fishing, as necessary to prevent them from harvesting more than their allocation of the TAC or of the part of their TAC allocated to a specific season in the specifications, to prevent them from failing to harvest their allocation of the TAC, and to prevent them from exceeding bycatch limits. A fleet sector may experience several openings and closing during a year.

Management plans make provisions for the "roll-over" of unharvested TAC allocations from one fleet sector to another. Under the provisions of Amendment 46, in effect in the BSAI from 1997 to 1999, NMFS in-season managers were required to reallocate any unfished jig allocations to fixed gear vessels on September 15 of each year. Further, if NMFS in-season managers determined during a fishing year that trawler, hook and line, or pot fishermen would be unable to take their allocation, the managers were responsible for reallocating the projected unused amount to the other gear types. Typically, most of the jig allocation and some of the trawl allocation are reallocated to longline gear in the fall of the year.

Historically, P.cod harvests have not been evenly distributed through the year. The BSAI P.cod fishery usually occurs from February to April, with a smaller fishery also occurring from September to October. Generally the fishery occurs to a greater extent in critical habitat in the winter (January to April) than in the summer (May to August) or fall (September to December), and appears to have been relatively consistent in the timing of harvest. The GOA P.cod fishery occurs primarily from
February to March. The percent of harvest in critical habitat in the GOA fishery also appear to be higher in the winter than in the summer or fall.[4]

4.5.3 Groundfish observer program

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[4] National Marine Fisheries Service, Alaska Region. Protected Resources Division. "A Discussion Paper on Potential Interactions Between Steller Sea Lions and the BSAI and GOA P.cod Fisheries." June 6, 2000. Pages 8-9, Table 6, page 22.

A domestic observer program has been in operation since 1990. Vessels over 125 feet length over all (LOA) are required to have an observer onboard at all times. Vessels between 60 feet and 124 feet LOA are required to have an observer onboard 30% of the time, and vessels less than 60 feet LOA are not required to have observers.[5]

The presence of an observer, who notes the geographic coordinates at which gear is operated, makes it possible to determine what proportion of a vessel's harvest was taken inside or outside of critical sea lion habitat. In the absence of this information the location of harvests must be estimated. Since observer coverage is 100% for vessels over 124 feet, data on location of P.cod harvests is very good for this fleet segment. The data is not as good for vessels from 60' to 125' because of the more limited observer coverage. There is no observer coverage on vessels under 60' so, for vessels in these fleet segments, only rough estimates of the location of harvest, with respect to critical habitat, can be made.

4.5.4 P.cod CDQ

In 1998, and in subsequent years, 7.5% of the BSAI P.cod TAC has been set aside as a reserve for Community Development Quotas (CDQs). These CDQs are distributed among six CDQ groups operating in the BSAI. The CDQ groups may either fish, themselves, or lease their allocations to others. Table 4.5.4.1 shows CDQ allocations and harvest for 1998-2000. The net revenues from CDQ harvests (or leases) are divided among 65 member villages represented by the CDQ groups. These funds support community development, infrastructure investment, and economic diversification in villages with virtually no other means of economic sustenance.

Table 4.5.4.1 CDQ Allocations and Harvests, 1998-2000

Year	Amount available (metric tons)	Catch (metric tons)	Amount remaining (metric tons)	Percent remaining (metric tons)
1998	15,750	2,148	13,602	86.36
1999	13,275	12,495	780	5.88
2000	14,475	9,261	5,214	36.02

Source: NMFS Alaska Region web site. Year 2000 estimates as of July 10.

4.5.5 Vessel moratorium and limited entry

In 1996, a Vessel Moratorium Program (VMP) limiting the entry of new vessels into the groundfish fishery was implemented for a period of three years (Aug. 10, 1995, 60 FR40763). The VMP was extended for one year in 1999 (Jan 25, 1999, 64FR 3651). The purpose was to mitigate problems rising from unconstrained entry into the common property fishery. Vessels were eligible to continue in the fishery if they had been used to make at least one landing of groundfish from January 1, 1988 to February 9, 1992.[6] The moratorium

[5] DiCosimo, Jane. "Summary of the Gulf of Alaska Groundfish Fishery Management Plan. NPFMC. April, 1998.; Witherell, David. "Summary of the Bering Sea and Aluetian Islands Groundfish Fishery Management Plan." NPFMC. March 31, 1997.

[6] DiCosimo, Jane. "Summary of the Gulf of Alaska Groundfish Fishery Management Plan. North Pacific Fishery Management Council. April, 1998.

applied to groundfish in general, and not specifically to vessels targeting P.cod.

The moratorium did not constrain the number of vessels that could fish for P.cod very much. Given normal turnover of vessels in fisheries, a large number of operations would qualify for a groundfish permit. Since the permit was a groundfish permit and not specifically a P.cod permit, vessels were free to shift their effort among groundfish fisheries.

As of January 1, 2000, persons with vessels in the groundfish fishery had to hold a license issued under the License Limitation Program (LLP) which replaced the VMP. The rule exempted relatively small vessels (less than 26 feet in the GOA and less than 32 feet in the BSAI), vessels under 60 feet using jig gear, and some vessels fishing in CDQ fisheries from the limitation requirements. Licenses were issued to persons, giving them the right to fish with vessels named and described on the licenses.

Licenses were issued with endorsements for fishing areas that corresponded to Federal management areas. Separate endorsements were issued for the Bering Sea, Aleutian Islands, and Western, Central, and Eastern Gulf of Alaska. Endorsements were not severable from the licenses. Licenses were transferable through license markets subject to certain restrictions. No species endorsement exists for the groundfish fishery.

The license limitation program is still evolving. In April 2000, the NPFMC adopted Amendment 67 which defined qualification criteria for P.cod endorsements in the BSAI fixed gear fisheries. Amendment 67 is not scheduled to become effective, if approved by the Secretary, until April 16, 2002. The Council has also notified GOA fishermen that it will be considering rationalization options for the GOA P.cod fishery.[7]

4.5.6 State waters fishery

Cod are caught within Alaska state waters under two management regimes: (a) parallel seasons in the BSAI and GOA and (b) GOA state fishing seasons under Alaska's P.cod Management Plans.

The parallel state fisheries are open for fishing in state waters in the BSAI and GOA when the federal fishery in adjacent waters is open and close when it closes. Harvests from these parallel fisheries are counted against the TACs being harvested in the federal fisheries. Legal federal gears are permitted in state waters.

In 1996, the Alaska Board of Fisheries created state water P.cod fisheries in the state's Prince William Sound, Cook Inlet, Kodiak, Chignik, and South Alaska Peninsula management areas. Since 1997, the federal P.cod TACs in the GOA have been affected by developing P.cod fisheries in state waters. These state fisheries are managed to open when fishing in federal waters (and in the parallel federal fishery in state waters) is closed, and to close when the federal fisheries are open. Aggregate harvests from these fisheries are summarized in Table 4.5.6.1, below. The federally managed TACs have been adjusted downward from ABC levels by the amount of guideline harvest levels (GHLs) established by the State. These "state" fisheries were designed to increase the available fishing for small vessels from regions located close to the fishery. These fisheries are prosecuted with pot and jig gear.

Table 4.5.6.1 P.cod Harvests in State Fisheries
(pounds)

[7] NPFMC. *News and Notes*. April 2000. Page 2-3.

Year	Prince William Sound	Cook Inlet	Kodiak	Chignik	So. Alaska Peninsula	Total
1997	200,510	868,940	7,600,571	1,143,261	9,370,498	19,183,780
1998	418,976	867,623	8,279,269	5,609,498	8,639,769	23,815,135
1999	not available	1,538,904	10,781,817	6,454,215	11,880,116	
Source: Alaska fishery management area reports to the Alaska Board of Fisheries; Cook Inlet - P. Malecha, (Alaska CFEC), pers. Comm. 8-16-00.						

4.5.7 P.cod and Steller sea lion interactions

The western U.S. Steller sea lion population (that is, west of 144°W long.) fell by about 80% between the late 1970s and 1996. Evidence suggests that P.cod fisheries and Steller sea lions compete for the same "prey"species and that the fishery may be reducing the availability of P.cod to the sea lions.[8]

The Endangered Species Act (ESA) requires federal agencies to *"insure"* that their agency actions do not *"jeopardize"* the continued existence of threatened or endangered species or result in the *"destruction or adverse modification"* of the species' critical habitat. The history of the status of Steller sea lions under the ESA is described in Section 2.2.1. This history explains the origins of the proposals being evaluated here.

On July 19, 2000, the Honorable Thomas S. Zilly, United States District Court Judge for the Western District of Washington, issued an order that granted a motion for an injunction prohibiting all groundfish trawl fishing within Steller sea lion critical habitat in the BSAI and GOA west of 144° W, effective August 8, 2000. This order would eliminate cod trawling in critical habitat during the last months of the 2000 season and possibly after.

The motion for an injunction had been filed by Greenpeace, the American Oceans Campaign, and the Sierra Club, and requested injunctive relief until NMFS issued a legally adequate biological opinion addressing the combined, overall effects of the North Pacific groundfish fisheries on the Steller sea lion and its critical habitat, pursuant to the ESA.

4.6 Alternative Mitigation Actions

4.6.1 Mitigation principle one: temporal dispersion

For the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) federal management areas, the proposed *"mitigation principles"* (accompanied by several specific alternatives, options, and suboptions) provide for significant temporal adjustments to the 'status quo' pattern of utilization of this area's P.cod resource. Under the mitigation principle of *temporal dispersion*, a primary objective is *"... to more evenly distribute the P.cod trawl, pot, longline, and jig fisheries catch..."* throughout the fishing year. Temporal dispersion serves to diminish the risk of localized depletions which may be caused by pulse fishing.

[8] National Marine Fisheries Service, Alaska Region. Protected Resources Division. "A Discussion Paper on Potential Interactions Between Steller Sea Lions and the BSAI and GOA P.cod Fisheries." June 6, 2000.

To this end, this first mitigation principle provides that the existing P.cod fishing seasons in the Gulf of Alaska, Bering Sea and/or Aleutian Islands management areas be further subdivided into seasonal apportionments.

For example, in the BSAI area under the status quo, the P.cod TAC is apportioned in three seasonal increments (Jan.1 - April 30; May 1 - August 31; and September 1 - December 31). One mitigation alternative to the status quo pattern (listed below as 'Alternative 2) regarding temporal dispersion would treat separately the Bering Sea from the Aleutian management area. For the BS area, there would be two season releases. The "A" season would be set from January 20 through April 30, each year, while the "B" season would extend from May 1 through November 1. Under this proposal, no more than forty percent of the respective area's total annual TAC for P.cod could be taken in the "A" season, with the balance (sixty percent) made available in the "B" season, each year.

Under this mitigation alternative, a suboption would contain a provision such that the Aleutian Islands management area would be apportioned a separate P.cod TAC from that of the Bering Sea. On this basis, two distinct "temporal dispersion" options for the AI management are proposed. The first would pattern releases of P.cod TAC on the same schedule as enunciated above for the BS management area. Similarly, the Aleutian P.cod TAC would be restricted to harvesting no more than 40% of the total annual AI P.cod TAC in the "A" season, 60% in the "B" season. A second alternative would completely close the Aleutian Islands area to all directed fishing for P.cod , year-round (a parallel action to that taken in the Steller/pollock RFRPA action).

Several additional 'options' could be considered, consistent with mitigation principle one, in connection with the alternatives outlined above. These might include: 1) consideration of a January 1 start date for 'fixed-gear' operators, while retaining the January 20 start date for trawl and jig gear groups; and 2) consideration of a later start date for the "B" season for all gear groups.

A second temporal dispersion alternative to the status quo (listed elsewhere as Alternative 3), which has been characterized as an effort to *"... design a fishery based on levels of fishing highly likely to avoid competition with Steller sea lions"*, would impose a uniform allocation scheme on both the BS and AI management areas. Specifically, this alternative would simply divide the P.cod fishing year into three intervals. The season dates would be January 20 - April 30; May 1 -August 31; and September 1 - October 31. The area TACs would be divided, as well, with 40% of the annual total apportioned to period one, and 30% each to the second and third periods. Under this alternative, all fishing for P.cod would be required to take place *outside* Steller sea lion critical habitat (further details of this provision are presented in the 'spatial dispersion' section). An additional suboption here could also include a "total closure" to all P.cod fishing in the Aleutian management area, depending again upon creation of an Aleutian area TAC, separate from that of the Bering Sea area.

Specific to the GOA P.cod fisheries in federal waters, this principle would require management on the basis of modified seasonal TAC releases, as well. The first temporal dispersion proposal for the GOA P.cod fisheries is similar to that contemplated for the Bering Sea subarea, inasmuch as the fishing season would be divided in two, with the "A" release becoming available on January 20 and extending no later than April 30, each year. The "B" season allocation would become available on May 1, with this season extending no later than November 1.

One temporal suboption, available under this alternative for the GOA, would have the start of the "B" season postponed until July 1, each year.

Under this proposed alternative, the GOA EEZ P.cod TAC releases would continue to be based upon the current TAC apportionments between Western/Central management areas, which exist under the status quo. It would, however, limit the aggregate catch in the "A" season to no more than 40% of the total annual TAC, with 60% released in the "B" season.

As was the case for the BS and AI management areas, a more restrictive alternative in the GOA would involve designing a fishery ... *highly likely to avoid Steller sea lions/P.cod fishing competition*. This alternative would impose a uniform allocation of P.cod TAC in the GOA federal fishery, dividing the fishing year into three trimesters. The season dates would be January 20 - April 30; May 1 - August 31; and September 1 - October 31. The area TAC releases would be apportioned 40% in the first trimester, 30% each in the second and third. Under this scenario, all federal waters' P.cod fishing would be restricted to areas *outside* Steller sea lion critical habitat (more detail is offered under the 'spatial dispersion' section).

4.6.2 Mitigation principle two: spatial dispersion

A primary objective of *spatial dispersion* of the P.cod fisheries under federal management is to have the distribution of catch mirror the distribution of exploitable P.cod biomass, for each seasonal TAC release, including allocations made to areas within critical habitat and outside of critical habitat.

The allocation of catch according to the geographic distribution of stock biomass, as suggested by mitigation principle two, implies some subdivision of the entire area into meaningful geographic units. For the P.cod stocks in the BSAI region, specific geographic areas have already been identified (e.g., Aleutian Islands area, eastern Bering Sea). In the GOA, geographic management areas for the Western/Central/Eastern zones have already been established, and the Shelikof Strait area has been identified as critical habitat for Steller sea lions.

Consistent with mitigation principle two, management areas for the spatial dispersion of P.cod fishing effort in the Aleutians, eastern Bering Sea and GOA target fisheries in the EEZ should be based on these (and/or other meaningful) geographic delineations which are proportional to P.cod stock distribution.

In this connection, the first of the two alternatives to the status quo would distribute the seasonal P.cod TAC apportionments in the BSAI management area geographically (in addition to temporally). Under this alternative, it is proposed that no more than 50% of the "A" season catch be permitted inside the area designated as Steller sea lion critical habitat.[9] In the "B" season, the amount of catch allowed within this area would be restricted to the average survey biomass estimated to be within the CH.[10]

If the BS and AI areas are divided into distinct management areas, with separated TAC amounts (as suggested in one of the options under consideration in this alternative), the same basic management scheme would apply to each, with the catch restriction extending to all CH, as defined in the respective areas. With a separate TAC, the "B" season limit on catch "inside CH" in the AI management area (based on survey biomass estimates) would be limited to 80.5% of the annual AI TAC amount, or 48.3% (i.e., 80.5% x 60% = 48.3%)

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[9] That is, no more than 20% of the total annual allowable catch, or 50% of the "A"-season apportionment

[10] For the period 1995-99, this was 3.6%, based on an estimated 6% of P.cod biomass in CH during the "B" season, or 6% of "B"-season apportionment.

For GOA, under this same alternative, the geographic dispersion principle translates into a requirement that no more than 20% of the total annual catch (or 50% of the "A"-season apportionment, by area W/C) be taken within CH, in the "A" season. GOA directed P.cod catch in CH in the "B" season (again by area) shall be set at the estimated survey biomass level, in federally managed areas. That suggests that, for the Western management area, the "B" season limit would be 39.6% (i.e., 66% x 60% = 39.6%) and in the Central area, 27% (i.e., 45% x 60% = 27%). In addition, for the GOA only, a suboption could include imposition of a CH P.cod catch limit only in the "A" season, although all rookeries and important haulout sites would remain closed year round (details of this proposal are presented in the next section).

4.6.3 Mitigation principle three: fishing exclusion zones

Notwithstanding the foregoing discussion, in some circumstances spatial dispersion, wherein P.cod catch is proportionate to stock distribution within a given area, is not sufficient to provide the level of Steller sea lion protection deemed necessary. In such cases, fishing *exclusion zones* are believed to be an appropriate management option. Mitigation principle three provides for complete exclusion of P.cod directed fishing from specific habitat zones, based on the available evidence that the regions around major rookeries and haulouts are so essential to the recovery and conservation of the western population of Steller sea lions that risk of competition from any P.cod fishing must be completely eliminated. This argument proceeds from the assumption that such exclusions are particularly important to protect prey resources for reproductive females and for pups and juveniles learning to forage.

Based on the need to eliminate the possibility of competition in foraging areas immediately adjacent to rookeries and important haulouts, this principle proposes to establish exclusion zones which provide absolute spatial separation of P.cod fishing and Steller sea lion foraging areas adjacent to terrestrial haulouts and rookeries. These exclusion zones are specified in the proposed FMP amendment so as to provide protection for all rookeries and haulouts used by significant numbers of animals since the beginning of the decline in the 1970s.

In the Bering Sea and Aleutian Islands subareas, the first alternative to the status quo (Alternative 2) proposes to close all rookeries and important haulout sites (as those have been defined within the EA portion of this document) to fishing for P.cod, for the entire fishing year. In the GOA management area (and subareas) it is proposed that all rookeries and important haulout sites be closed to all federally authorized P.cod fishing, year round, however, a suboption would place no other restrictions on P.cod fishing in CH, in the GOA.

In the second alternative to the status quo (Alternative 3), a blanket closure of all P.cod fishing, in all Steller sea lion critical habitat would be imposed, in all federally managed areas (i.e., BS, AI, and GOA). In addition, (as noted under principle one) the entire Aleutian Islands management area could be closed to all P.cod fishing, year round.

4.6.4 The "no action" alternative (status quo baseline)

It is standard practice for all regulatory analyses to include an examination of the "no action" management option (herein, identified as Alternative 1), to contrast the range of outcomes of proposed or contemplated actions with those of the "status quo" condition. Often this is done by assuming that, absent the proposed action, the fishery would revert to the management and operational patterns observed in the latest period prior to the proposed implementation date for the action. In this case, that would be the 1999 fishing year (the last year for which complete fisheries data are available). In general, this is the analytical approach which has been adopted in connection with the P.cod-Steller Mitigation Action FMP proposal. However, several important regulatory and legal changes to the P.cod directed fishery have occurred (or will soon occur) which make a strict adherence to this approach less appropriate. These changes (e.g., adoption of Amendment 64) will be referenced, and their implications discussed, as appropriate, as the analysis develops.

4.6.4.1 The Bering Sea and Aleutian Islands

Historically, there has been only a single P.cod TAC for the combined BSAI management area. Under provisions of Alternatives 2 and 3, the BSAI area may be split into separate BS and AI P.cod management areas. The split involves the separation of the AI statistical areas 541, 542, and 543 from the other BSAI areas. Separate TACs would be created for the new BS and AI areas.

In 1999, the BSAI TAC was 177,000 mt[11]. The 1999 BSAI area regulations called for 7.5% of the TAC to be set aside for CDQ operations. Thus, 13,275 mt were set aside for the CDQ operations and the balance of the TAC, 163,725 mt, was allocated to the non-CDQ fleets.

The TAC allocated to the non-CDQ fleets was divided among three gear groups. Trawl operations received 47%, and this was divided equally between trawl catcher-processors and trawl catcher vessels. Each of these two trawler groups received 38,475 mt. The fixed gear fleet of longline and pot operations received 51% of the TAC (or 83,500 mt) and jig fishermen received 2% of the TAC (or 3,275 mt).[12]

In 1999, the Council recommended that the longline and pot allocation be apportioned between three separate seasons. Sixty thousand metric tons were apportioned to a first season, running from January 1 to April 30; 8,500 tons to a second season, running from May 1 to August 31; and 15,000 mt were allocated to a third season, running from September 1 to the end of the year. Again, these apportionments applied to the entire BSAI; there was no BS or AI distinction.

NMFS in-season managers opened and closed the different fisheries as necessary to prevent fleet sectors from harvesting more than their allocation of the TAC, to prevent them from failing to harvest part of the TAC, and to prevent them from exceeding bycatch limits. Openings, closing,, and re-allocations of P.cod in the BS and AI were handled jointly during 1999.

Trawl catcher-processors were managed as follows:

- trawling opened on January 20
- trawling closes in critical habitat in Area 542 on Feb. 13
- trawling reopens in critical habitat in Area 542 on March 1
- trawling closed again in critical habitat in Area 542 on March 31
- trawling reopens in critical habitat in Area 542 on April 5

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[11] The following discussion of the 1999 TAC and its allocations and apportionments is drawn from "Fisheries of the Exclusive Economic Zone Off Alaska; Bering Sea and Aleutian Islands; Final 1999 Harvest Specifications for Groundfish." *Federal Register*. 64(47): 12103-12116. March 11, 1999. Specifically pages 12106, 12109.

[12] Amendment 64 to the groundfish FMP, currently under consideration, would elaborate these allocations for the fixed gear fleet. Under Amendment 64 the fixed gear fleet would be divided into four components. The freezer-longliners would receive 80% of the fixed gear allocation, longline catcher vessels would receive 0.3%, pot and longline catcher vessels less than 60 ft. in length overall (LOA) would receive 1.4%, and pot vessels would receive 18.3%.

- trawling closed on May 6
- 5,000 mt of catcher-processor allocation reallocated to fixed gear on September 24
- trawling reopened on October 1
- trawling closed on October 18
- trawling reopened on November 16 for rest of year
- 2,000 mt reallocated from catcher-processors to fixed gear on December 6

Trawl catcher vessels were managed as follows
- trawling opened on January 20
- trawling closes in critical habitat in Area 542 on Feb. 13
- trawling reopens in critical habitat in Area 542 on March 1
- trawling closed again in critical habitat in Area 542 on March 31
- trawling reopens in critical habitat in Area 542 on April 5
- trawling closed on April 11
- trawling reopened on October 1
- trawling closed on October 18
- trawling reopened on November 16 for rest of year
- 2,000 mt reallocated from catcher vessels to fixed gear on December 6

Longliners were managed as follows:
- longlining opened on January 1
- longlining closed on April 17
- longlining reopened on September 15
- longliners share a 7,800 mt reallocation from trawl catcher-processors and jig with pot fishermen on September 24
- longlining closed on October 19
- longlining reopened on December 6 for the rest of the year
- longliners share a 4,000 mt reallocation from trawlers with pot fishermen on December 6

Pot fishermen were managed as follows:
- pot fishing opened on January 1
- pot fishing closed on April 17
- pot fishing reopened on May 1
- pot fishing closed on June 9
- pot fishing reopened on September 1
- pot operations share a 7,800 mt reallocation from trawl catcher-processors and jig operations with longliners on September 24
- pot fishing closed on October 19
- pot fishing reopened on December 6 for the rest of the year
- pot fishermen share a 4,000 mt reallocation from trawlers with longliners on December 6

Jig operations were managed as follows
- jig fishing opened on January 1
- 2,800 mt of jig allocation reallocated to fixed gear on September 24

The counts of vessels actually used in the BSAI P.cod fishery from 1995-1999 may be found in Table 4.6.4.1.1. For example, the table shows the numbers of catcher vessels and catcher processors targeting P.cod in the BSAI in 1999. In the baseline year, there were 76 longliners, equally divided between catcher vessels and catcher processors. There were 102 pot vessels, of which 89 were catcher vessels and 13 were catcher processors. There were 105 trawlers, of which most (79 of 107) were also catcher vessels, and 26 were catcher processors. Small trawlers and fixed gear vessels (that is, vessels less than 60 feet) are not active in the AI EEZ fisheries. Data on landings from 1988 to 1998 show no retained groundfish harvests in the AI EEZ for these vessel classes.[13]

Table 4.6.4.1.1 Numbers of BSAI catcher vessels and catcher processors that targeted P.cod, 1995-1999.

		Catcher-vessels			Catcher processors	
		<60	60-125	>125	<125	>125
Longline	1995	52	5	0	16	28
	1996	39	8	1	13	26
	1997	19	12	0	12	26
	1998	17	5	0	9	27
	1999	19	16	3	12	26
Pot	1995	13	79	24	4	4
	1996	3	63	24	4	9
	1997	4	52	19	6	7
	1998	4	46	21	2	5
	1999	4	62	23	3	10
Trawl	1995	0	66	20	7	33
	1996	1	79	26	8	31
	1997	0	63	22	10	31
	1998	2	60	23	8	28
	1999	1	54	24	7	19

Note: Includes only vessels that fished part of Federal TACs.
Source: Blend estimates, NMFS permits. NMFS, REFM.

Note that in many instances there are only a few large vessels in a fishing gear-processor mode category during a year. (For example, there is only one longline catcher vessel over 125 feet in 1995.) Federal confidentiality rules require that there be three or more observations before data that can be used to estimate gross revenues may be reported. State confidentiality rules, which govern data from Alaska fish tickets, are stricter, requiring four or more observations. It is, therefore, impossible to report landings information for some of these vessel categories, in some years.

Table 4.6.4.1.2 summarizes data on P.cod catches in the BSAI from 1995 to 1999. Trawl gear was the most important, in terms of the volume of the catches, during this period. Trawl catcher vessels and

[13] Draft Programmatic Supplemental environmental Impact Statement, Chapter 3, “Social and Economic Conditions.” Dated July 28, 2000.

trawl catcher processors both took significant parts of the catches. Longline gear was the second most important in terms of volume. Longline catcher processors were much more important that longline catcher vessels. Pot gear was the third, in terms of catch volume; pot catcher vessels took a much larger part of the catch than pot catcher processors. Finally, jig gear generated relatively small catches, almost entirely taken by catcher vessels.

Table 4.6.4.1.2 P.cod catch in the BSAI by catcher category, and gear, 1995-1999. (1,000 metric tons, round weight)

		Bering Sea and Aleutians		
Gear	Year	Catcher vessels	Catcher processors	Total
Longline	1995	3	101	103
	1996	0	94	95
	1997	0	124	124
	1998	0	100	100
	1999	0	89	89
Pot	1995	16	5	20
	1996	24	8	33
	1997	17	5	22
	1998	10	4	14
	1999	13	3	16
Trawl	1995	52	69	122
	1996	61	52	113
	1997	63	48	111
	1998	40	42	82
	1999	36	32	68

Note: Includes Eastern, Central, and Western Gulf. Includes only catches counted against Federal TACs. A dash indicates that data are not available, either because there was no activity or to preserve confidentiality.

Source: PreliminaryTable 4 of the 1999 Economic SAFE report.; Blend estimates, NMFS.

Tables 4.6.4.1.4 to 4.6.4.1.6 show estimated harvests for medium and large trawlers, longliners, and pot vessels within and outside of critical habitat. These tables cover the years 1996 to 2000. The 2000 data are incomplete.

Allocation of the harvest to inside and outside CH categories is based on observations by onboard observers. The large vessels (125 feet and up) have 100% observer coverage. For these boats, all harvests are assumed to be allocated inside or outside CH correctly. Each of the medium sized vessels

(60 to 124 feet) carries an observer 30% of the time. The estimates of the harvests within and outside of CH for the medium sized vessels are based on extrapolations from observed harvests to the total harvests.

Estimates of harvests by small vessel (less than 60 feet) inside and outside of CH are conjectural. It is likely that two separate approaches could provide pounds for harvests from critical habitat. It can be assumed that, in the limit, all small vessel harvests are made from critical habitat. It is likely, however, that some small vessels operate outside of critical habitat, at least at times, so this would provide an upper bound to small vessel critical habitat harvests.

Alternatively, the percentages of the harvest taken from CH by medium vessels (60'-125') might be applied to the small vessel fleet. It is likely that this would provide an *underestimate* of the true percentage of catch taken from CH by small vessels. The medium sized vessels have, in general, greater operational capabilities than the smaller vessels and probably take a larger percentage of their harvests from outside of critical habitat. There are no statistical data available that indicate which of these approaches provide estimates closer to the actual small vessel percentages from critical habitat.

Table 4.6.4.1.4 shows the estimated harvests, in and out of critical habitat, by the medium and large longliners in the BSAI. The data are broken out by vessel length and processor mode (that is, separately for catcher processors and catcher vessels). In 1999, catcher processors from 60' to 125' took 17.8% of their harvests from critical habitat, while the catcher processors greater than 125 feet took 27.3% of their harvest from critical habitat. Longline catcher vessels took considerably larger percentages of their harvests from critical habitat. Medium longliners took about 83% of their harvest from critical habitat, while large longliners took almost all of their harvest (99.8%) from critical habitat.

Table 4.6.4.1.5 shows similar data for the medium and large pot vessels. In 1999, the pot catcher processors between 60' and 125' took all (100%) of their harvest from within critical habitat. Pot catcher processors greater than 125 feet took much less, about 56%, from critical habitat. Both medium and large pot catcher vessels took almost all of their harvests (over 96% in each case) from within critical habitat.

Table 4.6.4.1.6 provides similar data for the medium and large trawl vessels. In 1999, the medium trawl catcher processors took about 43% of their harvest from within critical habitat, while the large trawl catcher processors took about 63% from within critical habitat. The medium trawl catcher vessels took almost all of their harvest (99.7%) from within critical habitat, while the larger trawl catcher vessels took 84.5% of their harvest from within critical habitat.

Table 4.6.4.1.3 below, summarizes data on landings in critical habitat from the three following tables, Tables 4.6.4.1.4 to 4.6.4.1.6. Table 4.6.4.1.3 shows the percentages of the medium and large vessel harvests from critical habitat made by each of the fleet segments. Among the medium and large vessels, the trawl catcher fleet took the largest proportion of the harvest from critical habitat, followed by the longline catcher processors.

Table 4.6.4.1.3 The relative shares of medium and large vessel BSAI critical habitat harvests made by different fleet segments in 1999

Fleet segment	Harvest from BSAI critical habitat	Percent of harvest from critical habitat
Longline catcher processor	23,334	29.5
Longline catcher vessel	88	0.1
Pot catcher processor	3,329	4.2
Pot catcher vessel	10,007	12.6
Trawl catcher processor	9,871	12.5
Trawl catcher vessel	32,569	41.1
Total harvest	79,198	100.0
Source: The following tables 4.6.4.1.4 to 4.6.4.1.6		

Table 4.6.4.1.4 BSAI P.cod medium and large vessel longline harvest inside and outside of critical habitat, 1996-1999

			Total cod harvest			Harvest from critical habitat			Percent from critical habitat		
Data status	Processor mode	Year	< 60	60-125	> 125	< 60	60-125	> 125	< 60	60-125	> 125
CH data	Catcher Processor	1996		11,565	82,859		2,703	19,521		23.4	23.6
		1997		9,757	114,231		2,405	28,151		24.7	24.6
		1998		6,646	92,962		1,619	29,534		24.4	31.8
		1999		9,856	79,078		1,752	21,582		17.8	27.3
	Catcher Vessel	1996		37*	-		23*	-		62.9	
		1997		14*	-		4*	-		27.1	
		1998		62*	-		9*	-		45.4	0.0
		1999		102*	-		88*	-		83.3	99.8

Note: These estimates are based on observer data and the blend. Year 2000 estimates were prepared in July 2000 and are incomplete. “-“ indicates confidential data has been deleted. “*” means confidential data for another category has been added to this category.

Table 4.6.4.1.5 BSAI P.cod pot medium and large vessel harvest inside and outside of critical habitat, 1996-1999

			Total cod harvest			Harvest from critical habitat			Percent from critical habitat		
Data status	Processor mode	Year	< 60	60-125	> 125	< 60	60-125	> 125	< 60	60-125	> 125
CH data	Catcher Processor	1996		1,370	8,519		759	4,421		55.4	51.9
		1997		1,411	4,623		1,143	1,569		81.0	33.9
		1998		-	5,650*		-	2,577*		71.5	42.8
		1999		-	5,822*		-	3,329*		100.0	55.7
	Catcher Vessel	1996	-	-	-	-	-	-		86.2	94.7
		1997		11,541	4,493		10,828	4,471		93.8	99.5
		1998		5,318	2,723		5,203	2,723		97.8	100.0
		1999		7,320	3,006		7,076	2,931		96.7	97.5

Note: These estimates are based on observer data and the blend. Year 2000 estimates were prepared in July 2000 and are incomplete. "-" indicates confidential data has been deleted. "*" means confidential data for another category has been added to this category.

Table 4.6.4.1.6 BSAI P.cod trawl medium and large vessel harvest inside and outside of critical habitat, 1996-1999

		Total cod harvest			Harvest from critical habitat			Percent from critical habitat		
Processor mode	Year	< 60	60-125	> 125	< 60	60-125	> 125	< 60	60-125	> 125
Catcher Processor	1996		1,441	19,140		838	11,130		58.2	58.1
	1997		3,796	17,409		2,673	10,320		70.4	59.3
	1998		1,162	17,420		849	10,889		73.1	62.5
	1999		997	14,891		431	9,440		43.2	63.4
Catcher Vessel	1996	-	-	24,311	-	-	17,946		91.6	73.8
	1997	-	-	26,384	-	-	21,193		96.2	80.3
	1998	-	-	17,920	-	-	14,976		99.4	83.6
	1999	-	-	-	-	-	-		99.7	84.5

Note: These estimates are based on observer data and the blend. Year 2000 estimates were prepared in July 2000 and are incomplete. “-“ indicates that dataq has been deleted to protect confidentiality. “*” means confidential data for another category has been added to this category.

Through the CDQ program, a portion of the BSAI groundfish, prohibited species, halibut, and crab TAC limits are allocated to 65 eligible Western Alaska communities. Table 4.6.4.1.8. lists the CDQ groups and the communities that are members of each group. These communities must use the proceeds from the CDQ allocations to start or support commercial fishery activities that will result in ongoing, regionally based, commercial fishery or related businesses. Although the CDQ program began in 1992 with the allocation of 7.5 % of the BSAI pollock TAC, and was expanded in 1995, as part of the halibut and sablefish Individual Fishing Quota Program, P.cod allocations were not begun until 1998.[14] [15]

The six CDQ groups are eligible to harvest parts of the P.cod CDQ reserve. These groups and their 1999 allocations are shown in Table 4.6.4.1.7. The CDQ groups harvested 12,494.7 mt in 1999, or about 94% of their allocation. These CDQ groups operated pollock and other groundfish trawl catcher processors, catcher vessels and mothership operations, and longline catcher vessels and catcher processors. The bulk of their P.cod harvest was taken by longline catcher processors.[16]

Table 4.6.4.1.7 1999 CDQ Group P.cod allocations

Aleutian Pribilof Island Community Development Association	2,124 mt
Bristol Bay Economic Development Corporation	2,655 mt
Central Bering Sea Fishermen's Association	1,327.5 mt
Coastal Villages Regional Fund	2,256.75 mt
Norton Sound Economic Development Corporation	2,389.5 mt
Yukon Delta Fisheries Development Association	2,522.25 mt
Total	13,275 mt

[14] The Magnuson-Stevens Act requires that the allocation of crab to the CDQ Program be phased in with a 3.5% allocation in 1998, a 5.5% allocation in 1999, and a 7.5% allocation in 2000.

[15] The groundfish and halibut CDQ fisheries are managed by NMFS and the crab CDQ fisheries are managed by the State of Alaska.

[16] Per. Comm. S. Bibb, NMFS Sustainable Fisheries. September 9, 2000.

Table 4.6.4.1.8 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
Goodnews Bay
Hooper Bay
Kipnuk
Kongiganak
Kwigillingok

CVRF (cont.)

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
Sheldon Point

4.6.4.2 The 1999 fishery in the Gulf of Alaska

The parts of the GOA management area potentially impacted by Alternatives 2 and 3 include the waters in the EEZ in the Gulf of Alaska from 170°W to 147°W. This includes the waters to the south of the Eastern Aleutians (including the waters south of Unimak and Unalaska Islands and False Pass, to the south of the Alaska Peninsula, to the south of Southcentral Alaska, and around Kodiak Island. This area includes management areas 610, 620, and 630.

The TAC in the GOA is divided into Western GOA (WGOA) and Central GOA (CGOA) components. The WGOA corresponds to area 610 and the CGOA corresponds to areas 620 and 630. The WGOA contains the waters south of the Eastern Aleutians and the Alaska Peninsula, to a point slightly east of the Shumagin Islands. The CGOA includes the waters from a point east of the Shumagins, as far east as the eastern end of Montague Island, off of Prince William Sound (PWS). The CGOA includes the waters around Kodiak Island.

In 1999, the WGOA management area had an Allowable Biological Catch (ABC) of 29,540 mt. From this, 5,910 mt was set aside for harvest during the State of Alaska's "state managed directed P.cod fishery". The remainder, 23,630 mt, was left as a TAC for the federal fishery (including the federal fishery taking place as a "parallel" fishery within Alaska state waters. Under the FMP, 90% (21,267 mt) of the P.cod TAC was set aside for fishing operations delivering to inshore processors, and 10% (2,363 mt) was set aside for the fishing operations delivering to offshore processors.[17]

In 1999, the CGOA management area had an ABC of 53,170 mt. From this, 10,235 mt was set aside for harvest during the State of Alaska's "state managed directed P.cod fishery". The remainder, 42,935 mt, was left as a TAC for the federal fishery (including the federal fishery taking place as a "parallel" fishery within Alaska state waters). Under the FMP, 90% (38,642 mt) of the P.cod TAC was set aside for fishing operations delivering to inshore processors, and 10% (4,294 mt) was set aside for the fishing operations delivering to offshore processors.[18]

NMFS in-season managers opened and closed the different fisheries, as necessary, to prevent the inshore and offshore fleets from harvesting more than their allocation of the WGOA TAC, to prevent them from failing to harvest part of the TAC, and to prevent them from exceeding by-catch limits. The patterns of openings and closings were different in the WGOA and CGOA.

In the WGOA the fleet faced the following openings and closings:

For the inshore fleet:
- Jig and fixed gears open on January 1
- Trawl gear opens on January 20
- Inshore fishing is closed on March 8 for the rest of the year

For the offshore fleet:
- Jig and fixed gears open on January 1
- All offshore gear is closed on January 20
- Trawl gear normally opens on January 20 but opening this year is delayed by offshore closure
- Offshore reopens on April 18
- Offshore closes on June 7 for the rest of the year

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[17] "Fisheries of the Exclusive Economic Zone Off Alaska; Gulf of Alaska; Final 1999 Harvest Specifications for Groundfish." *Federal Register*. 64(47): 12094-12103. March 11, 1999. Specifically pages 12096 and 12100.

[18] Ibid.

In the Central Gulf of Alaska the inshore and offshore fleets faced the following openings:

For the inshore fleet:
- Jig and fixed gears open on January 1
- Trawl gear opens on January 20
- Inshore fishing is closed on March 14
- Inshore fishing reopens on September 1
- Inshore fishing closes October 5 for the rest of the year

For the offshore fleet:
- Jig and fixed gears open on January 1
- All offshore gear is closed on January 20
- Trawl gear normally opens on January 20 but opening this year is delayed by offshore closure
- Offshore reopens on February 25
- Offshore closes on October 5 for the rest of the year

Table 4.6.4.2.1 below shows the numbers of catcher vessels and catcher processors targeting P.cod in the GOA from 1995 to 1999. In 1999, there were 409 longliners. Most of these (387) were catcher vessels, although 22 were catcher processors. There were 91 pot vessels, of which 80 were catcher vessels, and 11 were catcher processors. There were 114 trawlers, of which 105 were catcher vessels and 9 were catcher processors. Catcher vessels are a relatively larger proportion of the fleets in the GOA than they are in the BSAI. In the GOA, 90% of the TAC is allocated to the inshore sector served by the catcher vessels, while only 10% is allocated to the offshore sector. Explicit inshore/offshore allocations are not a part of the P.cod allocations in the BSAI.

Note that in many instances there are only a few large vessels in a fishing gear-processor mode category during a year. There is, for instance, only one longline catcher vessel over 125 feet listed in 1995. Federal confidentiality rules require that there be three or more observations before data that can be used to estimate gross revenues may be reported. State confidentiality rules, which govern data from fish tickets, are stricter, requiring four or more observations. Thus, it is not possible to report landings information for some of these vessel categories in some years.

Table 4.6.4.2.1 Numbers of GOA catcher vessels and catcher processors that targeted P.cod, 1995-1999.

		Catcher-vessels			Catcher processors	
		<60	60-125	>125	<125	>125
Longline	1995	338	46	1	13	7
	1996	190	15	1	12	4
	1997	361	29	1	9	5
	1998	306	34	2	4	4
	1999	348	37	2	11	11
Pot	1995	99	76	9	1	2
	1996	79	59	4	0	0
	1997	89	53	3	0	0
	1998	111	49	5	0	1
	1999	130	65	2	2	9
Trawl	1995	55	79	9	5	9
	1996	53	48	7	3	13
	1997	58	69	9	5	1
	1998	52	61	3	6	7
	1999	50	52	3	6	3

Note: Includes only vessels that fished part of Federal TACs.
Source: Blend estimates, NMFS permits.
National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070

Table 4.6.4.2.2 summarizes data on P.cod catches in the GOA from 1995 to 1999. Trawl gear was the most important, in terms of the volume of the catches, during this period. Trawl catcher vessels took much more of the P.cod catch than did catcher processors. Longline and pot gears also made significant landings in the GOA. Pot catcher vessels accounted for much more of the catch than pot catcher processors. Longline catcher processors made significant landings, although in recent years longline catcher vessels landings were larger. Finally, jig gear generated relatively small catches.

Table 4.6.4.2.2 P.cod catch in the GOA by catcher category, and gear, 1995-1999. (1,000 metric tons, round weight)

Gear	Year	Catcher vessels	Catcher processors	Total
longline	1995	5	6	11
	1996	5	5	10
	1997	7	4	11
	1998	6	3	10
	1999	7	5	12
Pot	1995	15	0	16
	1996	12	-	12
	1997	9	-	9
	1998	-	-	-
	1999	14	4	19
Trawl	1995	38	4	42
	1996	40	6	46
	1997	46	2	48
	1998	36	5	41
	1999	35	2	37

Note: Includes Eastern, Central, and Western Gulf. Includes only catches counted against Federal TACs. A dash indicates that data are not available, either because there was no activity or to preserve confidentiality.

Source: Preliminary Table 4 of the 1999 Economic SAFE report.; Blend estimates, NMFS.

Tables 4.6.4.2.4 to 4.6.4.2.6 show estimated harvests for medium and large trawlers, longliners, and pot vessels within and outside of critical habitat. These tables cover the years 1996 to 2000. The 2000 data are incomplete.

As noted earlier, allocation of the harvest to inside and outside critical habitat is based on data collected by fisheries observers. The large vessels (larger than 125 feet) have 100% observer coverage, the medium vessels (60'-125') each are required to carry an observer 30% of the time, and the small vessels (under 60 feet) do not carry observers. This makes estimation of small vessel catch inside CH problematic. Estimates of small vessel harvests within critical habitat may be made by extrapolating from the activities of the medium vessels, in which case the harvests of the small vessels within CH would be underestimated, or they may be made by assuming the small vessels do all of their fishing within critical habitat, in which case they would be overestimated. There are no statistical data on harvest location that can be used to determine which estimation method would produce more accurate results.

Table 4.6.4.2.4 shows the estimated harvests, in and out of critical habitat, by the medium and large longliners in the GOA. The data are broken out by vessel length and processor mode (that is, separately for catcher processors and catcher vessels. In 1999, catcher processors from 60'-125' took about 34% of their harvest from within critical habitat, while catcher processors greater than 125 feet took about 52% from critical habitat. Longline catcher vessels from 60'-125' took almost all (99.7%) of their harvests from within critical habitat. Large longline catcher vessels (over 125') weren’t active in the GOA.

Table 4.6.4.2.5 shows similar data for medium and large pot vessels. In 1999, the pot catcher processors between 60' and 125' took about 72% of their harvest from within critical habitat. Larger pot catcher processors (over 125 feet) took about 24% of their harvest from critical habitat. Medium pot catcher vessels took about 54% of their harvest from within critical habitat, while large pot catcher vessels took about 98% of their harvest from critical habitat.

Table 4.6.4.2.6 shows similar data for medium and large trawl vessels. In 1999, the medium trawl catcher processors took about 25% of their harvest from critical habitat, while the larger catcher processors took about 4% from critical habitat. The medium trawl catcher vessels took about 57% of their harvest from critical habitat, while the larger trawl catcher vessels took about 73% of their harvest from critical habitat.

Table 4.6.4.2.3 below, summarizes data on landings in critical habitat from the three following tables, Tables 4.6.4.2.4 to 4.6.4.2.6. Table 4.6.4.2.3 shows the percentages of the medium and large vessel harvests from critical habitat made by each of the fleet segments. Among the medium and large vessels, the trawl catcher fleet took the largest proportion of the harvest from critical habitat, followed by the pot and longline catcher vessels.

Table 4.6.4.2.3 The relative shares of medium and large vessel GOA critical habitat harvests made by different fleet segments in 1999.

Fleet segment	Harvest from GOA critical habitat	Percent of harvest from GOA critical habitat
Longline catcher processor	2,682	7.7
Longline catcher vessel	5,589	16.0
Pot catcher processor	2,198	6.3
Pot catcher vessel	6,674	19.2
Trawl catcher processor	792	2.3
Trawl catcher vessel	16,915	48.5
Total harvest	34,850	100.0

Source: The following tables 4.6.4.2.4 to 4.6.4.2.6

Table 4.6.4.2.4 GOA P.cod medium and large longline vessel harvest inside and outside of critical habitat, 1996-1999										
		Total cod harvest			Harvest from critical habitat			Percent from critical habitat		
Processor mode	Year	< 60	60-125	> 125	< 60	60-125	> 125	< 60	60-125	> 125
catcher Processor	1996		2,174	3,740		786	1,029		36.1	27.5
	1997		2,409	1,550		1,397	1,069		58.0	68.9
	1998		3,277	572		2,844	164		86.8	28.7
	1999		2,451	3,551		838	1,844		34.2	51.9
Catcher vessel	1996		3,895*	-		3,700*	-		95.0	
	1997		6,390*	-		4,927*	-		77.1	
	1998		5,475*	-		3,735*	-		68.2	
	1999		5,606*	-		5,589*	-		99.7	

Note: These estimates are based on observer data and the blend. Year 2000 data were prepared in July 2000 and are incomplete. "-" indicates that data has been suppressed to protect confidentiality. "*" means confidential data for another category has been added to this category.

Table 4.6.4.2.5 GOA P.cod medium and large pot vessel harvest inside and outside of critical habitat, 1996-1999

		Total cod harvest			Harvest from critical habitat			Percent from critical habitat		
Processor mode	Year	< 60	60-125	> 125	< 60	60-125	> 125	< 60	60-125	> 125
catcher Processor	1996		-	-		-	-		100.0	32.5
	1997									
	1998			-			-			100.0
	1999		-	6,945*		-	2,198*		72.2	23.8
Catcher vessel	1996		11,460	65		9,352	4		81.6	5.7
	1997		8,672*	-		6,021*	-		68.6	94.1
	1998		9,839	318		6,290	318		63.9	100.0
	1999		11,767*	-		6,674*	-		53.5	98.3

Note: These estimates are based on observer data and the blend. Year 2000 data were prepared in July 2000 and are incomplete. "-" indicates that data has been suppressed to protect confidentiality. "*" means confidential data for another category has been added to this category.

Table 4.6.4.2.6 GOA P.cod medium and large trawl vessel harvest inside and outside of critical habitat, 1996-1999

		Total cod harvest			Harvest from critical habitat			Percent from critical habitat		
Processor mode	Year	< 60	60-125	> 125	< 60	60-125	> 125	< 60	60-125	> 125
catcher Processor	1996		-	10,611*		-	9,749*		77.8	93.1
	1997		670*	-		349*			46.3	58.5
	1998		3,186	4,270		108	1,112		3.4	26.1
	1999		4,175*	-		792*	-		25.1	4.0
Catcher vessel	1996		22,596	4,869		15,347	2,234		67.9	45.9
	1997		32,155	9,933		21,417	9,792		66.6	98.6
	1998		29,878*	-		21,422*	-		74.1	54.3
	1999		29,243*	-		16,915*	-		56.9	72.6

Note: These estimates are based on observer data and the blend. Year 2000 data were prepared in July 2000 and are incomplete. "-" indicates that data has been suppressed to protect confidentiality. "*" means confidential data for another category has been added to this category.

The State of Alaska opens its own waters to fishing for P.cod in seasons that parallel openings and closings for P.cod in the Federal EEZ. During these parallel seasons the gears permitted to fish in federal waters are allowed to fish in state waters; their catches are counted against the federal management TACs and the allocations of those TACs in specifications. Vessel moratorium and license programs in federal waters do not apply to these state parallel fisheries.

Table F shows the harvests by gear type from the parallel fisheries in Alaska waters during 1999 for trawl, pot, and longline gear. For each of these gear types, almost all of this fishing took place in the first trimester of the year, and for each, almost all took place within the critical habitat. Typically only small proportions of the catch, 1.4% for trawl gear, 4.5% for longline, and 3% for pots, were taken outside of critical habitat in state waters.

In addition to the state fisheries that parallel the federal fisheries, Alaska has had its own state P.cod fisheries since 1997, in its South Alaska Peninsula, Chignik, Kodiak, Cook Inlet, and Prince William Sound management areas. These management areas border the federal WGOA and CGOA areas. These pot and jig fisheries are only open when the fisheries in adjacent federal fishery management areas are closed.

The Western GOA includes Alaska waters in the State's South Alaska Peninsula Management Area. In 1999, this state management area opened on March 15, seven days after the close of the parallel fishery, with a guideline harvest level (GHL) of 5,897 mt. The fishery was only open to pot and jig gears. The pot fishery was closed on April 11 and was then reopened on October 31 for the rest of the year. The jig season remained open until the end of the year. Fifty-two vessel operators used pot gear and landed 5,064 mt and 25 fishermen used jig gear and took 325 mt..[19]

The Central GOA (CGOA) includes Alaska waters in the State's Chignik, Kodiak, Cook Inlet, and Prince William Sound management areas. The available information on the state managed cod fisheries in the CGOA follows:[20]

- The Kodiak fishery opened to pot and jig gear on March 21, seven days after the federal closure in the CGOA, with a GHL of 5,307 mt. The pot fishery closed on April 26 and the state jig fishery closed on September 1, when the parallel fishery in state waters was opened to conform to a federal opening in the EEZ. Both state fisheries were reopened on October 5, following the closure of the federal fishery and the parallel state fishery. During this state fishery 73 pot vessels took 3,841 mt, while 114 jig vessels took 1,049 mt. Eight vessels fished both gears.[21]
- The Chignik fishery opened to pot and jig gear on April 15 with a GHL of 3,719 mt. The state fishery was closed between September 1 and October 5 during a federal opening in the EEZ and

[19] Ruccio, Michael P and David R. Jackson. "Westward Region Groundfish Fisheries, 1999. Report to the Alaska Board of Fisheries." Regional Information Report 4K00-14. Alaska Department of Fish and Game. Kodiak: February 2000., Pages 5-7, Table 10, page 18.

[20] These descriptions are based on information in reports filed by state fishery managers with the Alaska Board of Fisheries. The report covering the Chignik and Kodiak fisheries was prepared in February 2000 and provides complete details on the 1999 fishery. The Prince William Sound report was prepared in November 1999 and provides an incomplete picture. The most recent Cook Inlet report found is dated October 1998 and doesn't provide details about 1999 or complete details about 1998.

[21] Ruccio and Jackson, Page 3-4, Table 3, page 14.

concurrent parallel fishery in state waters. The state fishery reopened on October 5 and remained open the rest of the year. During this fishery 33 pot vessels took 2,836 mt, while 10 jig vessels took 92 mt. Two vessels fished both gears.[22]

- The Prince William Sound fishery opened to pot and jig gear seven days after the closure of the adjacent federal fishery, on March 21, with a GHL of about 422 mt. By October 15 the fishery had taken about 149 mt.[23]
- The most recent available report on the Cook Inlet fishery does not cover 1999, but does provide some information about 1998. This note will therefore look at the Cook Inlet fishery in 1998. In 1998 the Cook Inlet state P.cod fishery opened on March 17 with a guideline harvest level of about 1,089 mt. Fishing with pot gear was closed on April 7 and reopened on June 15. The fishery for jig gear was open continuously. Both fisheries were still open in mid-September. Total harvest when the report was prepared, probably mid-September, was about 185 mt. Nine pot vessels harvest 105 mt, while 32 jig vessels harvested 80 mt.[24]

4.6.4.3 Onshore plants and communities

Significant portions of P.cod harvests are processed in inshore processing plants and communities. Inshore plants include shore based plants that process groundfish, as well as floating processors moored or anchored near shore in protected bays and harbors. This discussion follows the detailed descriptions of inshore processing contained in the "Social and Economic Conditions" analysis of a draft version of the Groundfish Programmatic EIS.[25] This section uses the sectoral breakout adopted there. Four sectors are examined here:

- Bering Sea Pollock inshore plant
- Alaska Peninsula and Aleutian Islands inshore plant
- Kodiak Island inshore plant
- Southcentral Alaska inshore plant

*Bering Sea Pollock inshore plant*s

This group of fish processing plants includes the major onshore plants at Unalaska/Dutch Harbor and Akutan, and two large pollock processing ships or barges that have anchored near shore in Beaver Inlet of Unalaska and, more recently, near Akutan. These plants process species from the BS, AI, and the WGOA. Pollock is the most important species processed by these plants in volume and value. P.cod is the second most important groundfish species.

From 1995 to 1999, six plants fell into this category. Between 1995 and 1999, the total round weight of

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[22] Ruccio and Jackson, Page 4, Table 7, page 16.

[23] Berceli, Robert, Charles Trowbridge, Morris Lambdin, and William R. Bechtol. "Review of Groundfish Fisheries in the Prince William Sound Management Area: Report to the Alaska Board of Fisheries. Regional Information Report 2A99-30. Alaska Department of Fish and Game. Anchorage: November 1999. Pages 6-7 and Table 6, page 21.

[24] Trowbridge, Charles E. "Cook Inlet Area Groundfish Report to the Alaska Board of Fisheries 1998." Regional Information Report 2A98-37. Alaska Department fo Fish and Game. Anchorage: October 1998. Pages 8-9, Table 7 on page 15.

[25] Prepared by Hartley and Downs. Forthcoming. See sections 3.10.2.3.1 to 3.10.2.3.4.

P.cod reported delivered to these plants ranged from a high of about 59,000 metric tons round weight in 1996 to a low of about 37,000 mt in 1999. From 1995 to 1999 the wholesale value of the production (for all species and products) ranged from a high of $340.4 million in 1995, to a low of $253.9 million in 1998. The value was $268.4 million in 1999. Surimi production, for which P.cod are not used, accounted for about half of this 1999 wholesale value.

Alaska Peninsula and Aleutian Islands inshore plant

This group of fish processing plants includes plants from Chignik Lagoon in the east, west along the Alaska Peninsula and the Aleutians out to Adak, and north to St. Paul Island in the Pribilofs. There is geographic overlap between this group of plants and those included in the Bering Sea Pollock Inshore category since the distinctions between the two groups have to do with product as well as with location. These plants are highly diversified, processing salmon and crab as well as groundfish. Salmon has historically been, and remains, the "foundation" species for these plants. P.cod is the most important of the groundfish species that they process.

Between 1995 and 1999, the number of plants in this category that processed P.cod ranged from six to ten (in 1999). Between 1995 and 1999, the total round weight of P.cod reported delivered to these plants ranged from a high of about 31,000 mt round weight in 1996, to a low of about 19,000 mt in 1999. From 1995 to 1999, the wholesale value of the production (for all species and products) ranged from a high of $56.7 million in 1999, to a low of $45.2 million in 1998.

Kodiak Island inshore plants

This group of fish processing plants is located in Kodiak. These plants depend almost exclusively on GOA groundfish. P.cod and pollock are the most important species; P.cod is the most important by value. These plants differ from the plants in Southcentral Alaska by their ability to handle larger volumes of fish.

Between 1995 and 1999, the number of plants in this category that processed P.cod ranged from nine to 11. There were, reportedly, ten in 1999. Between 1995 and 1999, the total round weight of P.cod reported delivered to these plants ranged from a high of about 31,000 mt round weight in 1995, to a low of about 24,000 mt in 1996. In 1999, these plants took delivery of about 31,000 mt of P.cod. From 1995 to 1999, the wholesale value of the production (for all species and products) ranged from a high of $84 million in 1995 to a low of $62.9 million in 1997. Their wholesale value was estimated at $74 million in 1999.

Southcentral Alaska inshore plants

This group of fish processing plants is in Southcentral Alaska, in areas that border the Gulf of Alaska, Cook Inlet, and Prince William Sound. These plants process groundfish from the Bering Sea and Gulf of Alaska. Most of these plants were started to process salmon and subsequently began to process groundfish to increase annual revenues and aid in covering fixed costs. These plants are distinguished from plants in the other areas described, by the relatively low volumes of groundfish they process as well as by location. These plants are located in a wide range of communities, including Homer, Kenai, Nikiski, Ninilchik, Seward, Soldotna, Cordova, Valdez, Whittier, and Anchorage, among others.

Between 1995 and 1999, the number of plants in this category that processed P.cod ranged from 16 in

1995 and 1996 to 18 in 1999. Between 1995 and 1999, the total round weight of P.cod reported delivered to these plants ranged from a high of about 6,000 mt round weight in 1996, to a low of about 3,000 in 1999. From 1995 to 1999, the wholesale value of the production (for all species and products) ranged from a high of approximately $40 million in 1995, to a low of $26.3 million in 1999.

4.7 Economic implications of the Mitigation Principles-based alternatives

While a comprehensive quantitative estimate of the probable economic or social impacts on the P.cod fisheries of the Bering Sea, Gulf of Alaska, and/or Aleutian Islands management areas attributable to any of the three proposed mitigation principles is difficult to derive, there are several obvious (if largely qualitative) outcomes that can be predicted, beyond the relatively straight forward calculation of changes in gross revenues (presented below in Sections 4.10 and 4.11).

First, any regulatory action that requires an operator to involuntarily alter his or her fishing pattern (whether temporally or geographically) will impose costs. Furthermore, it is likely that some or all of these costs will be uncompensated, under the newly mandated regulatory regime.

Within the present P.cod/Steller sea lion mitigation action context, for example, it is *unlikely* that, following time or area closures of fishing grounds that have historically been the preferred site of P.cod harvesting activity for an operation, increases in catch in the areas which remain open (or during alternative time periods) will fully offset the costs imposed by the mitigation action. If they did, then presumably, a profit maximizing operator would have adopted these fishing patterns and schedules voluntarily, all else equal. So, temporal, spatial, and/or exclusionary zone management actions, as defined under the mitigation principles, will impose direct and unavoidable costs on the participants of the eastern Bering Sea, Gulf of Alaska, and Aleutian Islands P.cod target fisheries, if adopted.

The economic, operational, and socioeconomic response of (and resultant outcomes for) individual operators may take several forms. For example, anecdotal information supplied by the industry in public meetings and through individual contacts suggests that P.cod CPUE may decline, in some cases significantly, as a result of operations being forced into unfamiliar or unfavorable areas (or periods of the year). These declines, while perhaps present for all fishing sectors, will not likely be uniformly distributed across each management area, gear type, processing mode, or vessel size category and thus may carry with them very different implications for future profitability, economic viability, and sustained participation in these fisheries.

In general, with (the hypothesized) reductions in CPUE, greater investments of time, labor, and other variable inputs (e.g, fuel) will be required to catch the same amount of fish. Simply ‘running’ to one of the remaining ‘open’ fishing areas, prospecting for harvestable concentrations of P.cod, then (depending operating on mode) running back to port with catch or product will likely require a greater total number of operating days, for a given vessel, to take the available TAC, all else equal.[26] How many additional days may be required would vary by stock and ocean conditions, rates of success in locating fishable concentrations of P.cod in remaining open areas or time periods, operational mode and capacity, etc. But clearly, as “catch per unit effort” declines, “cost per unit of catch” will increase.

It is possible, in the limit, that some portion of the P.cod TAC will not be harvested at all. At the very

[26] In the limit, of course, adoption and implementation of the mitigation actions could result in the failure of one or more sectors to catch 100% of its allocation.

least, the distribution of catch, by sector, processing mode, gear, and/or area might be significantly altered.

The most obvious candidates to suffer an immediate re-distributive loss in catch share would seem to be the class of smaller vessels, especially those delivering catch to onshore processors. These operations are, by definition, physically constrained to operating relatively nearer shore and near their delivery port. Under the range of mitigation actions being considered, these operation, even more than others, may experience significant economic costs and operational burdens, owing to increased running and queuing times (thus, reducing the actual time spent "fishing") and loss of access to the resource base (due to limited operating range) as traditional fishing grounds relatively nearer delivery ports are closed, leaving more distant areas as the only available fishing alterative. In such circumstances, these operators of very small vessel may be confronted with the alternative of either exiting the P.cod fishery, altogether, or assuming far greater risk to vessel and crew, associated with operating farther offshore and/or in more extreme weather and sea conditions, approaching their vessel's physical limits.

In the latter regard, the early season opening dates (e.g., January 1 for fixed gear operators under one proposal) will, reportedly, tend to place a disproportionately greater burden on the small boat segment of this industry. Specifically, the more severe operating conditions associated with this period of time would be expected to result in increased abandonment of gear (with the direct and indirect economic consequences therewith associated), loss of catch, and increased 'ghost' fishing (i.e., fish are killed but not landed, imposing both economic and ecological costs). The extent of these costs and losses would be highly variable, depending on a range of exogenous factors. Any attempt at placing a dollar figure on these costs at this time would be largely speculative. They do, however, represent a potential economic consequence of this aspect of the proposed actions, depending of the specific form of the program adopted.

Another common potential problem for all operators delivering catch ashore for processing is the effective time limit which exists from "first catch onboard" until offloading must take place to deliver a "salable" catch. Informed sources in the industry place the maximum interval at 72 hours. Clearly, if fishing grounds which remain open under the dispersion principles are more remote (or conditions more extreme), greater portions of this 72 hour window will be consumed in transporting catch from the grounds to the plant. For smaller vessels, with more limited holding capacity and slower running speeds, this limit will impose relatively greater constraints. In any case, the potential for higher variable operating costs for fuel, lubricants, stores, etc (consumables); and greater general wear and tear on equipment, vessel, and crew, even without a reduction in gross revenues, will decrease the operating margins for all. For some, the reductions may be expected to cause earnings to fall below break-even, resulting (in the longer run) in departure from the P.cod fishery, entirely. Quantitative estimates of these costs are not possible, given available information. They, nonetheless, are appropriately attributable to the structural changes envision under the mitigation action.

Neither are the risks of economic failure and resultant departure of capacity from the fishery limited to the small, and/or inshore sectors of the industry. A number of characteristics and operational attributes of several of the sectors of this industry could result in this outcome for its members.

For example, according to industry sources, trawl gear is, by-in-large, ill-suited to targeting P.cod after the late-winter and early-spring spawning aggregations break up. When P.cod disperse, trawl CPUEs decline to levels which are uneconomical. Therefore, a mitigation action which forced fishing out of areas where, or into times when, P.cod spawning aggregations are not present, could effectively place the resource beyond the functional reach of this gear group, for some or all of the season. Incidentally, P.cod pot operators report the same potential problem. Namely, once P.cod spawning aggregations disperse, the catch rates for pot gear no longer are sufficient to support an economically viable fishery. The *de facto* result of such a change would be a reapportioning of catch from trawlers (and, apparently, pot operators) to one or more of the alternative gear groups, less dependent upon such concentrations. Unfortunately, the dearth of operating cost and net earnings information for the groundfish fishing industry, as a whole, and for the P.cod fishing sectors in particular, makes a quantitative estimate of this potential impact impossible to derive.

In a similar vein, the P.cod pot harvesting sector has reported that it faces several (additional) *unique* constraints, in connection with participation in the exploitation of the P.cod resource. Pot boats tend to set their gear very near shore, in generally small and well defined areas (often, these are immediately adjacent to Steller sea lion rookeries and haulouts. For example, a major pot fishery is prosecuted near the rookeries in Unimak Pass). They reportedly do so principally because of the high cost (and frequency) of gear conflicts with other gear operator (e.g., longliners, but especially trawler) when the several gear types attempt to fish the same waters. Increased potential for gear conflicts, with the associated costs of gear loss or damage, may be an unanticiapted result of imposing structural changes on these fisheries of the kind envisioned in the mitigation action alternatives.

A fully rigged P.cod pot costs $650.00, according to industry sources. Gear conflicts which result in the loss of even a single pot per day, or serious damage to even a small number of pots, can quickly exceed the value of the expected P.cod catch for an operator in this sector, industry members report. Similarly, gear conflicts between trawls and longlines impose damage, loss, and potentially significant costs to these other gear operators, as well. At present, as noted, pot gear operators tend to set in specific near-shore areas, known to trawlers and longliners. The other two gear groups reportedly routinely avoid those areas, thus minimizing the potential for gear conflict (with the associated cost of damage and loss). Should the near shore areas be closed to all P.cod fishing, the potential for gear conflicts will increase, all else equal.

Another element of this discussion which is, reportedly, unique to at least a subset of the pot sector pertains to the practice of taking P.cod, early in the calendar year, for use by these same operations as bait, for their crab fisheries. Reportedly, over half of the combination crab/P.cod fleet (on the order of 125 boats) depend economically upon the ability to "bait fish" P.cod before the crab opening. Loss of this source of high quality "fresh" bait would, they submit, have a very significant adverse impact on the CPUE, operating costs, and thus economic value of the crab fisheries these vessels participate in. Frozen bait is said to be significantly inferior to "fresh" P.cod, and costs roughly $0.50/lb, when it is available. An average crab trip for this fleet is seven to ten days, during which time they typically use 8,000 pounds of bait (ca. $4,000 per vessel, per trip, replacement cost).[27] While P.cod taken for "own-use bait" purposes is not landed, processed, or sold, it does represent an economically important "product form" for this segment of the industry, which could be put at risk, under the proposed mitigation action..

In the BSAI, P.cod TAC is strictly apportioned between the several authorized gear groups, so unanticipated re-distributive effects of the proposed mitigation principles is (in theory) somewhat constrained. In part, the regulatory mechanism which already exists, governing in-season TAC roll overs among users groups, is one example of how this might be controlled in the BSAI management area. In the GOA, however, the P.cod TAC is currently apportioned <u>only</u> between the two general processing-mode categories, "inshore" and "offshore", so predicting (much less assessing) the effects of any *de facto*

[27] Per. Comm., Lance Farr, July 7, 2000

inter-sectoral transfers is much more difficult.

Further confounding a clear understanding of the economic, operational, and regulatory consequences of this aspect of the proposed action is the range of interactions which are exogenous to the process. For example, while the position of, say, freezer longline operations may appear to be enhanced, relative to other gear operators (on the basis of the projected outcome of implementation of the mitigation actions), for the reasons just mentioned, longliners (and to an equal degree, trawlers) face severe constraints on their ability to fish P.cod in the late-spring, summer, and early-fall months due to halibut (and for trawlers, add crab) bycatch cap limitations. Furthermore, the freezer longliners, reportedly, begin to record higher rates of interactions with albatross (among other protected sea birds) when their fishing activity extends into late-summer.[28]

Finally, P.cod pot operators suggest that, even if they appear technically to benefit in some way, relative to the other gear users under the proposed action, if pushed north, out of EBS CH areas, their crab bycatch rates will become prohibitive and they will actually be forced to forego significant amounts of P.cod catch.[29]

4.7.1 Product - market effects

Whether and how the aforementioned potential (if largely unintended) reapportionments might impact the aggregate economic value of the P.cod harvest cannot be predicted, *a priori*. Some reports suggest that the quality of P.cod harvested and processed at-sea is uniformly higher than that of product produced onshore, owing to the significant difference in the interval of time between catch and processing. Others suggest that, even within the at-sea sector, P.cod harvested with pot or hook and line gear is significantly better than that taken in trawls, and thus commands a higher unit price (for which there is some empirical evidence). For example, price data (very generously) supplied by several independent industry sources seem to suggest that, for 1999 and 2000, there was a "price premium" of between $0.10 and $0.15 per pound being offered for the same product forms (e.g., P.cod H&G western-cut and eastern-cut) for freezer longline caught fish, as compared to C/P trawl-caught cod.[30] On the other hand, the industry reports that, given the "short" worldwide supply of cod, <u>any</u> fish delivered into the market has commanded a very good price, in recent months[31]. While time and data preclude a detailed examination of this issue, the information available seem to suggest that, while there has traditionally been some "price discrimination" between the supply sources, current international market conditions may reduce (but perhaps not fully offset) the economic importance of this differential, at least for the immediate term.

Since quality, condition, and size of fish determine, to some extent, which product form(s) and market(s) the output is sold into, a significant shift of catch *among* sectors might be expected to impact consumer prices and supplies, as well. In this connection, it is also generally acknowledged that P.cod are of a significantly lower quality in the period (roughly) late-May through mid-August. To the extent that the

[28] Per. Comm., Thorn Smith, August 2000.

[29] Per. Comm., Arni Thompson, July 2000.

[30] Per. Comm., Bill Atkinson, July 2000.

[31] Per. Comm., John Henderschedt, July 2000.

mitigation actions, contemplated herein, shift a significant portion of the available TAC (and thus catch) into this period of the year, undesirable quality, product mix, market, and value effects will necessarily accrue (in addition to the other adverse economic consequences cited above).

Finally, on this point, P.cod harvested in the AI management area are reported to be consistently larger fish, on average, than are those caught elsewhere.[32] Since, all else equal, larger fish are more valuable, a closure (or other significant restriction) of the Aleutian Islands area to P.cod fishing would be expected to disproportionately adversely impact these same economic and market elements.

A thorough treatment of this issue is beyond the capabilities of this analysis. Nonetheless, it should be noted, virtually all of the product forms deriving from BSAI and GOA P.cod catches trade in world markets, where supply and demand relationships are further complicated and confounded by macroeconomic influences. Markets are very dynamic institutions. Changes in supply on the order of those which may be associated with the proposed mitigation action could certainly result in significant price, market share, and demand substitutional responses, which cannot be quantitatively anticipated. This potentiality, however, should be understood as one consequence of the proposed action.[33]

4.7.2 TAC roll-over provisions

With many of the P.cod/Steller mitigation provisions included in this proposed action, it may be that portions of the TAC apportioned to one or another gear group will not be fully harvested by the assigned sector. Some of the reasons for this are treated above, and there may be others. Even under the status quo regime, some apportioned P.cod TAC inevitably becomes surplus to the needs and ability of the group to which it has been apportioned, as the season proceeds. In its recent action on FMP Amendment 64, the Council adopted specific provisions which formalize the in-season transference of these surplus TAC amounts among gear groups. The same provisions are envisioned to apply under the proposed P.cod/Steller sea lion mitigation action.[34] The specific BSAI roll-over provisions are summarized in the following section.

In recommending Amendment 64 to the BSAI FMP, the Council provided direction on how “roll-overs” of unused or surplus P.cod TAC should be treated. Roll-overs from the jig or trawl sectors will be apportioned among the freezer longline and pot sectors according to the actual harvest of roll-overs from 1996-98. Projections indicate that 94.7 percent of the cod “roll-overs” would be allocated to the freezer longline fleet and the remaining 5.3 percent would go to the pot fleet. In addition, any unharvested portion of the “catcher vessel longline”, and the “under 60' pot and longline” vessel allocation that is projected to remain unused shall be rolled over to the freezer longliner fleet in September.

Baseline information on the fixed gear P.cod fishery from 1992-99 is presented in Table 4.7.2.1. That

[32] Per. Comm., Susan Robinson, August 2000.

[33] Changes in the product mix or the amounts of individual products on the market, resulting directly from the proposed “mitigation principles”, are difficult to anticipate or value. Further complicating the attempt to estimate impacts is the fact that a significant share of total P.cod output from BSAI and GOA fisheries is exported. Changes in consumer surplus (and, for that matter, producer surplus) attributable to a regulatory action, but which accrue to non-U.S. consumers (producers), are not to be included in impact estimates, according to OMB direction.

[34] Because there is no gear allocation in GOA, roll-over provisions for that management area are irrelevant. The 90%/10% “inshore-offshore” split does not provide for shifting of ‘surplus’ P.cod TAC on that basis.

table shows the number of vessels that participated in the P.cod fishery and the amount of catch they accounted for by vessel type, including the roll-overs (i.e., the portion of the TAC that was allocated to the trawl or jig sectors of the P.cod fishery at the beginning of the year, but reallocated to the fixed gear sector in September because it would not have been harvested otherwise). The roll-over provisions require that, on September 15 of each year, the Regional Director reallocate 100% of any projected unused amount of the P.cod allocated to jig vessels to the fixed gear vessels. Also, if, during a fishing year, the Regional Director determines that vessels using trawl gear or hook-and line or pot gear will not be able to harvest the entire amount of P.cod allocated to those vessels, then NMFS shall reallocate the projected unused amount of P.cod to vessels using the other gear type(s).

Typically, the trawl sector would not have harvested the entire allocation because they reached their halibut bycatch cap, and the jig sector because they had insufficient effort to harvest their 2 percent of the BSAI TAC. The table shows that freezer longline vessels caught over 80 percent of the fixed gear harvest in every year except 1996. That year they harvested about 75 percent. Longline catcher vessels harvested the smallest percentage–less than 1%–of P.cod each year. Those vessels never harvested more than 1,000 mt. Prior to 2000, pot vessel harvests were greatest in percentages caught during the years 1995-97, with pot catcher-processors taking between 4 and 7% and pot catcher vessels between 10 and 19%. These years, and 1998, represent the time period considered in the amendment package to determine the TAC split among sectors. In 2000, a delay in the C. opilio Tanner crab season from January 15 to April 1 provided an additional opportunity to crab vessels to harvest P.cod with pot gear. As a result, the pot gear fleet harvested over 20 percent of the initial fixed gear TAC allocation prior to March 10, when the attainment of the first seasonal allowance of P.cod was reached and the fishery closed.

Baseline information on the trawl gear P.cod fishery from 1992-99 is presented in Table 4.7.2.2.

Table 4.7.2.1: Catch of P.cod in the BSAI fixed gear P.cod target fishery from 1992-99 (in mt, including roll-over catch)

		Longline						Pot						Fixed Gear Total	
		Catcher/Processors			Catcher Vessels			Catcher/Processors			Catcher Vessels				
Year	Length	#	Catch	%	#	Catch	%	#	Catch	%	#	Catch	%	Unique #	Catch
96	0-59	-	-	-	14	86	50%	-	-	-	4	86	50%	18	171
	60-124	14	23,162	55%	7	100	0%	2	conf.	4%	65	17,590	42%	88	42,281
	125+	25	67,951	84%	-	-	-	9	6,775	8%	26	5,785	7%	60	79,793
96 Total		39	91,112	74%	21	186	0%	11	6,775*	7%	95	23,461	19%	166	122,245
97	0-59	-	-	-	6	44	56%	-	-	-	3	34	44%	9	122
	60-124	14	28,357	68%	8	162	0%	3	1,472	4%	58	11,704	28%	83	41,766
	125+	24	91,711	91%	-	-	-	6	3,543	4%	19	5,348	5%	49	100,094
97 Total		38	120,068	84%	14	206	0%	9	5,015	4%	80	17,075	12%	141	141,982
98	0-59	-	-	-	8	16	35%	-	-	-	3	30	65%	11	118
	60-124	11	22,609	75%	1	conf.	0%	2	conf.	conf.	50	6,710	22%	64	30,354
	125+	25	72,270	93%	-	-	-	5	2,729	4%	20	2,358	3%	50	76,992
98 Total		36	94,879	88%	9	16*	0%	7	2,729*	3%	73	9,098	8%	125	107,465
99	0-59	-	-		10	85	69%	-	-	-	4	38	31%	14	123
	60-124	12	11,949	60%	9	75	0%	3	154	1%	65	7,689	38%	89	19,867
	125+	26	65,029	90%	-	-		10	2,977	3%	23	4,072	5%	59	72,078
99 Total		38	77,238[1]	84%	19	160	0%	13	3,131	3%	92	11,799	13%	162	92,328

Source: ADF&G fishtickets and NMFS Blend data 1992-99.

* Excludes confidential (conf.) landings.

[1]For 1999, a minimal amount of the catch in the freezer longline sector is not attributed to a specific length class, thus, the length classes will not add up to the total catch.

Table 4.7.2.2: Retained catch of P.cod and participation in the directed BSAI P.cod fishery by vessels using trawl gear

Year	Length	Trawl Gear						Trawl Gear Total	
		Catcher Processors			Catcher Vessels				
		Vessels	Catch	%	Vessels	Catch	%	Vessels	Catch
96	0-59'	-	-	-	5	706	100.0%	5	706
	60-124	8	1,250	3.2%	81	38,375	96.8%	89	39,625
	125+	30	15,290	59.7%	44	10,320	40.3%	74	25,610
96 Total		38	16,540	25.1%	130	49,401	74.9%	168	65,941
97	0-59'	-	-	-	10	96	100.0%	10	96
	60-124	11	2,632	7.3%	69	33,622	92.7%	80	36,254
	125+	31	16,912	62.7%	39	10,052	37.3%	70	26,964
97 Total		42	19,544	30.9%	118	43,770	69.1%	160	63,314
98	0-59'	-	-	-	8	825	100.0%	8	825
	60-124	8	1,124	4.2%	63	25,557	95.8%	71	26,681
	125+	28	15,720	65.9%	34	8,127	34.1%	62	23,847
98 Total		36	16,844	32.8%	105	34,509	67.2%	141	51,353
99	0-59'	-	-	-	5	371	100.0%	5	371
	60-124	7	2,820	8.6%	66	29,915	91.4%	73	32,735
	125+	19	12,212	61.3%	31	7,697	38.7%	50	19,909
99 Total		26	15,032	28.4%	102	37,983	71.6%	128	53,015

Sources: ADFG Fishticket data for catcher vessels and NMFS Blend data for catcher processors
Note: The catch and number of vessels in the <60' class includes boats that had unknown lengths. They were included in that class so that number of vessels would be above the confidentiality threshold. There were only 3 catcher vessels <60' in 1996, 6 in 1997, 2 in 1998, and 1 in 1999.

Table 4.7.1 was prepared for the Amendment 64 analysis which considered alterative fixed gear allocations of P.cod. All provisions of FMP Amendment 64 will apply to, and are included by reference in, the proposed management of the P.cod fisheries under the P.cod/Steller mitigation action. For a detailed analysis of the impacts and provisions of Amendment 64, the reader is referred to the EA/RIR/IRFA prepared in support of that action. A brief summary of the key finding from the RIR is included below.

Impacts of including P.cod roll-overs

Analysis contained in the Amendment 64 RIR concluded that, if one includes roll-overs from the trawl and jig sectors in projecting catch estimates for the fixed gear sector, the result is a reduction of approximately one percent in catch harvested by the pot sector. According to that analysis, this is likely due to two factors. First, many of the pot vessels leave the cod fishery to harvest crab before the roll-over portion of the TAC is harvested. Second, P.cod are generally more dispersed from late summer through early winter, when compared to spring spawning aggregations. Using pot gear to harvest cod is more difficult when the fish are less aggregated. Both of these factors likely contribute to the lower relative catch by pot vessels later in the year.

Pot vessels tend to flow into the cod fishery after the winter crab fisheries close. Pot vessels also land cod during the summer when the longline fleet is closed down because they reached that trimester's halibut bycatch cap. Later in the year, when the cod roll-over amounts are being fished, most of the catch is being taken by the longline fleet. Therefore, excluding cod harvests that were rolled-over from the jig and trawl fisheries would benefit the pot fleet.

Roll-over amounts of cod can be estimated by subtracting the annual catch information, presented above, from the information in Table 4.7.2.1 and 4.7.2.2. The results of that calculation are presented in Table 4.7.2.3.

Table 4.7.2.3 Estimates of roll-over harvests by sector, 1996-98.

YEAR	Freezer Longline	Longline CV	Pot C/P	Pot CV	Total
1996	5,951	2	199	789	6,942
1997	7,740	0	25	78	7,843
1998	6,814	0	17	53	6,884
Total	20,506	3	241	919	21,669

These patterns are likely to be quite different under either Alternative 2 or Alternative 3 of this P.cod/Steller mitigation action, as restriction on the geographic and temporal prosecution of the P.cod fishery are dramatically changed by provisions of the action. However, the roll-over *"mechanism"*, established in Amendment 64, will extend to the proposed P.cod fishery under this mitigation proposal.

4.8 Spill-over effects on non-P.cod fisheries

It is possible that actions which are taken in connection with the proposed P.cod/Steller mitigation principles could have unanticipated spillover effects on non-P.cod fisheries. For example, under provisions of the improved retention/improved utilization regulations (IR/IU), operations which are targeting species other than P.cod must, nonetheless, retain 100% of their cod bycatch (up to the "maximum retainable bycatch" level. 50 CFR 679.20 (e) and 50 CFR 679.27).[35] Nonetheless, under IR/IU economic discards of P.cod bycatch are strictly prohibited (although reports do indicate significant quantities of cod discards continue).

Bycatches of P.cod are significant, and reportedly largely unavoidable, in many groundfish trawl fisheries. To the extent that geographic and/or temporal dispersion of effort "targeting" P.cod results in higher rates of bycatch of P.cod in non-target fisheries, operational costs may be imposed on the non-P.cod target groundfish sector. Whether these costs are offset by the value of the retained cod will depend on a number of factors. These include (among others), the condition of the cod bycatch (e.g., 'summer' fish are of generally lower quality, and P.cod taken in a 'codend' of flatfish are often reported to be in very poor physical condition), the holding and/or processing capability of the intercepting vessel, the duration of the fishing trip for the 'target' species, and the nature and availability of a market for the resulting P.cod output. The marketplace will largely determine whether, and by how much, cod bycatch is an economic and operational burden to vessels fishing other than P.cod groundfish targets.

There may be, yet, another "spill-over" effect resulting directly from the proposed mitigation action, unique to the GOA management area. Industry sources suggest that, in the GOA, one potential response to the proposed P.cod action may be a tendency for the industry to shift away from a "directed" P.cod fishery, and toward a "topping-off" bycatch fishery for this species (thus, avoiding the more onerous operational burdens of the mitigation action, while continuing to exploit P.cod, albeit at the MRB 20% rate). The extent to which this is economically feasible is an empirical question. However, the GOA groundfish fisheries tend, on average, to be much more "mixed" target and diverse than, say, the EBS groundfish fisheries.

Actions which may be taken in connection with the proposed P.cod/Steller mitigation principles may have a varying effect on different fishing fleets and different areas, based on their level of reliance on P.cod as a component of their overall fishing income. This section provides an analysis of the relative economic dependence on earnings from P.cod fishing in the Bering Sea and Gulf of Alaska, by various fleet components. To address this issue, ex-vessel values were obtained from a computer analysis of the Commercial Fisheries Entry Commission data files for the years 1988 through 1998. This analysis shows the respective contribution of P.cod earnings, compared with other groundfish earnings, and earnings from the harvest of other species. The analysis identifies those fleet components, by region and gear type, most dependent upon P.cod.

Data for 1998 are the most current available from the Alaska fish ticket computer files for catcher boats fishing off Alaska. The analysis shows the respective earnings for the most current year (1988), as well as the annual average for the years 1988 through 1997. The average annual earnings assessment is provided as a check to see if the most current year is consistent with the longer term pattern in the fishery.

Regions defined for the analysis were the Bering Sea, the Central Gulf of Alaska, and the Western Gulf of Alaska.

Harvest, earnings, and participation data were grouped into the following categories:

[35] The Improved Retention/Improved Utilization amendments were implemented in the BSAI and GOA groundfish fisheries in January, 1998, and set out (relatively) ambitious goals for reducing bycatch discards and increasing utilization, especially of P.cod and Alaska pollock.

1) harvest and earnings from P.cod in the specific area (i.e. Bering Sea, Central Gulf or Western Gulf). The Bering Sea includes statistical areas 500 through 538. The Central Gulf includes statistical areas 620 and 630. The Western Gulf includes statistical area 610.
2) harvest and earnings from all groundfish (including P.cod) by the same vessel group in the respective area.
3) harvest and earnings from all groundfish (including P.cod) by the same vessel group in all areas of Alaska
4) the harvest and earnings of other species, including: salmon, halibut, herring, crab and other non-groundfish fisheries is grouped, and included as 'other species'.
5) the specific type of gear employed in the fishery, including: trawl, hook & line (HAL), pot and jig.
6) the number of unique participants in the fishery, by group and gear type.

The fleets were defined by major characteristic, according to the categories previously developed for the SEIS evaluating impacts of the Stellar Sea Lion protection alternatives on pollock fisheries in the Bering Sea and Gulf of Alaska.

The fleet designations are:

Small trawlers - the small trawler category includes trawl catcher vessels less than 60 feet in length. These vessels include the salmon seine fleet, which comprise a large component of the P.cod and groundfish effort in the Central Gulf and Western Gulf.

Small non-trawlers – the small non-trawler category includes catcher vessels less than 60 feet in length participating in fixed gear groundfish fisheries, including P.cod.

Under 32 feet – this category includes vessels less than or equal to 32 feet length overall participating in fixed gear groundfish fisheries, including P.cod.

AFA crab boats – this category include American Fisheries Act (AFA)-qualified trawl catcher vessels with crab endorsements. It includes all trawl catcher vessels which are qualified to participate in AFA pollock cooperatives, and are also qualified to participate in the Bering Sea and Aleutian Islands (BSAI) crab fisheries under the BSAI crab license limitation plan (LLP).

AFA non-crab boats –this category include American Fisheries Act (AFA)-qualified trawl catcher vessels without crab endorsements. It includes all trawl catcher vessels qualified to participate in AFA pollock cooperatives, but not qualified to participate in the Bering Sea and Aleutian Islands (BSAI) crab fisheries under the BSAI crab license limitation plan (LLP).

Non AFA trawlers - this category includes trawl catcher vessels greater than or equal to 60 feet length overall using trawl gear for the majority of their catch. The vessels in this category are not qualified to participate in AFA pollock cooperatives. Since they are over 60 feet in length overall, they are also not able to participate in Alaska commercial salmon seine fisheries.

Fixed gear crab less than 125 feet – these vessels are from 60 to 125 feet length overall, and rely on pot gear for participation in both crab and groundfish fisheries. All vessels in this group are qualified to participate in crab fisheries under the BSAI crab license limitation plan. Some vessels in this group use longline gear in groundfish fisheries.

<u>Fixed gear crab greater than 125 feet</u> – these vessels are over 125 feet length overall, and rely on pot gear for participation in both crab and groundfish fisheries. All vessels in this group are qualified to participate in crab fisheries under the BSAI crab license limitation plan. Some vessels in this group use longline gear in groundfish fisheries.

<u>Fixed gear groundfish only</u> – this group includes vessels greater than 60 feet length overall using primarily longline gear. No vessels in this group are qualified for the BSAI crab license limitation plan. They target primarily on halibut and high value groundfish.

The Small trawl fleet, using <u>trawl gear</u>, has a relatively strong dependence on earnings from P.cod, particularly in the Central and Western Gulf management areas. The relative contribution, by fishery, is shown in Table 4.8.1. In the Central Gulf, this fleet group gained 9.16 percent of its 1998 total fishing revenue from P.cod. In the Western Gulf, this group had an even higher dependence on P.cod. In 1998, P.cod accounted for 24.75 percent of total fishing revenue. This fleet group is also characterized by a high reliance on other species fisheries. These earnings were comprised mostly by salmon, but halibut and herring also provide a substantial contribution to income. Participation in the salmon and halibut fisheries is largely limited by regulation, consequently there is relatively little flexibility for expansion of other fisheries income to replace the component provided by P.cod. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the ‘other species’ category.

Table 4.8.1: Relative Importance of P.cod Income – Small Trawl Fleet/Trawl Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	small trawlers	Bering Sea	trawl	1.65%	8.94%	74.53%	25.47%
'88-97 avg.	small trawlers	Bering Sea	trawl	7.23%	13.27%	64.82%	35.18%
1998	small trawlers	Central Gulf	trawl	9.16%	20.48%	58.86%	41.14%
'88-97 avg.	small trawlers	Central Gulf	trawl	12.59%	18.46%	47.21%	52.79%
1998	small trawlers	Western Gulf	trawl	24.75%	31.77%	57.01%	42.99%
'88-97 avg.		Western Gulf	trawl	25.27%	29.53%	44.49%	55.51%

source: ADF&G fish ticket files and NPFMC data analysis

The Small non-trawl fleet, using hook & line gear, has a relatively strong dependence on earnings from P.cod, particularly in the Central Gulf area, with a lesser reliance in the Bering Sea and Western Gulf. The relative contribution, by fishery, is shown in Table 4.8.2. In the Central Gulf, this fleet group gained 8.46 percent of its 1998 total fishing revenue from P.cod. In the Western Gulf, this group had a lesser dependence on P.cod accounting for only 1.99 percent of total fishing 1998 fishing revenue. This fleet group is also characterized by a high reliance on other species fisheries. These earnings were comprised mostly by salmon and halibut. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.2: Relative Importance of P.cod Income – Small Non-Trawl Fleet/Hook & Line

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	small non-trawl	Bering Sea	hal	1.21%	3.97%	29.01%	70.99%
'88-97 avg.	small non-trawl	Bering Sea	hal	3.61%	6.54%	52.87%	47.13%
1998	small non-trawl	Central Gulf	hal	8.46%	20.36%	35.59%	64.41%
'88-97 avg.	small non-trawl	Central Gulf	hal	6.71%	19.40%	33.46%	66.54%
1998	small non-trawl	Western Gulf	hal	1.99%	4.99%	26.85%	73.15%
'88-97 avg.	small non-trawl	Western Gulf	hal	0.28%	7.63%	29.83%	70.17%

source: ADF&G fish ticket files and NPFMC data analysis

The Small non-trawl fleet, using pot gear, has a relatively strong dependence on earnings from P.cod, particularly in the Central Gulf area, with a lesser reliance in the Bering Sea and Western Gulf. The relative contribution, by fishery, is shown in Table 4.8.3. In the Central Gulf, this fleet group gained 24.90 percent of its 1998 total fishing revenue from P.cod. In the Western Gulf, this group had a slightly lesser dependence on P.cod. In 1998, P.cod accounted for 13.55 percent of total fishing revenue for that area. This fleet group is characterized by a high reliance on other species fisheries. These earnings were comprised mostly by salmon and halibut. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the'other species' category.

Table 4.8.3: Relative Importance of P.cod Income – Small Non-Trawl Fleet/Pot Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	small non-trawl	Bering Sea	pot	4.12%	4.12%	15.51%	84.49%
'88-97 avg.	small non-trawl	Bering Sea	pot	3.41%	9.77%	43.32%	56.68%
1998	small non-trawl	Central Gulf	pot	24.90%	24.90%	45.26%	54.74%
'88-97 avg.	small non-trawl	Central Gulf	pot	3.41%	9.77%	43.32%	56.68%
1998	small non-trawl	Western Gulf	pot	13.55%	13.56%	51.26%	48.74%
'88-97 avg.	small non-trawl	Western Gulf	pot	2.96%	9.81%	23.95%	76.05%

source: ADF&G fish ticket files and NPFMC data analysis

The Small non-trawl fleet, using jig gear, has a relatively strong dependence on earnings from P.cod in the Bering Sea, with a substantially lesser reliance in the Central and Western Gulf areas. The relative contribution, by fishery, is shown in Table 4.8.4. In the Bering Sea area, this fleet group gained 36.88 percent of its 1998 total fishing revenue from P.cod. In 1998, P.cod accounted for 5.65 percent of total fishing revenue in the Central Gulf and 3.31 percent in the Western Gulf. This fleet group is characterized by a very high reliance on other species fisheries. These earnings were comprised mostly by salmon and halibut. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.4: Relative Importance of P.cod Income – Small Non-Trawl Fleet/Jig Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	small non-trawl	Bering Sea	jig	36.88%	36.88%	46.05%	53.95%
'88-97 avg.	small non-trawl	Bering Sea	jig	15.30%	15.32%	32.29%	67.71%
1998	small non-trawl	Central Gulf	jig	5.65%	6.28%	17.03%	82.97%
'88-97 avg.	small non-trawl	Central Gulf	jig	5.86%	12.58%	31.88%	68.12%
1998	small non-trawl	Western Gulf	jig	3.31%	3.47%	21.43%	78.57%
'88-97 avg.	small non-trawl	Western Gulf	jig	2.51%	2.71%	21.02%	78.98%

source: ADF&G fish ticket files and NPFMC data analysis

The Under 32 foot fleet, using hook and line, is a relatively small group of vessels with a small level of dependence on earnings from P.cod in the Bering Sea and the Western Gulf. Halibut, and to a lesser extent, salmon, are the primary target species for this fleet. In the Central Gulf, P.cod provided 16.58 percent of total fishing revenue in 1998. The relative contribution, by fishery, is shown in Table 4.8.5. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.5: Relative Importance of P.cod Income – Under 32 Feet/Hook & Line Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	under 32 ft.	Bering Sea	hal	0.03%	0.03%	0.09%	99.91%
'88-97 avg.	under 32 ft.	Bering Sea	hal	3.81%	5.26%	11.74%	88.26%
1998	under 32 ft.	Central Gulf	hal	16.58%	17.97%	25.81%	74.19%
'88-97 avg.	under 32 ft.	Central Gulf	hal	6.59%	11.50%	15.75%	84.25%
1998	under 32 ft.	Western Gulf	hal	0.50%	0.50%	31.64%	68.36%
'88-97 avg.	under 32 ft.	Western Gulf	hal	2.37%	3.09%	10.00%	90.00%

source: ADF&G fish ticket files and NPFMC data analysis

The Under 32 foot fleet, using jig gear, is a relatively small group of vessels having a high level of dependence on earnings from P.cod, particularly in the Bering Sea. In 1998, P.cod accounted for 82.85 percent of total fishing income for this group in the Bering Sea. Halibut and salmon are a large component of landings and value for this fleet in the Western Gulf. The relative contribution, by fishery, is shown in Table 4.8.6. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species category.

Table 4.8.6: Relative Importance of P.cod Income – Under 32 Feet/Jig

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	under 32 ft.	Bering Sea	jig	82.85%	82.85%	83.24%	16.76%
'88-97 avg.	under 32 ft.	Bering Sea	jig	22.24%	23.12%	36.24%	63.76%
1998	under 32 ft.	Central Gulf	jig	20.72%	27.62%	62.74%	37.26%
'88-97 avg.	under 32 ft.	Central Gulf	jig	6.59%	13.12%	40.58%	59.42%
1998	under 32 ft.	Western Gulf	jig	82.85%	11.55%	47.67%	52.33%
'88-97 avg.	under 32 ft.	Western Gulf	jig	3.14%	11.61%	29.11%	70.89%

source: ADF&G fish ticket files and NPFMC data analysis

The AFA crab fleet, using trawl gear, has a relatively small dependence on earnings from P.cod in the Central Gulf and Western Gulf areas. As might be expected, crab provide most of the fishing income for this fleet. In the Bering Sea, this fleet group gained 12.19 percent of its 1998 total fishing revenue from P.cod. The relative contribution, by fishery, is shown in Table 4.8.7. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species category.

Table 4.8.7: Relative Importance of P.cod Income – AFA Crab/Trawl Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	AFA crab	Bering Sea	trawl	12.19%	71.69%	82.32%	17.68%
'88-97 avg.	AFA crab	Bering Sea	trawl	12.75%	78.26%	88.24%	11.76%
1998	AFA crab	Central Gulf	trawl	3.88%	19.71%	87.67%	12.33%
'88-97 avg.	AFA crab	Central Gulf	trawl	7.10%	23.77%	87.91%	12.09%
1998	AFA crab	Western Gulf	trawl	2.65%	6.84%	87.45%	12.55%
'88-97 avg.	AFA crab	Western Gulf	trawl	1.38%	6.73%	89.01%	10.99%

source: ADF&G fish ticket files and NPFMC data analysis

The AFA non-crab fleet, using trawl gear, has a relatively modest dependence on earnings from P.cod, but they do contribute an important share. In the Bering Sea in 1998, P.cod accounted for 13.36 percent of total fishing revenue. In the Central Gulf and Western Gulf areas, P.cod accounted for 8.90 percent and 1.52 percent, respectively, of total fishing income. The relative contribution, by fishery, is shown in Table 4.8.8. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.8: Relative Importance of P.cod Income – AFA Non-Crab/Trawl Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	AFA non-crab	Bering Sea	trawl	13.36%	82.85%	99.06%	0.94%
'88-97 avg.	AFA non-crab	Bering Sea	trawl	10.69%	81.63%	98.33%	1.67%
1998	AFA non-crab	Central Gulf	trawl	8.90%	39.75%	96.60%	3.40%
'88-97 avg.	AFA non-crab	Central Gulf	trawl	11.99%	39.92%	95.20%	4.80%
1998	AFA non-crab	Western Gulf	trawl	1.52%	7.93%	98.88%	1.12%
'88-97 avg.	AFA non-crab	Western Gulf	trawl	4.64%	9.74%	98.53%	1.47%

source: ADF&G fish ticket files and NPFMC data analysis

The Non-AFA fleet, using trawl, has a relatively high dependence on earnings from P.cod in all areas. In the Bering Sea, the level of contribution total fishing income by P.cod was 13.62 percent in 1998. However, the 1988-1997 average in the Bering Sea for this fleet was much higher at 30.10 percent. In the Central Gulf area, P.cod accounted for 22.42 percent in 1998, again slightly lower than the long term average. In the Western Gulf, P.cod accounted for 19.04 percent of total fishing income in 1998. In the Western Gulf, the 41.42 percent contribution from 'other' species is primarily from halibut and crab. The relative contribution, by fishery, is shown in Table 4.8.9. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.9: Relative Importance of P.cod Income – Non- AFA/Trawl Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	non-AFA trawlers	Bering Sea	trawl	13.62%	14.49%	91.17%	8.83%
'88-97 avg.	non-AFA trawlers	Bering Sea	trawl	30.10%	50.76%	86.08%	13.92%
1998	AFA non-crab	Central Gulf	trawl	22.42%	73.11%	84.13%	15.87%
'88-97 avg.	non-AFA trawlers	Central Gulf	trawl	26.68%	64.99%	81.46%	18.54%
1998	non-AFA trawlers	Western Gulf	trawl	19.04%	26.12%	58.58%	41.42%
'88-97 avg.	AFA non-crab	Western Gulf	trawl	19.37%	23.10%	74.73%	25.27%

source: ADF&G fish ticket files and NPFMC data analysis

The Fixed gear crab fleet less than 125 feet in length overall, using hook and line gear , has a small dependence on earnings from P.cod in all areas. Most of the fishing income for this fleet comes from halibut and crab fisheries. The relative contribution, by fishery, is shown in Table 4.8.10. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.10: Relative Importance of P.cod Income–Fixed Gear Crab <125 feet/Hook & Line

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	fixed gear crab <125 ft.	Bering Sea	hal	0.02%	0.02%	55.38%	44.62%
'88-97 avg.	fixed gear crab <125 ft.	Bering Sea	hal	3.93%	4.22%	29.25%	70.75%
1998	fixed gear crab <125 ft.	Central Gulf	hal	1.77%	9.70%	37.88%	62.12%
'88-97 avg.	fixed gear crab <125 ft.	Central Gulf	hal	1.83%	11.02%	28.93%	71.07%
1998	fixed gear crab <125 ft.	Western Gulf	hal	0.01%	9.92%	48.90%	51.10%
'88-97 avg.	fixed gear crab <125 ft.	Western Gulf	hal	0.16%	1.61%	16.55%	83.45%

source: ADF&G fish ticket files and NPFMC data analysis

The Fixed gear crab fleet less than 125 feet in length overall, using pot gear, has a mixed dependence on earnings from P.cod, in the Bering Sea and Central Gulf areas. There is a lesser reliance on P.cod in the Western Gulf. The relative contribution, by fishery, is shown in Table 4.8.11. In the Central Gulf, this fleet group gained 21.62 percent of its 1998 total fishing revenue from P.cod. In the Bering Sea, P.cod accounted for accounted for 7.11 percent of total fishing revenue in 1998. This fleet group is also characterized by a high reliance on other species fisheries. These earnings were comprised largely by crab and halibut. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.11: Relative Importance of P.cod Income–Fixed Gear Crab <125 feet/Pot Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	fixed gear crab <125 ft.	Bering Sea	pot	7.11%	7.13%	23.48%	76.52%
'88-97 avg.	fixed gear crab <125 ft.	Bering Sea	pot	8.19%	8.20%	12.57%	87.43%
1998	fixed gear crab <125 ft.	Central Gulf	pot	21.62%	21.62%	39.40%	60.60%
'88-97 avg.	fixed gear crab <125 ft.	Central Gulf	pot	11.23%	11.27%	27.13%	72.87%
1998	fixed gear crab <125 ft.	Western Gulf	pot	2.42%	2.42%	17.62%	82.38%
'88-97 avg.	fixed gear crab <125 ft.	Western Gulf	pot	4.17%	4.17%	24.60%	75.40%

source: ADF&G fish ticket files and NPFMC data analysis

The Fixed gear crab fleet greater than 125 feet in length overall, using pot gear, has a low level of dependence on earnings from P.cod in the Bering Sea and Central Gulf and Western Gulf areas. As might be expected, most of the fishing income for this group is from crab fisheries. The relative contribution, by fishery, is shown in Table 4.8.12. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.12: Relative Importance of P.cod Income–Fixed Gear Crab >125 feet/Pot Gear

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	fixed gear crab >125 ft.	Bering Sea	pot	3.73%	3.73%	27.21%	72.79%
'88-97 avg.	fixed gear crab >125 ft.	Bering Sea	pot	5.10%	5.10%	7.55%	92.45%
1998	fixed gear crab >125 ft.	Central Gulf	pot	no catch	no catch	no catch	no catch
'88-97 avg.	fixed gear crab >125 ft.	Central Gulf	pot	2.59%	2.59%	2.63%	97.37%
1998	fixed gear crab >125 ft.	Western Gulf	pot	1.55%	1.55%	7.64%	92.36%
'88-97 avg.	fixed gear crab >125 ft.	Western Gulf	pot	1.40%	1.40%	3.53%	96.47%

source: ADF&G fish ticket files and NPFMC data analysis

The Fixed gear groundfish only fleet, using hook and line gear, has a small dependence on earnings from P.cod, in all areas. Halibut and high valued groundfish provide most of the revenues for this group. The relative contribution, by fishery, is shown in Table 4.8.13. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.13: Relative Importance of P.cod Income–Fixed Gear Groundfish Only/Hook & Line

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	fixed gear groundfish only	Bering Sea	hal	1.09%	1.09%	50.51%	49.49%
'88-97 avg.	fixed gear groundfish only	Bering Sea	hal	10.24%	15.41%	62.47%	37.53%
1998	fixed gear groundfish only	Central Gulf	hal	0.72%	20.07%	53.27%	46.73%
'88-97 avg.	fixed gear groundfish only	Central Gulf	hal	2.74%	19.21%	64.60%	35.40%
1998	fixed gear groundfish only	Western Gulf	hal	0.05%	16.25%	60.93%	39.07%
'88-97 avg.	fixed gear groundfish only	Western Gulf	hal	2.55%	11.29%	68.04%	31.96%

source: ADF&G fish ticket files and NPFMC data analysis

The Fixed gear groundfish only fleet, using pot gear, has a relatively modest dependence on earnings from P.cod in the Bering Sea and Western Gulf areas. However, there is a higher reliance on P.cod in the Central Gulf. The relative contribution, by fishery, is shown in Table 4.8.14. In the Central Gulf, this fleet group gained 31.50 percent of its 1998 total fishing revenue from P.cod. In the Western Gulf, most of the 'other species' earnings came from crab fisheries. Table 4.8.15 shows the respective proportion of total income for P.cod, other groundfish in the area, total groundfish landings including other areas, and the 'other species' category.

Table 4.8.14: Relative Importance of P.cod Income–Fixed Gear Groundfish Only/Hook & Line

year	group	area	gear	P.cod	groundfish in area	all groundfish	other species
1998	fixed gear groundfish only	Bering Sea	pot	5.82%	5.91%	54.95%	45.05%
'88-97 avg.	fixed gear groundfish only	Bering Sea	pot	4.87%	4.95%	56.97%	43.03%
1998	fixed gear groundfish only	Central Gulf	pot	31.50%	31.50%	53.01%	46.99%
'88-97 avg.	fixed gear groundfish only	Central Gulf	pot	24.05%	24.11%	47.29%	52.71%
1998	fixed gear groundfish only	Western Gulf	pot	3.78%	3.78%	11.19%	88.81%
'88-97 avg.	fixed gear groundfish only	Western Gulf	pot	2.79%	5.40%	29.90%	70.10%

source: ADF&G fish ticket files and NPFMC data analysis

Table 4.8.15: Ex-vessel Earnings by Species, Fleet Group and Area 1998

GROUP		AREA	GEAR	P. COD EARNINGS	GROUNDFISH EARNINGS IN AREA	TOTAL GROUNDFISH VESSELS	TOTAL GROUNDFISH EARNINGS	OTHER SPECIES EARNINGS	OTHER SPECIES VESSELS
Small	Trawlers	Bering Sea	Trawl	$24,288	$131,357	5	$1,095,493	*	3
Small	Trawlers	Central Gulf	Trawl	$1,545,441	$3,455,754	49	$9,930,814	$6,940,689	44
Small	Trawlers	Western Gulf	Trawl	$3,537,507	$4,541,122	41	$8,149,278	$6,144,457	39
Small	Non-Trawlers	Bering Sea	Hal	$10,763	$35,347	6	$258,239	$631,787	5
Small	Non-Trawlers	Bering Sea	Pot	*	*	3	*	*	3
Small	Non-Trawlers	Bering Sea	Jig	$78,792	$78,792	4	$98,386	*	1
Small	Non-Trawlers	Central Gulf	Hal	$2,217,804	$5,338,914	169	$9,333,210	$16,888,795	162
Small	Non-Trawlers	Central Gulf	Pot	$3,298,141	$3,298,329	57	$5,994,794	$7,250,776	50
Small	Non-Trawlers	Central Gulf	Jig	$449,982	$500,386	89	$1,355,783	$6,606,637	76
Small	Non-Trawlers	Western Gulf	Hal	$5,039	$135,172	9	$528,546	$1,243,188	9
Small	Non-Trawlers	Western Gulf	Pot	$2,108,708	$2,110,061	59	$7,975,153	$7,581,595	57
Small	Non-Trawlers	Western Gulf	Jig	$66,273	$69,596	20	$429,638	$1,574,942	18
Under	32 Feet	Bering Sea	Hal	*	*	1	*	*	1
Under	32 Feet	Bering Sea	Jig	$37,694	$37,694	6	$37,871	*	2
Under	32 Feet	Central Gulf	Hal	$267,420	$289,834	20	$416,289	$1,196,437	14
Under	32 Feet	Central Gulf	Jig	$100,458	$133,921	23	$304,168	$180,630	9
Under	32 Feet	Western Gulf	Hal	*	*	3	*	*	2
Under	32 Feet	Western Gulf	Jig	$6,774	$27,799	7	$114,712	$125,949	4
AFA	Crab Boats	Bering Sea	Trawl	$4,248,251	$24,992,065	38	$28,695,700	$6,163,582	35
AFA	Crab Boats	Central Gulf	Trawl	$507,760	$2,577,305	17	$11,464,500	$1,612,437	15
AFA	Crab Boats	Western Gulf	Trawl	$262,151	$1,280,990	19	$16,953,165	$2,093,195	16
AFA	Non Crab Boats	Bering Sea	Trawl	$5,939,629	$36,833,051	48	$44,038,285	$418,895	9
AFA	Non Crab Boats	Central Gulf	Trawl	$1,740,060	$7,775,954	28	$18,895,746	$665,869	11
AFA	Non Crab Boats	Western Gulf	Trawl	$436,771	$2,274,781	29	$28,379,681	$320,255	7
Non AFA	Trawlers	Bering Sea	Trawl	$601,475	$640,007	10	$4,026,004	$390,159	4
Non AFA	Trawlers	Central Gulf	Trawl	$3,530,846	$11,514,279	42	$13,250,670	$2,498,912	21
Non AFA	Trawlers	Western Gulf	Trawl	$606,124	$831,506	9	$1,865,057	$1,318,794	8
Fixed Gear	Crab <125 Ft.	Bering Sea	Hal	*	*	1	*	*	1
Fixed	Crab <125 Ft.	Bering Sea	Pot	$2,613,909	$2,621,323	42	$8,637,312	$28,149,983	42

Gear									
Fixed Gear	Crab <125 Ft.	Central Gulf	Hal	$139,953	$768,759	12	$3,001,031	$4,922,124	12
Fixed Gear	Crab <125 Ft.	Central Gulf	Pot	$1,683,951	$1,684,019	16	$3,069,184	$4,719,776	15
Fixed Gear	Crab <125 Ft.	Western Gulf	Hal	*	*	1	*	*	1
Fixed Gear	Crab <125 Ft.	Western Gulf	Pot	$363,346	$363,348	18	$2,648,775	$12,386,048	18
Fixed Gear	Crab 125 Ft. or >	Bering Sea	Pot	$802,859	$802,884	18	$5,857,248	$15,667,909	18
Fixed Gear	Crab 125 Ft. or >	Western Gulf	Pot	$97,616	$97,616	5	$482,405	$5,835,144	5
Fixed Gear	Groundfish Only	Bering Sea	Hal	*	*	2	*	*	1
Fixed Gear	Groundfish Only	Bering Sea	Pot	$195,615	$198,545	6	$1,846,914	$1,514,417	5
Fixed Gear	Groundfish Only	Central Gulf	Hal	$79,952	$2,220,120	26	$5,890,928	$5,168,622	26
Fixed Gear	Groundfish Only	Central Gulf	Pot	$1,034,893	$1,034,899	13	$1,741,697	$1,543,886	12
Fixed Gear	Groundfish Only	Central Gulf	Jig	*	*	1	*	*	0
Fixed Gear	Groundfish Only	Western Gulf	Hal	*	*	3	*	*	3
Fixed Gear	Groundfish Only	Western Gulf	Pot	$35,262	$35,262	4	$104,450	*	3
Fixed Gear	Groundfish Only	Western Gulf	Jig	*	*	1	*	*	1

Source: Data from ADF&G fish ticket files and NPFMC staff analysis

‘Hal’ signifies ‘hook and line gear

An * in a cell implies a value which cannot be reported due to confidentiality constraints (e.g., fewer than four vessels in a group)

4.9 Attainment of the TAC

There is very little empirical experience upon which to base predictions about how the several operational sectors that make up the BSAI and GOA P.cod fisheries will adapt to and accommodate the basic structural changes in their respective operating environments envisioned in the mitigation proposal. Anecdotal reports from several of the gear-sectors suggest that it is unlikely that the full TAC will be taken, given the precepts and provisions of either Alternative 2 or Alternative 3, but confirmation of this assumed outcome must await empirical experience.

4.10 Economic effects of the alternatives

In the absence of empirical data, it is necessary to make a number of simplifying assumptions in the preparation of an analysis of the probable economic effects of the alternative proposed actions. First, it is assumed that the total allowable catch (TAC) amount for P.cod, specified by NMFS, in the BSAI and the GOA for 2000 will remain essentially unchanged over the interval of the analysis. Second, it is assumed that the current apportionments of P.cod TACs by fishing industry sector and/or geographic areas also will remain unchanged through the duration of the analysis (except as explicitly specified in the suboptions) and that fishery harvest patterns will conform to these apportionments. The TACs and apportionments for the 2000 BSAI and GOA groundfish fisheries (including P.cod) are specified by notices published in the Federal Register. Third, price calculations are based upon 1998 ex-vessel and a three year average (i.e., 1996, 1997, and 1998) fish product price, being the most recent price series for which complete estimates are available. Fourth, it is assumed that the proposed restrictions on P.cod fishing in Steller sea lion critical habitat will result in effective *forfeiture* of all harvests that otherwise would have occurred within the restricted area, but for the proposed mitigation action.

The last assumption cited above likely results in an *overstatement* of the potential loss, since it is probable that some amount of foregone catch in CH areas would be captured in areas (or during times) which remain open, although this is not assured. It is not possible, however, to predict how much could or would be made up, nor how the resulting catch would be distributed temporally, geographically, or among user groups or sectors of the industry. Therefore, by assuming that all catch attributable to the requisite closures would be foregone, the assessment presents an *"upper-bound"* estimate of the gross revenue reductions attributable to the mitigation actions, as they extend to fishing activity in the sea lion conservation area and/or critical habitat.

Because the estimated gross revenue impacts are linear, however, it is possible to evaluate any alternative "assumption" concerning the amount of foregone P.cod catch, by a given gear group, processing mode, or area, by applying an alternative multiplicative factor. That is, the estimates presented below assume a 100% (1.0) loss factor. If one were to hypothesize that, say, 10% of the estimated GOA CH foregone P.cod catch, for a given sector, would be "made up" outside of the closed areas, by that sector, one would multiply the estimated loss in potential gross revenues (presented below), for that sector and mode in the GOA management area, by 0.9 (i.e., assuming a 90% loss factor), and so on.

The interpretation of the economic value of foregone catch 'inside CH' to recovered catch 'outside', *between* gear-types and/or processing modes is somewhat more complex (owing to the variability in "value per round weight ton of P.cod " by sector), but the same line of reasoning pertains. For example, based on assumed product value and total catch statistics, the round weight equivalent "value" per ton of P.cod (weighted by product mix and evaluated at the first wholesale level) in, say, the BSAI P.cod trawl C/P sector is $803.03. The equivalent "value" per round weight ton in the P.cod pot C/P sector is $813.04. Therefore, if a ton of P.cod catch were assumed "foregone" by the trawl C/P sector, due in some way to the mitigation restrictions on fishing in CH, the estimated reduction which would accrue to the aggregate BSAI P.cod trawler C/P sector's total gross revenues would reflect the $803.03 figure. However, if it was further assumed that the ton of P.cod foregone by the trawl sector was subsequently 'rolled-over' to (and harvested by), say, the P.cod pot catcher-processor sector, then that additional ton could be added to the BSAI P.cod pot C/P's aggregate gross revenues, but at the prevailing "value" per round weight ton for that sector, which is $813.04. While technically feasible, again, no effort has been made to evaluate the myriad combinations of potential inter-sectoral transferences which, in theory, could emerge, since their likelihood, scope, and composition cannot be readily anticipated.

In summary then, placing any economic value on the foregone catch is problematic. First, at present the latest available ex-vessel and product price data series for BSAI and GOA groundfish extend only through 1998. Second, markets are very dynamic institutions. Changes in supply on the order of those which may result from the proposed mitigation actions would almost certainly result in significant price responses which cannot be quantitatively anticipated. Third, virtually all of the product forms deriving from BSAI and GOA P.cod catches trade in world markets where supply and demand relationships are further complicated and confounded by macroeconomic influences.

Notwithstanding these constraints, it is possible to provide "gross" estimates of the likely magnitude of direct reductions in total gross revenues (in this case, at the processor level), attributable to foregone catches of the order projected under the two primary P.cod/Steller mitigation alternatives to the status quo.

Briefly, the following describes the procedure used to generate the product value per metric ton of P.cod catch by processing sector. First, catch data from 1999 NMFS Blend estimates were extracted, selecting "P.cod target" records only, for total P.cod catch. The 'processing-sector' field was added to the catch data by matching from a "look-up" table by processor identification code (id). The catch data were summed, producing a table of catch weight by species and processing sector.

Product weights were extracted from NMFS' 1999 Weekly Production Reports (WPR). The 'processing-sector' field and the COAR (Commercial Operators' Annual Report) prices, averaged over the years 1996-98, were added to the product weight data by matching from "look-up" tables, by processor id for the 'processing sector' field, and by at-sea or inshore sector, area, species and product type for the 'price' field. A 'value' field was then created and value was calculated by multiplying product weight by average product-specific price. Finally, the data were aggregated to produce total product values by species and processing sector.

The catch data from the blend and the product-value data from the WPRs were combined by matching the two sets of data, by species and processing sector. The product value per ton of catch was calculated by dividing total product value by the total weight of catch, for each processing sector combination.

The results of this analytical procedure yielded the following "gross product value per ton total round weight catch" of P.cod, employed in the subsequent evaluation of the mitigation alternatives: Pot C/Ps $813.04; Trawler C/Ps $803.03; and Freezer longliners $766.87. All catcher vessel landing, no matter the gear type employed, were valued at the inshore plant first wholesale product value (for reasons cited below) in the area adjacent to catch. These were: BSAI inshore $904.78; Aleutian Islands and Peninsula inshore $1,353.79; Kodiak inshore $1,192.58, per metric ton of total cod round weight catch.

The differences (in some instances, relatively significant differences) in these derived values between areas and sectors may, in part, be the result of variation in product output composition (e.g., a greater range of products, and thus value, obtained from each ton of fish), a more consistent output of relatively "higher" unit value product(s), or a greater proportion of "retained" to "total" P.cod catch. The inability to isolate and distinguish inshore production (either by gear type or "directed" versus "bycatch" source) may also introduce uncertainty into the estimates.

4.10.1 Alternative 2 in the BSAI

Under the set of limiting assumptions (cited above), if the restrictions on P.cod fishing critical habitat in the combined BSAI management area were imposed and, as assumed, all 'predicted' catch in excess of the new limits in this area were *foregone* by the relevant sector, the estimated change in total gross product value, by sector, as compared to the "baseline" case, would be as indicated in the column headed "Inside CH". If ,as an additional option, the closure were extended to include the area of the EBS SCA, outside of CH, the *additional* cost would be estimated as under the heading "Residual SCA" in the following tables:

Table 4.10.1.0 Alternative 2 (Combined BSAI management area TAC)

Sector	**Change in Gross Product Value ($) ***	
Season	[NOTE: values in parentheses are negative predicted Gross Product Values]	
	"Inside CH"	**"Residual SCA"****
Trawl C/V		
"A"	**($ 25,505,453)**	**($1,134,000)**
"B"	$ 945,572	**($11,800)**
Trawl C/P		
"A"	**($ 13,814,262)**	**($1,717,400)**
"B"	**($ 279,874)**	**($47,400)**
Jig		
"A"	**($ 430,628)**	
"B"	**($ 2,037,164)**	
Freezer L.L.		
"A"	$ 1,814,640	**($1,322,100)**
"B"	**($ 3,097,838)**	**($873,500)**
L.L C/V		
"A"	$ 49,427	
"B"	**($ 119,949)**	
Pot C/V		
"A"	**($ 2,932,259)**	**($266,400)*****
"B"	**($ 4,125,532)**	**($443,500)*****
Pot C/P		
"A"	**($ 73,658)**	
"B"	**($ 1,145,761)**	
C/V <60'		
"A"	**($ 162,126)**	
"B"	**($ 682,119)**	

***** Gross Product Value estimates for the "combined BSAI TAC" option reflect the weighted round value per ton of total catch for each of the two areas, separately, as reported below.
****** The estimated foregone SCA-residual catch values differ, depending upon whether the baseline TAC is assumed to be BSAI-wide, or only that of the EBS management area.
******* SCA Pot catch is not broken out by C/P C/V category

4.10.1.1 P.cod CDQ

CDQ P.cod allocations would be assumed to be subject to all the provisions of the proposed mitigation action. Since cod CDQ apportionments did not begin until 1998, the "projected" catch estimates for this sector are based on the average of 1998 and 1999 reported landings (while as noted, the balance of the catch estimates are average over the period 1996 through 1999). The CDQ P.cod allowance has been taken (for all practical purposes) exclusively by the freezer longline sector and literally entirely from the EBS area. Under Alternative 2, CDQ catch would be "assumed" to redistribute across both the BS and AI management areas and has been assumed to remain essentially freezer-longliner prosecuted. Historically, operators fishing P.cod CDQ have taken the vast majority of their allocation in what would be, under Alternative 2, the "B"-season, and then most of that catch 'outside CH'. Adopting all the analytical assumptions (employed above) results in the conclusion that P.cod CDQ fisheries "could", under Alternative 2, substantially increase their take of P.cod in the "A"-season, and *within* CH, (as compared to their traditional patterns) if they so choose. The potential change in gross product value estimated for the CDQ sector, under Alternative 2, suggests that these operators could increase their "A" season gross product value in the EBS by approximately $1,773,000. Most of this EBS 'gain' would be offset by a projected decline in their "B" season gross product value of $1,546,793. For the AI management area, the predicted "A" season result suggests a *reduction* in the "projected"CDQ P.cod harvest for this area of approximately $466,800, only partially offset by a "B" season predicted catch under Alternative 2 of $286,200. There is no particular reason to assume that this sector will, in response to adoption of Alternative 2, alter its historical fishing patterns to coincide with these "predicted" behaviors, since to do so would (according to the assessment) impose economic losses on the sector, while actually increasing fishing pressure on CH areas, in apparent countervailence of the objectives of the proposed mitigation action.

4.10.1.2 Specify separate TACs for BS and AI management areas

Under Alternative 2, the option of separating the aggregate BSAI P.cod TAC into two separate, area specific TACs has also been proposed. An assessment of the gross product value implications that suboption may imply, utilizing the same set of assumptions and data as above, is presented below.

Table 4.10.1.2.1 Alternative 2 (Separate BS management area TAC suboption)

Sector / Season	Assumed Value/MetricTon R.Wt.	Change in Gross Product Value ($) "Inside CH"	"Residual SCA"
	[NOTE: values in parentheses are negative predicted Gross Product Values]		
Trawl C/V			
"A"	$ 904.78	**($ 22,571,281)**	**($1,250,000)**
"B"		$ 754,873	**($13,000)**
Trawl C/P			
"A"	$ 803.03	**($ 5,436,882)**	**($3,447,300)**
"B"		$ 369,068	**($95,000)**
Jig			
"A"	$ 904.78	**($ 383,259)**	-
"B"		**($ 1,813,076)**	-
Freezer L.L.			
"A"	$ 766.87	$ 3,343,836	**($1,282,700)**
"B"		**($ 2,102,195)**	**($847,400)**
L.L C/V			
"A"	$ 904.78	$ 43,990	-
"B"		**($ 39,679)**	-
Pot C/P			
"A"	$ 813.04	$ 66,683	**($275,300)***
"B"		**($ 565,240)**	**($458,400)***
Pot C/V			
"A"	$ 904.78	**($ 2,932,714)**	
"B"		**($ 3,751,031)**	
C/V <60'			
"A"	$ 904.78	**($ 136,823)**	
"B"		**($ 647,268)**	

***** SCA Pot catch is not broken out by C/P C/V category

Table 4.10.1.2.2 Alternative 2 (Separate AI management area TAC suboption)

Sector / Season	Assumed Value/MetricTon R.Wt.	Change in Gross Product Value ($)
	[NOTE: values in parentheses are negative predicted Gross Product Values]	
Trawl C/V		
"A"	$ 1,353.79	**($ 4,300,676)**
"B"		$ 3,017,575
Trawl C/P		
"A"	$ 803.03	**($ 2,201,821)**
"B"		$ 1,564,245
Jig		
"A"	$ 1,353.79	**($ 70,877)**
"B"		**($ 97,622)**
Freezer L.L.		
"A"	$ 766.87	**($ 2,349,052)**
"B"		$ 1,440,300
L.L C/V		
"A"	$ 1,353.79	$ 8,135
"B"		**($ 20,408)**
Pot C/P		
"A"	$ 813.04	**($ 115,825)**
"B"		**($ 114,627)**
Pot C/V		
"A"	$ 1,353.79	**($ 105,858)**
"B"		**($ 138,341)**
C/V <60'		
"A"	$ 1,353.79	**($ 25,303)**
"B"		**($ 34,851)**

Based upon this simple comparison of the "predicted" catch, by sector, "inside" CH and "outside" CH in the proposed "A" and "B" seasons (as defined under Alternative 2), with the "projected" catch, based upon the historical status quo model, extrapolated over the new seasonal fishing periods, the net impact on gross product value (assuming none of the foregone catch displaced from CH is made up 'outside') is the sum of the "A"- and "B"-season dollar amounts, by gear group/processing mode. With the optional extension of the residual SCA area to the closure, those additional amounts would, likewise, be added to these total impacts.

It is, perhaps, interesting to note that in four cases in the AI option, five in the BS option and three in the combined BSAI option, under this scenario, shifting TAC-share (and thus effort) to conform to the Alternative 2 parameters actually produced gross product value increases (amounts presented without brackets) in one or the other prescribed P.cod seasons. This should not be surprising, since it is entirely consistent with the intent of the proposed action. That is, by moving large portions of the annual TAC into the latter portion of the year, effort presumably must follow, all else equal. Assuming it does, a larger share of the sector specific catch will occur in the "B" season than has traditionally been observed. This will produce equivalently larger product values for this period, as well. Put another way, to the extent that the late-season P.cod fishery has historically been a "mop-up" fishery, with most of the target catch having been taken early in the year, under the proposed mitigation action, the projected later season catch values reflect a change by the industry to a full-scale target fishery, later in the calendar year, on the majority of the annual TAC.

It is important to point out, here as elsewhere, that the dollar amounts cited are not intended to be interpreted as "point estimates", but instead should be regarded as "directional" indicators, reflecting the order of magnitude of these potential gross product value impacts. Furthermore, these estimates, as noted, reflect an 'upper-bound' (or worst-case) loss, attributable to the proposed action. Some (but unlikely all) of the P.cod catch displaced from CH may be captured in areas (and/or times) which are not restricted by the mitigation actions. One cannot, however, readily anticipate where, when, nor to whom these recovered catches may accrue.

4.10.2 Alternative 2 in the GOA

The Gulf of Alaska presents a slightly different management challenge with respect to the proposed action, since at present, the GOA P.cod fishery is not segmented on the basis of gear-apportionments, but instead by area and "inshore"/ "offshore" allocations. Notwithstanding this complication, if one follows the same steps employed in the evaluation of the BSAI management areas, the following results emerge for the Gulf P.cod fishery:

Table 4.10.2.1 Alternative 2 (Combined W&C GOA management area TAC)

Sector	**Assumed Value/MetricTon R.Wt.**	**Change in Gross Product Value ($)**
Season	[NOTE: values in parentheses are negative predicted Gross Product Values]	
Trawl C/V		
"A"	$ 1,192.58	**($ 14,087,775)**
"B"		$ 11,562,719
Trawl C/P		
"A"	$ 803.03	**($ 2,104,545)**
"B"		$ 1,948,661
Freezer L.L.		
"A"	$ 766.87	**($ 1,430,572)**
"B"		$ 1,481,637
L.L C/V		
"A"	$ 1,192.58	**($ 306,073)**
"B"		$ 123,111
Pot C/P		
"A"	$ 813.04	$ 85,943
"B"		$ 42,493
Pot C/V		
"A"	$ 1,192.58	**($ 2,602,751)**
"B"		$ 1,225,334

The suboption, under Alternative 2 for the GOA, to continue the management TAC split between Western and Central areas results in the following outcome:

Table 4.10.2.2 Alternative 2 (Western GOA management area TAC suboption)

Sector / **Season**	**Assumed Value/MetricTon R.Wt.**	**Change in Gross Product Value ($)**
	[NOTE: values in parentheses are negative predicted Gross Product Values]	
Trawl C/V		
"A"	$ 1,192.58	**($ 9,681,697)**
"B"		$ 4,102,475
Trawl C/P		
"A"	$ 803.03	**($ 565,407)**
"B"		$ 317,509
Freezer L.L.		
"A"	$ 766.87	**($ 1,627,709)**
"B"		$ 1,550,374
L.L C/V		
"A"	$ 1,192.58	**($ 125,290)**
"B"		$ 27,526
Pot C/P		
"A"	$ 813.04	**($ 22,025)**
"B"		**($ 31,541)**
Pot C/V		
"A"	$ 1,192.58	**($ 304,139)**
"B"		**($ 351,526)**

Table 4.10.2.3 Alternative 2 (Central GOA management area TAC suboption)

Sector / **Season**	**Assumed Value/MetricTon R.Wt.**	**Reduction in Gross Product Value ($)**
	[NOTE: values in parentheses are negativepredicted Gross Product Values]	
Trawl C/V		
"A"	$ 1,192.58	**($ 5,086,521)**
"B"		$ 6,684,941
Trawl C/P		
"A"	$ 803.03	**($ 1,335,119)**
"B"		$ 1,370,759
Freezer L.L.		
"A"	$ 766.87	**($ 95,615)**
"B"		$ 187,469
L.L C/V		
"A"	$ 1,192.58	**($ 166,053)**
"B"		$ 81,725
Pot C/P		
"A"	$ 813.04	$ 83,983
"B"		$ 55,009
Pot C/V		
"A"	$ 1,192.58	**($ 1,909,195)**
"B"		$ 1,221,871

4.10.3 Alternative 2 -- BSAI and GOA 'suboptions'

4.10.3.1 Delay starting date of "B" season

Alternative 2 contains an option (under both the BSAI and GOA components) which, if adopted, would delay the opening date of the "B" season. In the absence of specific details concerning any such program, a rigorous assessment of the likely economic and operational effects cannot be undertaken. Nonetheless, there are several general observations which may be offered. On the one hand, delaying the start of the "B" fishing season, by definition, automatically reduces individual operational flexibility by further constraining the period during which P.cod fishing can take place. How much of a burden this might impose would likely vary from operation to operation, and perhaps by gear type, region, and processing mode.

Alternatively, in similar situations for other groundfish fisheries, the industry has testified that, even when it is clearly not in the best interest of either an individual operator or the aggregate fishing sector to do so, under 'open access' management, when the fishery opens everybody ***must*** go fishing. In order to protect their respective potential catch share, operators report they feel compelled to be on the grounds when the fishery opens, even if doing so produces a lower quality (and thus lower value) product, or otherwise reduces the earning potential of their business. This is so, even though, if given the individual opportunity to rationalize their fishing pattern, they'd prefer to delay the start of the fishery until fish and fishing conditions were optimal.

Because there is general agreement that P.cod are of relatively poorer quality in the early- to mid-summer, all participants might agree that a delay in the "B" season opening is economically and operationally desirable. Selecting a precise alternative opening date, which suits everyone's interests, however, might be more problematic.

4.10.3.2 Open the "A" season January 1 for fixed gear

An earlier start date for the fixed gear sector would permit greater operational flexibility for participants in these gear sectors, all else equal. It could diminish the potential for gear conflicts between fixed and trawl operations (although would not impact conflicts 'among' fixed gear types). It is also possible that having access to the P.cod resource twenty days prior to beginning of the trawl season could benefit fixed gear operators through higher CPUE, as well as potentially providing some market advantages (e.g., they would be the sole source of supply over that period). Confirmation of these impacts must await empirical data.

4.10.3.3 Create separate gear allocations for CH limits

To some degree, opening the fishery on January 1 to "fixed gear" only, engenders many of the aspects of a separate gear allocation option. That is, one might reasonably assume that benefits would accrue in the form of relatively higher CPUEs, than under an undifferentiated CH allocation; that costs attributable to gear conflicts among gear groups (although not within gear groups) would be reduced; and market effects might emerge. How this optional proposal might be further extended, and with what additional distributional implications for each respective sector, is less clear.

4.10.3.4 Closure of Aleutian Islands

Alternatives 2 and 3 of the P.cod/Steller mitigation proposal include an additional "suboption" which calls for the complete closure of the Aleutian Islands management area to all P.cod target fisheries, consistent with the MA principles. Although the total amount of catch and numbers of operators potentially impacted by this action are relatively small, as compared to the eastern Bering Sea or even GOA P.cod fisheries, if the AI closure option were adopted, the foregone catch could not be made up in areas which remained open. Therefore, the economic and socioeconomic costs would be substantially more significant than those estimated under the separate AI TAC suboption, above, wherein only a portion of the CH catch was assumed forfeited by the fleets.

If one adopts the same underlying assumptions and methodology used to value attributable changes in gross product output for other elements of Alternative 2 (above), but extends the assessment to include the forfeiture of the total Aleutian TAC, the following results emerge (all 'value' estimates are negative):

Table 4.10.3 **Alternative 2 - Aleutian Islands Closure Option**

Product Price $	Outside CH Value $	Inside CH Value $	Total Foregone Value $	Gear Sector
1,353.79	**1,249,513**	**1,249,513**	**2,499,027**	**Trawl C/V**
1,353.79	**730,965**	**3,017,575**	**3,748,540**	
803.03	**741,176**	**741,176**	**1,482,352**	**Trawl C/P**
803.03	**433,588**	**1,789,940**	**2,223,528**	
1,353.79	**106,342**	**106,342**	**212,683**	**Jig**
1,353.79	**62,210**	**256,815**	**319,025**	
766.87	**1,228,863**	**1,228,863**	**2,457,727**	**Freezer L.L.**
766.87	**718,885**	**2,967,705**	**3,686,590**	
1,353.79	**8,135**	**8,135**	**16,270**	**C/V L.L.**
1,353.79	**4,759**	**19,646**	**24,405**	
813.04	**294,357**	**294,357**	**588,715**	**Pot**
813.04	**172,199**	**710,873**	**883,072**	
1,353.79	**37,964**	**37,964**	**75,928**	**C/V <60'**
1,353.79	**22,209**	**91,683**	**113,892**	
TOTAL	**5,811,166**	**12,520,588**	**18,331,753**	

This is clearly a crude estimate of the attributable economic impact of this specific action. This is so because the estimate reflects only the gross wholesale value of the potentially foregone output and, thus, does not capture changes in operating and production costs that may accompany adjustments to the mitigation action closure. These changes may increase or decrease the estimated impact.

In addition, if adopted, the closures may result in economic redistributions among operations in ways that have not been anticipated in the calculation. For example, smaller, less efficient vessels may be relatively less capable of adjusting to the new management regime(s) than are their larger counterparts. How such intra-sectoral and geographic redistributions may effect individual sectors or communities remain largely empirical questions.

Alternatively, if there is no complete closure of the Aleutian Islands P.cod fishery, the "no P.cod fishing zone" provisions of the MA would nonetheless apply. In this case, it is assumed that, while fishing would be displaced to areas outside the identified haul-out and rookery area closure zones, some or all of the TAC apportionment for this area would be harvested. While additional costs, in the form of operational and variable cost increases, would be expected to accompany this spacial displacement of effort, no empirical data are available upon which to base a quantitative estimate.

4.10.3.5 No CH limits beyond closure of rookeries and important haulouts

One of the suboptions articulated under Alternative 2, for the Gulf, includes a provision that all rookeries and important haulout sites be closed to all P.cod fishing, but that no other restrictions be imposed on these fisheries in the balance of the GOA CH. Steller sea lion critical habitat constitutes a proportionately far larger share to the fishable shelf in the GOA, than it does in the Bering Sea. Therefore, adoption of this option, under Alternative 2, would very clearly increase the operational flexibility and reduce potential compliance costs, especially for small vessel operators. In so doing, it could substantially reduce the projected adverse economic impact, as enumerated in terms of gross product values foregone, cited in Tables 4.10.2.1 through 4.10.2.3, above. How much of a reduction would, of course, depend upon the amount of projected GOA catch which would be represent within rookeries and important haulout closed areas; how much of that could and would be made up in remaining open areas; when such catches would occur; and by which gear group and processing mode.

4.10.3.6 Limit CH fishing only in the "A" season

Another option included in the GOA Alternative 2 suite would apply the proposed CH limits only in the "A"-season. If the same set of limiting assumptions employed above, in the assessment of the generalized Alternative 2 evaluation, were utilized to assess the potential foregone catch attributable to this suboption (again, as measured as the reduction in gross product value), the following results emerge. As before, these gross dollar amounts should be regarded, not as 'point estimates' of the gross value foregone, but rather as indicative of the likely magnitude (and distribution) of revenue reductions, attributable to this proposed action. Furthermore, these estimated amounts reflect an 'upper-bound' on the range of foregone gross product value (subject to all the afore mentioned caveats) and would be reduced by any catch amounts "made up" in areas or times not restricted by these "A"-season limits.

Sector	Sub Sector	Projected Inside CH (m. tons)	GOA Value ($/ton)	Reduction in Gross Product Value ($)
Trawl				
	CV	19,117	1,192.58	22,798,777
	C/P	4,388	803.03	3,523,688
Pot				
	CV	3,266	1,192.58	3,895,299
	C/P	142	813.04	115,503
Fixed Gear				
	Freezer LL	3,105	766.87	2,381,287
	CV LL	356	1,192.58	425,116
TOTAL				**33,139,670**

Adoption of this suboption would be expected to reduce the cost and operational burden on the GOA P.cod fishery, as compared to Alternative 2 without this provision, by increasing the operational flexibility of the fleet in the "B" season. As this is effectively a modification of the "No CH limits in GOA ..." suboption treated immediately above, the same types of operational outcomes could be anticipated, although to a reduced degree, since in the current suboption, the CH limits would only be relaxed in the "A", rather than "A" and "B" seasons.

4.10.4 Alternative 3 in the BSAI and GOA

Under the provisions of Alternative 3, the entire CH would be closed to all P.cod directed fishing, in the Bering Sea, Aleutians, and Gulf of Alaska. The fishing year would be divided into three periods,. These would be January 20 - April 30; May 1 - August 31; and September 1 - November 1. The respective area TACs would be apportioned 40% in the "A" season, 30% each in the "B" and "C" seasons. The "suboption" to further separate BSAI into two distinct TAC management areas is also contained in Alternative 3.

Complete closure of the entire CH to all P.cod fishing is such a substantial departure from historical experience that predicting the probable response of the industry, by sector or in the aggregate, is effectively impossible. How much 'could' be taken outside CH, how much 'would' be taken, when, and by whom are all highly speculative. A fall-back, in the absence of any empirical information or experience, is to again employ the "simplifying" assumptions and procedures outlined above. Doing so, the following results emerge for Alternative 3.

Specifically, if all "projected" catch (based upon the historical patterns of the respective sectors) within CH were assumed foregone, in response to the mitigation restrictions, the economic impact, as measured in terms of gross product value, would be on the order of $85 million. The sectoral shares of this assumed "forfeiture" break down as follows, for the combined BSAI management area option,

Table 4.10.4.1 Alternative 3 BSAI Management Area TAC

CH Catch ($):	Gear	"A" Season	"B" Season	"C" Season
	Trawl C/V	33,097,168	98,547	322,390
	Trawl C/P	20,552,225	610,967	881,740
	Jig	1,076,731	1,076,731	1,076,731
	Freezer L.L.	9,356,846	1,086,363	4,022,343
	CV L.L.	–	80,451	48,395
	Pot	5,422,368	4,150,061	1,259,586
	CV < 60'	384,393	384,393	384,393

For the BS management area, taken in isolation, the figure approaches $65.7 million, with a rough break down by gear sector as follows:

Table 4.10.4.2 Alternative 3 BS Management Area TAC Suboption

CH Catch ($):	Gear	"A" Season	"B" Season	"C" Season
	Trawl C/V	29,327,907	108,000	353,319
	Trawl C/P	11,433,670	556,526	153,828
	Jig	958,291	958,291	958,291
	Freezer L.L.	6,598,787	707,000	3,184,860
	CV L.L.	–	39,397	8,200
	Pot	4,966,231	3,349,134	1,053,117
	CV < 60'	342,110	342,110	342,110

For the Aleutian management area, in isolation from the BS area, the numbers approach $16 million, with a distribution of forgone CH catch value approximately as follows:

Table 4.10.4.3 **Alternative 3 AI Management Area TAC Suboption**

CH Catch ($):

Gear	"A" Season	"B" Season	"C" Season
Trawl C/V	5,550,189	-	-
Trawl C/P	2,942,997	65,936	159,759
Jig	177,218	177,218	177,218
Freezer L.L.	3,577,915	502,588	1,024,817
CV L.L.	-	22,290	17,764
Pot	484,400	731,555	192,789
CV < 60'	63,267	63,267	63,267

In the GOA, the equivalent numbers for Alternative 3, including each of the TAC suboptions for CH, appear below:

Table 4.10.4.4 **Alternative 3 W&C GOA Management Area TAC**

CH Catch ($):

Gear	"A" Season	"B" Season	"C" Season
Trawl C/V	22,798,777	563,953	1,723,820
Trawl C/P	3,523,688	217,373	90,403
Pot C/V	3,895,229	355,611	474,207
Pot C/P	115,503	277,808	-
Freezer L.L.	2,381,287	28,451	1,548
C/V L.L.	425,116	51,225	14,942

If the GOA TAC were subdivided into Western and Central components, the result would be:

Table 4.10.4.5 **Alternative 3 Western GOA Management Area TAC Suboption**

CH Catch ($):

Gear	"A" Season	"B" Season	"C" Season
Trawl C/V	12,265,805	6,256	-
Trawl C/P	773,247	12,957	-
Pot C/V	624,413	441,012	419,750
Pot C/P	108,489	169,019	-
Freezer L.L.	2,609,981	9,877	1,561
C/V L.L.	177,253	44,181	10,915

Table 4.10.4.6 **Alternative 3 Central GOA Management Area TAC Suboption**

CH Catch ($):

Gear	"A" Season	"B" Season	"C" Season
Trawl C/V	10,453,551	452,624	1,396,012
Trawl C/P	2,348,670	167,575	73,212
Pot C/V	2,746,805	-	109,928
Pot C/P	22,694	114,607	-
Freezer L.L.	224,102	16,590	234
C/V L.L.	228,525	12,633	4,973

These estimated "forgone catches", under Alternative 3, represent extreme upper-bound limits on the gross product value loss, since they explicitly assume all projected catch (based upon historical operational shares) will be forfeited. This is clearly an outcome that would not be expected. However, as under Alternative 2, there is no empirical basis upon which to estimate how much of the CH catch would be "made up" outside of closed areas, when such catches might occur, nor by which gear group or processing mode. Therefore, hypothetical "scenarios", varying one or another of the combinations of "who", "when", and "where" have not been undertaken. Once again, the estimates should not be regarded as "point estimates" of the probable economic impact, by sector, as measured in terms of foregone gross product value. Instead, the reflect the *"order of magnitude"* and *"direction"* of the likely impacts, by gear group and processing mode.

4.10.4.1 P.cod CDQ

Under provisions of Alternative 3, the P.cod fishery would be temporally divided into three periods, with 40% of the TAC apportioned to the first period, 30% each to the second and third seasons. All fishing in CH would be prohibited. The P.cod allocation to CDQ would be regulated on this basis, if Alternative 3 were adopted and implemented. On the basis of an assessment of average CDQ performance in the P.cod fishery, 1998 through 1999, employing all the assumptions and acknowledging all the caveats cited above, the resulting estimated foregone gross product value to CDQ operators, attributable to provisions of Alternative 3, are $297,000 in the "A" season; $2,117,000 in the "B" season; and $1,653,000 in the "C" season; for a total of $3,119,000. As before, these estimates should be regarded as indicative of the *"order of magnitude"* of the probable attributable change, and an 'upper-bound' estimate at that, for all the reasons cited in the preceding sections.

4.11 Summary and "net benefit" conclusions

Data limitations concerning cost structure, operating patterns and strategies, ownership and affiliation relationships, prices and markets limit the Agency's ability to disentangle and quantify the economic and socioeconomic implications of the proposed P.cod/Steller mitigation action. Nonetheless, the foregoing assessment of the "potential" economic effects and "probable" responses of the several sectors which comprise the BS, AI, and GOA P.cod fishing industry should provide an adequate basis upon which to judge the relative implications of the several proposed Steller sea lion mitigation actions and suboptions.

One should not lose sight of the fact that the purpose of the proposed management amendment is to adopt a mitigation program which will avoid the likelihood of the P.cod fisheries off Alaska *jeopardizing* the continued existence of the western population of Steller sea lions, or adversely modifying their critical habitat. In 1990, the Steller sea lion (Eumetopias jubatus) was designated as a threatened species under the Endangered Species Act of 1973 (ESA). The designation followed severe declines throughout much of the Gulf of Alaska and Aleutian Islands region. In 1993, critical habitat for the species was defined to include (among other areas), the marine areas within 20 nm of major rookeries and haulouts of the species west of 144°W longitude. In 1997, two separate populations were recognized, and the western population (west of 144°W longitude) was reclassified as endangered. Counts of adults and juveniles in the western population of Steller sea lions declined by 72% between the late 1970s and 1990. The decline has continued in the 1990s, with counts dropping 27% from 1990 to 1996. The absolute magnitude of the decline has been smaller in recent years because the population has been severely reduced. The rate of decline, however, remains a serious problem.

Multiple factors have surely contributed to the decline, but considerable evidence indicates that lack of available prey is a major problem. Foraging studies confirm that Steller sea lions depend on P.cod as prey, and sea lions may be particularly sensitive to the availability of prey during the winter. The significance of P.cod to Steller sea lions may have increased since the 1970s, due to shifts in community composition related to oceanographic changes.

P.cod are also the target of extensive fisheries that have, as described above, become concentrated in time and space. This concentration occurs in Steller sea lion critical habitat, and may reduce prey availability at critical times in the life history of sea lions. Cod fisheries, then, may compete with sea lions, and either contribute to their decline or impede their recovery.

While the current action is technically taken under the authority of the Magunson-Stevens Fishery Conservation and Management Act, it is largely motivated by Endangered Species Act concerns and considerations. The latter Act clearly dictates that *any* cost incurred to assure the continued existence of an endangered species is justified by the implicit benefit to society of avoiding irreparable harm or extinction of the designated species. On this basis alone, the proposed mitigation action, which proposes to avoid further destructive competition between the western stock of Steller sea lions and the P.cod fisheries of the BSAI and Western and Central GOA, or further detrimental alteration of their designated critical habitat, must be found to yield a “net benefit to the Nation”.

It is incumbent upon the Secretary, with the advice of the Council, to balance the competing tradeoffs inherent in the suite of alternatives available under this action. That is, while the objective remains the protection and enhancement of the western Steller sea lion resource (and the critical habitat it relies upon), achieving that objective should be done in the most efficient (i.e., least cost) and least burdensome manner possible, so as to “maximize” the net benefit to the Nation deriving from this suite of management actions. The analysis in the preceding RIR, and that contained in the following IRFA section, point out the nature, gross magnitude, and distribution of economic and social impacts which can reasonably be assumed to accompany the range of P.cod mitigation alternatives and suboptions.

5.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

If it cannot be certified that a proposed rule “*will not* have a significant economic impact on a substantial number of small entities”, an initial regulatory flexibility analysis (IRFA) must be prepared. To ensure a broad consideration of impacts and alternatives, NMFS has prepared an IRFA pursuant to 5 USC 603, without first making the threshold determination of whether or not this proposed action would have a significant economic impact on small entities.

The central focus of the IRFA should be on the economic impacts of a regulation on small entities and on the alternatives that might minimize the impacts and still accomplish the statutory objectives.

5.1 Requirement to prepare an IRFA

The level of detail and sophistication of the analysis should reflect the significance of the impact on small entities. Under 5 U.S.C., Section 603(b) of the RFA, each IRFA is required to address:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, record keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;

- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule;

- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the Magnuson-Stevens Act and any other applicable statutes and that would minimize any significant economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

  1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;

  2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;

  3. The use of performance rather than design standards;

  4. An exemption from coverage of the rule, or any part thereof, for such small entities.

5.2 What is a "small entity"?

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) and small government jurisdictions.

5.2.1 Small businesses

Section 601(3) of the RFA defines a "small business" as having the same meaning as "small business concern" which is defined under Section 3 of the Small Business Act. "Small business" or "small business concern" includes any firm that is independently owned and operated and not dominate in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor...A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the form is a joint venture there can be no more than 49% participation by foreign business entities in the joint venture."

The SBA has established size criteria for all major industry sectors in the US including fish harvesting and fish processing businesses. A business involved in fish harvesting is a small business if it is independently owned and operated and not dominant in its field of operation (including its affiliates) and if it has combined annual receipts not in excess of $ 3 million for all its affiliated operations worldwide. A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or less persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $3 million criterion for fish harvesting operations. Finally a wholesale business servicing the fishing industry is a small businesses if it employs 100 or less persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when (1) A person is an affiliate of a concern if the person owns or controls, or has the power to control 50% or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) If two or more persons each owns, controls or has the power to control less than 50% of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors or general partners controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint venturers if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

5.2.2 Small organizations

The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

5.2.3 Small governmental jurisdictions

The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of less than 50,000.

5.3 Reason for considering the proposed action

The purpose and intent of the Steller sea lion management action, under consideration herein, were treated at length in Sections 4.2 and 4.3 of the Regulatory Impact Review. A detailed description of the problem that underlies the proposed action, and the actions objectives, is contained in Section 1.0 of this combined EA/RIR/IRFA document.

5.4 Number and description of affected small entities

The following series of subsections enumerate, to the extent practicable, the number and nature of the "small entities" which comprise the commercial sectors, not-for-profit organizations, and governmental jurisdictions and communities which depend directly or indirectly upon the P.cod fisheries of the Bering Sea and Gulf of Alaska. Taken as a whole, these "entities" define the potentially impacted universe for purposes of the IRFA.

5.4.1 Small businesses in the BSAI P.cod fishery

To identify the number and type of business concerns participating in the BSAI P.cod fishery that meet the definition of "small entities," each must be measured against the size and affiliation standards outlined in Section 5.2.1.

While available data on ownership and affiliation patterns in the 1999 BSAI P.cod fishery are not sufficiently detailed to discern whether each individual business concern meets the definition of "small entity," data available from the draft sector profiles prepared for the Programmatic SEIS[36], preliminary tables prepared for the 1999 NMFS Economic SAFE[37] document, and a data run of catcher vessels grossing under $3 million in all fisheries, do allow some general conclusions to be drawn concerning the number of small entities present in recent years in each component of the industry. These general conclusions are displayed in Table 5.4.1.1.

Table 5.4.1.1 also contains a summary of the "not-for-profit" and "governmental jurisdictions" with direct linkages to this fishery. These entities will be treated in subsequent sections of the IRFA, but are presented in the table for completeness.

[36] Draft Programmatic Supplemental Environmental Impact Statement, Chapter 3, "Social and Economic Conditions." Dated July 28, 2000.

[37] Draft tables prepared for the "Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of the Groundfish Fisheries Off Alaska, 1999." REFM. Alaska Fisheries Science Center. NMFS.

Table 5.4.1.1 Estimated numbers and types of entities participating in the BSAI P.cod fishery.

Industry component or type of entity	*Small*	*Large*	*Total*
Longline catcher processor	38	0	38
Longline catcher vessel	38	0	38
Pot catcher processor	12	1	13
Pot catcher vessel	89	0	89
Trawl catcher processor	18	8	26
Trawl catcher vessel	79	0	79
Inshore processors	5	5	10
CDQ groups (not-for-profit)	6	0	6
Government jurisdictions	69	1	70

Source: Summarized from text.

Shore based plants and floating processors operating within Alaskan waters process most of the P.cod harvested by pot and longline catcher vessels. Five of these processors will likely be considered small entities with fewer than 500 employees. In total they processed less than 150 mt of BSAI P.cod in 1998. The other five processors would be considered large entities, and they processed the vast majority of the shoreline landings in 1998 (about 9,000 mt).[38]

Catcher vessels of all types, delivering their product to on-shore plants, played a significant role in the BSAI in 1999. They took about 40% of the catch in the BS and almost half in the AI. There were 38 longline catcher boats active in the BSAI P.cod target fisheries in 1999, 89 pot catcher vessels, and 79 trawl catcher vessels. Fish ticket and NMFS permit data indicate that no catcher vessel had gross revenues greater than $3 million from all its fisheries activities during 1999. In the absence of ownership or affiliation data, all of these catcher vessels have been assumed to be small entities. This may overstate the actual number of small entities in the catcher boat fleet because some catcher vessels may be affiliated or owned by “large entities”, e.g., by processing firms, while some may have ownership affiliations with other catcher vessels or catcher processors. Detailed ownership and affiliation information is limited for the catcher-processor fleets in the GOA. On the basis of conversations with informed industry sources all longline, and pot catcher-processors, and two-thirds of the trawl catcher-processors, have been designated as small. If more precise data become available, prior to completion of the Final Regulatory Flexibility Analysis, the totals will be corrected.

Table 5.4.1.2 Number of catcher vessels that targeted P.cod and had less than $3 million in gross revenues by area, gear and vessel-length class, 1999.

[38] NPFMC and NMFS. “EA/RIR/IRFA for Amendment 64 to the Fishery Management Plan for Bering Sea/Aleutian Islands Groundfish. Allocation of P.cod Among Fixed Gear Sectors” June 22, 2000. Page 71.

		Vessel-length class			
Area	Gear	unknown	< 60	60-125	>125
Central GOA	longline	25	425	94	2
	pot	5	86	86	0
	trawl	1	28	101	12
Western GOA	longline	2	48	24	1
	pot	0	51	20	1
	trawl	0	31	24	14
Bering Sea	longline	2	29	29	1
	pot	0	2	69	31
	trawl	2	5	171	74
Aleutians	longline	2	11	18	3
	pot	1	2	16	12
	trawl	0	0	5	5

Note:No catcher vessel had gross revenue greater than $3 million. The same vessel may be counted in more than one area/gear category.

Source: Fish tickets, NMFS permits. National Marine Fisheries Service, 7600 Sand Point Way N.E., Seattle, WA 98115-0070.

5.4.2 Small not-for-profit organizations

The Community Development Quota (CDQ) program was implemented in December 1992, as part of the original BSAI Inshore/Offshore FMP amendment. The CDQ program has made it possible for both individuals from western Alaska villages and the CDQ groups (which were formed to facilitate administration of the program) to participate directly in the commercial fisheries occurring in the adjacent Bering Sea and Aleutian Islands management areas. The six CDQ groups participating in the BSAI P.cod fishery, comprised of 65 western Alaska Native villages, are the only small not-for-profit organizations that have been identified as potentially directly affected by the Steller sea lion/P.cod mitigation alternatives under consideration. (The CDQ program does not extent to the Gulf of Alaska fisheries.)

5.4.3 Small governmental jurisdictions

Sixty-five CDQ communities and eleven Alaska non-CDQ communities (Unalaska/Dutch Harbor, Sand Point, King Cove, Chignik, Falls Pass, Cordova, Seward, Homer, Atka, Adak, and Kodiak[39]) are identified as small governmental jurisdictions with direct involvement in and dependence upon the BSAI and/or GOA P.cod fishery. The remaining government jurisdiction with direct involvement in these fisheries, Seattle, Washington, does not qualify as a small governmental jurisdiction. The small governmental jurisdictions with direct linkages to the BSAI and GOA P.cod fisheries are described in detail in Section 5.5.3.

5.4.4 Small businesses in the GOA P.cod fishery

As was the case for the BSAI fisheries, to identify the number and type of business concerns participating in the GOA P.cod fishery that meet the definition of "small entities," each must be measured against the size and affiliation standards outlined in Section 5.2.1.

Shore based and inshore floating processors handle most of the harvest from the GOA. By regulation, 90% of the P.cod TAC in the GOA is allocated to the inshore sector and only 10% to the offshore sector.

The designation of small and large entities in the GOA P.cod processing sector has been based on the description of processors in the current draft of the Programmatic EIS. In the description in that document, on-shore processors handling P.cod fall into three groups. A group of ten large processors was designated "Kodiak Island inshore plants." These plants processed a wholesale value of about $74 million (or an average of $7.4 million each) in all fisheries products in 1999. On the basis of their production levels and their affiliations, these plants have been designated large. Likewise, a group of ten large processors was designated "Alaska Peninsula and Aleutian Islands Inshore Plants." These plants processed a wholesale value of about $56 million (or an average of $5.6 million each) in all fisheries products in 1999. On the basis of their production levels and affiliations, these plants have also been designated large. Conversely, a group of 18 "Southcentral Alaska inshore plants" processed about $26.3 million (are an average of $1.46 million each) in all fisheries products in 1999. These plants have been designated as small entities. Many of these plants may be affiliated with larger fish processing firms, however, they have been designated as small entities in order to reduce the risk of underestimating the number of small entities.

Catcher vessels harvest most of the available TAC in the GOA. As noted earlier, 90% of the GOA TAC is allocated to the inshore sector. A large fleet of catcher vessels fishes in the Gulf; in 1999 there were 387 longliners, 197 pot vessels, and 105 trawlers. While detailed ownership and affiliation information is very limited (even more so than for the BSAI management area), it appears that virtually all of the vessels operating in this fishery meet the "small entity" definition. and NMFS data suggests that all landed less than $3 million from all fisheries. By making this simplifying assumption, even if some of these boats are actually "affiliated" with larger entities, the IRFA avoids the risk of *understating* the potential impact on "small entities." If more precise data become available, prior to completion of the Final Regulatory Flexibility Analysis, the totals will be corrected.

[39] Note: While Sand Point, King Cove, and Kodiak are all located in the Gulf of Alaska, each has traditionally received groundfish harvested from the Bering Sea for processing, thus their inclusion here. Absent from the list of BSAI communities dependent on P.cod is Akutan. As the community profiles will show, Akutan is a *unique* case insofar as the "village" of Akutan is regarded as being distinctly separate and largely independent of the fish processing facility of the same name, located near by. Indeed, the community of Akutan is counted among the 65 CDQ communities, referenced above.

Detailed ownership and affiliation information is also limited for the catcher-processor fleets in the GOA. On the basis of conversations with informed industry sources all longline, trawl and pot catcher-processors have been designated as small. As noted above, even if some of these boats are actually "affiliated" with larger entities, the IRFA avoids the risk of *understating* the potential impact on "small entities." If more precise data become available, prior to completion of the Final Regulatory Flexibility Analysis, the totals will be corrected.

Catcher processors receive 10% of the GOA TAC by regulation. Relatively small numbers (compared to the BSAI) of catcher-processors were active in the GOA cod fisheries. In 1999 there were 14 longliners, 11 pot vessels, and 9 trawlers.

There are no CDQ (or other not-for-profit) entities associated with the GOA P.cod target fishery.

The preliminary 1999 participation data are summarized in Table 5.4.4.1, below. These findings are subject to change as better data become available.

Table 5.4.4.1 Estimated numbers and types of entities participating in the GOA P.cod fishery.

Industry component or type of entity	***Small***	***Large***	***Total***
Longline catcher processor	13	0	13
Longline catcher vessel	387	0	387
Pot catcher processor	11	0	11
Pot catcher vessel	197	0	197
Trawl catcher processor	9	0	9
Trawl catcher vessel	105	0	105
Inshore processors	18	20	38
Government jurisdictions	8	1	9

Source: Summarized from text.

5.5 Effects of the proposed mitigation action on small entities

5.5.1 Impacts on small businesses

After reviewing the alternatives and sub-options analyzed in "environmental assessment" and "regulatory impact review" sections of this document, several conclusions may be drawn concerning the potential differential impacts of the alternatives on small businesses in the BSAI and GOA. These are summarized in the following sections.

5.5.1.1 Impacts on catcher boats

Alternatives 2 and 3 are likely to impose a number of adverse economic impacts on catcher vessels. These are detailed qualitatively in section 4.7 and their estimated impacts on fleet gross revenues are detailed in sections 4.10 and 4.11. As pointed out in section 4.7, these alternatives will almost certainly impose net costs on fishing operations since they will be forced to adopt fishing new fishing patterns from those they had voluntarily chosen. Summarizing the discussion in section 4.7, the adverse impacts may include the following:

- greater running time and reduced fishing time
- increased variable operating costs
- higher potential physical risk and associated increases in insurance costs
- reduced CPUE and consequent increases in costs per delivered ton
- possible failure to harvest part of the fleet's TAC allocation
- forced exit from the fishery for some vessels as revenues fall below break-even levels
- possible increased gear conflicts

In general, many of these impacts are likely to affect smaller vessels more adversely than larger ones. Operational, logistical, and variable operating cost data are not available with which to assess the probable net economic effects of the actions, although the RIR section of this document qualitatively evaluates a number of cost categories and operational impacts which may reasonably be expected to accompany the range of actions under consideration. On the basis of available information and empirical data, it is not possible to *quantitatively* evaluate the size and distribution of potential adverse impacts which may be associated with the proposed Steller sea lion actions.

5.5.1.2 Impacts on onshore processors

Section 4.7.1 discussed the impacts of the alternatives on products and markets. As noted there, Alternatives 2 and 3 could result in adverse impacts, in the form of changes in operating periods or duration of openings, changes in product mix and quality, availability of raw material and/or quality of fish delivered, and market or price effects. There is no reason to conclude, however, that these impacts would accrue disproportionally to the small processors, vis a` vis the large onshore processors. No data are presently available with which to quantitatively assess the probability and magnitude of these potential impacts.

5.5.1.3 Impacts on catcher processors

For a given gear sector, catcher processors tend to be relatively larger vessels than catcher vessels. In addition, since they process their own catch, they are not dependent on deliveries to a fixed shoreline point as the catcher vessels. The increased mobility of catcher processors may mean that the adverse impacts of these proposals may not be as severe for catcher processors.

While all catcher vessels are small entities, catcher processor operations may be large or small entities. As discussed earlier, Alternatives 2 and 3 may make it relatively harder for smaller vessels to continue to operate. This might lead to a reallocation of harvest from smaller to larger catcher processors. To the extent to which small entity status is correlated with catcher processor vessel length, these provisions may lead to a reallocation from catcher processors that are small entities to those that are not.

5.5.2 Impacts on small organizations

The only entities directly associated with the P.cod target fisheries which meet the strict RFA standards for inclusion as "small organizations" are the Community Development Quota (CDQ) groups. The Alaska CDQ program was designed to provide an avenue of entry into the BSAI management area pollock harvesting and processing sectors for groups of communities adjacent to, but with no prior history of participation in, these economically important fisheries. Established in 1991, the program established six "not-for-profit" CDQ groups. These include: (1) the Aleutian Pribilof Island Community Development Association [comprised of six communities]; (2) the Bristol Bay Economic Development Corporation [comprised of 17 communities]; (3) the Norton Sound Economic Development Corporation [comprised of 15 communities]; (4) the Yukon Delta

Fisheries Development Association [representing 6 communities]; (5) the Central Bering Sea Fisherman's Association [representing a single community]; and (6) the Coastal Villages Region Fund [comprised of 20 communities]. The estimated value of the potentially forfeited CDQ P.cod catch (along with the assumptions, caveats, and limitations necessary to interpret the estimates) is included in Sections 4.10.1.1 and 4.11 of the RIR.

5.5.3 Impacts on small governmental jurisdictions

None of the proposed P.cod mitigation alternatives "directly" impact small governmental jurisdictions, in the sense of imposing regulatory, reporting, or other compliance requirements on them. However, some significant changes in P.cod target harvest patterns seem certain, as described in detail in the EA and RIR sections above, as a result of spatial, temporal, or exclusionary dispersion of the target fishery. These will result in indirect and induced impacts on dependent communities. The size, nature, and scope of these likely "indirect" economic and socioeconomic impacts on the principal P.cod-dependent communities, adjacent to the eastern Bering Sea, Aleutian Islands, and Gulf of Alaska management areas, will vary directly with the magnitude of these changes and may be appropriately attributable to the proposed Steller sea lion mitigation regulatory alternatives.

A description of the potentially effected small governmental jurisdictions is provided below. In addition to those explicitly described in the following section, the 65 CDQ villages, referenced in the section on small "not-for-profit" entities, immediately above, would be among the "small government jurisdictions" indirectly impacted by the proposed action.

When NMFS Blend data are employed to rank Alaska fishing ports, from highest to lowest, on the basis of their groundfish landings and value, the first five ports account for in excess of 95% of total Alaska groundfish landings.

These communities are, in order:

Port	*Metric tons* (Groundfish)*	*Value*	*No. of Processors (Groundfish)*
1. Dutch Harbor/Unalaska	224,000	$59,774,500	6
2. Akutan	<120,000	NA	1
3. Kodiak	84,000	$33,488,800	9
4. Sand Point	<45,000	NA	1
5. King Cove	<25,000	NA	1

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

The communities of Dutch Harbor/Unalaska and Akutan are located on the Bering Sea side of the Alaska Peninsula/Aleutian Island chain, while Sand Point and King Cove are on the Gulf of Alaska side. Kodiak Island, where the port and City of Kodiak are located, is in the Gulf of Alaska.

Pollock is the primary groundfish species landed and/or processed in these five ports, but P.cod making up almost all of the remaining catch. In Dutch and Akutan, pollock represented 83% and 76%, respectively, of the

1997 total groundfish landings in these ports (P.cod accounting for virtually all of the balance).[40] In the case of Sand Point, pollock was 69% of groundfish landings, P.cod 29%, with fractional percentages of other groundfish species accounting for the rest. King Cove presented the single exception amongst these groundfish landing port communities, with pollock catch-share at 31% and P.cod at 69% of the groundfish total. Kodiak presented the most diversified species complex, with pollock representing 43%, P.cod 36%, assorted flatfishes at 14%, and a mix of other groundfish species making up the balance of the total. These data clearly demonstrate, however, the significant dependence these five communities have on the P.cod resource.

Taken in total, the majority of the output from the processing operations in these landings ports is exported, principally to Asian markets, although some enters other markets, including the U.S. domestic market for secondary processing and/or sale.

While substantial reductions in catch deliveries of any groundfish species, in the eastern Bering Sea, GOA, or Aleutian Islands management areas, could have indirect economic consequences for any or all of these port communities, the impacts would be relatively more severe and direct if P.cod catches were substantially reduced (acknowledging that pollock remains the single most important species for most). Furthermore, these impacts would not be uniform in distribution across the primary groundfish landings port communities, owing to geographic location, physical proximity to fishing grounds, plant capacity and capability differences, availability and variety of support facilities offered, and intermediate and final markets served.

In addition, the inshore processors in each of these port communities compete directly with the catcher/processor fleets, which participate in many of these same fisheries.[41] Each sector has different capabilities and limitations. And, while each supplies some amount of product into common markets, each also has developed the potential to focus a portion of its operation on specific markets. These attributes suggest variability in response to changing management environments, such as might be associated with application of the Steller/P.cod mitigation principles.

Based upon the relatively limited data which are available on individual communities and processing facilities, the following characterizations of the principal P.cod-dependent Alaska landings ports can be offered.[42]

5.5.3.1 Unalaska/Dutch Harbor

Unalaska/Dutch Harbor is located approximately 800 miles southwest of Anchorage and 1,700 miles northwest of Seattle. Unalaska is the 11th largest city in Alaska, with a 1999 Alaska Department of Community and Regional Affairs (DCRA) certified year-round population of 4,178. The name Dutch Harbor is often applied to the portion of the city located on Amaknak Island, which is connected to Unalaska Island by a bridge. Dutch Harbor is fully contained within the boundaries of the City of Unalaska, which encompasses 115.8 square miles of land and 98.6 square miles of water (Alaska Department of Community and Regional Affairs, 1998).

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[40] Source: State of Alaska Fish tickets

[41] Some of these port communities earn considerable revenues from supporting and servicing the catcher/processor, catcher boat, and/or mothership fleets. In these instances, a reduction in P.cod catch in any of the sectors could compound the economic dislocation for the local community.

[42] The proposed P.cod/Steller sea lion mitigation actions may cause shifts in operating patterns and schedules; changes in product mix, quality and/or price; increases in operating costs; and, in the limit, some inter-, as well as intra-sectoral redistribution. Any of these may have localized impacts which are not amenable to quantitative measurement, given currently available data.

The population of Unalaska is primarily non-Native, although the community is culturally diverse. According to the 1990 U.S. Census, there were 682 total housing units, and 107 of these were vacant. More than 2,500 jobs were estimated to be in the community. The official unemployment rate at that time was 1.0%, with 7.8% of the adult population not in the work force. The median household income was reportedly $56,215, and 15.3% of residents were living below the poverty level.

Unalaska/Dutch Harbor has been called *"... the most prosperous stretch of coastline in Alaska."* With 27 miles of ports and harbors and several hundred local businesses, most of them servicing, supporting, or relying on the seafood industry, this city is generally regarded to be at the heart of the Bering Sea fisheries.

Not only is Dutch Harbor the top ranked fishing port in terms of the tonnage of fish landed in Alaska, but it has held that distinction for the Nation, as a whole, each year since 1989, and ranked at or near the top in terms of value of fish landed over the same period.

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

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

Nonetheless, since the mid-1980s, groundfish has accounted for the vast majority of landings in Unalaska/Dutch Harbor. While pollock is by far the most important groundfish species landed in Dutch Harbor, P.cod is an important species, in terms of overall value of landings.

The facilities and related infrastructure in Unalaska support fishing operations in the eastern Bering Sea, Aleutian Islands, and GOA management areas. Processors in this port receive and process fish caught in all three areas, and the wider community is linked to, and substantially dependent upon, serving both the inshore and at-sea sectors of the fishing industry.

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

> *"If it weren't for the seafood industry, Unalaska would not be what it is today. . . In 1991, local processors handled 600 million lbs. of seafood onshore, and 3 billion lbs. of seafood were processed offshore aboard floating processors that use Dutch Harbor as a land base. Seven shore-based and many floating processors operate within municipal boundaries."* (NPFMC, 1994. p. 26).

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

Because of this high level of economic integration between Unalaska/Dutch Harbor and the fishing industry, any action which significantly reduced or substantially redistributed the total catch of P.cod from the eastern Bering Sea or Aleutian Islands (and to a lesser extent the GOA) management areas would be expected to have an adverse economic impact on the port and surrounding community.

Detailed data on costs, net earnings, capital investment, and debt service for the harvesting, processing, and fisheries support sectors in Unalaska/Dutch Harbor are not available. Therefore, it is not possible to quantify net economic impacts on this community. It is apparent, however, that there are no alternative fisheries into which the port might diversify, in order to offset a significant reduction in P.cod target fishing activity. Neither are there prospects (at least in the foreseeable future) for non-fishery related economic activity in Unalaska/Dutch Harbor that could substantially mitigate impacts from a significant reduction in locally based P.cod fishing activity.

While Dutch Harbor has been characterized as one of the world's best natural harbors, it offers few alternative opportunities for economic activity beyond fisheries and fisheries support. Its remote location, limited and specialized infrastructure and transportation facilities, and high cost make attracting non-fishery related industrial and/or commercial investment doubtful, at least in the short-run. [43]

Diminished P.cod fishing and processing activities would result in greater seasonal fluctuation in private sector jobs in this community. This situation would diminish opportunities and the number of permanent, year-round residents of Unalaska/Dutch Harbor would perhaps decline. This, in turn, would alter the composition and character of the community and place new, and different, demands on local government.

The municipal government of the City of Unalaska is substantially dependent upon the tax revenues which are generated from P.cod fishing, processing, and support activities. While a detailed treatment of municipal tax accounts is beyond the scope of this assessment, it is clear that, between the State of Alaska's Fisheries Business Tax and Fishery Resource Landings Tax revenues (both of which are shared on a 50/50 basis with the community of origin), local raw fish sales tax, real property tax (on fishery-related property), and permits and fees revenues associated with fishing enterprises, the City of Unalaska derives a substantial portion of its operating, maintenance, and capital improvement budget from fishing related business activities. Should the P.cod harvest in the eastern Bering Sea or Aleutian Islands management areas be substantially reduced, the municipality could experience a substantial reduction in its tax base and revenues.

The local private business infrastructure which has developed to support the needs and demands of the fishery-based population of Unalaska/Dutch Harbor would clearly suffer severe economic dislocation, should the number of employees in the local plants and fishing fleets decline significantly, in response to P.cod catch reductions. Insufficient cost and investment data exist, however, with which to estimate the magnitude of net economic impacts to these private sector businesses.

5.5.3.2 Akutan

The community of Akutan is located on an island of the same name in the eastern Aleutians, one of the Krenitzin Islands of the Fox Island group. The community is approximately 35 miles east of Unalaska and 766

[43] Sea floor minerals exploration, including oil drilling, in the region have been discussed. No such development seems likely in the short run, however. Unalaska, is becoming a destination for a modest level of sport fishing charters, aided by recognition of the world record halibut landed there several years ago.

air miles southwest of Anchorage. Akutan is surrounded by steep, rugged mountains reaching over 2,000 feet in height. The village sits on a narrow bench of flat, treeless terrain. The small harbor is ice-free year round, but there are frequent storms in winter and dense fog in summer. The Alaska Department of Community and Regional Affairs (DCRA) certified 1999 population was 408, although the population can swell to well over 1,000 during peak fish processing periods.

During the 1990 U.S. Census, there were 34 total housing units, and three of these were vacant. There were 527 jobs estimated to be in the community. The official unemployment rate at that time was 0.4%, with 7.4% of all adults not in the work force. The median household income was $27,813, and 16.6% of the residents were living below the poverty level. There is one school in the community, serving 24 students.

Village water is supplied from local streams, treated, and piped into homes. The seafood processing plant adjacent to the community operates its own water treatment facility.

Akutan ranks as the second most significant landings port for groundfish, on the basis of tons delivered, and has been characterized as a *unique* community in terms of its relationship to the BSAI fisheries. According to a recent social impact assessment, prepared for the Council[44], while Akutan is the site of one of the largest of the onshore groundfish processing plants in the region, the community is geographically and socially separate from the plant facility.

As a result, Akutan has a very different relationship to the region's P.cod fisheries than does, for example, Unalaska/Dutch Harbor or Kodiak. While the community of Akutan derives economic benefits from its proximity to the large Trident Seafoods shore plant, the entities have not been integrated in the way other landings ports and communities on the list have. And, while the community derives some economic benefits (including a 1% raw fish tax) from the nearby plant, unless a change in P.cod landings were of sufficient magnitude to severely destabilize the region's fisheries, which the Trident Seafood plant depends upon, there are not likely to be significant impacts on the *village* of Akutan attributable to moderate changes in plant operating patterns.

Although this conclusion pertains to the community of Akutan, implications for the landings port of Akutan are quite different. Because the Trident plant is the principal facility [45] in the Akutan port, a substantial change in P.cod landings in this region, in response to P.cod/Steller mitigation action induced management changes, could have negative implications.

The community of Akutan and the Aleutians East Borough are in the process of working with the Corps of Engineers to develop a harbor to be located at the head of the adjacent bay. They are also working on plans for development of an airport in the community. Significant reductions in production of P.cod in Akutan, combined with impacts from other similarly-affected fisheries, may diminish Akutan's opportunity to provide planned support services to the fishing industry. Alternative economic development opportunities of any kind are extremely limited for the community.

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[44] Inshore/Offshore-3 Socioeconomic Description and Social Impact Assessment. Impact Assessment, Inc. NPFMC. July 15, 1998.

[45] Historically, a number of smaller, mobile processing vessels have operated out of the port of Akutan, seasonally.

There does not appear, for example, to be an obvious alternative fishery resources which could be developed to offset a significant reduction in P.cod landings in Akutan. Fisheries for crabs, halibut, salmon, and herring, while important sources of income to the region, are fully developed. Therefore, should P.cod landings to this port be significantly reduced in response to Steller mitigation temporal or geographic dispersion principles, some jobs held by employees of the plant would likely disappear, or at a minimum, become seasonal. Consequently, some people would likely leave the area.

No data on cost, net revenues, capital investment and debt structure are available with respect to Trident Seafood's Akutan plant complex. It is not possible, therefore, to quantify probable attributable net economic impacts to plant owners/operators of a potential reduction in P.cod landings. While some adjustment to alternative groundfish species might be possible in response to a decline in P.cod deliveries, insufficient data exist to support an analysis of this scenario. One may conclude, however, that this is an economically inferior solution for the plant, otherwise one would observe it engaged voluntarily in this behavior, at present.

5.5.3.3 Kodiak

The fishing port of Kodiak is located near the eastern tip of Kodiak Island, southeast of the Alaska Peninsula, in the Gulf of Alaska. The City of Kodiak is the sixth largest city in Alaska, with a DCRA certified 1999 population of 6,869. The City of Kodiak is 252 air miles south of Anchorage. The port and community are highly integrated, both geographically and structurally. The port and community are the *de facto* center of fishing activity for the Gulf of Alaska.

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

Kodiak supports at least nine processing operations which receive groundfish (including P.cod) harvested from the GOA and, to a lesser extent, the eastern Bering Sea and Aleutian Islands management areas, and four more which process exclusively non-groundfish species. The port also supports several hundred commercial fishing vessels, ranging in size from small skiffs to large catcher/processors and everything in between.

According to data supplied by the City, *"The Port of Kodiak is 'home port' to 770 commercial fishing vessels. Not only is Kodiak the state's largest fishing port, it is also home to some of Alaska's largest trawl, longline, and crab vessels."*

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

Kodiak processors are dependent on P.cod landings as an important part of their overall operations. Kodiak is truly a multi-species fishing community. The port participates in a broader range of groundfish fisheries than other ports in the state. Most activity centers on the numerous flatfish species which are present in the GOA, but also includes relatively significant rockfish and sablefish fisheries. In addition, salmon, halibut, crabs, and herring fisheries are very important to the local community. Many of these fisheries are highly seasonal, and Kodiak processors have come to rely upon P.cod landings to extend their range of operation.

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

In 1997, for example, the port recorded salmon landings of just under 44 million pounds, with an estimated ex-vessel value of over $12 million. Approximately 4.3 million pounds of Pacific herring were landed in Kodiak with an ex-vessel value of more than $713,000. Crab landings exceeded 1.1 million pounds and were valued ex-vessel at more than $2.7 million.

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

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

While Kodiak appears to have a much more mature and diversified economy than any other groundfish landings ports in Alaska, it is likely that a substantial reduction in P.cod landings in the GOA (and to a lesser degree, Aleutian Islands and/or eastern Bering Sea management areas) could impose adverse economic impacts on the community.

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

No alternative fishery resource appears available to Kodiak fishermen and processors that could ameliorate significant reductions in P.cod landing that might be associated with one or more of the Steller mitigation principles. Neither do there appear to be non-fishery based opportunities, at least in the short run, which could be developed to reduce any adverse economic impacts of such a change in regional P.cod harvesting and processing.

5.5.3.4 Sand Point, King Cove and False Pass

These are three independent and geographically separate landings ports within the Southwest Alaska peninsula area. They are all members of the Aleutians East Borough. Sand Point and King Cove each have major processing plants that operate year-round. False Pass operates primarily as a buying station for salmon, but is also a base for seasonal floating processing operations.

The Alaska Department of Community and Regional Affairs certified 1999 population for Sand Point was 842. Sand Point is located on Humboldt Harbor, Popof Island, 570 air miles from Anchorage. It is described by the Alaska Department of Community and Regional Affairs as “a mixed Native and non-Native community” with a large transient population of fish processing workers. During the April 1990 U.S. Census, there were 272 total housing units, and 30 of these were vacant. A total of 438 jobs were estimated to be in the community. The official unemployment rate at that time was 2.9%, with 32.1% of all adults not in the work force. The median household income was $42,083, and 12.5% of the residents were living below the poverty level.

King Cove is located on the North Pacific side of the Alaska Peninsula, 625 miles southwest of Anchorage. Its 1999 DCRA certified population was 691. The community is characterized as a mixed non-Native and Aleut village. In the 1990 U.S. Census, there were 195 total housing units, with 51 of these vacant. The community had an estimated 276 jobs, with an official unemployment rate of 1.8% and 24.0% of all adults not in the work force. The median household income was $53,631, and 10% of the residents were living below the poverty level.

False Pass is located on the eastern shore of Unimak Island on a strait connecting the Gulf of Alaska to the Bering Sea. Unimak Island is the first island of the Aleutian Chain. It is located 646 miles southwest of Anchorage and 40 miles southwest of Cold Bay. The name False Pass is derived from the natural passage (Isanotski Strait) separating the Gulf of Alaska, through Bechevin Bay to the Bering Sea. False Pass is primarily an Aleut community, with 76.5 percent of the population in the 1990 census listed as Alaska Native. The 1999 DCRA certified False Pass population was 68. The community has an estimated 23 jobs, mostly in the private sector.

False Pass grew from the establishment of the Peter Pan Seafoods cannery in 1917. The cannery was destroyed by fire in 1981. the cannery docks and shoreline support facilities continue to operate during the summer season. The Peter Pan facility serves as the community store and fuel supply for boats and vehicles.

Falls Pass, King Cove, and Sand Point, like Akutan, are part of the Aleutians East Borough. All these communities have extensive historical linkages to commercial fishing and fish processing of P.cod. As early as the late 1890's, commercial cod stations operated in Sand Point, processing large volumes of locally caught P.cod. During the 1930's, the cod resource declined and commercial effort shifted to salmon. In the 1980's, fishermen and processors from the area re-developed the P.cod fishery, which currently supports resident commercial fleets delivering catch to local plants. These local catches are substantially supplemented by deliveries from large, highly mobile vessels, based outside of the three Alaska Peninsula communities.

King Cove possesses a deep water harbor which provides moorage for approximately 90 vessels of various sizes, in an ice-free port. Sand Point, with a 25 acre/144 slip boat harbor and marine travel-lift, is home port to what some have called *"... the largest fishing fleet in the Aleutians"* (NPFMC, 1994).
For decades, each of these the two communities has concentrated principally on salmon fisheries. For example, in 1997, both Sand Point and King Cove recorded salmon landings of several million pounds.[46] In addition, King Cove had significant landings of Pacific herring and crabs. Recently, each community has actively sought to diversify its fishing and processing capabilities. Groundfish, including P.cod, is key to these diversification plans.

[46] State of Alaska data confidentiality requirements preclude reporting actual quantities and value when fewer than four independent operations are included in a category. Sand Point and King Cove each have only one processor reporting catch and production data.

By any measure, these three communities are fundamentally dependent upon fishing and/or fish processing. In recent years, groundfish (primarily pollock and P.cod) have supplanted salmon, herring, and crabs as the primary target species, becoming the basis for each community's economic activity and stability.

False Pass has a much less developed infrastructure to support fishing operations than do either Sand Point or King Cove, but several facilities have been added in recent years, including a dock, a boat ramp, and a commercial uplands storage and service area. The community and the Aleutians East Borough are currently working with the Corps of Engineers to develop a boat harbor for the community.

Few employment alternatives to commercial fishing and fish processing exist, within the cash-economy, in these communities. However, subsistence harvesting is an important source of food, as well as a social activity, for local residents in Sand Point, King Cove, and False Pass.

Any action which significantly diminishes the harvest of GOA and BSAI P.cod resources could adversely impact these communities. King Cove is somewhat unique among the principal Alaska groundfish ports insofar as it is relatively more dependent upon P.cod than pollock, among the groundfish species landed (69% and 31%, respectively). Sand Point follows the more typical pattern with pollock and P.cod representing 69% and 29% of its groundfish landings, respectively, in 1997.

False Pass is one of the community development quota (CDQ) communities, working with the Aleutian/Pribilof Island Community Development Association (APICDA) as its partner. The residents, along with APICDA, are actively working to develop resident based fishing and processing, based on P.cod. Economic feasibility of development plans in the community may hinge on potential reductions in available P.cod harvests in the Bering Sea and Gulf of Alaska waters, adjacent to the community.

No data on cost, net revenues, capital investment and debt structure are available with respect to the Sand Point or King Cove plant complexes. It is not possible, therefore, to quantify probable attributable net economic impacts to plant owners/operators of a potential reductions in P.cod catches and deliveries to these landings ports.

As suggested earlier, these are very small, isolated villages with exceedingly limited infrastructure. A significant reduction in P.cod deliveries would likely result in costs, in the form of stranded capital and job losses.

Furthermore, there does not appear to be any viable alternative economic activity which could alleviate the probable adverse impacts on these small communities from a significant decline in their primary groundfish species deliveries. To add to the potential impact of any reductions in the availability of P.cod, the region's salmon fisheries are the target of an allocation dispute with the Yukon-Kuskokwim region. This dispute has unfurled before the Alaska Board of Fisheries for at least 15 years, but recently, Governor Knowles added his voice in opposition to the Alaska Peninsula salmon fisheries. The resolution of this issue is unclear, but it is clear that the fishermen and processors in the area cannot count on expanded salmon activities to fill any earnings shortfalls created by a decline in P.cod fishing activity.

No alternative fishery resource appears available to King Cove, Sand Point, or False Pass fishermen and processors that could ameliorate significant reductions in P.cod landing that might be associated with one or more of the mitigation principles. Neither do there appear to be non-fishery based opportunities, at least in the short run, which could be developed to reduce any adverse economic impacts of such a change in regional P.cod harvesting and processing.

5.5.3.5 Atka and Adak

Atka and Adak are the westernmost civilian communities on the Aleutian Islands, and share a strong reliance on P.cod fisheries, as a part of their economic development plans.

The village of Atka is located on Atka Island in the Aleutian Islands chain, approximately 300 miles west of Unalaska/Dutch Harbor and 90 miles to the east of Adak. The island, which is approximately 55 miles long, has a rugged mountainous terrain with steep hills and high rocky cliffs along the shores of numerous bays and inlets. The community of Atka is located on the shore of Nazan Bay on the eastern end of the island.

The DCRA certified 1999 population of Atka was 105. The residents are predominantly Aleut. Human populations have occupied the island for at least 2,000 years. With Russian occupation, Atka became an important trade site and safe harbor. Akta residents were evacuated in World War II when the Japanese attached Unalaska. The community was mostly destroyed and had to be rebuilt after the war ended.

Residents in Atka recognized in the early 1980's that their community was not going to survive without a viable economy. In response, the Atka Fishermen's Association was formed in 1984 to assist in the development of commercial fishing activities. The initial focus was on halibut, but quickly shifted to include P.cod. The Atka Fishermen's Association funded and constructed a local fish processing plant, Atka Pride Seafoods, with assistance of the Economic Development Administration. The community has also developed a new dock and port facility in Nazan Bay, with the cooperation and assistance of the Corps of Engineers.

Aside from commercial fishing , there are almost no employment opportunities in Atka. Year round work is limited to several education-related and government-related jobs.

Atka has a 3,100 foot runway that provides an air link for the community. In addition to fishing and fish processing activities, Atka residents provide support services to large offshore catcher vessels and catcher-processor vessels. Reductions in availability of P.cod will have direct adverse impacts to the commercial fishing operations of residents, as well as the service sector related to transient vessels using the community's facilities.

Adak is a community on Adak Island located 350 miles west of Unalaska/Dutch harbor, 1,300 miles west of Anchorage, and 1,400 miles east of Madagan in eastern Russia. Historically, Adak was home to Aleuts villages. Adak was developed as a Naval Air Station after World War II broke out. Until recently, the Navy operations supported a population of 5,000 residents.

Beginning in the mid 1990's, the Navy reduced the personnel stationed at Adak and the base was eventually closed. Navy land holdings on Adak have reverted to the U.S. Fish & Wildlife Service. When a pending land exchange is completed the extensive naval facilities on Adak Island will be owned by the Aleut Corporation.

Adak has an extensive infrastructure left by the Navy. There are 1,051 housing units on Adak, along with huge storage and shop buildings, freezer plants, fuel tanks, water treatment plants, power plants, schools, administration and recreation buildings. The island has two 7,800 foot paved runways and a control tower.

The current population of Adak is approximately 320. Recent employment on the island has been directed toward environmental cleanup associated with closure of the base. However, commercial fishing activities and support facilities are anticipated to form the economic base for the community. The Aleut Corporation hopes to develop the community as its economic activities are expanded and diversified to provide employment opportunities for residents. In 1998, Norwegian owned Adak Seafood Company began operations on Adak, focusing on P.cod (as well as pollock, Atka mackerel, halibut and brown king crab). This company was recently sold its operations to Norquest Seafoods, Inc.

In March 1999, the Alaska Board of Fisheries established a limited fishery in State waters, adjacent to Adak, for P.cod and rockfish. Fishing is limited to vessels 60 feet in length or less, using jig, longline or pot gear. This measure is intended to encourage development of a local resident fleet.

No alternative fishery resource appears available to Adak fishermen and processors that could ameliorate significant reductions in P.cod landing that might be associated with one or more of the Steller/P.cod mitigation dispersion principles. Neither do there appear to be non-fishery based opportunities, at least in the short run, which could be developed to reduce any adverse economic impacts of such a change in regional P.cod harvesting and processing.

5.5.3.6 Chignik

Chignik is a small community on the south side of the Alaska Peninsula on Anchorage Bay. It is 450 miles southwest of Anchorage and 260 miles south of Kodiak. The area encompasses three small communities, known as the ‘Chigniks’.

Chignik has a new boat harbor constructed in cooperation with the Corps of Engineers. There is a State-owned 2,600 foot gravel airstrip.

Chignik has a 1999 DCRA certified population of 103. Chignik has long been known for the its sockeye fisheries that take place in Chignik Lagoon and nearby waters. There are two major processing plants in the community. Traditional species landed and processed in Chignik include salmon, herring, halibut, P.cod and crabs. P.cod is a relatively modest, but important fishery for Chignik residents. Landings of P.cod have ranged from 1 million to 5 million pounds in recent years. In 1999, 43 vessels participated in the State managed P.cod fishery. Of the total, 33 vessels used pot gear, 10 vessels used jig gear, and 2 vessels used both types of gear.

P.cod activity in Chignik occurs in the State managed fishery and will not be directly affected by reductions in P.cod landing that might be associated with one or more of the proposed Steller mitigation principles and associated FMP alternatives. However, measures implemented in federal waters may be applied to the State-managed fishery in the future. If this comes to pass, the level of commercial fishing activity in Chignik could be significantly diminished, with substantial adverse economic and socioeconomic implications for these small communities.

5.5.3.7 Cordova, Seward, and Homer

While Cordova, Seward, and Homer do not rank among the top “P.cod-dependent” port communities in Alaska, they do actively participate in the Prince William Sound fishery for P.cod, and also provide support services to fishermen operating in the Gulf. Aspects of the proposed Steller sea lion mitigation action, under consideration, may significantly effect the prosecution of this target fishery. Therefore, the action may have direct and indirect implications for these three communities. Each is profiled below.

Cordova is located at the southeastern end of Prince William Sound, in the Gulf of Alaska. The community was built on Orca Inlet, at the base of Eyak Mountain. It lies 52 air miles southeast of Valdez and 150 miles southeast of Anchorage.

The 1999 DCRA certified population was 2,435. Cordova has a land area of 4.6 square miles. The area has historically been the home to Aleuts, with the addition of migrating Athabascan and Tlingit natives who called themselves Eyaks. Alaskan Natives of other descents also settled in Cordova. Orca Inlet was originally named "Puerto Cordova" by Don Salvador Fidalgo, in 1790.

One of the first producing oil fields in Alaska was discovered at Katalla, 47 miles southeast of Cordova, in 1902. The town of Cordova was named in 1906, by Michael Heney, builder of the Copper River and Northwestern Railroad. Cordova became the railroad terminus and ocean shipping port for copper ore from the Kennecott Mine up the Copper River. The first trainload of ore was loaded onto the steamship "Northwestern," bound for a smelter in Tacoma, Washington, in April 1911. The Bonanza-Kennecott Mines operated until 1938 and yielded over $200 million in copper, silver, and gold. The Katalla oil field produced until 1933, when it was destroyed by fire. Fishing became the economic base in the early 1940s.

Today, Cordova has a majority non-Native population, but sustains a significant Native community with an active Village Council. Commercial fishing and subsistence are central to the community's culture.

Cordova supports a large fishing fleet, for Prince William Sound, and several fish processing plants. Three hundred ninety-three residents hold commercial fishing permits, and nearly half of all households have someone working in commercial fish harvesting or processing. Copper River red salmon, pink salmon, herring, halibut, and groundfish, among other species, are harvested and processed locally.

The largest employers are seafood processing companies, the Cordova school district, hospital, city government, and the State Department of Transportation. The U.S. Forest Service and the U.S. Coast Guard maintain personnel in Cordova, as well. In 1989, the Prince William Sound Science Center was established to study and monitor the ecosystem of the Sound.

Cordova is accessed by plane or boat. It is linked directly to the North Pacific Ocean shipping lanes through the Gulf of Alaska. It receives year-round barge service and State Ferry service in the summer. Harbor facilities include a breakwater, dock, a 500-slip small boat harbor, boat launch, boat haul-out, a ferry terminal, and marine repair services.[47]

Seward is situated on Resurrection Bay on the southeast coast of the Kenai Peninsula, 125 highway miles south of Anchorage. It lies at the foot of Mount Marathon, and is said to be the gateway to the Kenai Fjords National Park. Seward has a DCRA certified population in 1999 was 3,010 and a land area of 15.4 square miles. Seward is primarily a non-Native community, although the Mount Marathon Indians are very active in the community.

As the southern terminus for the Alaska Railroad and highway link to Anchorage and the Interior, Seward has long been a transportation center. The economy has diversified with tourism, commercial fishing and processing, ship services and repairs, oil and gas development, a coal export facility for Usibelli Mine, a State Prison, and the University of Alaska's Institute of Marine Sciences. The new $52 million Alaska SeaLife Center was scheduled to open in May 1998.

[47] Alaska Department of Community and Regional Affairs. 1999.

Eighty-one residents hold commercial fishing permits. Seward hosted tourists from over 110 cruise ship dockings in 1997. Over 200,000 travelers toured the Kenai Fjords National Park visitors center in Seward in 1996.

As noted, Seward is connected to the Alaska Highway system by the Seward Highway. Daily air services and charters are available at the State-owned airport. The Port serves cruise ships, the State Ferry, cargo barges and ocean freighters from Seattle and overseas. The small boat harbor has moorage for 650 boats, and two boat launch ramps. The Alaska Railroad provides over 1.4 billion pounds of cargo transit each year, importing cargo for the Interior and exporting coal to the Pacific Rim. A new railroad depot was completed in the fall of 1997.

Homer is located at the southern terminus of the Sterling highway, approximately 133 air miles southwest of Anchorage. It began as a mining community in the 1890's and developed mining and fish canneries. Homer has long provided moorage and support services to commercial fishers. The Icicle Seafoods plant on the Homer Spit burned recently, leaving the community without a fish processor.

Homer's 1999 DCRA certified population was 3,010. There is a small native population.

Homer has a diverse economy, based on commercial fishing, tourism, sport fishing, regional services and retail sales to peninsula residents. The community has developed as a cruise ship destination, with approximately 10 dockings each summer. Exports of wood chips are shipped from Homer, via a chip-loading facility.

As suggested, all three of these communities may incur indirect adverse impacts from adoption and implementation of the proposed P.cod/Steller mitigation action, although the extent of these impacts is likely (proportionately) smaller than for any of the other communities profiled in this section.

5.5.3.8 Regional Profiles of the Bering Sea, Aleutians, and Gulf of Alaska

An aggregated Regional overview of the small jurisdictions, dependent upon groundfish fishing, in general, and P.cod harvests, in particular, is included below. These summaries, which appear in, *Sector and Regional Profiles of the North Pacific Groundfish Fisheries* (in press), were prepared by Northern Economics, in association with KEA Environmental, Inc., in connection with the much broader Programmatic Environmental Impact Statement for all Bering Sea, Aleutian Islands, and Gulf of Alaska Fisheries, under development by NMFS Alaska Region. They, nonetheless, provide a useful overview, at a somewhat lower scale of detail, of these dependent regions, placing the proposed mitigation action in a clearer context. The complete document includes two additional regions, which are not reproduced below, but are referenced in the following text. Quoting from the report:

> Alaska Peninsula and Aleutian Islands Region
>
> Overview. AKAPAI region is in several ways the center of the Alaska groundfish fishery. The adjacent FMP area features the greatest groundfish harvest, and it sees activity from virtually all onshore and offshore fishery sectors. During 1991-1999, this region accounted for more than four times the volume of groundfish processed inshore in the other Alaska regions combined. This volume includes 89 percent of the pollock, 68 percent of the P.cod, 53 percent of the flatfish, and 20 percent of the ARSO processed. Relative dependence on the groundfish fishery varies across communities in the region: four of Alaska's top five groundfish landing ports are in this region, but some other communities have little if any direct involvement with the fishery.

Population. The AKAPAI region has the smallest population (6,934 in 1997) 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 4,178) 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, three (Akutan [population 408], King Cove [population 691], 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 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 1997, 2,989 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 1997.

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 have 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, pollock comprises more than 83 percent of the groundfish volume processed, P.cod 13 percent, and flatfish and ARSO 3 percent and 1 percent, respectively. This pattern by species varies considerably from patterns in other Alaska regions. At 544,100 total reported metric tons of groundfish 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 $325 million and a value of $598 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.

Processor Ownership. Though the center of 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 residents, and the number of smaller inshore plants owned varied between zero and two per year over the period 1991-1999. To the extent that economic benefits flow to the location of ownership, these benefits leave the region. Because of the small number of entities, information on volume and value of groundfish processed cannot be disclosed.

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. These vessels are owned primarily by Sand Point residents, with secondary clusters in Unalaska and King Cove. In 1999, these vessels employed 349 persons, with $3 million in payments to labor. In 1998, 97 percent of the retained harvest from these vessels came from the WG and CG FMP areas. About 59 percent was P.cod, and 40 percent was pollock.

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.

Processing Diversity. For the smaller groundfish processing plants in the region, groundfish roughly accounted for between 10 and 25 percent of ex-vesselvessel 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-vesselvessel 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.

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.

The following tables summarize information on regional engagement with the groundfish fishery.

NOTE: Table numbers have been retained from the original report

Table 3.10-37. North Pacific Groundfish Fishery Participation Measures for the Alaska Peninsula and Aleutian Islands Region by Year, 1991-1999

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	NA	1,503	1,463	1,631	1,850	1,996	1,860	1,752	1,997
Payments to Labor ($Millions)	NA	112	66	88	116	100	99	92	98
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	NA	518.3	534.2	551.7	567.2	548.2	532.5	486.5	544.1
Product (Thousands of Tons)	NA	153.1	152.6	172.8	183.2	177.6	176.2	165.2	191.0
Utilization Rate (Percent)	NA	29.5	28.6	31.3	32.3	32.4	33.1	34.0	35.1
Product Value ($Millions)	NA	374.0	217.9	291.4	386.6	331.6	330.5	304.4	325.2
Value per Ton ($)	NA	721.5	407.8	528.2	681.6	605.0	620.7	625.6	597.7
Processors Owned by Regional Residents									
No. of Processors Owned	0	0	1	1	4	3	3	2	2
Reported Tons (Thousands)	*	*	*	*	*	*	*	*	0

Wholesale Value ($Millions)	*	*	*	*	*	*	*	*	*
Catcher Vessels Owned by Regional Residents									
No. of Catcher Vessels	74	87	52	80	93	91	103	89	NA
Employment (Persons)	285	291	203	298	360	340	378	349	NA
Payments to Labor ($Millions)	2.5	2.3	1.4	1.8	2.0	3.1	3.9	3.0	NA

* Value suppressed due to the confidentiality of the data.
NA = Not available

Table 3.10-38. Groundfish Reported by BS Pollock and Alaska Peninsula and Aleutian Island Inshore Plants by Species, 1999

	Total Reported Harvest by Species				
	FLAT	ARSO	PCOD	PLCK	Total
Reported Tons (Thousands)	9,501	4,057	56,111	474,401	544,070

Source: NMFS Blend Data, 1991-1999.

Table 3.10-39. Retained Harvest by Catcher Vessels Owned by Residents of the Alaska Peninsula and Aleutian Islands Region by FMP Subarea, 1998

	Retained Harvest and Ex-vesselVessel Value by FMP Subarea					
	AI	BS	WG	CG	EG	Total
Retained Tons (Thousands)	0.0	0.7	19.0	8.0	a	27.8
Ex-vesselVessel Value ($Millions)	0.0	0.4	5.4	1.6	a	7.4

[a] Due to the confidentiality of the data presented, this value has been added to the CG value.

Table 3.10-40. Retained Harvest by Catcher Vessels Owned by Residents of the Alaska Peninsula and Aleutian Islands Region by Species, 1998

	Retained Harvest and Ex-vesselVessel Value by Species				
	ARSO	FLAT	PCOD	PLCK	Total
Retained Tons (Thousands)	0.2	0.0	16.3	11.2	27.8
Ex-vesselVessel Value ($Millions)	0.3	0.0	5.5	1.5	7.4

Kodiak Island Region

Overview. AKKO encompasses the Kodiak Island Borough (KIB) and other parts of the Kodiak archipelago. 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. The region accounted for almost 14 percent of the volume of groundfish processed inshore in all regions of the state (1991-1999). This volume included 9 percent of the pollock, 24 percent of the P.cod, 41 percent of the flatfish, and 27 percent of the ARSO category of groundfish processed.

Population. 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. 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 terms of aggregated statistical economic sector measures, fishing and fish processing activities rank first for this region. This sector provides an important base for the retail, service, and government sectors, which follow it in relative size. The military sector is also significant, 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. Pollock comprises about 51 percent of the groundfish by volume processed in AKKO. P.cod makes up about 27 percent, flatfish about 15 percent, and ARSO about 7 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, utilization is higher and the value per ton of final product is higher.

Processing Ownership. Although Kodiak residents own both onshore and offshore processing facilities, onshore plants that process pollock and P.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. The total volume of groundfish processed by regionally owned processing facilities was 37,500 metric tons: about 16 percent pollock, 39 percent P.cod, 24 percent flatfish, and 22 percent ARSO. The value of the groundfish processed by these regionally owned facilities was $22.5 million: 60 percent from P.cod, only 3 percent from pollock, 20 percent from flatfish, and 17 percent from Atka mackerel, rockfish, sablefish, and other groundfish (ARSO).

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 numbers. Most of the fleet's fishing activity is in the CG, and product is delivered to Kodiak shore plants. Since 1991, catcher vessels owned by AKKO residents have harvested a significant amount of fish in the BS as well. In 1996 these vessels harvested about the same amount in the BS as in the CG. Since 1996, Kodiak-owned vessels have tended to harvest 2.5 to 3.5 times as much groundfish in the CG as in the BS. The 1999 harvest was 76,200 metric tons in 1999: 58 percent pollock, 31 percent P.cod, and about 13 percent in each of the other two categories. In value, P.cod contributed 43 percent, pollock about 30 percent, flatfish about 6 percent, and ARSO about 22 percent.

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. This pattern differs from what occurs in adjacent Alaska regions (AKAPAI and AKSC). More than 50 percent of the groundfish catcher vessels participate in the halibut fishery, and more than 33 percent participate in the salmon fishery.

Processing Diversity. Groundfish have accounted for roughly 30 to 45 percent of ex-vessel value for AKKO onshore processing plants from 1991 to 1998, with a general increase in value over this period. Groundfish are economically more important than any other species or species group, with salmon a relatively close second. Halibut, while relatively more important for AKKO than for AKAPAI, accounts for less than 25 percent of the ex-vessel value of groundfish for AKKO.

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).

The following tables provide summary information on regional engagement with the groundfish fishery.

Table 3.10-41. North Pacific Groundfish Fishery Participation Measures for the Kodiak Island Region by Year, 1991-1999

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999
Processor Employment and Payments to Labor									
Employment (Est. FTEs)	NA	455	557	502	561	429	473	534	574
Payments to Labor ($Millions)	7	26	27	29	31	25	24	27	29
Groundfish Processing by Regional Inshore Plants									
Reported Tons (Thousands)	NA	92.2	111.9	98.9	76.8	66.0	83.7	96.8	101.4
Product (Thousands)	NA	23.9	28.9	25.8	24.3	20.5	21.5	24.1	27.7
Utilization Rate (Percent)	NA	26.0	25.8	26.1	31.6	31.0	25.7	24.9	27.3
Product Value ($Millions)	NA	69.0	72.3	77.5	84.0	63.44	62.9	70.4	74.0
Value per Ton ($)	NA	748.4	645.8	783.9	1,093.7	960.5	751.5	727.2	729.9
Processors Owned by Regional Residents									
No. of Processors Owned	9	10	11	10	9	6	5	7	10
Reported Tons (Thousands)	38.8	74.7	79.4	78.9	43.4	32.7	38.2	32.4	37.5
Wholesale Value ($Millions)	NA	50.8	46.8	51.6	29.6	19.4	18.1	17.4	22.5
Catcher Vessels Owned by Regional Residents									
No. of Catcher Vessels	204	229	162	196	198	182	217	205	NA
Employment (Persons)	796	886	628	669	751	715	804	767	NA
Payments to Labor ($Millions)	8.7	10.6	8.5	8.7	10.7	11.3	12.4	8.9	NA

* Value suppressed due to the confidentiality of the data.
NA = Not available

Table 3.10-42. Groundfish Reported by Kodiak Inshore Plants by Species, 1999

	Total Reported Harvest by Species				
	FLAT	ARSO	PCOD	PLCK	Total
Reported Tons (Thousands)	8,659	9,814	30,738	52,143	101,354

Source: NMFS Blend Data, 1991-1999.

Table 3.10-43. Retained Harvest by Catcher Vessels Owned by Residents of the Kodiak Region by FMP Subarea, 1998

	Retained Harvest and Ex-Vessel Value by FMP Subarea					
	AI	BS	WG	CG	EG	Total
Retained Tons (Thousands)	0.0	16.9	2.2	56.8	0.3	76.2
Ex-Vessel Value ($Millions)	0.1	3.4	1.0	17.0	0.8	22.3

[a] Due to the confidentiality of the data presented, this value has been added to the CG value.

Table 3.10-44. Retained Harvest by Catcher Vessels Owned by Residents of the Kodiak Region by Species, 1998

	Retained Harvest and Ex-Vessel Value by Species				
	ARSO	FLAT	PCOD	PLCK	Total
Retained Tons (Thousands)	4.4	4.5	23.4	43.9	76.2
Ex-Vessel Value ($Millions)	4.8	1.3	9.7	6.6	22.3

5.6 Reporting and record keeping requirements

The proposed Steller sea lion mitigation action contains no new or revised record keeping or reporting requires. Therefore, there are no attributable costs or burdens to cite.

5.7 Other relevant Federal regulations

The foregoing analysis, contained in both the regulatory impact review and regulatory flexibility analysis sections of this document, provides extensive treatment and documentation of the close relationship which exists between the proposed P.cod/Steller sea lion mitigation FMP amendment and the recently enacted Steller/Atka mackerel and Steller/Pollock actions. All three actions share a common set of objectives, namely, to implement fishery management measures that reduce or eliminate competition between the respective fisheries (in the present case, P.cod) and Steller sea lions by precluding fisheries around rookeries and major haulouts and by dispersing the fishery over time and space to minimize the likelihood of locally depleting prey resources to foraging sea lions.

While the three related actions contain many common elements which influence the implementation, application, and effectiveness of the respective Steller sea lion mitigation proposals, there does not appear to be any duplication, overlap, or conflict between the related actions. Neither are there other pending Federal regulations, which can be identified, which would have such undesirable interactions with the proposed action.

5.8 Alternatives which minimize impacts on small entities

Among the suite of alternatives summarized in the proposed mitigation action, there are several specific provisions (in the form of suboptions) which, if adopted, would *explicitly* accommodate 'small entities', and thus diminish the potential burden on these special populations of concern. These suboptions are treated in detail in Section 4.10.3 in the RIR and include a range of provisions which seek to scale back the geographic scope of management restrictions, or reschedule season openings to provide additional operational flexibility and economic opportunity.

These optional alterations in the baseline Alternative 2 proposed action do provide greater possibilities for the continued participation (and economic viability) of small entities, by supplying expanded access (albeit somewhat more restricted than under the status quo) to near-shore CH areas in the BSAI and GOA management regions. As noted, while CH areas are important fishing areas to all components of this industry, small vessel operators are particularly dependent on fishing these areas. When compared to the larger vessels in the fleet small vessels face the additional constraints imposed by restricted mobility dictated by limitations of their physical plant, which makes access loss to near-shore areas doubly burdensome, all else equal. Whether these suboptions, which explicitly or implicitly account for and accommodate the limitations of small entities, simultaneously achieving the principal objectives of the action, remains to be fully evaluated.

Based upon the EA and RIR analyses, reported above, there would be expected to be the potential for significant adverse economic impacts on a substantial number of small entities, attributable to the proposed mitigation actions, as these terms are defined under RFA.

6.0 CONCLUSIONS

For conclusions see sections 3.1.7 and 3.2.1.4.

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8.0 LIST OF PREPARERS

David Ackley, John Lepore, Nina Mollett, Mary Furuness, Galen Tromble, Ben Muse, Sue Salveson
Sustainable Fisheries Division
National Marine Fisheries Service
Alaska Regional Office
P.O. Box 21668
Juneau, AK 99802

Shane Capron, Michael Payne, Tim Ragen
Protected Resources Division
National Marine Fisheries Service
Alaska Regional Office
P.O. Box 21668
Juneau, AK 99802

Elizabeth Sinclair, Lowell Fritz, Pat Livingston, Grant Thompson, Julie Pearce, Lew Queirollo
Alaska Fisheries Science Center
National Marine Fisheries Service
7600 Sand Point Way NE, BIN C15700
Seattle, WA 98115-0070

Cathy Coon
North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501-2252

Kristin Mabry
Alaska Department of Fish and Game
(Juneau Office)

Martin D. Smith
University of California, Davis
Davis, CA 95616

Dr. Jim Richardson
ResourcEcon
308 G. St., Suite 302
Anchorage, AK 99501

9.0 FIGURES - See the table of contents (in left window) for Figures 1 - 31

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APPENDIX 1 - Essential Fish Habitat

Introduction

The area affected by this action has been identified as EFH for all managed species in the BSAI and GOA. The following EFH Assessment will address the mandatory requirements of an assessment, incorporating the information required in 50 CFR 600.920(i) and enumerated in the Interim Final Rule (IFR)(62 FR 66531, December 19, 1997) implementing the EFH provisions of the Magnuson-Stevens Act. These requirements, which are dealt with by turn in the following sections, include the following:

- a description of the proposed action
- an analysis of the effects, including cumulative effects, of the proposed action on EFH, the managed species, and associated species, such as major prey species, including affected life history stages;
- the Federal agency's view of the action on EFH; and
- proposed mitigation, if applicable.

EFH is defined in the Magnuson-Stevens Act as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." (16 U.S.C. 1802 Sec. 3, 104-297). The IFR defines adverse effect as "any impact which reduces quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, or reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (62 FR, 66551, December 19, 1997).

An EFH assessment may incorporate by reference other relevant environmental assessment documents, such as an ESA Biological Assessment, another NEPA document, or an EFH Assessment prepared for a similar action.

The question addressed by this assessment is whether the proposed changes in the cod fishery will have an effect on EFH different from the effect the fishery normally has. The common sense answer is that if fishing is reduced in Steller sea lion critical habitat areas, the effects on EFH will also be reduced in those areas, and if some of the fishing effort moves to areas which are not currently heavily fished, the benthic habitat in those areas will see more disturbance of the types explained in section 3.7.3 below. This assessment includes a condensed analysis of the effect on EFH of the fishing gears used in the cod fishery, primarily the effect of bottom trawl gear, which has been the primary focus of gear research. For more detailed information, please consult the EA for the 2000 groundfish specifications (NMFS 1999), along with the EA for the EFH Amendments to the Alaska Region FMPs (NMFS 1998a) and the EIS for the groundfish specifications (NMFS 1998b). A comprehensive analysis of the effects of fishing gear will be part of the expanded EIS for the groundfish fisheries currently under preparation by NMFS. It must be stressed that the action under consideration here will not change the TAC and probably will not change the proportion of gear used in the fishery.

Description of Action

For a detailed description of the proposed action, please see Section 2.3 of this EA/RIR/IRFA. Three alternatives are under consideration. Alternative 1 proposes little or no change in the current allocation of cod by seasons or sectors. Alternative 2 would split the TAC into two seasons, cap the amount of TAC that could be taken within the SCA or within critical habitat, and split the BSAI into two management areas, each with its own TAC. Alternative 3 would prohibit all fishing in the SCA and would temporarily allocate the amount of cod taken outside of critical habitat into three seasons.

Analysis of Effects

The Pacific cod fishery is the second largest Alaskan groundfish fishery. In 1999, the TACs for Pacific cod constituted nine percent of the combined groundfish TAC in the BSAI and 22% of the combined TAC in the GOA. It is also a complex fishery which employs four kinds of gear: trawl, longline, pot, and jig gear. Any major industrial fishery such as this one will have some impact on EFH. Trawling in particular has effects on the benthic habitat which have been the subject of considerable recent research worldwide. Indirect effects of removing the targeted catch and associated bycatch include changing the proportions of species and, within species, changing age, size and sex proportions.

The purpose of this assessment, again, is not to examine the effects of the fishery on EFH per se but to try to assess the effects on EFH of proposed changes in the fishery. Although the goal of the rule is to benefit habitat for Steller sea lions, it does not necessarily follow that all the effects of the rule will be beneficial to EFH for all managed species. An action which changes the geographical and seasonal patterns of the fishery in order to reduce competition with Steller sea lions may have adverse effects on habitat in areas where fishing concentration increases as a result.

Description of EFH for Species Affected by Action

The area affected by the proposed action, since it consists of the entire EEZ under management by the Council, by definition includes EFH for all of the FMP managed species, at all life stages. EFH for these species at each life stage, to the extent that it is understood, is described and identified in five FMP amendments which were approved January 20, 1999. These are: Amendment 55 to the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area; Amendment 55 to the FMP for Groundfish of the Gulf of Alaska; Amendment 8 to the FMP for the Commercial king and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands; Amendment 5 to the FMP for Scallop Fisheries off Alaska; and Amendment 5 to the FMP for the Salmon Fisheries in the Exclusive Economic Zone off the Coast of Alaska.

The species under management are categorized as follows in the FMPs: walleye pollock, Atka mackerel, Pacific cod, deep water flatfish, Rex sole, shallow water flatfish, flathead sole, arrowtooth flounder, sablefish, other slope rockfish, Pacific ocean perch, shortraker and rougheye rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, and "other species": sharks, skates, sculpins, squid and octopus.

Seven prohibited species are taken incidentally in the groundfish fisheries: Pacific salmon, steelhead trout, Pacific halibut, Pacific herring, Alaska king crab, Tanner crab, and snow crab.

Forage fish species may also be considered in an EFH assessment. These are abundant fishes that are preyed upon by commercially important groundfish species, marine mammals and seabirds. They are defined in NMFS regulations (CFR 50 Sec. 679.2) to include all fish of the following families: *Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae*; and species in the Order *Euphausiacea* (krill). If an activity negatively affects these species, it would be considered an indirect effect on EFH, since they are prey for managed species.

Gear Use in the Pacific Cod Fishery

Direct effects to the substrate and water are primarily caused by fishing gear which touches the bottom. Pacific cod is the only groundfish species that is not harvested predominately by one type of gear, and the only kind that is caught in pots. In 1999, 47.5% of the P. cod catch was taken by trawls, 37.9% by hook and line gear, and 14.6% by pots. In 1995, the respective percentages were 19.8%, 15.8%, and 6%. The large decrease in the percentage taken by trawlers and longliners is accounted for by the recent substantial increase in pot gear use (partly attributable to closure of the *C. opilio* fishery. Table 1 gives the Pacific cod catch off Alaska by area and gear over the 1994-1999 period (Hiatt and Terry 1999), and, for comparison, the entire groundfish catch by gear. Although the percentage of cod catch taken by trawls has decreased, Pacific cod is still the largest bottom trawl fishery in Alaska. The pollock fishery, which accounted in 1998 for 65% and in 1999 about 57% of the groundfish catch, is by law entirely a pelagic fishery in the Bering Sea, and has a small bottom trawl component in the GOA.

Bottom Trawl Gear

Bottom trawl gear is the focus of most of the concern about fishing gear used in the North Pacific. The following is a concise summary of some of the information available on these effects. For more information, please consult the 1998 EIS for the groundfish fisheries (NMFS 1998b) and the EA for the year 2000 specs (NMFS 1999). NMFS is preparing a new EIS for the groundfish fisheries which will also contain comprehensive information on trawling effects.

<u>Trawl Research in Alaska</u>
Some studies have been done on the Alaska fisheries. In order to study the long-term effects of trawling on the benthos in the eastern Bering Sea, McConnaughey *et al.* (1999) conducted a study on megafauna populations in a shallow, soft-bottom area. The researchers collected samples of 92 taxa at 42 pairs of adjacent heavily-trawled and untrawled sites. The following generalizations were drawn from multi- and univariate statistical tests and raw patterns in the data: (1) sedentary megafauna (e.g., anemones, soft corals, sponges, whelk eggs, ascidians), neptunid whelks and empty shells were more abundant in the unfished (UF) area; (2) mixed responses were observed in motile groups (e.g., crabs, sea stars, whelks); and (3) overall diversity and niche breadth of sedentary organisms (e.g., sponges, anemones, soft corals, stalked tunicates) indicated that long-term exposure to bottom trawling, at least in the experimental area, reduces diversity and increases patchiness of this epibenthic community.

A study by Freese *et al.* (1999) trawled eight sites in August 1996, using a chartered trawler with a Nor'eastern bottom trawl, modified with 0.6-m tires in the bosom and fitted with 0.45-m rockhopper discs and steel bobbins along the wings. From a research submersible, the researchers videotaped each trawl path and a nearby reference transect to obtain quantitative data. They found that a single trawl pass affected the dominant features on the seafloor, displacing a significant number of boulders and removing or damaging large epifaunal invertebrates. A significantly lower density of sponges and anthozoans was found in the trawled transects than the reference transects, and more of these organisms were damaged in the trawled transects. Close to 70% of vase sponges, 55% of sea whips, over 20% of brittle stars and 13% of finger sponges were damaged. The study detected no change in the density of most motile invertebrates, nor damage to them. A subsequent survey at these sites will address longer-term issues, including whether delayed mortality of apparently undamaged invertebrates may have resulted in greater impact than the study detected, or, or the other hand, whether some invertebrate may recover from the damage. The study addressed only single tows to seafloor habitats; the authors note that areas subjected to multiple impacts would probably show a greater reduction in density of the affected taxa and increased damage to these organisms.

Table 1. Groundfish catch off Alaska by area, gear and species groups, 1994-1998 (1,000 mt, round weight)(NPFMC 1999).

Year	GOA	BSAI	All Alaska	GOA	BSAI	All Alaska
		Pacific Cod			**All Groundfish**	
		All Gear			***All Gear***	
1994	9	193	224	233	1,947	2,180
1995	29	245	313	212	1,930	2,141
1996	24	241	309	201	1,849	2,050
1997	22	257	326	228	1,831	2,059
1998	21	196	257	244	1,621	1,865
1999						
		Trawl			***Trawl***	
1994	2	99	131	195	1,829	2,025
1995	2	122	163	164	1,782	1,946
1996	2	113	159	162	1,699	1,860
1997	2	111	160	193	1,654	1,847
1998	1	82	123	208	1,476	1,685
1999						
		Longline			***Longline***	
1994	7	86	93	29	108	137
1995	11	103	114	32	127	158
1996	10	95	105	27	117	144
1997	11	124	135	25	154	180
1998	10	100	110	25	130	155
1999						
		Pot Gear			***Pot Gear***	
1994	--	8	--	--	8	--
1995	16	20	36	16	20	36
1996	12	33	45	12	33	45
1997	9	22	31	9	22	31
1998	10	14	24	10	14	24
1999						
		Jig Gear			*Jig Gear*	
1994						
1995						
1996						
1997						
1998						
1999						

The effects on invertebrates found by the Freese study have implications for managed species such as king crab (*Paralithodes camtschaticus*) nd Tanner crab (*Chionocetes bairdi*). Epifaunal invertebrates are structural components of fish habitat, providing cover for demersal fishes. When boulders are displaced, they can still provide cover, but displacing piles of boulders reduces the number and complexity of crevices. The researchers observed that various taxa, primarily rockfish (*Sebastes* spp.), use cobble-boulder and epifaunal invertebrates for cover, but it was not clear to them which elements of the habitat are required. Other studies have noted the preference of rockfish for different kinds of cover. Although reducing the number of sponges and associated invertebrate taxa reduces the shelter value of the invertebrate community, it is not known whether this change produces a measurable difference in recruitment for any taxon. Freese and his co-authors (1999) speculate however that extensive trawling over wide areas could impact the spatial patterns of invertebrate diversity for species which are vulnerable to trawl damage.

General observations on trawling applicable to North Pacific

In a review of 22 studies worldwide, Auster and Langton (1999) found that despite their wide geographic range, from tropical to boreal, all studies showed similar classes of impacts. They found that mobile fishing gear reduced habitat complexity in three ways: (1) the epifauna is removed or damaged; (2) sedimentary bedforms are smoothed and bottom roughness is reduced, and (3) taxa which produce structure, including burrows and pits, are removed. These findings are consistent with the findings of the Alaska studies discussed above. Also applicable to the Alaska situation is the idea that environmental variables, including the make-up of the bottom, depth of the water column, oxygen content in bottom layers (Krost 1993), and natural wind stress (Riemann and Hoffman 1991), will play a role in determining the severity and direction of impacts.

Another review , conducted by the International Council for the Exploration of the Seas (ICES) reviewed evidence for the effects of fishing gear on the benthic ecosystems of the North and Irish Seas (ICES 2000). Like the Auster and Langton study, it found strong evidence for removal of major physical features, changes in seafloor structure, and reduction of structural biota. The report also found strong evidence, which could not always be attributed unambiguously to bottom trawls, that trawling leads to a reduction in the geographic range of species and changes in the relative abundance of species. Furthermore, the report found moderately strong evidence for decreases to species with low turnover, and for increases in scavenger populations and species with high turnover rates. Unlike the Auster and Langton review, the ICES review found only weak evidence for reductions in habitat complexity and disproportionate reductions in fragile and surface living species. While this was a significant report, its applicability to Alaska fisheries is limited: those seas have much longer fishing histories, covering most of the last millennium; and a large proportion of the fishing there, and most of the reviewed research, was done with beam trawls, a gear that is not used in Alaska fisheries and that is radically different in many respects from the otter trawls used off Alaska.

Cumulative and long-range effects from bottom trawl gear

Some evidence exists that the effect of trawling on both bedforms and invertebrates that live on them is cumulative. Some studies (e.g., Prena *et al.* 1999) indicate that invertebrates become more patchy and decrease in abundance with multiple trawls. Smoothing caused by multiple trawls removes, at least temporarily, patchy biogenic depressions, which are important habitat features for juvenile fish. It also moves boulders, which are an important characteristic in the GOA, but not on the shallow shelf of the EBS (Jones 1992, Kaiser and Spencer 1996, Reise 1982). The probability of a particular spot being dragged over by a full net might also increase in a densely trawled area. Finally, multiple trawls in an area could increase the cumulative effect of the winnowing phenomenon described above.

Relatively few studies worldwide have carefully examined long-term effects of bottom trawling, primarily due to an absence of proper control areas. In their review of trawl studies, Auster and Langton (1999) caution that it is not easy to characterize the long-term effects of fishing on the benthic community structure.

> “The pattern that does appear to be emerging from the available literature is that communities that are subject to variable environments and are dominated by short-lived species are fairly resilient. Depending on the intensity and frequency of fishing, the impact of such activity may well fall within the range of natural perturbations. In communities that are dominated by long-lived species in more stable environments, the impact of fishing can be substantial and longer term.

Generalizations about trawl-related effects on the benthos and relative sensitivities of different habitat types should be considered with caution, however, because of important differences in scientific methods and the likelihood of site-specific responses. For example, Thrush *et al.* (1998) also 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, McConnaughey's recent work in the Bering Sea did, in fact, demonstrate significant overall differences in benthic populations and community structure in a high-energy soft-bottom environment with long-term exposure to bottom trawling (McConnaughey *et al.* 2000). Although the study area was generally deeper (44 to 52 m) than the study areas supporting Thrush's statement, it was nevertheless located well within the depth range for seabed disturbance by storm waves and is clearly affected by strong tidal flow, given the prevalence of sand waves in the area. 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 thus were focused on short-term, acute impacts, while the Bering Sea study considered differences attributable to a long history of trawling (or not) and thus addressed more chronic effects. Small-scale experiments such as most of those examined in the Auster and Langton study are usually done in reasonably homogeneous habitats and over short time scales and could miss chronic, 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).

Little work has been done showing a direct connection between the effects of trawling on habitat complexity and the population of managed fish. None has been done in the North Pacific. A study in western Australia (K. J. Sainsbury 1988) concluded that alteration of the area of different types of habitat would be likely to alter community composition. This conclusion was based on an analysis of the catch per unit effort of certain fish species in the paths of photographed trawl paths which had classified into habitat types by cluster analysis of the presence and approximate size of the epibenthic fauna in each photograph.

Thrush *et al* conclude that, although unequivocally linking structural changes to changes in ecosystem function is difficult, the weight of evidence should be of concern. Auster and Langton (1999) similarly conclude that primary information is lacking which would be necessary to strategically manage fisheries without invoking precautionary measures.

Longline Gear[48]

Very little information exists regarding the effects of longlining on benthic habitat. Observations of halibut gear made by NMFS scientists during submersible dives off southeast Alaska provide some information (NPFMC 1992). The following is a summary of these observations: "Setline gear often lies slack on the sea-floor and meanders considerably along the bottom. During the retrieval process, the line sweeps the bottom for considerable distances before lifting off the bottom. It snags on whatever objects are in its path, including rocks and corals. Smaller rocks are upended, hard corals are broken, and soft corals appear unaffected by the passing line. Invertebrates and other lightweight objects are dislodged and pass over or under the line. Fish, notably halibut, frequently moved the groundline numerous feet along the bottom and up into the water column during escape runs disturbing objects in their path. This line motion was noted for distances of 50 feet or more on either side of the hooked fish."??

A potential problem that does occur with longline gear is ghost fishing of lost gear. Lost longline gear may continue to catch fish as as long as bait exists on the hooks. Fish caught on the hook may itself become a form of bait for subsequent fish. Not until all of the hooks are bare, will this lost gear stop fishing. The extent to which this occurs and its effects on habitat have not been analyzed.

[48]This section is from the EA for the EFH amendments (NMFS 1998, p. 319); there are some minor edits.

Pot Gear[49]

Pot gear is used in the North Pacific to harvest crabs and groundfish. This gear type likely affects habitat during the process of settling and retrieving pots; however, no research has been conducted to date.

Like longline gear, lost pot gear has the potential to cause ghost fishing. Biodegradable panels are required on pots to limit this effect, but they will continue to fish until the pot deteriorates. Lost pot gear may also add vertical structure to the seafloor which could be used by anemones and other organisms.

Jig Gear

No studies have been done to our knowledge on the effects of jig gear on habitat in the North Pacific.

Indirect Effects on the Fishery

<u>Loss of Prey</u>

Loss of prey for a managed species is listed in the Interim Final Rule as an indirect adverse effect on EFH. Actions that significantly reduce the availability and population of a major prey species, either through direct harm, capture, or adverse impacts to the prey species' habitat, may be considered to have adverse effects on a managed species and its EFH. The action under consideration here has been developed with the intention of reducing competition for prey, specifically Pacific cod, with Steller sea lions. It is possible however that as the fishery concentrates in other areas, the catch of Pacific cod and bycatch species will reduce prey for other fish species in those areas. In other words, it is common sense to say that any action taken to change the fishery in substantial ways will have a multitude of complex effects on prey-predator proportions throughout the waters being fished, many of them unpredictable. However, it is not being proposed to change the TAC and it is unlikely that these changes will substantially affect the availability of prey for managed FMP species.

<u>Effect of action on species growth and fecundity</u>

Reduction of species fecundity is another item listed in the IFR as an indirect adverse effect on EFH. Such an effect might be expected if food intake to support reproduction for any managed species were reduced. No such effect is expected from this action.

Agency Views of Proposed Action

The action under consideration has been designed to increase the availability of Pacific cod to Steller sea lions in their critical habitat. The TAC for cod is not expected to change. To the extent that fishing is reduced in Steller sea lion critical habitat and SCA areas, some reduction in the effects of fishing gear on EFH in those areas may also be expected. However, the fishing effort will shift elsewhere. Fishing, and the effects of fishing on benthic habitat, will increase in some areas. Testimony from the fishing fleet is that cod will be much harder to find, especially in winter, outside the Steller sea lion management areas. To the extent this is true, and that CPUE is lower as a result of this action, there may be more trawling per ton of fish caught, and concomitantly more pressure on EFH in those areas. Furthermore, there could be cumulative effects from this action combined with other actions to protect Steller sea lions from competition with the Atka mackerel and pollock

[49]Ibid., p. 320.

fishery (which, however, is entirely pelagic in the BSAI and mostly pelagic in the GOA). Without knowing in advance where the fishery will concentrate and whether CPUE will actually be effected, such effects are largely unpredictable, but it is worth noting that the proposed alternatives entail some potential for adverse localized effects to EFH.

Mitigation

This action is aimed at reducing food competition with the endangered western population of Steller sea lions and any adverse effects on EFH for managed species will be localized and unpredictable. Therefore, mitigation efforts have not taken place for this action, although numerous actions have been taken to mitigate the effects of groundfish fishing generally in the North Pacific (see EFH assessment for 2000 TAC, NMFS 1999). Many vulnerable areas to which the fishery might otherwise move are already protected from trawling. A list of all closed or seasonally closed areas, accompanied by maps, can be found at the NPFMC website, http://www.fakr.noaa.gov/npfmc/Reports/closures.pdf. A consultation with the NMFS Alaska Region Habitat Conservation Division is taking place on this action.

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APPENDIX 2 - Possible Localized Depletions of Pacific Cod in the Eastern Bering Sea