# APPENDIX F-4

## Qualitative Analysis Paper

## Steller Sea Lion Protection Measures

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ABC | acceptable biological catch |
| BiOp | Biological Opinion |
| BSAI | Bering Sea/Aleutian Islands |
| CDQ | Community Development Quota |
| EBS | Eastern Bering Sea |
| EFH | Essential Fish Habitat |
| ESA | Endangered Species Act |
| FMPs | Groundfish Fishery Management Plans |
| GOA | Gulf of Alaska |
| HAPC | Habitat Areas of Particular Concern |
| HCR | Harvest Control Rule |
| MMPA | Marine Mammal Protection Act of 1972 (amended 1994) |
| MPAs | Marine Protected Areas |
| nm | nautical miles |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NOAA Fisheries | National Marine Fisheries Service |
| NPFMC | North Pacific Fishery Management Council |
| NRC | National Research Council |
| OFL | overfishing level |
| OPR | Office of Protected Resources |
| PSC | prohibited species catch |
| RPA | Reasonable and Prudent Alternatives |
| SAFE | Stock Assessment and Fishery Evaluation |
| SEIS | Supplemental Environmental Impact Statement |
| TAC | total allowable catch |
| USFWS | U.S. Fish and Wildlife Service |
| VMS | Vessel Monitoring System |

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# Steller Sea Lion Protection Measures

## 1.0 Introduction

Since the listing of Steller sea lions under the Endangered Species Act (ESA) in 1990, Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Groundfish Fishery Management Plans (FMPs) have been modified to include measures designed to protect Steller sea lions from deleterious effects that may result from groundfish fisheries. These measures (referred to as the Steller sea lion Protection Measures) were developed and adopted to ensure that the groundfish fisheries would not jeopardize the continued existence of Steller sea lions or adversely modify their critical habitat, as required by the ESA. The purpose of this qualitative impact assessment is to evaluate the effects of the Steller sea lion Protection Measures on Steller sea lions and other resources under a series of four alternative groundfish management policies, including the status quo, and to evaluate the effects of associated FMP scenarios as a proxy for each alternative.

The organization of this analysis provides background on the decline of the Steller sea lion, hypotheses for the decline, and a description of the current protection measures. The effects of these measures are discussed qualitatively by alternative and FMP "Bookend" followed by a comparison among all the options. A description of current research is also provided.

### 1.1 Regulatory Overview

There are two major laws that protect Steller sea lions and require the North Pacific Fishery Management Council (NPFMC) to address their conservation in the FMPs . The first is the Marine Mammal Protection Act of 1972 (amended 1994) (MMPA). This law places Steller sea lions under the jurisdiction of the National Marine Fisheries Service (NMFS), Office of Protected Resources (NOAA [National Oceanic and Atmospheric Administration] Fisheries, OPR). The goal of the MMPA is to provide protection for marine mammals so that their populations are maintained as a significant, functioning element of the ecosystem. The MMPA established a moratorium on the taking of all marine mammals in the United States with the exception of subsistence use by Alaska Natives. Under the authority of this Act, NOAA Fisheries, OPR monitors populations of marine mammals to determine if a species or population stock is below its optimum sustainable population. Species that fall below this level are designated as "depleted." Populations or stocks (e.g., the western stock of Steller sea lions) listed as threatened or endangered under the ESA, are automatically designated as depleted under the MMPA.

The ESA was enacted in 1973 and reauthorized in 1988. This law provides broad protection for species that are listed as threatened or endangered under the Act. Steller sea lions were considered for protection under the ESA due to the rapid decline in the western portion of its range over the last 30 years (Loughlin *et al.* 1990, Loughlin *et al.* 1992, York *et al.* 1996). On November 26, 1990, the Steller sea lion was listed as threatened under the ESA (55 FR 40204), and on August 27, 1993, critical habitat was designated based on observed movement patterns (58 FR 45269). In 1997, the Steller sea lion population was split into two separate stocks: the western stock which occurs westward from Cape Suckling (144° W) and the eastern stock which occurs east of 144° W from southeast Alaska to California (Bickham *et al.* 1996) (Figure 1). After separation of the two stocks, the western stock was listed as "endangered" in 1997 due to the continued

precipitous decline in this portion of its range (62 FR 30772). The eastern stock remains classified as "threatened."

The mandatory protection provisions of the ESA have led to numerous administrative and judicial actions and has brought the issue of fisheries/sea lion interactions under intense scrutiny. Section 7(a)(2) of the ESA requires federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of its designated critical habitat. For federal fishery management actions, the action agency, the National Marine Fisheries Service, Office of Sustainable Fisheries (NOAA Fisheries), is required under Section7(a)(2) to consult with the Steller sea lion expert agency, NOAA Fisheries OPR, to determine if the proposed action may affect Steller sea lions or their critical habitat. If the proposed action may affect Steller sea lions or its designated critical habitat, formal consultation is required. Formal consultation is a process between the action and expert agency that determines whether a proposed action is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. The process begins with the action agency's assessment of the effects of their proposed action on listed species and concludes with the issuance of a "Biological Opinion" (BiOp) by the expert agency. A biological opinion is a document which includes: a) the opinion of NOAA Fisheries OPR as to whether or not a federal action (such as federally authorized fisheries) is likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat; b) a summary of the information on which the opinion is based; and c) a detailed discussion of the effects of the action on listed species or designated critical habitat. If the BiOp concludes that the proposed action is likely to jeopardize the continued existence of threatened or endangered species or adversely modify critical habitat, then the expert agency recommends. Reasonable and Prudent Alternatives (RPAs) to avoid the likelihood of "jeopardy" or "adverse modification" of critical habitat. The resulting legal requirements limit the NPFMC from adopting FMP policies that result in a jeopardy finding for the Steller sea lions.

## 1.2 Steller Sea Lion Decline

### Western Stock

The primary reason for listing the western stock of Steller sea lions was its dramatic decline (>15 percent per year) in their core breeding areas during the 1970s and 1980s, leading to their protection under the ESA in 1990 (Loughlin *et al.* 1990, Loughlin *et al.* 1992). The rate of decline has slowed since that time but the population has continued to decline by about 4.2 percent per year between 1991 and 2002 at 84 trend sites (SAFE 2002) (Figure 2). However, surveys at trend sites have shown a slight increase of 5.5 percent between 2000 and 2002, the first region-wide increase in the last two decades. A similar trend was also documented within the Kenai-to-Kiska sub areas (70 sites between the Kenai Peninsula and Kiska Island, Western Aleutians), which showed an increase of 4.8 percent from the last surveys. The overall long-term trend, however, still showed a decline of 3.1 percent from 1991 to 2002 (SAFE 2002).

### Eastern Stock

The eastern stock of Steller sea lions has been increasing in size since the 1990s and does not appear to be in any jeopardy of extinction. Since 1990, this stock has shown an increase of 15.4 percent based on adult and juvenile counts at trend sites (SAFE 2002). Recent surveys of non-pups at 10 trend sites in Southeast

Alaska suggests no change in the long-term trend of regional increase at a rate of approximately 2 percent per year over the last decade (SAFE 2002). The eastern stock of the Steller sea lion may be at its highest abundance in recent history (Calkins *et al.* 1999). While still protected under the ESA, the eastern stock has not been the subject of nearly as much administrative action as the western stock.

**Hypotheses for Decline**

Although factors and mechanisms for the decline of the western stock of Steller sea lions have been, and continue to be, the subject of intensive research, it is generally thought that the decline is due to a combination of factors. These factors may include nutritional stress resulting from competition with fisheries, disease/parasitism, predation, regime shift/climate change affecting prey, and anthropogenic factors such as entanglement in fishing gear, intentional killing, or pollution/contaminants (Kruse *et al.* 2001, Ferrero and Fritz 2002, NRC 2002). The magnitude or contribution of some of these factors may have changed over the course of the decline, specifically between the period of rapid decline from the 1970s to 1990 and the more moderated rate of decline from 1990 to the present (NRC 2002). Hypotheses for the mechanism behind the decline fall into two general categories:

1. Bottom-up theories - physical and biological factors that affect the capacity of the environment to support sea lions. Some of the major carrying capacity factors include the following:

   – large-scale fishery removals have reduced the availability or quality of prey species;
   – climate change/regime shift in the late 1970s has changed the abundance or distribution of prey species;
   – non-lethal disease has reduced the foraging efficiency of sea lions; and
   – pollutants concentrated through the food web have contaminated fish eaten by the sea lions, possibly reducing their fecundity or increasing mortality.

2. Top-down theories - factors that affect the mortality of the sea lion independent of capacity of the environment to support sea lions. Top-down theories involve external forces such as predators, humans or pathogens. These mortality factors include the following:

   – predators such as killer whales or sharks have switched their prey preference to sea lions;
   – incidental take of sea lions through capture or entanglement in fishing gear has increased as a result of the expansion of commercial fisheries;
   – takes of sea lions in the subsistence harvest have been higher than estimated;
   – shooting of sea lions has been underestimated in the past and/or present; and
   – pollution or disease has increased mortality independently of effects of nutrition.

The National Research Council (NRC) (2002) considered that the decline observed in the 1970s and 1980s were precipitated by one or more bottom-up factors, such as competition with fisheries or climate change. The more gradual downward trends in the 1990s appear to have been influenced by top-down factors, such as predation (NMFS 2001a, NRC 2002).

However, these factors may be acting most strongly against juveniles between the time they are weaned and when they are grown to adult size and foraging capability (Kruse *et al.* 2001, Ferrero and Fritz 2002). Adult females may also be affected because of the physiological stress and limited geographic mobility when caring

for pups. Hence, much of the focus on minimizing human effects on these animals has been on protecting the integrity of food supplies near rookeries and haulouts (NMFS 2001a). This is a bottom-up factor that may be currently affecting Steller sea lions, a conclusion that the NRC (2002) also made. It is important to realize that the key issue for the survival and reproductive success of sea lions is not necessarily the total amount of fish that are present, but how available the prey are to foraging sea lions (NMFS 2001a). Major changes in the abundance and distribution of preferred prey species or prey patches may decrease foraging efficiency, thus exposing them to increased predation pressure from killer whales and sharks.

NOAA Fisheries evaluates the impacts of all federal actions that would adversely affect Steller sea lions and if it is determined that an action potentially would, management measures to alleviate the adverse effect are recommended by NOAA Fisheries. Since NOAA Fisheries cannot control climate and oceanic changes, like El Niño Events, or the behavior of killer whales, their management efforts are necessarily focused on minimizing the potential for the fisheries to induce localized depletions of prey, even though other factors may be involved in the population decline. The allocation of total allowable catch (TAC) among different seasons, areas, and gear types and fishing closures near rookeries and haulouts has been the main thrust of these management measures (NMFS 2001a).

Public policy debates, and several legal actions, have focused on the uncertainty of scientific evidence for a significant fisheries impact. While new research was initiated to address some of the scientific uncertainty, the NPFMC and NOAA Fisheries implemented a series of fishery management measures that assumed there were some adverse impacts from groundfish fishing to Steller sea lions as stated in the BiOps. The emphasis of the measures has been on distributing the fishery over broader temporal and spatial scales to minimize localized depletion of sea lions' prey, alleviating fishing pressure in nearshore zones around rookeries and haulouts and in important sea lion foraging areas, and instituting harvest limits to protect overall abundance of prey.

Along with these efforts to protect the food supply of sea lions, the amount of acceptable incidental take of sea lions by the fishery has also been greatly reduced. The previously legal and common practice of fishermen shooting at sea lions to kill them or chase them away from their gear has been prohibited.

## 2.0 Analysis of Alternatives

Four policy alternatives are under consideration by NPFMC. Each policy alternative contains two "bookends," or examples, containing a range of management measures that illustrate how the framework could be implemented. These bookends provide a level of detail that allows analysis and provides contrasting policies. They also provide a means for communicating to the public how the NPFMC intends to implement its preferred alternative, while allowing, under the ESA, the management flexibility to adaptively manage the fishery through future FMP amendments.

**Alternative 1 – Continue Under the Current Risk Averse Management Policy:** Under this alternative, NPFMC would continue to manage the groundfish fisheries based upon the present conservative and risk-averse policy. This policy assumes that fishing results in some adverse impacts to the environment and that, as these impacts become known, mitigation measures will be developed and appropriate FMP amendments will be implemented. The approach would be to continue the current Steller sea lion Protection Measures that are now in effect and continue to cooperate with U.S. Fish and Wildlife Service (USFWS) in

regards to ESA-listed species under their jurisdiction to protect ESA-listed marine mammals and seabird species.

**Alternative 2 – Adopt a More Aggressive Management Policy:** A less precautionary management policy (i.e., more aggressive harvest policy) would be implemented based upon the concept that the present policy is overly conservative and that higher harvests could be taken without threat of overfishing the target groundfish stocks. This policy assumes that fishing at the recommended levels would have no adverse impact on the environment, except in specific cases that are generally known. Steller sea lion Protection Measures under the Alternative 1 policy would be included in order to avoid a jeopardy finding under the ESA.

**Alternative 3 – Adopt a More Precautionary Management Policy:** This policy would seek to accelerate the existing precautionary management measures through community or rights-based management, ecosystem-based management principles and, where appropriate and practicable, increase habitat protection and impose additional bycatch constraints. Under this approach, additional conservation management measures would be taken as necessary to respond to social, economic, or conservation needs. Additional measures would be taken if scientific evidence indicated that the fishery was negatively impacting the "environment," not just a population of a given species. Steller sea lion Protection Measures under the Alternative 3 policy would further marine mammal and seabird policy objectives to include maintaining or adjusting Steller sea lion Protection Measures to further reduce the risk of fishery-related impacts on Steller sea lions. Adoption of this policy would also result in continuing cooperation with USFWS to protect ESA-listed species and to initiate joint research programs.

**Alternative 4 – Adopt a Highly Precautionary Management Policy:** This policy places the burden on the resource user to demonstrate that the intended use would not have a detrimental effect on the environment before significant fishing could be allowed. The policy, as illustrated by its FMP framework, would impose very restrictive conservation and management measures that would only be modified or relaxed when additional, reliable scientific information becomes available. It would involve a strict interpretation of the precautionary principle. Management discussions would involve and be responsive to the public, but decreased emphasis would be placed on industry and community concerns, and more emphasis would be placed on ecosystem concerns and principles, including the identification and incorporation of non-consumptive use values. The overall premise is that fishing causes adverse impacts on the environment, but due to a lack of information and uncertainty, little is known about these impacts. Policy objectives under this alternative include increasing existing protection measures for Steller sea lions by further restraining fisheries in critical habitat and by setting more conservative harvest levels of prey species.

# 3.0 Alternative 1: Continue Under the Current Risk Averse Management Policy

## 3.1 Management Approach

Under Alternative 1, the NPFMC would continue working toward the goals of maintaining sustainable fisheries, protecting threatened and endangered species, and protecting, conserving and restoring habitats of living marine resources through existing institutions and processes. Fisheries are managed through the current risk-averse conservation and management policy that is based on a conservative harvest strategy. Under this policy, fishery impacts indicated by scientific evidence are mitigated as necessary. This management policy is based on the assumption that fishing produces some adverse impacts to the environment and, as these impacts become known, mitigation measures are developed and FMP amendments are implemented.

The goal of the present FMP in regard to endangered Steller sea lions is to maintain the current Steller sea lion Protection Measures in order to avoid a "jeopardy" determination under the ESA. To reach this goal, NOAA Fisheries relies upon ongoing scientific research to describe and quantify how the fisheries impact sea lions and adjust their mitigation programs accordingly. Failure to maintain adequate protection measures not only harms the sea lions' chances of recovery by failing to ensure an adequate and sustainable prey field for Steller sea lions, but opens the fisheries to legal challenges under the ESA, which may shut down the industry.

## 3.2 Overview of the Current Fishery Management Plan Management Measures

NOAA Fisheries, OPR issued a series of BiOps through Section 7 Consultation from 1990 to 2001 that analyzed whether the groundfish fisheries were contributing to the decline of sea lion populations, causing adverse modification to their designated critical habitat and/or preventing their recovery (Table 1). The latest BiOp issued in October 2001, analyzed a series of protection measures developed by the NPFMC's Steller Sea Lion Mitigation Committee (also referred to as the RPA Committee) to ensure that BSAI and GOA groundfish fisheries do not jeopardize the continued existence of Steller sea lions or adversely modify their critical habitat. A range of alternatives, including the alternative developed by the Steller Sea Lion Mitigation Committee were analyzed in the Supplemental Environmental Impact Statement (SEIS), in November 2001 (NMFS 2001b). The Steller Sea Lion Committee was specifically charged with looking for ways to achieve several objectives:

1. protect waters around rookeries and haulouts to prevent localized depletion of prey and potential competition;

2. temporally disperse the fisheries to reduce the probability for localized depletion by pulse or derby fishing; and

3. spatially disperse the fisheries to reduce the probability of localized depletions from concentrations of catch in local areas.

The 2001 BiOp analyzed the impacts of the groundfish fishery as promulgated under the Preferred Alternative of the Steller sea lion SEIS, the "area- and fishery-specific approach." This latest BiOp concluded that the federally managed groundfish fishery and the parallel state-managed groundfish fishery (i.e., pollock and cod), if conducted according to the Steller sea lion Protection Measures, would not likely jeopardize the continued existence of either the western or eastern stocks of Steller sea lions, nor would the fisheries be reasonably likely to adversely modify Steller sea lion designated critical habitats (NMFS 2001a).

**Table 1. Chronology of events leading to the Steller Sea Lion Protection Measures in the BSAI and GOA Fishery Management Plans.**

| Date | Milestone |
|---|---|
| November 1990 | Steller sea lion (prior to splitting eastern and western stocks) is listed as "threatened" under the ESA. Protection Measures include prohibition on shooting, reduced wasteful take, limited disturbance at rookeries. |
| August 1993 | Steller sea lion "critical habitat" is designated around rookeries and haulouts (20 nm) west of 144°, along with terrestrial and air zones around these areas. Three special aquatic foraging areas in Alaska are also classified as SSL critical habitat: Shelikof Strait, Bogoslof, and Seguam Pass Foraging areas. Critical habitat for the eastern stock, east of 144°, includes 3,000-foot buffer zone around rookeries and haulouts. |
| January 1996 | BiOp on the FMPs for the BSAI and GOA on proposed 1996 TAC specifications and their effects on the Steller sea lion. Concluded these actions would not jeopardize Steller sea lion or adversely modify critical habitat. |
| May 1997 | Western stock of the Steller sea lion is listed as "endangered" and the eastern population remains "threatened" under the ESA. |
| December 3, 1998 | BiOp 1 on the FMPs authorizing the BSAI Atka mackerel fishery, BSAI pollock fishery, and the GOA pollock fishery. Found Atka mackerel fishery would not cause jeopardy. Pollock fisheries were found likely to result in jeopardy. RPAs developed for pollock fishery. RPAs challenged in court. |
| December 22, 1998 | BiOp 2 on the FMP for all groundfish fisheries in BSAI and GOA on proposed 1999 harvest specifications. Found no jeopardy if pollock measures to avoid jeopardy are enforced. |
| January 1999 | NOAA Fisheries implements management measures as part of BiOp 1 RPAs and publishes emergency interim rule. |
| June 1999 | NOAA Fisheries extends emergency rule for the remainder of 1999 season. |
| July 1999 | Legal challenge to BiOp 1. Court upholds no jeopardy for Atka mackerel and jeopardy for pollock findings, but remands the RPAs. |
| October 1999 | NOAA Fisheries revises RPAs and issues the Final Reasonable and Prudent Actions for the 2000 fishery. |
| December 1999 | BiOp on authorization of the BSAI and GOA groundfish fisheries, TAC for 2000, and American Fisheries Act. Concludes action would not cause jeopardy to Steller sea lion. |
| January 2000 | NOAA Fisheries modifies Protection Measures to conform to revised BiOp 1 RPAs and puts out an emergency rule implementing them. |
| January 2000 | Court finds BiOp 2 no jeopardy conclusion inadequate. |
| July 2000 | Court issues an injunction prohibiting fishing with trawl gear in SSL critical habitat west of 144° until NOAA Fisheries comprehensive BiOp is completed. |
| November 2000 | Comprehensive FMP BiOp (BiOp 3) for all groundfish fisheries and non federal fisheries published. Environmental baseline finds that the Pacific cod, Atka mackerel, and pollock fisheries results in jeopardy in regard to the Steller sea lion. RPAs are included to avoid jeopardy. |
| January 2001 | NOAA Fisheries issues an emergency rule containing a suite of management measures that phases in certain provisions of the RPAs. |

**Table 1 (continued). Chronology of events leading to the Steller Sea Lion Protection Measures in the BSAI and GOA Fishery Management Plans.**

| Date | Milestone |
|---|---|
| January 2001 | NPFMC establishes an RPA Committee to develop Protection Measures for rest of 2001 and for 2002 and seasons beyond. Amended RPA developed to meet the requirements of ESA. |
| June 2001 | NPFMC recommends four alternatives to be analyzed in the Steller Sea Lion Protection Measures SEIS with Alternative 4, the RPA Committee's recommendation, as the Preferred Alternative. |
| July 2001 | NOAA Fisheries re-initiates Section 7 Consultation under the ESA and draft 2001 BiOp. The preferred alternative in the SSL SEIS is analyzed in the 2001 BiOp, which is included as Appendix A in the SSL SEIS. |
| September 2001 | NPFMC selects Alternative 4 with modifications as it met the requirements of the ESA and has the least impact on the human environment. |
| October 2001 | Final SEIS on Protection Measures and 2001 BiOp is released. The conclusion in the 2001 BiOp in regard to Steller sea lions supercedes the conclusions in the FMP BiOp. Protection Measures are implemented by emergency interim rule. |
| January 2002 | Emergency interim rule is extended through July 8, 2002. |
| May 2002 | Emergency interim rule is extended through December 31, 2002. |
| September 2002 | NOAA Fisheries issued a proposed rule to implement Steller Sea Lion Protection Measures. |

Source: Federal Register January 8, 2002 Preamble to Interim Rule, Steller Sea Lion Protection Measures, Proposed Rule, September 4, 2002.

It is important to note that the 2001 BiOp does not predict the recovery of the western stock of Steller sea lions to any specific level. In fact, it predicts they will continue to decline even after all the protection measures are implemented (NMFS 2001a). This conclusion is based on the continuing presence of external environmental factors hypothesized to be contributing to the decline, such as killer whale predation and climate-induced oceanographic changes. The BiOp determined that the groundfish fisheries did not add any appreciable risk to the population's potential to exist or recover in the wild. In addition to the management measures described in the Steller sea lion SEIS preferred alternative, the BiOp required NOAA Fisheries to implement four additional management measures in order to remain in compliance with the ESA. These include the following:

- NOAA Fisheries will monitor the take of Steller sea lions in the pollock, Pacific cod, and Atka mackerel fisheries. NOAA Fisheries will maintain and utilize the existing Observer Program to assess the incidental take of sea lions in each fishery.

- NOAA Fisheries will monitor vessel location and compliance with gear and directed fishing restrictions for the pollock, Pacific cod, and Atka mackerel fisheries. NOAA Fisheries will require electronic Vessel Monitoring System (VMS) devices and other record-keeping and reporting measures in order to monitor directed fishing.

- NOAA Fisheries will monitor harvest of pollock, Pacific cod, and Atka mackerel in sufficient detail to determine appropriate fishery closures by sector, gear type, and area.

- NOAA Fisheries will manage critical habitat harvest limits in the Atka mackerel fishery using conservative management strategies to minimize the likelihood of exceeding a critical habitat harvest limit. This means that if any part of a haul occurs inside critical habitat or it is not clear where the fishing occurred, the entire catch will be counted against the critical habitat limit. Where the harvest limit is relatively small, NOAA Fisheries must project when the limit will be reached and pre-announce the closure date.

**Final Steller Sea Lion Protection Measures**

Current regulations for Steller sea lion Protection Measures can be found at the NOAA Fisheries website: http://www.fakr.noaa.gov/protectedresources/stellers/protection.htm. A summary of the major measures are presented in Table 2. These Steller sea lion Protection Measures were deemed necessary based on the hypophysis that the continued decline of the western stock of the Steller sea lion is due to nutritional stress and that groundfish fisheries contribute to this stress by competing with sea lions for their key prey species. Management measures were specifically developed to reduce competitive interaction between Steller sea lions and the groundfish fisheries (NMFS 2001a). Mitigation efforts have focused on protecting the integrity of food supplies near rookeries and haulouts. Competitive interactions with the fishery may have the greatest effect on juvenile Steller sea lions between the time they are weaned and the time they reach adult size and foraging capability as the diving capacity of juveniles (and thus available foraging space) is less than that of adults (Burns *et al.* unpublished). Adult females may also be susceptible to nutritional stress due to reduced prey availability in the vicinity of rookeries because of the limited foraging distribution and increased energetic demands when caring for pups. Specifically, the intent of the protection measures was to avoid competition around rookeries and important haulouts with extra precaution in the winter, and to disperse the fisheries outside of those time periods and areas.

These regulations reflect the proposed action analyzed in the latest BiOp (NMFS 2001a) with some minor adjustments by the NPFMC in October 2001 (Figure 3). Some of the major measures include the following:

- fishery closures and no-transit zones within 3 nautical miles (nm) of 39 major rookeries;
- fishery closures for Atka mackerel, pollock, and Pacific cod within 10 to 20 nm of specified haulouts and rookeries;
- closure of the Seguam Pass foraging area and most of the Bogoslof area to all gear types;
- gear and TAC restrictions in areas designated as Steller sea lion critical habitat (the areas within 20 nm of major rookeries and haulouts);
- TAC apportionments by gear type, season, and geographic area; and
- closure of the Aleutian Islands Management area to pollock fishing.

**Table 2. Summary of Steller Sea Lion Protection Measures for 2002.**

| Areas or Category | Protection Measure |
|---|---|
| All federally permitted vessels- BSAI and GOA | Fishery closures and no-transit zones within 3 nm of 39 major rookeries (considered the most sensitive for females with pups); the nearshore marine critical habitat is considered the most important to protect from the interactions between the groundfish fisheries and the Steller sea lion |
| All directed fisheries for pollock, Pacific cod and Atka mackerel | Modified harvest control rule (HCR) to prohibit directed fishing when the biomass reaches 20 percent of its unfished level |
| | Closures within 10 nm or 20 nm of selected haulout and rookery sites to pollock, Pacific cod, and Atka mackerel directed fisheries in BSAI and GOA |
| | Closure of the Seguam foraging area and most of the Bogoslof area to all gear types |
| | A Vessel Monitoring System (VMS) requirement |
| | Closure of the Chignik area for pot, trawl, and hook-line gear |
| | Closure within 10-20 nm of 46 rookeries and haulouts for hook and line fishing for Pacific cod, and 44 rookeries and haulouts for pot fishing for Pacific cod |
| | Modification of the Community Development Quota (CDQ) groundfish program |
| Aleutian Islands | Closure of the directed fishery for pollock |
| | Pacific cod TAC apportionment by season and gear, and specific area restrictions that alternate with Atka mackerel fishery in critical habitat (statistical areas 542 and 543) |
| | Critical habitat harvest limit of 60 percent for Atka mackerel (statistical areas 542 and 543) |
| | Grouping of vessel for Atka mackerel fishing in critical habitat (statistical areas 542 and 543) |
| | Two observers required for critical habitat Atka mackerel directed fisheries |
| | At least a 3-nm closure around all haulouts for Atka Mackerel and Pacific cod trawl fishing |
| | No Atka mackerel critical habitat fishing west of 178°W longitude |
| Bering Sea | Two seasons (40:60 percent apportionment) for the pollock fishery with no more than 28 percent of the annual directed fishing allowance taken from the Steller sea lion conservation area before April 1 |
| | Continuation of BS pollock fishery cooperatives established under the American Fisheries Act |
| | Establishment of the Bering Sea Pollock Restriction Area during the A season |
| | Closure of the Catcher Vessel Operation Area to non-CDQ pollock catcher/processor during the B season |
| | Pacific cod TAC apportionments by season and gear, as well as gear-specific area restrictions |
| | Closure of all Bering Sea sub area critical habitat to Atka mackerel fishing |

**Table 2 (continued). Summary of Steller Sea Lion Protection Measures for 2002.**

| Areas or Category | Protection Measure |
|---|---|
| Gulf of Alaska | Even distribution of pollock harvest among 4 seasons |
| | Closure of directed fishing for pollock in areas that vary from 0 to 20 nm to 0 to 3 nm around rookeries and haulouts |
| | Two seasons (60:40 percent apportionment) for Pacific cod fishing and area restrictions that are dependent on gear type and vessel size |
| | Continuation of the NOAA Fisheries Chiniak Gully Research Project to explore the effects of commercial fisheries on pollock abundance and distribution in the GOA |

Source: Proposed Rules, Federal Register Vol. 67, No. 171 September 4, 2002.

In addition, the HCR has been modified. Under the previous HCR, the Acceptable Biological Catch (ABC) for target species was calculated as the fishing mortality rate that would reduce the spawning biomass per recruit to 40 percent of its theoretical unfished level ($F_{40\%}$). When the biomass of the target species fell below that calculated level (designated as $B_{40\%}$ and defined as the level of Maximum Sustainable Yield), fishing was allowed to continue but at a reduced rate. Only when spawning biomass per recruit was reduced to 2 percent of its unfished level was directed fishing for that species stopped. The new HCR, implemented by emergency rule in 2002, is essentially the same except that all targeted fishing is halted if spawning biomass per recruit is reduced to 20 percent of its unfished level.

VMS are required on all groundfish and individual fishing quota halibut vessels in order to allow NOAA Fisheries to monitor the fishing activity of the fleet in relation to closed and regulated areas. VMS units are tamper proof and transmit a coded signal via satellite that gives NOAA Fisheries the position and identity of each vessel on a real-time basis. These records are used to verify fishing logs and calculate the amount of fish caught within designated critical habitat.

The VMS requirements would facilitate enforcement of the following Steller sea lion Protection Measures and other regulation restrictions:

- closure of the Chignik area to pot, trawl, and hook-and-line gear;
- closure within 10-20 nm of 46 rookeries and haulouts to hook-and-line fishing for Pacific cod and 44 rookeries and haulouts to pot fishing for Pacific Cod;
- modification to the CDQ groundfish program;
- revisions to the Federal Fisheries Permit requirements; and
- changes to the catcher vessel fishing trip definitions.

## 3.3 Alternative 1 Effects

The Steller sea lion Protection Measures under Alternative 1 are essentially the same as those analyzed under the Preferred Alternative (Alternative 4) of the Steller sea lion SEIS (NMFS 2001b). Therefore, when addressing the direct, indirect, and cumulative effects of the Steller sea lion Protection Measures on the Steller sea lion and other components of the physical, biological, and human environment, it is assumed that these measures would have similar effects as those described in that document. The potential effects of these measures are summarized below.

**Physical Environment**

The Steller sea lion Protection Measures, as implemented under Alternative 1, would have little, if any, impact on the physical environment except for preventing additional alteration of the physical structure of the non-living substrate and the suspension of sediments in the 3-nm buffer zones around rookeries, haulouts, and areas within critical habitat closed to non-pelagic trawling. Bottom trawling would continue to some extent in Steller sea lion critical habitat under the Alternative 1 FMP. Fishing effort would be displaced to other areas, thus potentially affecting other habitats. Overall, there would be no adverse effects on the physical environment from implementing the Steller sea lion Protection Measures.

**Biological Environment**

Threatened and Endangered Species

**Steller Sea Lions:** The primary focus of the Steller sea lion Protection Measures under Alternative 1 is to minimize the effects of groundfish fisheries off Alaska on the western stock of the Steller sea lions and ensure that they do not jeopardize the continued existence of Steller sea lions or adversely modify their critical habitat as defined under the ESA. As such, the management measures under the Alternative 1 FMP were designed to reduce adverse effects on Steller sea lions by dispersing fishing effort through area closures, catch apportionment, and fishery-specific restrictions in a manner consistent with the FMP BiOp and the 2001 BiOp (NMFS 2000, NMFS 2001a).

Direct effects on Steller sea lions resulting from take, either direct mortality or injuries leading to mortality, incidental to activities related to groundfish fisheries under the Alternative 1 FMP would be expected to be similar to past years. The incidental take rate is approximately 10 per year or 1 sea lion for every 140,000 mt of groundfish harvested (NMFS 2001b). Fishing closures in Steller sea lion critical habitat could result in a slight decrease in direct mortality if this is where a large proportion of animals are taken. But when there is an overall TAC increase in Steller sea lion critical habitat, incidental take would be expected to increase since the overall factor correlated with take is the level of TAC for key prey species (e.g., pollock, Pacific cod, and Atka mackerel). If TAC for these primary target groundfish is similar to recent years, incidental take would be expected to be the same. At this relatively low level of incidental take, direct mortality from the groundfish fisheries would not substantially contribute to the further decline of the species.

Under the Alternative 1 FMP, harvest of important Steller sea lion prey species is not expected to have large beneficial or adverse effects to Steller sea lions since region-wide TAC would be the same as recent years. Under the Alternative 1 FMP, some fishing effort is simply displaced to areas outside Steller sea lion critical

habitat, but other efforts are more concentrated in Steller sea lion critical habitat. Overall effects of the Steller sea lion Protection Measures on harvest of prey were considered insignificant in the Steller sea lion SEIS (NMFS 2001b). Although decreased catch within Steller sea lion critical habitat theoretically leaves more fish for sea lions, catch outside critical habitat would increase to compensate for any forgone TAC within Steller sea lion critical habitat.

The indirect effects of the spatial and temporal provisions in Steller sea lion Protection Measures would be a reduction in competitive overlap of the fisheries with Steller sea lions in time and space. Elements of these measures are of some benefit to sea lions, especially during the breeding season, in that the spatial and temporal dispersion of fishing effort spreads out the catch. However, the benefits to sea lions during other times of the year are equivocal. The effect of the closures on Steller sea lions would depend on the region. Closure of Management Areas 4 and 5, Seguam Pass, and Steller sea lion critical habitat (20 nm) around five northern haulouts would have little benefit for Steller sea lions, since fishing effort has been minimal in this area in recent years. Closure of the Aleutian Islands to pollock fishing would also have little effect since pollock makes up only a minor portion of the sea lion diet in this region. However, closures in the GOA, would be more beneficial considering the importance of pollock to the sea lions in this region. The Steller sea lion SEIS rated this effect as conditionally significantly negative for spatial and temporal concentration of fisheries, largely based on the lack of positive change from recent years. To the extent that competition with the fisheries is a key factor in the decline of the Steller sea lion, these measures would reduce this competition with groundfish fisheries during the breeding season in the vicinity of important rookeries and haulouts and benefit animals to varying degrees depending on geographic location.

The 3-nm closures around rookeries and haulouts decrease the level of disturbance to Steller sea lions around these areas to the extent that fishing had previously been conducted in these areas prior to 1990, but disturbance from fishing activities away from rookeries has not been demonstrated to have an adverse effect on Steller sea lions (NMFS 2001b). Overall, the 3-nm closures would not be expected to modify Steller sea lion behavior to the extent that population level impacts could occur and thus would likely be considered insignificant.

**Eiders:** The Steller sea lion Protection Measures would be expected to have little if any effect on the threatened spectacled eider populations. Eider winter habitat occurs within the ice pack of the northern Bering Sea and there is little overlap in habitat with the groundfish fisheries (Peterson *et al.* 1999). The Steller's eider winter habitat is typically inshore and also has little overlap with groundfish fisheries (USFWS 2002).

**Short-tailed Albatross:** The groundfish fishing closures of the Seguam Pass foraging area for Steller sea lions and the critical habitat east of 173° W to the western boundary of Area 9, could reduce the potential for incidental take of endangered short-tailed albatross in the cod longline fishery. In addition, the seasonal apportionment of TAC of Pacific cod in the BSAI could also avoid times when these albatross are present in higher numbers. But overall, incidental take of short-tailed albatross is very low (<4 albatross over 2 years) and is not directly correlated with spatial or temporal distribution of fishing effort (NMFS 2001b). Specific closures under the Steller sea lion Protection Measures themselves are unlikely to have any substantial effect on incidental take.

**Cetaceans:** The five endangered cetaceans in the BSAI and GOA would not be expected to be adversely affected by the Steller sea lion Protection Measures. Prey overlap between these whales and the groundfish

fisheries is considered low. These fisheries target adult groundfish, whereas whales tend to target juveniles or smaller fish. The direct effect of incidental take, entanglement in fishing gear or disturbance from fishing activity on whales in the BSAI and GOA has not been found to have population-level effects (NMFS 2001b).

Target Species

**Pollock:** Under Alternative 1, the TAC for target groundfish species is managed to ensure populations and stocks are harvested below the overfishing level (OFL) by a harvest rule setting F=0 when $B=B_{20\%}$. The Steller sea lion Protection Measures seek to reduce the potential for localized depletion of Steller sea lion prey by redistributing pollock catch eastern Bering Sea (EBS). However, the distribution of pollock is not static, and is dependent on various environmental conditions. If the distribution of pollock is different than predicted, there is the potential that partitioning of the harvest could lead to excessive local harvest rates within a region (NMFS 2001b). However, this is more a problem for predators, such as Steller sea lion, than for the pollock stocks.

In the Aleutian Islands, no fishing for pollock would be allowed in 2003. In the EBS, the 10-nm closure areas around rookeries and haulouts would ensure that some portions of the pollock stock are protected from directed fishing. The Steller sea lion Protection Measures do not necessarily reduce the temporal and spatial aggregation of fishing in all areas of Steller sea lion critical habitat. However, one objective is to increase the amount of pollock available to the ecosystem in coastal regions. More commercial-sized pollock would be available as prey in critical habitat, also.

Overall, fishing as modified by the Steller sea lion Protection Measures would impact trophic interactions in coastal regions of the BSAI and GOA but the effect of these changes are difficult to predict because of the complex nature of the food web. Effects on pollock stocks were considered insignificant in the Steller sea lion SEIS (NMFS 2001b).

**Pacific Cod:** Under the target fish measure associated with the Steller sea lion Protection Measure under Alternative 1, the average fishing mortality imposed on the BSAI and GOA Pacific cod stock is well below the maximum sustainable yield. These measures also seek to reduce localized depletion by redistributing Pacific cod catch, although this is difficult because the stocks are very mobile.

The fishing seasons prescribed under the Alternative 1 policy Steller sea lion Protection Measures are expected to result in spatial and temporal distribution of catch similar to recent years with most of the catch occurring during January. The regions closed to the various gear types are regions that historically have had relatively low levels of fishing effort with those gears. Closed areas would ensure that some portion of the stock was protected from directed fishing. These actions are likely to ensure that BSAI and GOA cod stocks are harvested at a sustainable rate. Effects on cod were found to be insignificant in the Steller sea lion SEIS (NMFS 2001b).

**Atka Mackerel:** The Steller sea lion Protection Measures under the Alternative 1 policy are intended to reduce localized depletion by redistributing Atka mackerel catch within the BSAI by having two fishing seasons and specific catch limits within critical habitat. The TAC for Atka mackerel is apportioned 60 percent inside Steller sea lion critical habitat and 40 percent outside.

For BSAI Atka mackerel, the projected average fishing mortality rate under the Steller sea lion Protection Measures would increase from recent years but is still below the OFL and the spawning biomass level is maintained such that the stock would not be overfished.

With the additional fishing effort for Atka mackerel in Steller sea lion critical habitat under the apportioned TAC , the spatial aggregation of fishing in Steller sea lion critical habitat could increase but is not likely to affect the sustainability of the Atka mackerel stock. High catches of Atka mackerel in Steller sea lion critical habitat would impact the amounts of Atka mackerel available to the ecosystem. Fewer commercial-sized Atka mackerel would be available as prey in Steller sea lion critical habitat.

**Other Target Species:** The Alternative 1 FMP management measures under Steller sea lion Protection Measures would not be expected to have significant effects on flatfish, BSAI rockfish, GOA rockfish, and thornyheads. Measures are not likely to significantly affect the sustainability of these stocks, either through direct effects of fishing mortality or concentration of the catch, or indirect effects of change in prey availability and habitat suitability.

Non-Target Species

Non-target species include a wide range of species groups such as forage fish, other species, and non-specified. Since little is known of the seasonal distribution of most of the non-target species, the effect of changes in apportionment of harvest is also unknown. In addition, fishing closures and harvest limits in Steller sea lion critical habitat would likely result in the failure to fully harvest target fish TAC. This, in turn, would reduce the bycatch of non-target species in these areas. Changes to the fisheries under the Steller sea lion Protection Measures would likely not affect the non-target fish populations in the region (NMFS 2001b).

Prohibited Species

Chinook and other Pacific salmon are taken as bycatch in the groundfish trawl fisheries so any change in the distribution or time of fisheries could affect bycatch of these species. It appears that chinook salmon, other Tanner crab, and halibut bycatch rates are higher in Steller sea lion critical habitat (NMFS 2001b). The Steller sea lion 10-nm buffer in the vicinity of Unimak Island has been shown to have higher bycatch of chinook salmon (NMFS 2001b). Trawl closures under the Steller sea lion Protection Measures in nearshore areas around haulouts and rookeries would relocate fishing from areas of high bycatch and potentially decrease salmon bycatch as well as other protected species. However, the actual amount of change in the salmon bycatch would be difficult to predict and would not be expected to be radically different than in previous years (NMFS 2001b).

Halibut, Pacific herring, and crab bycatch in the groundfish fisheries would not be expected to be substantially different than recent years due to Steller sea lion closures or any displacement of fishing activity offshore (NMFS 2001b). Halibut bycatch is controlled by Prohibited Species Catch (PSC) limits (caps) for specific fisheries and if these caps are reached, the fisheries are closed. Thus, fishermen have a real incentive to avoid these species so as to maximize their groundfish harvest opportunity. Red king crab and Tanner crab in bycatch would be expected to remain at historic levels since PSC limits are in place for these species.

Essential Fish Habitat

The effects of the Steller sea lion Protection Measures on Essential Fish Habitat (EFH) are the indirect benefits to the benthic habitat that accrue as a result of the no-transit areas, no-fishing area closures and area-specific gear closures, especially for those that apply to non-pelagic trawling. Maintaining the closures within the 3-nm buffer zones around sea lion haulouts and rookeries and restrictions within 10 to 20 nm of key rookeries, to the extent that these areas were fished in the past, would protect benthic communities in these areas from further disturbance. Under the Steller sea lion Protection Measures, areas closed to trawling for the three main target species, all important prey for Steller sea lions, amount to approximately 50 percent of all Steller sea lion critical habitat. There is likely a wide range of benthic habitat types within the areas designated as Steller sea lion critical habitat, and protection of these areas provides additional areas of undisturbed benthic habitat. Closures of Steller sea lion critical habitat in the Aleutian Islands closely coincide with concentrations of Habitat Areas of Particular Concern (HAPC) biota in this area and also provide good habitat for Atka mackerel adults and late juveniles. However, the displacement of fishing effort out of Steller sea lion critical habitat and concentration of fishing effort in the areas remaining open may result in increased impacts to benthic habitat and EFH in other areas, some of which may have only been marginally fished in the past. Overall, the effects are likely a combination of decreased impact in some areas, and increased impacts in other areas. Effects of the Steller sea lion Protection Measures on EFH were considered insignificant in the Steller sea lion SEIS (NMFS 2001b).

Seabirds

Incidental take of seabirds in longline fisheries could be affected to some degree by any changes in the distribution and timing of the Pacific cod longline fisheries due to Steller sea lion Protection Measures since most of the incidental take of seabirds comes from these fisheries. Overall, the recently instituted seabird avoidance measures in the longline fisheries will produce greater benefits to the northern fulmar and other species in comparison to the benefits of closure of areas or restricted fishing under the Steller sea lion Protection Measures.

The 3-nm buffer zone, the no fishing closures, and the other Alternative 1 FMP groundfish fishing restrictions in Steller sea lion critical habitat would serve to further limit disturbance of forage fish schools in these areas and provide some level of benefit to piscivorus seabirds, especially where these closed areas overlap with seabird foraging concentration areas and large seabird colonies. However, this effect is difficult to quantify because of the very limited area involved and the ability of most seabirds to forage over a very large area. Overall, effects of the Steller sea lion Protection Measures on seabirds were considered insignificant in the Steller sea lion SEIS (NMFS 2001b).

Marine Mammals

Effects of the Alternative 1 FMP Steller sea lion Protection Measures on harbor seals relate to the spatial and temporal dispersion of the fisheries and the competition with the fisheries for prey species. Incidental take of harbor seal would be expected not to change from the relatively low level in the BSAI of 4 per year and GOA of <1 per year. Where the 3-nm buffer areas overlap with harbor seal haulouts and breeding areas, some protection is provided from fishery-related disturbance. However, coverage of important nearshore harbor seal habitats by these buffer zones is not global and many areas, such as the nearshore areas around

Kodiak Island and the Alaska Peninsula, are not afforded protection under these closures. Where management measures displace the pollock, Pacific cod and Atka mackerel fisheries farther offshore and leave more fish in coastal areas, some benefits to harbor seals are expected. TAC for the major prey species for harbor seal would generally be similar to recent years.

For the northern fur seal, the primary effects of the current Steller sea lion Protection Measures are related to the spatial and temporal shift in fishing effort in the Bering Sea. The spatial shift in the Bering Sea pollock fishery northward from the closed Steller sea lion Conservation Area to the summer and fall foraging habitat of the northern fur seals results in concentration of the fishing effort in this area, increased disturbance, and a potential competitive overlap with the groundfish fishery for prey. Expanding the pollock fishery from fishing only in the fall to the entire period when the fur seals are breeding, potentially increases the competition for prey species. Overall effects would be considered negative, but whether it would be significant at the population level is difficult to predict. Concerns have been raised by Alaska Natives in the Pribilof Island region about the potential adverse effects of the pollock fishery on the northern fur seal population and subsequently on subsistence harvest. As a result, this effect was considered conditionally significant negative in the Steller sea lion SEIS (NMFS 2001b).

Ecosystem

Effects of the Alternative 1 FMP Steller sea lion Protection Measures on the ecosystem were analyzed in the Steller sea lion SEIS using a range of environmental indicators (NMFS 2001b). With regard to predatory/prey relationships, effects were considered significantly beneficial in regards to forage availability when management measures result in more than a 10 percent increase in prey, such as pollock or other major prey species. Also considered significantly beneficial was the effect on species diversity, which was based on improved protection for a wide range of species. Indicators that were predicted not to change as a result of these measures were the effect on top predators, energy flow and balance, and the introduction of non-native species (NMFS 2001b).

Human Environment

Since the current Steller sea lion Protection Measures have the effect of greatly modifying the ways of fishing for groundfish, the effect on the human environment can be substantial, but some sectors and geographic areas are more affected than others (M. Hartley, personal communications). Economic effects of these measures have been analyzed in the Steller sea lion SEIS, and following is a general summary from this analysis (NMFS 2001b). Impacts generally fall into 3 main categories:

- non-market impacts;
- industry costs and market impacts; and
- indirect impacts.

The non-market effects caused by the Steller sea lion Protection Measures, such as existence value, subsistence, and eco-tourism, are generally considered beneficial in that anything that promotes the increase in recovery of the Steller sea lion would have a positive effect on these non-market activities. Subsistence costs would decrease with an increase in the number of animals. Rural residents would have more Steller sea lions to hunt and have to travel less to take them. The Steller sea lion SEIS found non-market effects of the Steller sea lion Protection Measures to be significantly positive (NMFS 2001b).

Industry costs and market impact were evaluated using an economic model (NMFS 2001b). Operation costs affect the fishing industry directly by increasing cost per unit harvest. The Alternative 1 FMP Steller sea lion Protection Measures affect the industry by increasing travel time to and from distant fishing grounds compared to prior years when such measures were not in effect. These impacts vary considerably between the various fisheries. The EBS pollock and cod fisheries are largely unaffected by changes under the Steller sea lion Protection Measures, whereas the changes to the GOA pollock, Pacific cod, and Atka mackerel fisheries have a much greater affect on industry costs. Time associated with learning how to fish new fishing grounds, reducing catch per unit of fishing effort from fishing less concentrated stocks, increasing down time and layups, all contribute to increasing costs to processors. If the operating costs increase, some negative impacts on the market would be expected.

The impact on markets for pollock, Pacific cod, and Atka mackerel are measured as changes in prices and product revenues. A market analysis conducted for the Steller sea lion SEIS found that implementing the Steller sea lion Protection Measures would have a relatively small effect on the markets of most of the product forms and the overall impact would be insignificant (NMFS 2001b).

Safety costs are an indirect economic factor affected by the current Steller sea lion Protection Measures. With the smaller boats, especially in the GOA, there would be operational costs for fishing farther offshore, in more remote fishing grounds, and operating during periods when weather conditions are more extreme. There is also an increased risk of accident and injury from working in unfavorable conditions (NMFS 2001b). However, it must be noted that many of these impacts can be mitigated by rationalization of the fisheries.

# 4.0 Alternative 2: Adopt a More Aggressive Management Policy

## 4.1 Management Approach

The Steller sea lion-related goals of the Alternative 2 policy are the same as Alternative 1: to be compliant with the Magnuson-Stevens Fishery Conservation and Management Act, the ESA, and other applicable laws. This alternative is designed to maximize the biological and economic yield from the fishery resource through a more aggressive harvest strategy while avoiding jeopardy. Alternative 2 is based on the assumption that fishing has no adverse impact on the environment except in specific cases when science provides convincing empirical evidence of harm.

## 4.2 Overview of Management Measures

Under this management policy, no fishing restrictions beyond those mandated under the Steller sea lion Protection Measures would be implemented unless scientific research yielded clear evidence of adverse impacts from the fisheries or that new measures would be beneficial to Steller sea lions. Alternative 2 proposes to amend the current FMPs to establish a less precautionary management policy while still preventing overfishing of target groundfish stocks. To illustrate the environmental consequences of this alternative, an FMP framework was developed. This FMP framework is comprised of two FMPs that serve as bookends to portray a range of management actions. Adoption of the Alternative 2 policy would result in changes made to the groundfish FMPs that fall within the FMP bookends.

## 4.3 Fishery Management Plan Bookend 2.1 Management Measures

Changes to the Steller sea lion Protection Measures under the FMP Bookend 2.1 would likely be very minor since the groundfish fisheries would still have to avoid jeopardy under the ESA. In the FMP illustration, no changes are contemplated to the current Steller sea lion Protection Measures. There would be changes to other FMP components that could have an effect on the Steller sea lions, such as changes to the TAC-setting process resulting in increased harvest of Steller sea lion prey species, repeal of current closed/restricted areas, and elimination of all trawl closure areas and fixed gear restrictions.

No additional sea lion programs or research efforts beyond those established under Alternative 1 would be required to implement FMP Bookend 2.1. However, at this end of the Alternative 2 policy spectrum, changes to some of the other FMP components illustrated in FMP 2.1, such as elimination of the Observer Program and VMS requirements, would alter the effectiveness of the existing Steller sea lion Protection Measures. Such changes in the fishery management would likely require a new Section 7 Consultation with NOAA Fisheries, OPR to determine if the new system places the sea lions in jeopardy. It would then need to be demonstrated that the subsequent changes were either positive or inconsequential to Steller sea lions or its critical habitat to avoid jeopardy.

## 4.4 Fishery Management Plan Bookend 2.1

**Physical Environment**

The Alternative 1 policy Steller sea lion Protection Measures would remain in place under the FMP Bookend 2.1. Therefore, the effects on the physical environment (both positive and negative) would be the same as the Alternative 1 FMP. These effects include preventing additional alteration of physical structure to the non-living substrate and sedimentation in the 3-nm buffer zones and areas within critical habitat closed to non-pelagic trawling. These effects were found to be insignificant in the Steller sea lion SEIS (NMFS 2001b).

**Biological Environment**

Threatened and Endangered Species

The area and fishing closures under the Steller sea lion Protection Measures for FMP Bookend 2.1 would be the same as those under Alternative 1 FMP, as required to avoid jeopardy (Figure 4). Therefore, effects of the area closures and other elements of the Steller sea lion Protection Measures on Steller sea lions would be the same. However, changes made to other FMP components would potentially have adverse effects, such as substantially higher TAC and the increased disturbance that would come with the higher harvest rate, changes to the Observer Program and repeal of the VMS requirements. These components, separate from the Steller sea lion Protection Measures, would likely trigger preparation of another BiOp to determine if the changes result in jeopardy.

The aggressive harvest strategy under FMP Bookend 2.1 would result in a substantially greater harvest of Steller sea lion prey through removal of the buffer between the ABC level and the OFL, removal of PSC limits, bycatch restrictions, and the optimum yield cap in the BSAI. This would potentially reduce the effectiveness of the Steller sea lion Protection Measures.

The amount of observer coverage in the fleet is an important consideration for determining the incidental take of sea lions. Since Steller sea lions are infrequently taken incidentally in the fishery, trying to extrapolate the number of sea lions taken by the whole fleet from only a small percentage of observed vessels is statistically problematic. Without VMS, NOAA Fisheries would have to rely on self-reported logs to determine the amounts of fish taken in Steller sea lion critical habitat. This could result in lower allowable catch levels to address concerns over unreported catch in these areas.

No change in effects on other ESA-listed species resulting from FMP 2.1 Steller sea lion Protection Measures would be expected since they are the same as the Alternative 1 FMP.

Target, Non-Target, and Prohibited Species

FMP Bookend 2.1 would establish a more aggressive harvest policy for the three main sea lion prey species (pollock, Pacific cod and Atka mackerel) while still preventing overfishing of these target groundfish stocks by maintaining harvest below the OFL for each species. More prey species would be harvested outside of critical habitat. Within critical habitat, harvest levels would be maintained at the current levels. Overall, the effects of the Steller sea lion Protection Measures on target, non-target, and prohibited species would be the same as those under the Alternative 1 policy.

**Human Environment**

Since the Steller sea lion Protection Measures under the FMP Bookend 2.1 would be the same as the Alternative 1 FMP, effects of these measures on the socioeconomic factors would also be the same.

## 4.5 Fishery Management Plan Bookend 2.2 Management Measures

Under the Alternative 2 policy range, FMP Bookend 2.2 would continue the current Steller sea lion Protection Measures similar to the Alternative 1 FMP (Figure 5). No additional sea lion programs or research efforts beyond the status quo would be implemented under FMP Bookend 2.2. Most of the other FMP 2.2 components would also be the same as the Alternative 1 FMP except that TAC may be set higher than current levels with a cap equal to the sum of all target ABCs. Although FMP Bookend 2.2 would likely retain the ban on targeting forage fish, the NPFMC would not need to account for changes in the food-web relative to the needs of marine mammals, or to include ecosystem-level considerations in fishery allocation decisions. The Observer Program and VMS requirements would be the same as Alternative 1 so monitoring of incidental take and harvest within Steller sea lion critical habitat would continue. For more information on the effects of these FMP components, see the TAC-Setting Bycatch Restrictions, and Observer Program discussions elsewhere in this section.

## 4.6 Illustrative Fishery Management Plan Bookend 2.2 Effects

**Physical, Biological, Human Environment**

Since FMP Bookend 2.2 Steller sea lion Protection Measures are the same as the Alternative 1 FMP, the effect of these measures on the physical, biological, and human environment would be essentially the same as described under the Alternative 1 policy and the current FMP.

# 5.0 Alternative 3: Adopt a More Precautionary Management Policy

## 5.1 Management Approach

The Steller sea lion-related goal of the Alternative 3 policy is very similar to the adaptive management policy of Alternative 1 in that it seeks to maintain or adjust current Steller sea lion Protection Measures as necessary to avoid jeopardy, or adverse modification of their designated critical habitat. The Alternative 3 policy, however, would place more emphasis on incorporating ecosystem-based management principles into allocation decisions and would implement more precautionary management measures beyond those currently in place under the Alternative 1 policy. Specific objectives under the Alternative 3 policy are to develop indices of ecosystem health as targets for management, adjust ABCs as necessary to account for uncertainty, incorporate ecosystem factors such as predator-prey relationships and regime shifts into allocation decisions, and initiate research on the habitat needs of different species in the food web.

## 5.2 Overview of Management Measures

As part of the goal to accelerate incorporating ecosystem considerations into management of the fisheries, NOAA Fisheries would develop indices of key ecosystem processes that would be used to track ecosystem health. Environmental measurements involving population trends and abundance of prey species of Steller sea lions and other marine mammals may well be included in these new ecosystem indices. The development of ecosystem indices would likely benefit from collaboration with academic research institutions and efforts to incorporate traditional ecological knowledge into fisheries management.

An additional goal under the Alternative 3 policy would be to increase the rationalization of the fisheries in order to reduce the "race for fish." Rationalization programs provide opportunities for tighter spatial-temporal controls on fishing effort, which are the basis of most of the Steller sea lion Protection Measures. For more information on how rationalization measures could effect the biological environment (see Appendix F-8, Overcapacity).

## 5.3 Fishery Management Plan Bookend 3.1 Management Measures

The Alternative 3 policy, as illustrated by FMP Bookend 3.1, would retain the Alternative 1 Steller sea lion Protection Measures that are designed to produce spatial and temporal dispersion of fishing effort within Steller sea lion critical habitat. These existing measures would be augmented by changes to other FMP Bookend 3.1 components such as setting TAC = or <ABC for all target and other species categories, setting ABC < OFL and a prohibition on bottom trawling for pollock in the BSAI (see Appendix F-1, TAC Setting Process).

Other FMP 3.1 components that could affect Steller sea lion Protection Measures include establishing goals and guidelines for selecting Marine Protected Areas (MPAs) and no-fishing zones (see Appendix F-3, Marine Protected Areas and Essential Fish Habitat). The MPA program would complement the effort to develop an index of ecosystem health. The establishment of no-fishing zones explicitly intended to benefit marine mammals such as the Steller sea lion would provide an opportunity to study the dynamics of fishery/ecosystem interactions. Reproductive success, foraging behavior, diet, physiological health, and other parameters could be measured and compared between populations within no-fishing zones, and populations

within areas where fishing was allowed. The results of such comparisons would provide scientific justification for future fishery management decisions, including those to protect Steller sea lions. These types of comparative studies would be greatly facilitated if protected areas could be matched with open-fishing areas that were similar in key respects such as similar habitats and fish communities. Establishing the criteria for selection of protected areas would be an important step in realizing this research potential.

The rationalization of fisheries under FMP Bookend 3.1 may benefit localized concentrations of fish that are important to Steller sea lions by spreading fishing pressure over time. It is thought that more dispersed fishing effort would cause less disruption of the prey field and, therefore, facilitate sea lion foraging success and reduce impacts on prey availability. Due to scientific uncertainty about this issue, the dynamics of fishing effort/prey field interactions would continue to be a research priority.

The Observer Program would be modified under FMP 3.1 to improve the collection of scientific data and to make it more independent from the fishing industry and NOAA Fisheries. The idea would remove any conflicts of interest and allow more third-party monitoring of the fishery data. While these changes would be oriented mostly toward data on target and non-target fish, they could impact Steller sea lion Protection Measures in at least two ways. First, improved scientific data on fishing effort and distribution may help refine future analyses of sea lion/fishery interactions. It would also contribute to an improved understanding of non-target fish and, therefore, to a better understanding of the food web. Second, the proposed changes would improve confidence in the accuracy of harvest data, which is important in Steller sea lion critical habitat considerations.

## 5.4 Fishery Management Plan Bookend 3.1 Effects

**Physical Environment**

Since the Steller sea lion Protection Measures under FMP Bookend 3.1 are the same as the Alternative 1 FMP, effects of these measures on the physical environment would be the same. (Figure 6). Substantive change to these measures as a result of research efforts would be difficult to predict at this point. Effects on the physical environment would include preventing additional alteration of the physical structure to the non-living substrate and suspension of bottom sediment in the 3-nm buffer zones and areas within critical habitat closed to non-pelagic trawling.

**Biological Environment**

Threatened and Endangered Species

The FMP Bookend 3.1 Steller sea lion Protection Measures would be the same as Alternative 1 in order to avoid jeopardy of Steller sea lions. Other FMP Bookend 3.1 components, such as MPAs and no fishing reserves, and use of other ecosystem indicators could offer additional benefits to the recovery of this species by limiting the competitive overlap of fisheries and Steller sea lions. The TAC-setting process component of FMP 3.1 would be the same as the Alternative 1 policy with the HCR prohibiting directed fishing when the biomass reaches 20 percent of its unfished level. Therefore, there would be no change in prey availability to Steller sea lions and other marine mammals as a result of this illustrative FMP.

Similarly, the effects of these measures on short-tailed albatross, Steller's and spectacled eiders, and endangered whale species would be expected to be similar to the Alternative 1 policy for this particular component. The development of ecosystem indices could potentially result in increased protection for these species, but it is difficult to speculate the degree and type of protection. The FMP 3.1 Bookend allows for adjustments to the Steller sea lion Protection Measures as appropriate based on new scientific research.

Target Fish/Non-Target/Protected Species

Since the FMP 3.1 Steller sea lion Protection Measures are the same as the Alternative 1 FMP, the effects of these measures on target, non-target, and protected species would be the same.

Essential Fish Habitat

The FMP 3.1 Steller sea lion Protection Measures would be the same as under the Alternative 1 policy; therefore, the effects on EFH, if any, would be the same. However, any adjustment to the current protection measures as a result of new research or application of ecosystem-based criteria would likely involve establishing new Steller sea lion Protection Measures, and this would indirectly benefit EFH in new areas to the extent they were disturbed by fishing in the past. Overall, effects of new or expanded Steller sea lion closures would be both positive and negative. As more EFH considerations are incorporated into the Steller sea lion closures and gear restrictions under the ecosystem-based approach, the more likely these measures will result in direct positive effects to Steller sea lions.

Marine Mammals

If the ecosystem-based approach takes into account important habitat of other key marine mammals, such as harbor seals and northern fur seals, Steller sea lion closures could also provide some benefits to these other marine mammals. As new research identifies additional areas important to marine mammals, some modification of existing Steller sea lion Protection Measures could occur and potentially reduce effects on other marine mammals in the region. Ecosystem-based criteria for new Steller sea lion Protection Measures would likely take into consideration unintended results of these measures. For example, the displacement of fisheries from Steller sea lion critical habitat to northern fur seal foraging areas in the EBS could result in adverse effects on fur seal foraging areas. A similar effect could occur in the GOA should new Steller sea lion closed areas overlap with sensitive harbor seal areas (e.g., the benefits that accrue to Steller sea lions could come at a cost to harbor seal).

Seabirds

Since the FMP Bookend 3.1 Steller sea lion Protection Measures are the same as under the Alternative 1 FMP, we predict no change in the effects on seabirds as a result of FMP 3.1.

However, other FMP 3.1 components that would afford additional protection to Steller sea lions such as increased area closures, development of MPAs/no-take marine reserves, rationalization of the fisheries, and spreading out the catch over a broader area could indirectly benefit seabirds by reducing disturbance of their prey. Changes in allocation from trawl to longline to protect EFH, however, would have the unintended effect of increasing seabird incidental take as a result of more hooks fished. These adverse effects will likely be mitigated through continued seabird avoidance measures currently in effect.

Ecosystem

Since the Steller sea lion Protection Measures would be basically the same as under the Alternative 1 policy, no difference in impacts on the ecosystem as a result of Steller sea lion Protection Measures is predicted. To the degree that the spatial and temporal separation of the groundfish fisheries from Steller sea lion critical habitat involves positive effect to the ecosystem and food web, we would expect these benefits to continue under the policy alternative. Effects on the ecosystem would be similar to what is described under Alternative 1.

Human Environment

The socioeconomic effects of Steller sea lion Protection Measures under FMP Bookend 3.1 would include additional or expanded closures should scientific evidence indicate that the existing Steller sea lion Protection Measures are inadequate and need to be revisited or expanded. In the event the closed areas are expanded, increased operating costs and/or reduced harvest levels would be expected, although the economic effects would be negative. In addition, if major changes in the time and area provisions of the existing Steller sea lion Protection Measures are proposed, such changes might require additional consultation under Section 7 of the ESA. This consultation could lead to additional protection measures that result in increased cost to fishermen and processors. Alternatively, improving the scientific data on the interaction of Steller sea lions and fisheries may allow for relaxation of some of the Steller sea lion Protection Measures and result in positive socioeconomic benefits.

## 5.5 Fishery Management Plan Bookend 3.2 Management Measures

At this end of the Alternative 3 policy range, the fishery management system is greatly influenced by ecosystem-based considerations and is much more precautionary in the face of scientific uncertainty. Steller sea lion Protection Measures illustrated in FMP Bookend 3.2 would be modified to increase the no-fishing buffer zones around rookeries and haulouts based on new telemetry data on sea lion foraging activity and customized for individual locations to reflect actual foraging behavior. For the purposes of this analysis, these new buffer zones are assumed to be 15 nm from shore in the Bering Sea and GOA, except where there is an overlap with MPAs and no-take reserves to protect EFH. Two types of MPAs would also protect Steller sea lion prey species and include "No Steller sea lion prey species hook and line, pot, and trawling MPAs" and "No Steller sea lion prey species trawling MPAs." These MPAs are distributed in a patchwork of 30-nm by 35-nm blocks. In the Aleutian Islands, a 15-nm buffer was applied to each of the Steller sea lion rookeries and haulouts. All rookeries within the Aleutian Islands carry a 3 nm no-transit area with an additional 10-nm (or more) buffer of no trawling for Steller sea lion prey species.

In addition, the HCR would be revised to include a constant buffer biomass for Steller sea lion for the three key Steller sea lion prey species. This means that directed fishing for target species would be halted if biomass ($B_{x\%}$) reached a certain level. This minimum biomass limit would represent the level of fish stocks needed to sustain local sea lion populations under natural foraging conditions.

Under other FMP Bookend 3.2 components, indicators of ecosystem health would become important tools for setting TAC. TAC determinations would be more species-specific than they are now and ABC levels would be calculated using more precautionary procedures. It is likely that overall TAC would be considerably

less than it is at present. Allocations of TAC among gear types, and in space and time would be based, in part, on protecting living marine resources, including Steller sea lions and other marine mammals. This could include a prohibition on non-pelagic trawling for pollock in both the BSAI and GOA.

Management efforts would also likely benefit from the increased contribution of traditional ecological knowledge anticipated under FMP Bookend 3.2. Contributions from academic institutions would also be necessary to help better understand the theoretical underpinnings of an ecosystem-based fishery management system. The collection of this information and its dissemination to the NPFMC and the public would require a new and innovative communication effort by NOAA Fisheries. More on the integration of traditional ecological knowledge can be found in Appendix F-9, Alaska Native Issues).

Under the EFH FMP Bookend 3.2 component, up to 15 percent of the BSAI/GOA would be included in MPAs and up to 5 percent of the area placed in no-take reserves to protect EFH. As explained above, these protected areas could also serve as marine mammal refuge and offer the opportunity for scientific research on the effectiveness of ecosystem-based management. Rationalization of all BSAI/GOA groundfish fisheries under the overcapacity FMP component would be a priority and could lead to substantial changes in the spatial-temporal distribution of fishing effort. New quota share programs could provide indirect benefits to Steller sea lions and other marine mammals.

## 5.6 Fishery Management Plan Bookend 3.2 Effects

**Physical Environment**

Steller sea lion Protections Measures under FMP Bookend 3.2 would include a very large increase in the size of the buffer zones; therefore, the area protected from increased non-pelagic trawling would be substantial. In these newly protected areas, effects on the physical environment would be benefits accrued from preventing additional alteration of the physical structure of the non-living substrate in areas previously fished. These new closures would also reduce the effects of suspension of bottom sediments from non-pelagic trawls.

**Biological Environment**

Threatened and Endangered Species

Increasing the buffer zones around the shoreline of the EBS and GOA, around rookeries and haulouts in the Aleutian Islands, and around the Steller sea lion no prey species MPAs, would further reduce the potential for competitive overlap of groundfish fisheries and Steller sea lion prey, and minimize the potential for localized depletion of prey species near and in Steller sea lion critical habitat (Figure 7). These new buffer zones are assumed to be 15 nm for this analysis, but it is anticipated that the size of these new zones would be based on telemetry data on various age classes of sea lions, conducted at individual sites, by such programs as the ongoing Satellite Telemetry and Steller Sea Lion Research Project (ADF&G and NMFS, 2002). Delineated areas would either be larger or smaller than the 15-nm zone but would likely contain the appropriate biological components of critical habitat for specific area rather than be based strictly on distance from shore. The application of these new buffer zones, if delineated using a broad spectrum of telemetry data, and the extensive areas within the no-take Steller sea lion prey species MPAs, would likely result in achieving the optimal separation of the fisheries and Steller sea lions during critical periods throughout the

year in comparison to current Steller sea lion Protection Measures under the Alternative 1 FMP, FMP 2.1 and 2.2, and FMP 3.1.

These increased Steller sea lion buffer zones would be expected to have little positive effect on the incidental catch of the short-tailed albatross, especially if these measures resulted in displacing the fisheries further offshore. Effects on the spectacled and Steller's eiders and the endangered cetaceans would be expected to be similar to what is described under the Alternative 1 policy.

Target/Non-target/Prohibited Species

The Steller sea lion Protection Measures under FMP Bookend 3.2, which include the increased buffer zones, the extensive no-take Steller sea lion prey species MPAs, and a revised HCR for Steller sea lion prey species, would be expected to result in some positive benefits to certain target, non-target, and protected species stocks. A reduction in TAC would ensure that target fish stocks are harvested at a sustainable rate well below the OFL. The increased buffer zone in Steller sea lion rookeries and haulouts and the lower TAC under FMP Bookend 3.2 would further ensure that more commercial-size fish would be available as predators and prey in Steller sea lion critical habitat.

A reduction in TAC under FMP 3.2 would also decrease bycatch of non-target, forage fish, and other species. Since distribution of these species is generally not known, the effects of this reduction in bycatch are also unknown.

Effects on prohibited species would generally be similar to the Alternative 1 FMP except that reductions in TAC for the groundfish fisheries would likely decrease prohibited species catch, assuming bycatch takes remained constant. Limits on prohibited species for individual fisheries would remain in place until it was determined they were no longer needed.

Essential Fish Habitat

Increases in Steller sea lion closures as illustrated in FMP 3.2 would increase the amount of benthic habitat protected from damage or modification by non-pelagic trawls. This would occur only to the extent that these areas were fished in past years. If TAC is not reduced proportionally to the areas closed to fishing, fishing effort would be displaced and some of these open areas could experience increased disturbance to fishing habitat. Long-term effects on benthic habitats are unknown. Other FMP 3.2 components, such as designating up to 20 percent of the BSAI and GOA into MPAs and no-take reserves and prohibition of bottom trawling for pollock GOA, would also have a substantial effect on the amount of EFH protected under this FMP. Overall, effects of the Steller sea lion Protection Measures on EFH under FMP 3.2 would be positive.

Seabirds

Effects of the FMP Bookend 3.2 Steller sea lion Protection Measures on seabirds would be similar to those under the Alternative 1 FMP, since all of the primary Steller sea lion management measures would remain in place. Additional Steller sea lion measures to increase buffer zone size in Steller sea lion critical habitat would have little effect on the incidental take of seabirds if fishing effort is displaced to other areas, especially if areas remaining open are seabird foraging areas. Other FMP 3.2 components, such as the

substantial reduction in TAC, especially in longline fisheries, would reduce incidental take of seabirds such as the northern fulmar and gulls, although this would likely be overshadowed by the benefits of the current seabird avoidance measures.

Marine Mammals

Increasing the size of buffer zones around Steller sea lion critical habitat under FMP Bookend 3.2 would be beneficial to harbor seals based on the increased protection the expanded areas provide to nearshore habitats and the reduction in competition for prey as described under the Alternative 1 FMP. Harbor seals benefit from any management measures that displace the harvest of pollock, Pacific cod, and Atka mackerel farther offshore, and measures that reduce TAC of these species (NMFS 2001b). Areas where new Steller sea lion buffer zones overlap with important breeding habitat for harbor seals, such as Tugidak Island south of Kodiak, would further benefit these animals. This protection would also extend to major harbor seal areas on the Alaska Peninsula and Kodiak Island, since they would be either within the 15-nm band or an MPA. Increased closures of the nearshore areas would have the tendency to displace fishing effort farther offshore, and potentially increase the overlap with fur seal foraging areas. Overall, the Steller sea lion Protection Measures under FMP Bookend 3.2 would be somewhat more beneficial to marine mammals than those under the Alternative 1 FMP.

Ecosystem

Since the FMP Bookend 3.2 Steller sea lion Protection Measures would be modified by increasing the size of the Steller sea lion buffers, (no Steller sea lion prey species MPAs) these measures would result in substantial decrease in the effects of fishing on the ecosystem within Steller sea lion critical habitat. More prey would be available in time and space to a wide variety of predators; therefore, the Steller sea lion measures would have a positive effect on the predator/prey relationships. Effects on species diversity would also be positive because of the potential effects on the declining Steller sea lions. Overall, the effects on the ecosystem under FMP Bookend 3.2 would be generally similar to those described in the Alternative 1 FMP, although the intensity of the effects would be greater under FMP Bookend 3.2. Ecosystem parameters not expected to change are effects on top predators and energy flow and balance (NMFS 2001b). Overall, effects of the new Steller sea lion Protection Measures under the FMP Bookend 3.2, although positive to several species, are considered insignificant on the ecosystem, similar to the finding for all the alternatives in the Steller sea lion SEIS (NMFS 2001b).

Human Environment

The increase in buffer zones to 15 nm around all shoreline and outside of no-take MPAs and the creation of no Steller sea lion prey species take MPAs under FMP Bookend 3.2 would likely result in vessels, primarily in the GOA (Alaska Peninsula and Kodiak), spending more time fishing farther from port and fishing in more difficult areas. These effects would be more severe for smaller catcher vessels. Reductions in TAC would result in less income for the fleet. Effects on the economies of the small rural communities and fishermen in these communities would be significantly adverse. Fishermen would need to travel further from their communities to fish (M. Hartley, Northern Economics, personal communication, 2002). Smaller boats would have to fish farther offshore and, therefore, experience higher operating costs and elevated safety risks, although these risks are difficult to quantify.

However, other FMP 3.2 components such as rationalization of all of the GOA and BSAI non-pollock/sablefish fisheries, can potentially mitigate many of these impacts on the human environment (see Appendix F-8, Overcapacity).

# 6.0 Alternative 4: Adopt a Highly Precautionary Management Policy

## 6.1 Management Approach

The goal of the Alternative 4 policy with regard to Steller sea lion Protection Measures is incorporated into a change in policy that transfers the burden of proof from the resource to the user when faced with uncertainty. This management policy is based on the same basic assumption as Alternative 1, that fishing produces adverse impacts on the environment but, due to incomplete data and scientific uncertainty, little is known about these impacts. Adoption of the Alternative 4 policy would require more information and conclusive studies to support large commercial harvests. Alternative 4 FMP Bookends 4.1 and 4.2 illustrate two FMPs (a fishing strategy and a no fishing strategy, respectively) where results from scientific studies are used to mitigate any adverse effects on the biological environment. Effect would need to be understood prior to preceding with a fishery. This policy would result in a number of changes to the existing FMPs that would substantially reduce the groundfish fisheries until more information is known about the frequency and intensity of fishery impacts upon Steller sea lions and the marine environment. Expanded fisheries research and monitoring programs will fill critical data gaps. Once more is known about fishery effects on the ecosystem, scientific information would be used to modify and relax the precautionary measures initially adopted.

## 6.2 Overview of Management Measures

The conservative management measures specific to Steller sea lions under the Alternative 4 policy would involve continued enforcement of the Steller sea lion Protection Measures as described under the Alternative 1 FMP. New fishing restrictions would likely be instituted to further protect Steller sea lion critical habitat such as gear restrictions, time and area closures, reapportionment of catch among gear types, and TAC adjustments to compensate for area closures. Programs would be developed to evaluate the status of other marine mammals and their interaction with groundfish fishing. For example, management measures that reduce impacts to the northern fur seal and the northern right whale would be developed.

## 6.3 Fishery Management Plan Bookend 4.1 Management Measures

Steller sea lion Protection Measures illustrated under FMP Bookend 4.1 would include a comprehensive ban on all trawling in all designated Steller sea lion critical habitat. It would also prohibit trawling in all fisheries that can be prosecuted with other gear types (i.e., Pacific cod). These restrictions would relocate trawling to areas outside critical habitat. TAC for Steller sea lion prey species would be calculated based on an $F_{75\%}$ strategy.

Other FMP Bookend 4.1 components, such as TAC-setting, would also have a substantial effect on Steller sea lions. The TAC-setting policies of FMP Bookend 4.1 would have the potential to positively impact the foraging ecology of marine mammals, including the Steller sea lion, through changes in the food-web. If

TAC-setting policies were proven ineffective, they would be modified with measures more likely to achieve policy objectives. Target fishing rates for most species would be set at $F_{75\%}$ and $B_{40\%}$ and would become an actual limit rather than a target. ABC for a species complex would be based on the TAC of the least abundant member of the group. ABCs would be calculated from the lower boundary of the confidence limits for the stock assessment rather than the center of the confidence range as is presently the case. Bycatch of prohibited species would have to be reduced by 30 to 50 percent or the fishing area would be closed.

Another FMP Bookend 4.1 component affecting Steller sea lions would be the establishment of no-take marine reserves in 20 to 50 percent of the BSAI/GOA. This would provide opportunities for scientific research on the impacts of fishing on Steller sea lions. Under FMP 4.1, the Observer Program would be expanded to include 100 percent coverage on vessels > 60 ft in length and at least 30 percent coverage on vessels < 60 ft in length and 100 percent observer coverage of the hauls. This would tend to increase the quantity and quality of marine mammal/fishery interaction data The increases in observer coverage, along with mandatory VMS for all groundfish vessels, would improve the monitoring and enforcement of fishing effort in the many restricted fishing areas.

FMP Bookend 4.1 places a high value on protecting the ability of local communities, most of which are predominately Alaska Native communities, to harvest fish and wildlife for subsistence and community development purposes. This may mean that at least some areas closed to commercial fishing may still be open to subsistence harvests. Monitoring of subsistence take, including Steller sea lions, would likely be a function of agency/community co-management organization efforts.

## 6.4 Fishery Management Plan Bookend 4.1 Effects

**Physical Environment**

The Steller sea lion Protection Measures under FMP Bookend 4.1 would be modified by eliminating all trawling in Steller sea lion critical habitat. The comprehensive ban on trawling in Steller sea lion critical habitat, when added to other FMP 4.1 components such as areas closed to trawling for other reasons and the marine no-take reserves, result in the elimination of trawling in over 50 percent of the fishable area. Effects of this large reduction in on-bottom and pelagic mobile fishing gear would be the protection of these areas from further modification of the non-living substrate and suspension of bottom sediments where trawling had occurred in the past.

**Biological Environment**

Threatened and Endangered Species

FMP Bookend 4.1 would restrict certain gear types, such as trawls, in Steller sea lion critical habitat and would set more conservative harvest levels for important prey species. This would greatly minimize the potential for localized depletion of prey species such as pollock, Pacific cod, and Atka mackerel within 20 nm of rookeries and major haulouts and substantially reduce competition with the groundfish fishery for prey. Restricting all trawling for target fish that could be caught by other gear types would significantly reduce the rate of harvest and spread out the fisheries efforts for species such as Pacific cod.

ABC calculations for the key sea lion prey species under the Alternative 1 policy Steller sea lion Protection Measures are based on a fishery mortality rate of $F_{40\%}$ and a spawning biomass of $B_{20\%}$. Under FMP Bookend 4.1, more conservative calculations of ABC ( $F_{75\%}$ and $B_{40\%}$) would be used instead. The results of these changes would be substantial reductions in the TAC of the key Steller sea lion prey species (e.g., pollock, Pacific cod and Atka mackerel).

In the near term, take of Steller sea lions in the groundfish fisheries would be substantially reduced to levels approaching zero until research determines how fishing can be conducted in a manner that assures minimal harm to the environment. Currently, incidental take of Steller sea lions in the groundfish fishery is very low and not considered to have an effect at the population level. A majority of the incidental take occurs in the Bering Sea groundfish trawl fishery, so any major reduction in this fishery as a result of the reduced TAC would lower incidental take. Additional measures and modifications of fishing methods would be developed to try and reduce this further, but this would be difficult considering the level of take in the groundfish fisheries is already very low (mean of 10/year) (Angliss and Lodge 2002).

New ecosystem-level research would be the focus of the Alternative 4 policy, although the details of such research efforts are as yet undefined. The ecosystem-level research objectives of FMP Bookend 4.1 would necessarily require extensive coordination between NOAA Fisheries, other research agencies, and academic institutions. These efforts would also need to include cooperative research programs with Alaska Native communities for data gathering and monitoring in order to enhance the use of traditional ecological knowledge in fishery management decisions.

Effects of the FMP Bookend 4.1 Steller sea lion Protection Measures on short-tailed albatross would likely be similar to the Alternative 1 FMP. If more of the target fish TAC from the trawl fisheries were taken using longline gear, the possibility for incidental take of short-tailed albatross would tend to increase. However, reductions in TAC would likely offset this increase. Proposed seabird avoidance measures would also likely compensate for any potential increase in incidental take of this endangered species. Further reducing the current take to levels approaching zero would require the design and implementation of even more efficient avoidance measures in the remaining fisheries. Such measures do not presently exist.

Target/Non-Target/Prohibited Species

Effects of the FMP Bookend 4.1 Steller sea lion Protection Measures on target fish, including the new TAC-setting methods and gear restrictions, would generally be similar to those under the Alternative 1 FMP in that stocks would not be overfished. However, under FMP Bookend 4.1, stocks would be maintained well above minimum stock size threshold, and, therefore, stocks would be much less likely to be over harvested. The effects of reducing TAC for target species would likely result in reduced levels of bycatch of non-target species. Prohibited species catch would continue to be limited by PSC limits for specific fisheries to achieve the reduction of 20 to 50 percent in bycatch of prohibited species. Lower limits would affect the ability of the fisheries to achieve the TAC before the fishery is closed because a prohibited species limit is reached. There would be substantial reductions in prohibited species catch from trawl gear closures in Steller sea lion critical habitat as well as in other areas closed to trawling. The trawl gear restrictions in specific fisheries such as Pacific cod would also reduce catch of prohibited species. These effects are all viewed as beneficial impacts on target, non-target, and prohibited species at this FMP Bookend.

Marine Mammals

Steller sea lion Protection Measures instituted under FMP Bookend 4.1 that would affect other marine mammals, would include a reduction in TAC and a ban on trawl gear in Steller sea lion critical habitat. Trawling would also be banned for species that could be caught by other methods. These measures would benefit other marine mammal species such as the northern fur seal and harbor seal. The level of reduction in TAC would be the major factor in determining the degree of benefit for these species. Banning trawling in all Steller sea lion critical habitat would further reduce competitive overlap between groundfish fishing and harbor seals. Reduction in TAC in areas outside of Steller sea lion critical habitat would particularly benefit the northern fur seal, which were affected by the displacement of fishing effort out of Steller sea lion critical habitat.

Seabirds

The existing and additional Steller sea lion Protection Measures under FMP Bookend 4.1, especially the no-trawl areas within Steller sea lion critical habitat, would have some beneficial effects on seabirds where these areas overlap with important foraging areas and major breeding colonies (Figure 8). These areas would provide undisturbed prey fields for several species of piscivorus seabirds and, to the extent that it benefits foraging success, effects would be positive.

The ban on trawling in Steller sea lion critical habitat, as well as other areas, and lower TAC levels would have the effect of reducing the bycatch of non-target species including forage fish. However, since bycatch of forage fish is currently already very low, reduction in bycatch would likely have an insignificant effect on seabirds (NMFS 2001b). Prohibitions on trawling in Steller sea lion critical habitat would likely result in a substantial increase in the use of longline gear and, therefore, potentially increase incidental take of seabirds, such as northern fulmars, in these fisheries. However, other FMP Bookend 4.1 components, such as the lower TAC, would offset some of the potential increase. This potential increase in longline incidental take, however, would also be offset by any new seabird protection measures. Therefore, the net effect on seabirds of any increased longline effort is presumed insignificant.

Human Environment

The effect of FMP Bookend 4.1 Steller sea lion Protection Measures would have negative effects on the fishing industry as the larger closed areas could redistribute fishing effort farther from port. It should be noted that the TAC component of FMP Bookend 4.1 would lower harvest rates and this component would likely result in more significant effects on the fishing industry than the expanded closed areas under the FMP 4.1 Steller sea lion Protection Measures. Non-market effects such as eco-tourism and subsistence likely would be positive.

## 6.5 Fishery Management Plan Bookend 4.2 Management Measures

Under FMP Bookend 4.2, all commercial groundfish fishing would be halted while research on environmental parameters continued and fisheries could be reviewed and certified as having no significant adverse environmental effects. Such a review and certification process could take up to two years. Without fishing during this time frame, there would be no Observer Program. All research would have to be either conducted with various agency personnel and vessels or contracted out to academic institutions and private

consultants until fisheries are permitted. Although this scenario would essentially eliminate incidental take of marine mammals in the near term, it is not clear what specific effect this would have on food availability for Steller sea lions and other marine mammals. This would undoubtedly be a major focus for ecological research after the fishery closures. Whether such changes in the food web could be measured on a population level for a given species would likely depend on the intensity of population monitoring for those species both before and after fishing is closed.

## 6.6 Fishery Management Plan Bookend 4.2 Effects

**Physical Environment**

The temporary closure of all commercial groundfish fishing activity would eliminate damage or modification to the non-living substrate in the short-term within Steller sea lion critical habitat as well as throughout the region. Groundfish fisheries, once certified by NOAA Fisheries, could be permitted to operate under fishery-specific regulations that mitigate all significant environmental effects.

**Biological Environment**

Threatened and Endangered Species

Under the FMP Bookend 4.2, there would be no fisheries in the near term, although research would continue (Figure 9). The research and development of protection measures and fishing methods to reduce incidental take of Steller sea lions and other marine mammals would require innovative approaches. Without an active groundfish fishery, research on the interactions between Steller sea lions and fisheries would likely not occur during the short-term but it would provide an opportunity to study Steller sea lion in the absence of fisheries. In the long term, fisheries would need to be certified as having no adverse impacts before they could occur. Therefore, effects of these new fisheries would need to be either positive or insignificant in regard to Steller sea lions, considering their endangered status. After specific groundfish fisheries are certified as having no adverse effects on the environment, it would seem prudent to conduct Section 7 Consultation to determine which of the current Steller sea lion Protection Measures were needed to avoid jeopardy under the Alternative 4 policy. The 3-nm no-transit zones around rookeries and haulouts would likely remain in place to minimize disturbance to these sensitive areas by non-fishing vessels.

Target/Non-Target/Prohibited Species

It is assumed that limited fishing would resume within 2 years as a result of agency review, but in the near term, TAC would be reduced to zero. Effects on fish populations would be expected to be positive in the short-term due to the absence of fishing mortality, but beyond 2 years, effects are more uncertain since the nature of the fisheries at that time is uncertain.

Ecological research required under FMP Bookend 4.2 would need to involve harvest of fish under controlled conditions to collect the appropriate data on target fish stocks, non-target populations, ecological relationships, and effects of fishing on the Steller sea lions, as well as other components of the environment. This fisheries research would likely need to include some harvest areas and reference areas to be able to compare and define the actual effects. It is expected that there would be some harvest of target fish within

Steller sea lion critical habitat under any research program, but harvest levels would need to be below any level that could adversely affect sea lions.

Essential Fish Habitat

Considering that all trawling, hook and line, and pot fishing would be stopped throughout the BSAI and GOA in the short-term, any area closures under the Steller sea lion Protection Measures be inconsequential. However, overall effect on EFH of the closure of the fishery would be positive. It is presumed that regulations issued for those fisheries certified as having no significant adverse effects would contain restrictions based on EFH and HAPC considerations.

Marine Mammals

With no groundfish fisheries authorized in the short-term, the Steller sea lion Protection Measures would have little, if any, direct or indirect effect on other marine mammals, nor would there be any cumulative effect. The 3-nm no-transit zones around Steller sea lion rookeries and haulouts would likely remain in effect under FMP Bookend 4.2 and, to the extent that it provides some protection to other marine mammals, would likely be beneficial. Overall, effects of the Steller sea lion Protection Measures on other marine mammals would be negligible and are overshadowed by the closure of the entire groundfish fishery.

Seabirds

The closure of groundfish fisheries in the Exclusive Economic Zone under FMP Bookend 4.2 would greatly overshadow any effects of the Steller sea lion Protection Measures on seabirds. The elimination of all commercial fishing would necessarily decrease the seabird incidental take to almost zero.

Ecosystem

Under FMP Bookend 4.2, effects of the Steller sea lion Protection Measures on the ecosystem would be inconsequential without an active fishery.

Human Environment

The impact of eliminating the groundfish fisheries under FMP Bookend 4.2 on the Alaska economy, and on the U.S. economy in general, would be significantly adverse. The closure of these fisheries would eclipse all economic effects of the Steller sea lion Protection Measures. The absence of fishing activity for at least 2 years and a slow initiation of fisheries that could demonstrate no adverse impact, especially to Steller sea lions, would give a fairly clear picture of the fisheries contribution to the overall decline. If the populations showed a region-wide response in counts of pups and non-pups, some strong inferences could be made. But if the population continues to stabilize at its current low level or declines, other factors would be suspect.

Small communities that rely on the catcher vessel fleet for direct and indirect income would be economically devastated by the closure of the groundfish fisheries. These impacts would prevail until each Alaska groundfish fishery was reviewed and certified to operate. Catcher vessels in the groundfish fishery would be shut down in the short-term unless they could convert to other uses or fisheries for species not regulated under the groundfish FMPs. These economic impacts would remain in place until such time that the certified

fisheries could begin operating under specific regulations. The certification process and the specific regulations, including any modification of the Steller sea lion Protection Measures for these fisheries, are unknown at this time. Steller sea lion Protection Measures would be at least as effective as the current measures.

# 7.0 Data Gaps and Information Needs

## 7.1 Information Needed to Monitor and Quantify Effects

**Recent Research**

A recent paper by Ferrero and Fritz (2002) outlines historical trends and recent developments in Steller sea lion research and describes how these efforts are coordinated for resource management needs. Research budgets have grown from less than $1 million annually prior to 1992, most of which went to basic population censussing, to over $40 million in 2002. The vast majority of this increase in funding has been instituted by Congress since 2000 in response to litigation that briefly halted the fishery and threatened to curtail it significantly. At issue was the scientific uncertainty regarding the mechanisms and magnitude of impact that the fishery had on Steller sea lions and a general lack of information on competing hypotheses regarding their population decline. The increase in funding was clearly meant to address this scientific uncertainty and its practical application to fishery management. There are presently over 150 separate research projects being conducted on Steller sea lions by a host of federal and state agencies, academic institutions, and non-governmental research organizations. NOAA Fisheries has worked with these various groups to develop a coordinated research framework that links individual project designs to the larger goal of explaining the continuing decline of Steller sea lions in part of their range. These projects have addressed one or more of the following areas of uncertainty that were specified in congressional appropriation documents and which may contribute to population declines:

- the availability of prey species
- predator/prey relationships
- predation by killer whales and sharks
- interactions between fisheries and Steller sea lions, including the localized depletion hypothesis
- regime shift, climate change, and other impacts associated with changing environmental conditions in the North Pacific and Bering Sea
- disease
- juvenile and pup survival rates
- population counts
- nutritional stress
- foreign commercial harvest of sea lions outside the exclusive economic zone
- residual impacts of former government-authorized Steller sea lion eradication bounty programs
- residual impacts of intentional lethal takes of Steller sea lions

In addition to these topics, NOAA Fisheries has initiated research on other crucial issues:

- the efficacy of management measures (e.g. no-trawl zones) designed to mitigate fisheries impacts
- expanded sea lion branding and tagging studies to investigate basic population demography

- expanded scat collection and telemetry studies to investigate diets and foraging behavior
- forage fish abundance and distribution surveys in sea lion habitats
- investigate effects of oil and other toxic contaminants on sea lions

The research framework organizes the various projects in two different ways: according to the questions they are seeking to answer and according to the methodology and scientific discipline being used in the research. This system helps NOAA Fisheries monitor whether there are gaps or redundancies in coverage of the various topics and also helps communication and coordination among researchers. The sharing of information and collaboration among different scientific disciplines is very important to the research policy because the "answer" to the decline may be a combination of factors rather than any one cause. Perhaps the most succinct way to summarize these various research projects is to list the major questions they are asking, all of which could be considered separate hypotheses for the sea lion's decline and lack of recovery (Ferrero and Fritz 2002).

It is important to note that much of the research now underway may not yield meaningful results for 5 to 10 years. The study of ecosystem interactions is not suited to quick and definitive experimental investigation. It is believed, however, that major data gaps are now being addressed in some fashion and that as information becomes available, the questions will be refined and the research will become more focused on those issues, which appear to be the most pertinent to the decline of Steller sea lions. In the meantime, the population trends of sea lions and direct fishery interactions will be monitored closely.

**National Research Council Review**

In 2000, the NRC was contracted to conduct a review of available information regarding the interactions between the groundfish fisheries and Steller sea lions and the role of the fisheries in trends of the Steller sea lion populations. Their review and analysis came up with a series of five general management options to address impacts of fisheries on the sea lions and ways to monitor their effectiveness. Most suggested management options are addressed to some extent in the Alternative Policies analyzed in this document.

1. Wait and see - give the Steller sea lion Protection Measures time to work.
   - monitor using annual surveys of trend sites and information from pup branding

2. Eliminate direct fisheries' impacts with expanded closures.
   - monitor fish population dynamics, both locally and at the stock level, to determine effects of fisheries on distribution and community composition

3. Establish experimental spatial management units consisting of two sets of closed and open areas for fishing per region, where each treatment is centered on a rookery.
   - monitoring with detailed local Steller sea lion censuses and spatial analyses of fish population changes for each experimental unit

4. Implement a "titration" experiment - restrictions on fisheries are increased progressively over time until a positive response is achieved.
   - monitoring of sea lion population trends

5. Micro-monitor and manage localized interactions between sea lions and fisheries to reduce mortality where and when it occurs in the future.
   - expansion of all monitoring activities around all rookeries to pinpoint times and places of increased mortality so action can be taken

Of these five options, only Option 3 would directly test the role of groundfish fishing in the decline of the Steller sea lion and was recommended as the preferred option (NRC 2002).

**Modeling**

As the previous discussion indicates, a multitude of physical and biological interactions are presently under investigation. Fitting all these pieces together to see the "big picture" will require the development of new mathematical models that describe the bioenergetics not only of Steller sea lions, but also of their major prey species and the impacts of fishing and ocean changes. This effort is presently underway and is the first attempt toward a larger ecosystem model that is called for in some of the Alternatives policies. This ecosystem model would include non-target fish and seabirds and many other elements in the BSAI/GOA ecosystems. However, there are many smaller pieces of the puzzle that need to be worked out in modeling before these grand, unifying models are even feasible. These run the gamut from the impacts of climate change on ocean currents to the relative importance of killer whale predation at different sea lion population levels.

## 8.0 Comparative Analysis of the Alternatives

The four policy Alternatives considered in this analysis cover the mandatory requirements of the 2001 BiOp and the subsequent Steller sea lion Protection Measures which keep the groundfish fisheries in compliance with the ESA. The Steller sea lion Protection Measures described in the Alternative 1 policy are also common to the Alternative 2 and Alternative 3 policies. Alternative 4 is different from the others in that the burden of proof is shifted to the user of the resource. The first three alternatives are similar in their application of the same risk-averse conservation and adaptive management approach used for the last 20 years by NOAA Fisheries and the NPFMC. In regards to Steller sea lion Protection Measures, the alternative policies differ in the degree of caution used in modifying these measures as scientific evidence becomes available and in how they deal with uncertainty in management decisions. A summary of major findings by alternative and resource category is presented in Table 3.

While certain biological and physical parameters can be sampled and estimated quantitatively, the impact of specific changes in fishing activities on particular species or ecosystem processes will always be subject to a substantial amount of uncertainty. The imprecise nature of fish and wildlife population estimates, plus natural fluctuations in population levels, makes it very difficult to say with certainty whether a given level of anthropogenic disruption is causing the population of a particular species to decline.

At one end of the policy spectrum is Alternative 2, a more aggressive harvest strategy, which has an underlying policy stating that impacts of the fisheries on Steller sea lions under the Steller sea lion Protection Measures are negligible and any additional regulations or restrictions on the fishing fleet are unwarranted unless new scientific research provides unequivocal evidence of adverse population-level impacts. Any change to the Steller sea lion Protection Measures would require the NOAA Fisheries, Office of Sustainable

Fisheries to show through Section 7 consultations with NOAA Fisheries OPR, that the new set of measures still avoids jeopardy. The use of the Observer Program and VMS to monitor fishing effort in critical habitats is also integral to this issue.

**Table 3. Summary of potential effects of the policy alternatives and FMP bookends.**

| EFFECT INDICATOR | Alternative 1.0 | Alternative 2.0 | | Alternative 3.0 | | Alternative 4.0 | |
|---|---|---|---|---|---|---|---|
| | FMP 1.0 | FMP 2.1 | FMP 2.2 | FMP 3.1 | FMP 3.2 | FMP 4.1 | FMP 4.2 |
| **Physical Environment** | | | | | | | |
| **Effect on Non-Living Substrate** | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures prevent additional alteration of the physical structure of the non-living substrate and the suspension of sediments in the 3-nm buffer zones around rookeries, haulouts, and areas within critical habitat closed to non-pelagic trawling. | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **BENEFICIAL EFFECT** This FMP closes areas 15 nm from shore except where there are MPAs or no-take reserves. Additional area closed to trawling for SSL prey species. | **BENEFICIAL EFFECT** All SSL critical habitat closed to trawling and closure of all trawling for species that can be taken by other gear would prevent additional damage to non-living substrate. | **BENEFICIAL EFFECT** This FMP closes all fisheries until they are certified as having no adverse effects. New fisheries would likely not adversely affect the physical environment. |
| **Biological Environment** | | | | | | | |
| **Effects on Threatened and Endangered Species** | **POSSIBLE BENEFICIAL EFFECT** SSL measures result in a reduction in overlap of fisheries and Steller Sea lions. | **POSSIBLE ADVERSE EFFECT** SSL measures are the same as Alternative 1 but other components such as increased TAC, removal of protected area, and increased disturbance would have adverse effects. | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **BENEFICIAL EFFECT** Near term closure of fisheries results in more SSL prey. |
| **Effects on Target Fish** | **POSSIBLE BENEFICIAL EFFECT** SSL measure help ensure stocks are harvested at a rate above MSST. | **POSSIBLE ADVERSE EFFECT** SSL Protection Measures the same as Alternative 1; However, harvest of target species substantially increased. | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 | **BENEFICIAL EFFECT** Closure of the fishery in the short term is beneficial and new certified fisheries would ensure stocks are maintained well above MSST. |

**Table 3 (continued). Summary of potential effects of the policy alternatives and FMP bookends.**

| EFFECT INDICATOR | Alternative 1.0 | Alternative 2.0 | | Alternative 3.0 | | Alternative 4.0 | |
|---|---|---|---|---|---|---|---|
| | FMP 1.0 | FMP 2.1 | FMP 2.2 | FMP 3.1 | FMP 3.2 | FMP 4.1 | FMP 4.2 |
| **Biological Environment (Cont.)** | | | | | | | |
| **Effects on Non-Target Fish** | **MINIMAL EFFECT** SSL Protection Measures would have little effect on non-target species. | **POSSIBLE ADVERSE EFFECT** SSL Protection Measures same as Alternative 1 FMP. However, removal of bycatch limits could have adverse effects. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** New SSL measure would have some benefit to non-target species. | **POSSIBLE BENEFICIAL EFFECT** Increased SSL buffers and MPAs could provide some benefit. Bycatch is reduced as overall harvest is lower. | **BENEFICIAL EFFECT** Closure of fisheries would reduce bycatch of benefit non-target species. |
| **Effects on Prohibited Species** | **MINIMAL EFFECT** SSL Protection Measures would not likely change the prohibited species bycatch limits. | **POSSIBLE ADVERSE EFFECT** SSL Protection Measures same as Alternative 1 FMP. However, other FMP components such as removal of PSC limits could have adverse effects. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** New SSL measure would have some benefit to prohibited species by reducing harvest. | **BENEFICIAL EFFECT** Increased SSL Protection Measures and reduced TAC would reduce harvest of prohibited species. | **BENEFICIAL EFFECT** During the period of no fishing, until such time that certain fisheries are certified, there would be no bycatch of prohibited species. It is unlikely that fisheries having high bycatch or creating other impacts on prohibited species would be certified. |
| **Effects on Essential Fish Habitat** | **POSSIBLE BENEFICIAL** SSL Protection Measures closure of 3-nm around rookeries and haulouts provides protection to benthic habitat. Areas closed to trawling for the three main target species, all important prey for SSLs, amount to approximately 50% of all SSL critical habitat. | **POSSIBLE BENEFICIAL** SSL measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL** SSL measures same as Alternative 1 FMP . | **POSSIBLE BENEFICIAL** SSL measures same as Alternative 1 FMP. | **BENEFICIAL EFFECT** New SSL shoreline buffers and MPAs would increase protection for EFH. | **BENEFICIAL EFFECT** Expanded SSL buffers and MPAs would increase protection for EFH. | **BENEFICIAL EFFECT** During the period of no fishing, until such time that certain fisheries are certified, there would be no adverse impacts on EFH . Fisheries that adversely impact EFH or Steller sea lion would not be certified. |

**Table 3 (continued). Summary of potential effects of the policy alternatives and FMP bookends.**

| EFFECT INDICATOR | Alternative 1.0 | Alternative 2.0 | | Alternative 3.0 | | Alternative 4.0 | |
|---|---|---|---|---|---|---|---|
| | FMP 1.0 | FMP 2.1 | FMP 2.2 | FMP 3.1 | FMP 3.2 | FMP 4.1 | FMP 4.2 |
| **Biological Environment (Cont.)** | | | | | | | |
| **Effects on Marine Mammals** | **POSSIBLE BENEFICIAL EFFECT** SSL closure could benefit other marine mammals where important habitats overlap with closed areas. | **POSSIBLE ADVERSE EFFECT** Same as Alternative 1 FMP; however, increased TAC of marine mammal prey could have negative effects. | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 FMP | **POSSIBLE BENEFICIAL EFFECT** Same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** New SSL shoreline buffers and MPAs increase protection to some marine mammals. | **BENEFICIAL EFFECT** No trawling in SSL critical habitat around rookeries and haulouts, and reduced trawling outside critical habitat, and reduction in TAC increases protection for other marine mammal species. | **BENEFICIAL EFFECT** During the period of no fishing, until such time that certain fisheries are certified, there would be no adverse impacts on marine mammals. Also, it is not likely that fisheries creating other impacts on marine mammals would be certified. |
| **Effects on Seabirds** | **MINIMAL EFFECT** SSL Protection Measures have little if any effect on seabirds. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **MINIMAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP with added shoreline buffer zones and MPAs. | **POSSIBLE BENEFICIAL EFFECT** No trawling in SSL critical habitat around rookeries and haulouts, reduced trawling outside critical habitat, and reduction in TAC increases protection for some seabird colonies and foraging areas. | **BENEFICIAL EFFECT** During the period of no fishing, until such time that certain fisheries are certified, there would be no direct adverse impacts on seabirds. Also, it is not likely that fisheries creating other impacts on seabirds would be certified. |

**Table 3 (continued). Summary of potential effects of the policy alternatives and FMP bookends.**

| EFFECT INDICATOR | Alternative 1.0 | Alternative 2.0 | | Alternative 3.0 | | Alternative 4.0 | |
|---|---|---|---|---|---|---|---|
| | FMP 1.0 | FMP 2.1 | FMP 2.2 | FMP 3.1 | FMP 3.2 | FMP 4.1 | FMP 4.2 |
| **Ecosystem Effects** | **POSSIBLE BENEFICIAL EFFECT** Potential increase in prey species such as pollock, Pacific cod and Atka mackerel. Potential increase in species diversity. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** Creation of SSL shoreline buffer zones and MPAs potentially benefits several species. | **BENEFICIAL EFFECT** SSL Protection Measure to close all trawling in SSL critical habitat and in fisheries that can use other gear. Increase in forage availability for predators and potential increase in species diversity. Effect on top predator would be beneficial. | **BENEFICIAL EFFECT** During the period of no fishing, until such time that certain fisheries are certified, there would be no adverse effects from the groundfish fishery on the ecosystem. Forage availability, effects on species diversity, and top predators would be beneficial. |

**Table 3 (continued). Summary of potential effects of the policy alternatives and FMP bookends.**

| EFFECT INDICATOR | Alternative 1.0 | Alternative 2.0 | | Alternative 3.0 | | Alternative 4.0 | |
|---|---|---|---|---|---|---|---|
| | FMP 1.0 | FMP 2.1 | FMP 2.2 | FMP 3.1 | FMP 3.2 | FMP 4.1 | FMP 4.2 |
| **Social and Economic Environment** | | | | | | | |
| **Non-Market Impacts** | **POSSIBLE BENEFICIAL EFFECT** If SSL measures aid recovery of the species, impacts are beneficial to eco-tourism and subsistence. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** SSL Protection Measures same as Alternative 1 FMP. | **POSSIBLE BENEFICIAL EFFECT** Increased SSL measure could benefit eco-tourism and subsistence. | **POSSIBLE BENEFICIAL EFFECT** Increased SSL measure could benefit eco-tourism and subsistence. | **POSSIBLE BENEFICIAL EFFECT** Eco-tourism and subsistence would benefit from increased SSL numbers and very limited fishing. |
| **Industry Costs and Market Impacts** | **POSSIBLE ADVERSE EFFECT** Increased operation costs in some fisheries. Industry cost and market impacts would be negatively affected by SSL measures. | **POSSIBLE ADVERSE EFFECT** SSL Protection Measure are the same as Alternative 1; therefore, industry cost and market impacts are the same. | **POSSIBLE ADVERSE EFFECT** SSL Protection Measure are the same as Alternative 1; therefore, industry cost and market impacts are the same. | **POSSIBLE ADVERSE EFFECT** SSL Protection Measure are the same as Alternative 1; therefore, industry cost and market impacts are the same. | **ADVERSE EFFECT** Creation of SSL shoreline buffers would negatively impact the fishing industry by increasing operating costs. | **ADVERSE EFFECT** Closure of trawling within 15 nm of rookeries and haulouts and reduction in TAC would negatively impact the industry. | **ADVERSE EFFECT** Closing fisheries would have adverse effects on rural communities and the catcher vessel fleet. |

Under either the Alternative 1(a) or 1(b) policy statement, NOAA Fisheries and the NPFMC would continue to minimize and adjust fishery restrictions in order to avoid a jeopardy finding through conservative cautionary management and ongoing Section 7 consultations. Alternative 1(b) acknowledges that the groundfish fishery has an impact on various parts of the environment but prioritizes management actions based on the scientific evidence of significant impact. Steller sea lion Protection Measures may be expanded beyond what is absolutely necessary in order to account for some uncertainty in understanding the interactions between the Steller sea lions and the fisheries. Research is directed toward understanding how various fisheries could contribute to the Steller sea lion decline so that the role of fisheries is properly cast.

Under the Alternative 2 policy, the Observer Program and VMS requirements could range from being repealed (FMP Bookend 2.1) to having the same coverage and function as at present (FMP Bookend 2.2 scenario). It seems highly unlikely that, given the continuing decline of the western stock of Steller sea lions and the existing Steller sea lion Protection Measures, NOAA Fisheries OPR would concur with eliminating both of these programs to monitor the groundfish fleet. NOAA Fisheries would need to find a compromise within the range of the Alternative 2 policy that does not result in a jeopardy finding.

The Alternative 3 policy assumes that the groundfish fishery has a greater impact on a number of environmental factors than presently realized, but that not all of it is negative. Mitigation efforts would still be prioritized by scientific evidence of adverse impact. For Steller sea lion Protection Measures, increased restrictions on the fishing fleet would occur based on scientific research but would not require that the research be definitive before taking action. Alternative 3 would thus be more "precautionary" in dealing with uncertainty and more emphasis would be placed on researching indirect fishery interactions with the ocean ecosystem, and similar to Alternative 1, understanding how fisheries could contribute to the Steller sea lion decline to properly cast the role of fisheries. It would also expand the Observer Program and VMS requirements to improve monitoring and enforcement of fishing restrictions in Steller sea lion critical habitats.

The Alternative 4 policy would assume that the fisheries are having many adverse impacts on the marine environment, similar to Alternative 1 and 3, including detrimental impacts on the food web of marine mammals, but currently enough is not known about fishery interactions to know what they are. Existing Steller sea lion Protection Measures would be expanded to attempt to eliminate all adverse impacts of the fisheries on Steller sea lions. The fishery would be greatly restricted relative to Alternative 1 until scientific evidence could make certain that there were no direct or indirect adverse impacts on protected resources. Environmental research would receive a much higher priority than in any other scenario. In the first three Alternative policies, various degrees of uncertainty about an impact would be used to limit restrictions on the industry. Under the Alternative 4 policy, the burden of proof is reversed and uncertainty about an impact would be used to stop fishing until each fishery could be reviewed and certified as resulting in no significant environmental impacts. Those fisheries that are certified as "acceptable" would be heavily monitored with observers and electronic gear to ensure compliance with any restrictions.

The fact is, no matter how much effort is applied to studying this dynamic marine environment, there will always be unanswered questions about the impacts of specific fisheries or mitigation efforts. This is not to say that the situation is hopelessly complicated and anything useful cannot be learned from ecological research. The policy alternatives vary in how much emphasis they place on understanding how the various system components, including marine mammals, respond to fishing, and how each alternative policy would try to incorporate this information into management decisions. From the least emphasis on ecosystem

function to the most, the policies would range in order from Alternative 2, Alternative 1, Alternative 3, to Alternative 4.

## 9.0 Conclusion

Since the Steller sea lion Protection Measures under the Alternative 1(a) or 1(b) policy represent the minimum level of protection necessary to avoid a jeopardy finding, the primary issue is how adaptable the alternative policies are to additional measures, such as expanded or fewer restrictions on fisheries as new information becomes available through scientific research. Anticipated modifications to the Steller sea lion Protection Measures under these alternative policies are difficult to predict since they rely on information not yet known.

Steller sea lion Protection Measures keep the groundfish fisheries in the BSAI and GOA in conformity with the ESA, and allow the fisheries to continue at a tremendous benefit to the economy. These measures are based on the principle that there are some adverse effects of the groundfish fisheries on Steller sea lions and these adverse effects include nutritional stress due to the indirect effects of localized depletion of prey species by the groundfish fisheries. The efficacy of these mitigation measures hinges on the validity of this theory. This theory is the underlying basis for Alternative 4.

The Alternatives examined in this paper represent a range of policy options but a key component of each alternative is the requirement to be in compliance with the ESA. The current Steller sea lion Protection Measures have been found to meet these requirements (NMFS 2001a). Changes to the management of the fisheries that substantially alter the underlying requirements would require further Section 7 consultations. Because the Steller sea lion Protection Measures range from Alternative 1 through 3, their effects on Steller sea lions, their critical habitat, and on other environmental resources are generally similar. The conservative management and Steller sea lion Protection Measures under Alternative 4 are substantially increased. The primary effect of the Steller sea lion Protection Measures is the separation of fishing effort in time and space to the extent that the competitive overlap between the groundfish fisheries and prey for the Steller sea lion has a minimal effect on their continued existence and chance for recovery.

Currently, a tremendous amount of monitoring and research is focused on a very wide range of issues concerning the decline of the Steller sea lion. The results of this research will likely be used to reevaluate all aspects of the current Steller sea lion Protection Measures and it is anticipated that additional Section 7 Consultations will be required in coming years to bring the Steller sea lion Protection Measures in line with current scientific research.

## 10.0 References


Alaska Department of Fish and Game (ADF&G) and National Marine Fisheries Service (NMFS). 2002. Satellite telemetry and the Steller sea lion research. Overview of the use of satellite telemetry in Steller sea lion research. http://www.fakr.noaa.gov/protectedresources/stellers/biop2002/support/ADFGandNMFS2001.pdf

Angliss, R.P., and Lodge, K.L. (2002)."Alaska Marine Mammal Stock Assessments, 2002." National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115.pp.203.

Beecham, J. W., J. C. Patton, and T. R. Loughlin. 1996. High variability for control-region sequences in a marine mammal: Implications for conservation and biogeography of Steller sea lions (Eumetopias jubatus). Journal of Mammalogy 77(1):95-108.

Calkins, D.G, D.C McAllister, G.W. Pendalton, and K.W. Pitcher. 1999. Steller sea lion status and trend in Southeast Alaska, 1979-1997. Marine Mammal Science 15:462-467.

Ferrero, R.C., and L.W. Fritz. 2002. Steller sea lion research and coordination: A brief history and summary of recent progress. NOAA Technical Memorandum NMFS-AFSC-129.

Kruse, G.H., M. Crow, E.E. Krygier, D.S. Lloyd, K. W. Pitcher, L.D. Rae, M. Ridgeway, R.J. Small, J. Stinson, and K.W. Wynne. 2001. A review of proposed fishery management actions and the decline of Steller Sea lions (*Eumetopias jubatus*) in Alaska: A report by the Alaska Steller sea lion restoration team.

Loughlin, T. R., A. S. Perlov, and V. A. Vladimirov. 1990. Survey of northern sea lions (Eumetopias jubatus) in the Gulf of Alaska and Aleutian Islands during June 1989. U. S. Department of Commerce, NOAA Technical Memorandum NMFS F/NWC-176, 26 pp.

Loughlin, T. R., A. S. Perlov, and V. A. Vladimirov. 1992. Range-wide survey and estimation of total number of Steller sea lions in 1989. Marine Mammal Science 83(3):220-239.

National Marine Fisheries Service. 1992. Recovery Plan for the Steller sea lion (*Eumetopias jubatus*). Prepared by the Steller sea lion recovery team for the National Marine Fisheries Service, Office of Protected Resources, Silver Springs, Maryland. 92 pp.

National Marine Fisheries Service. 1998a. Biological Opinion Section 7 Consultation on the BSAI and GOA groundfish management plans, 1999 and 2002. Alaska Regional Office and Alaska Fisheries Science Center, Juneau, Alaska.

National Marine Fisheries Service. 2000. Biological Opinion Section 7 Consultation on the groundfish management plans, 1999 and 2002. NMFS, Office of Protected Resources, NMFS, Silver Spring, Maryland.

National Marine Fisheries Service. 2001a. Endangered Species Act - Section 7 Consultation Biological Opinion and Incidental Take Statement. NMFS, Alaska Region Office of Protected Resources, Juneau, Alaska.

National Marine Fisheries Service. 2001b. Steller sea lion Protection measures - Final Environmental Impact Statement. NOAA - National Marine Fisheries Service, Alaska Region, Juneau, Alaska.

National Research Council, 2002. The decline of the Steller sea lion in Alaskan waters: Untangling food webs and fishing nets - Executive Summary. Committee on the Alaska groundfish Fishery and the Steller Sea Lion. The National Academies Press, Washington, D.C.

Petersen, M. R., W. W. Larned and D. C. Douglas. 1999. At-sea distribution of spectacled eiders (*Somateria fischeri*):120 year-old mystery resolved. Auk 116:1009-1020.

SAFE. (2002). Stock Assessment and Fishery Evaluation (SAFE) Report. Ecosystem Considerations for 2003, 213 pp. NPFMC, 605 West 4th Avenue., Suite 306, Anchorage, AK 99501. November 2002.

Sease, J.L., W.P Taylor, T.R. Loughlin, and K.W. Pitcher. 2001 Aerial and Land-based surveys of Steller Sea lions (*Eumetopias jubatus*) in Alaska, June and July 1999 and 2000. NOAA Technical Memorandum NMFS-AFSC-122.

Sease, J.L. 2002. Steller Sea lions survey results, June and July, 2002. Memorandum for the record. National Marine Mammal Lab - Alaska Fisheries Science Center and the Southwest Fisheries Science Center. 7 pp.

U.S. Fish and Wildlife Service. 2002. Steller's Eider Recovery Plan. Public Review Draft.

Wolfe, R.J, and Mishler. 1993. The Subsistence harvest of harbor sea and sea lions by Alaska natives in 1992. Technical Paper No. 229, Alaska Department of Fish and Game, Division of Subsistence. Juneau, Alaska. 443pp.

York, A.E., R.L Merrick, and T.R. 1996. An analysis of the Steller sea lion metapopulations in Alaska. Pages 259-292 in D.R. McCullough, Editor. Metapopulations and Wildlife Conservation. Island Press, Covelo, CA.

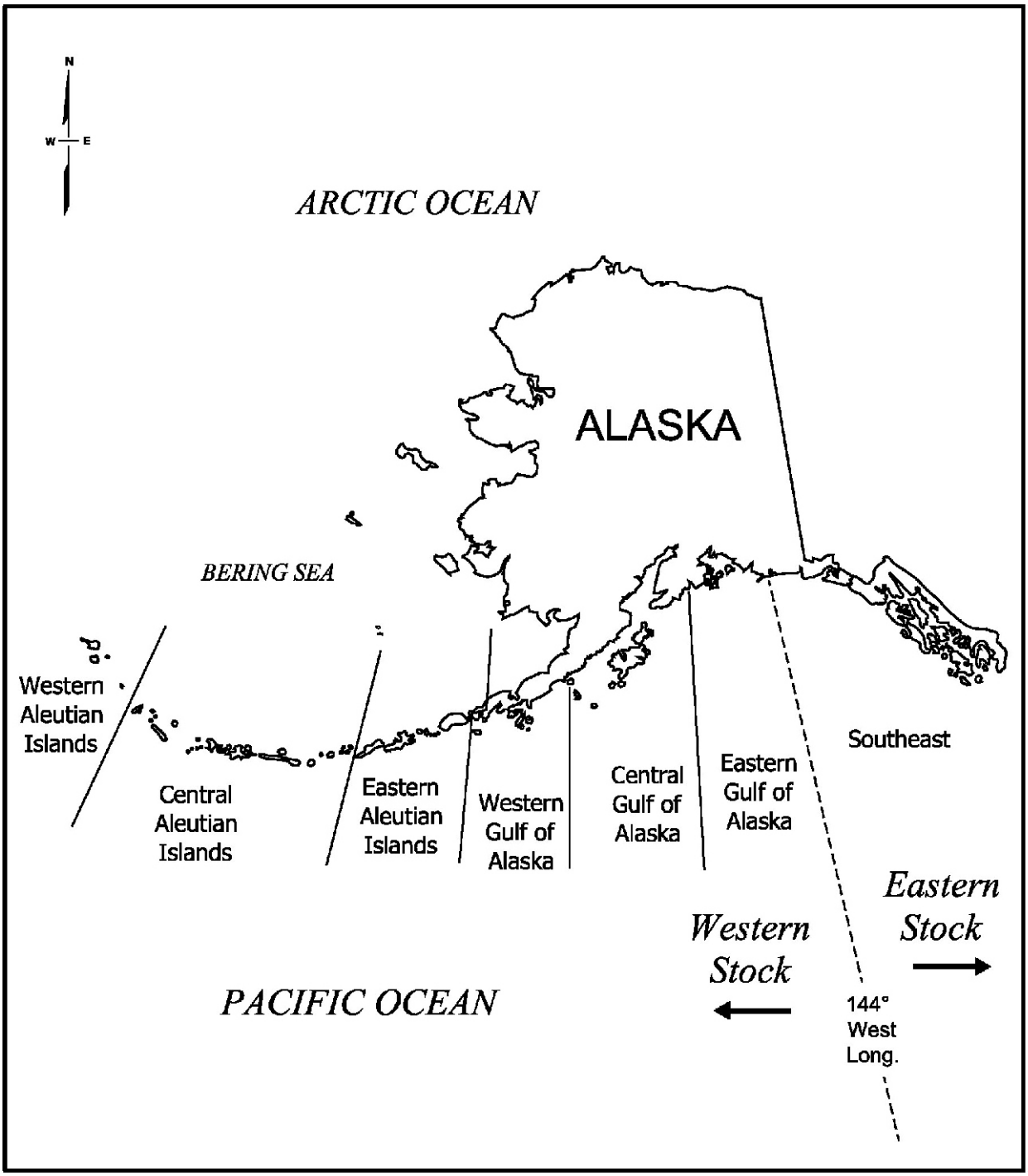



**Figure 1. Survey regions for Steller Sea Lion counts.**

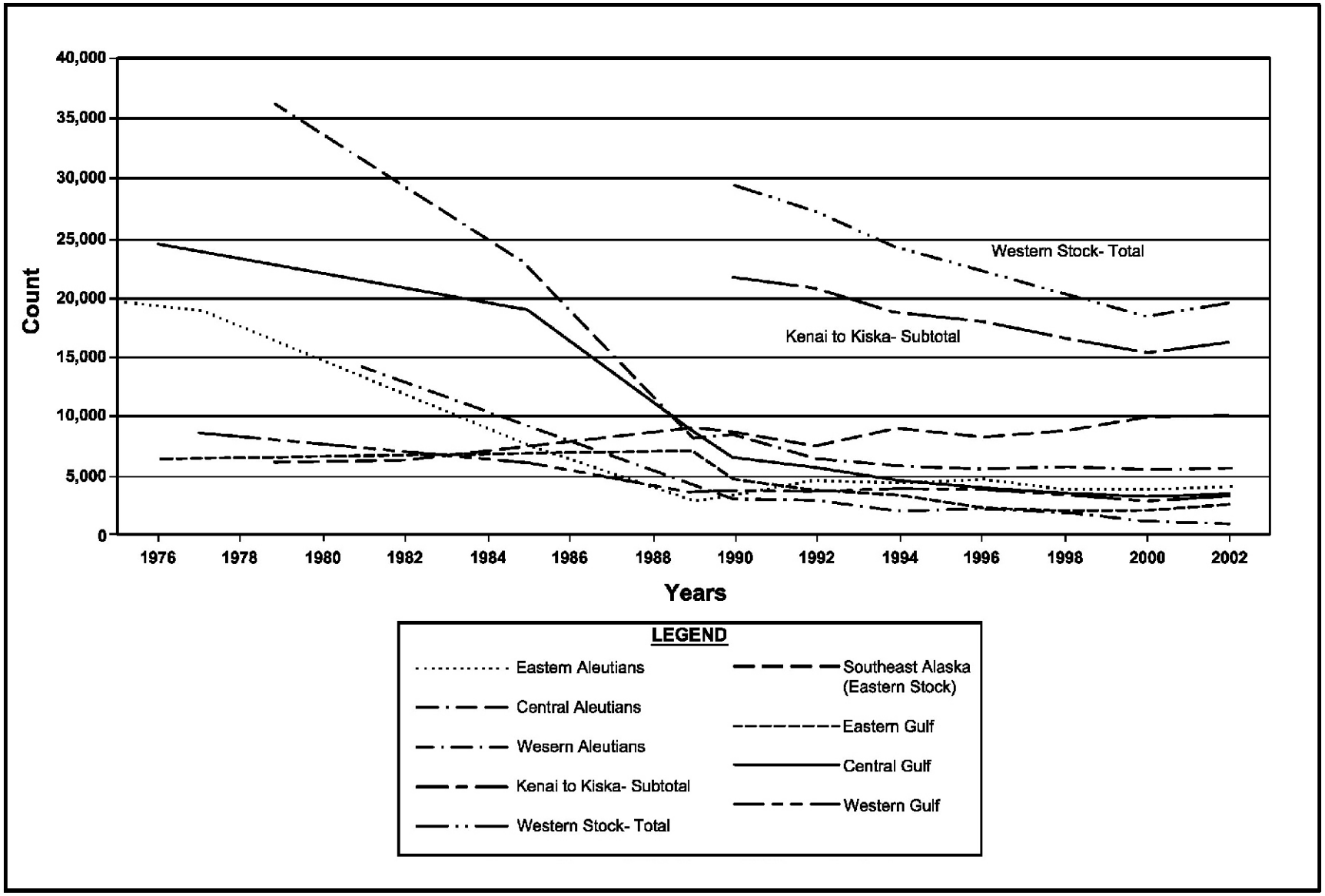



**Figure 2. Regional counts of adult and juvenile (non-pups) Steller Sea lions at trend sites in Alaska. Source: Sease, 2000; Sease, 2002 unpublished.**

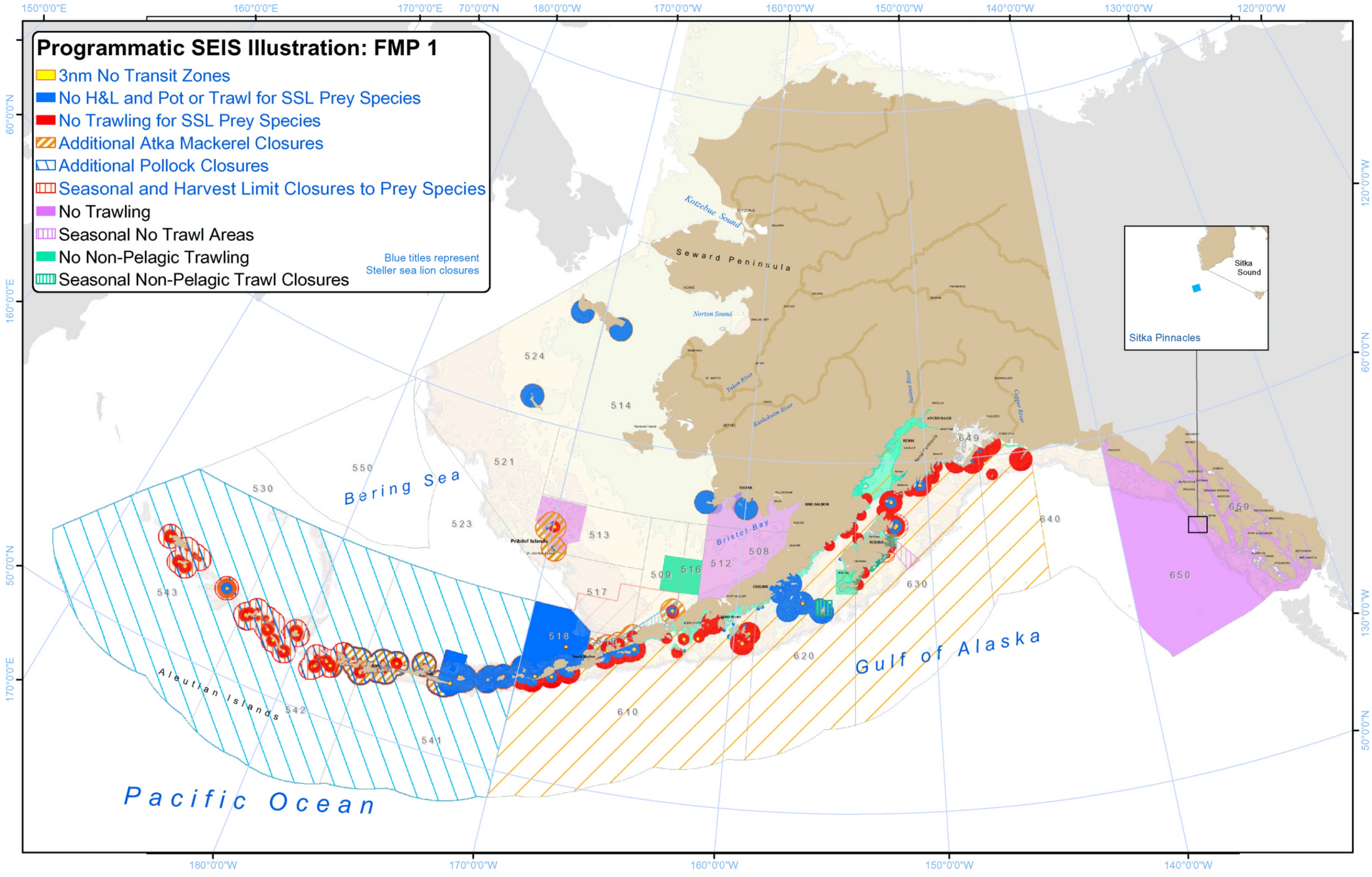



**Figure 3. FMP 1 map**

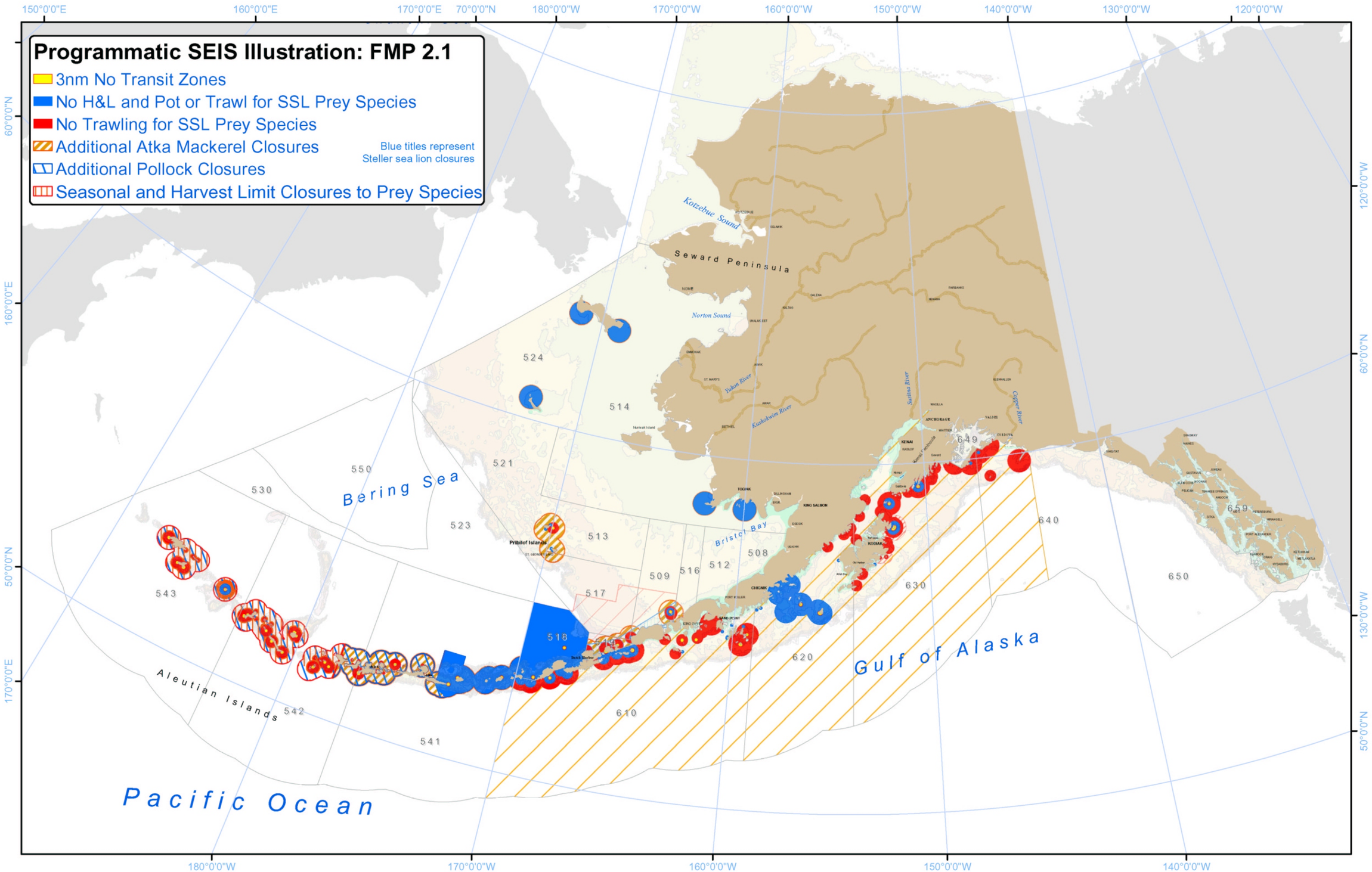



**Figure 4. FMP 2.1 map**

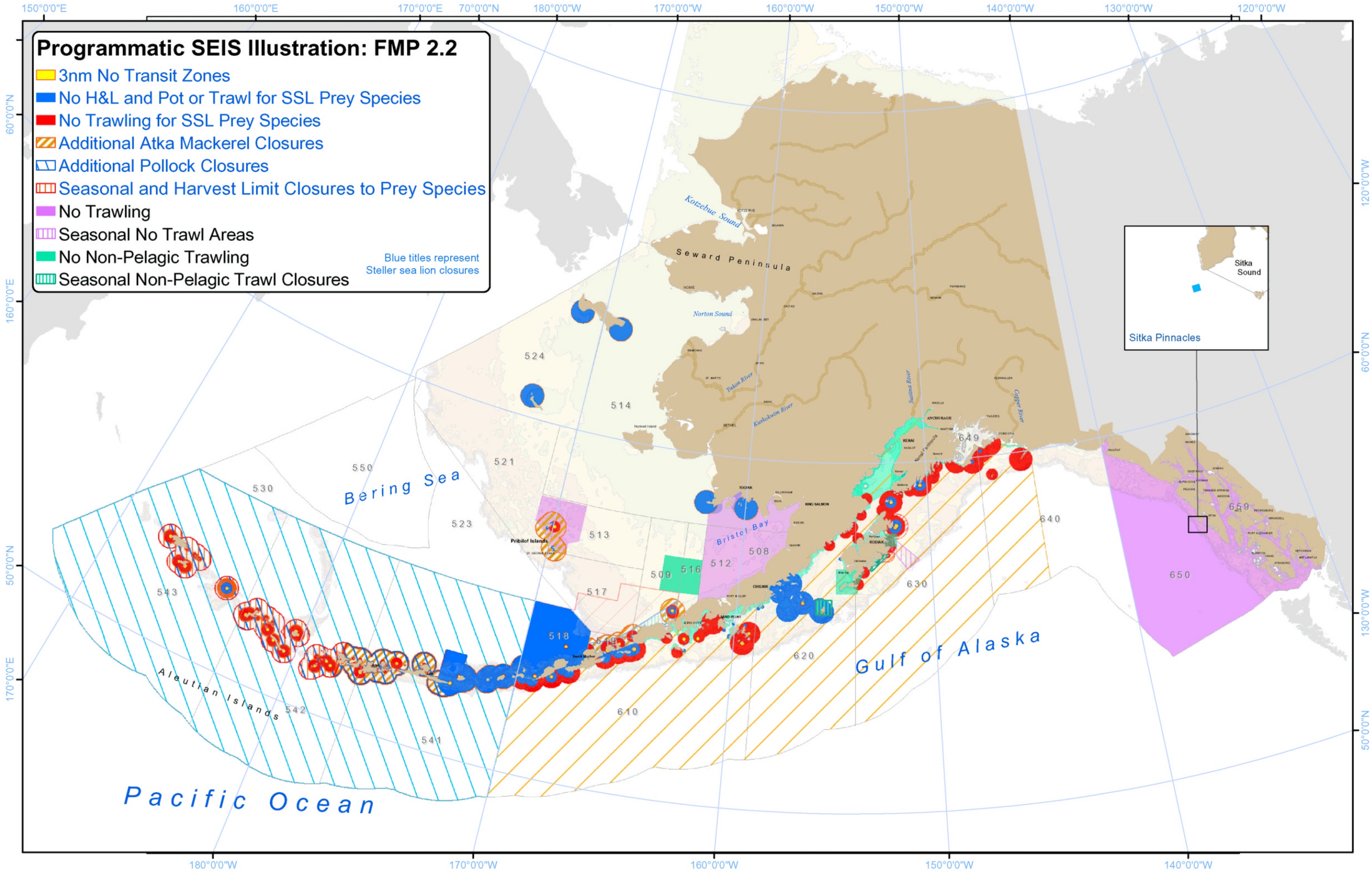



**Figure 5. FMP 2.2 map**

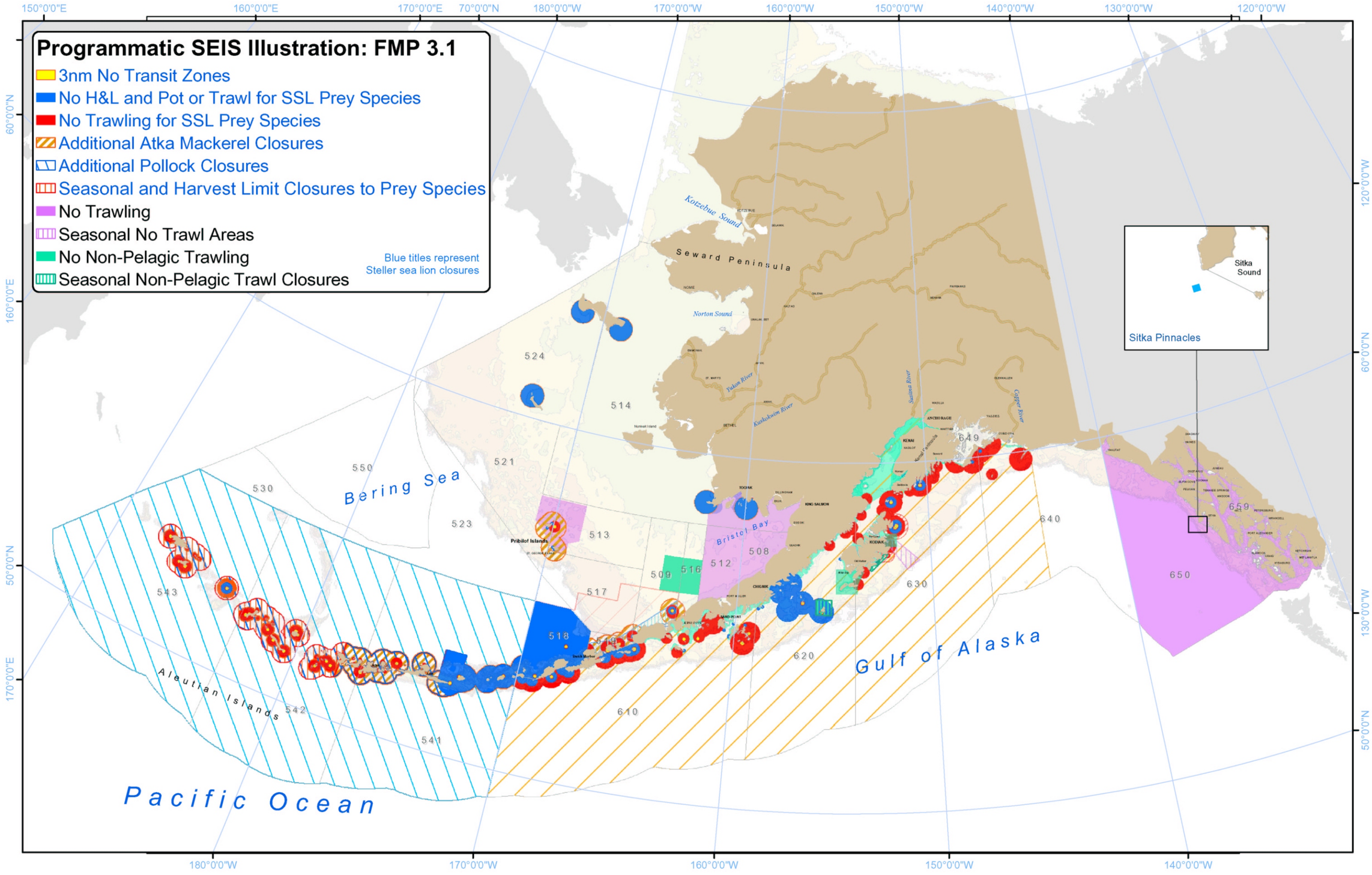



**Figure 6. FMP 3.1 map**

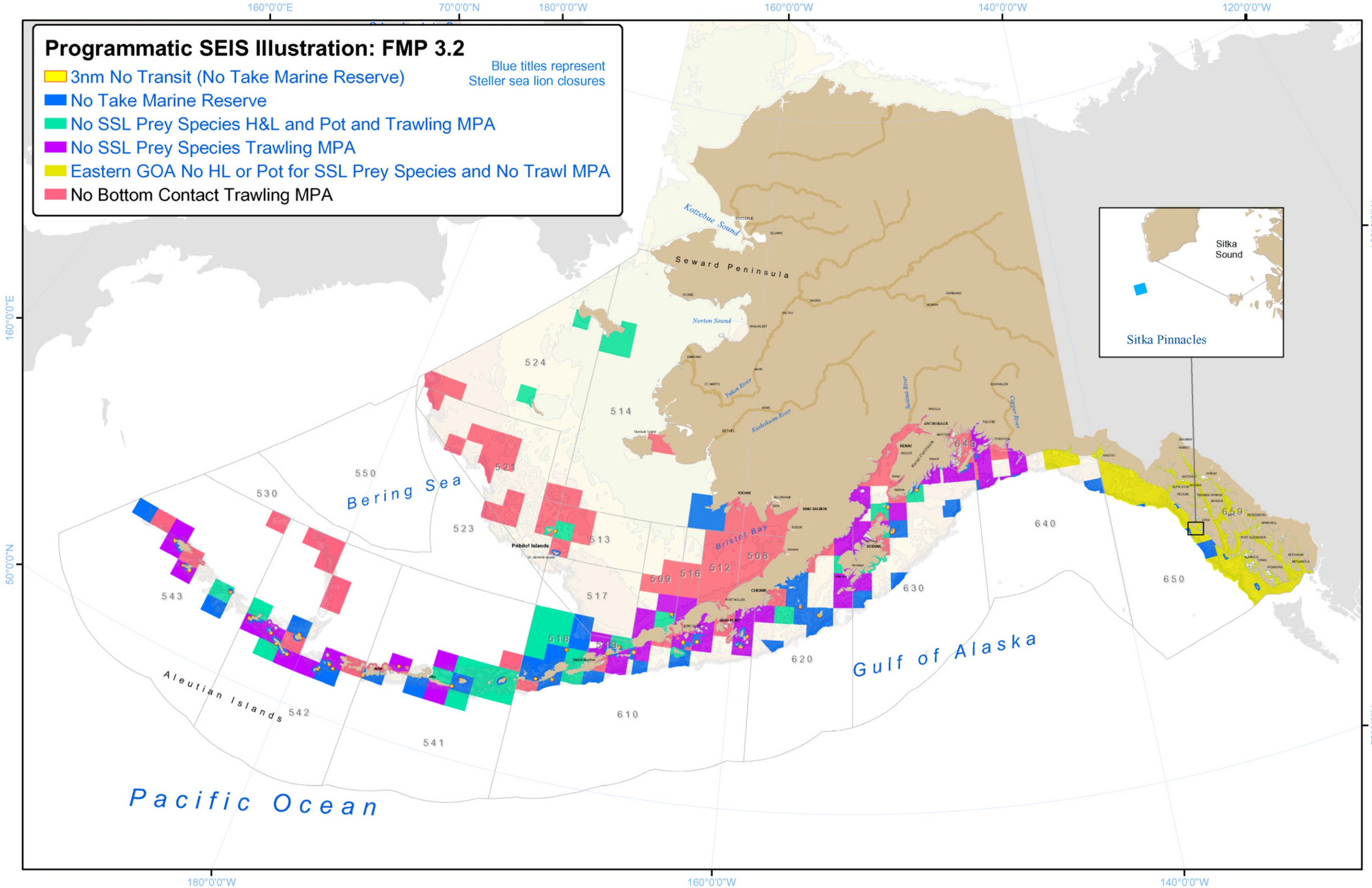



**Figure 7. FMP 3.2 map**

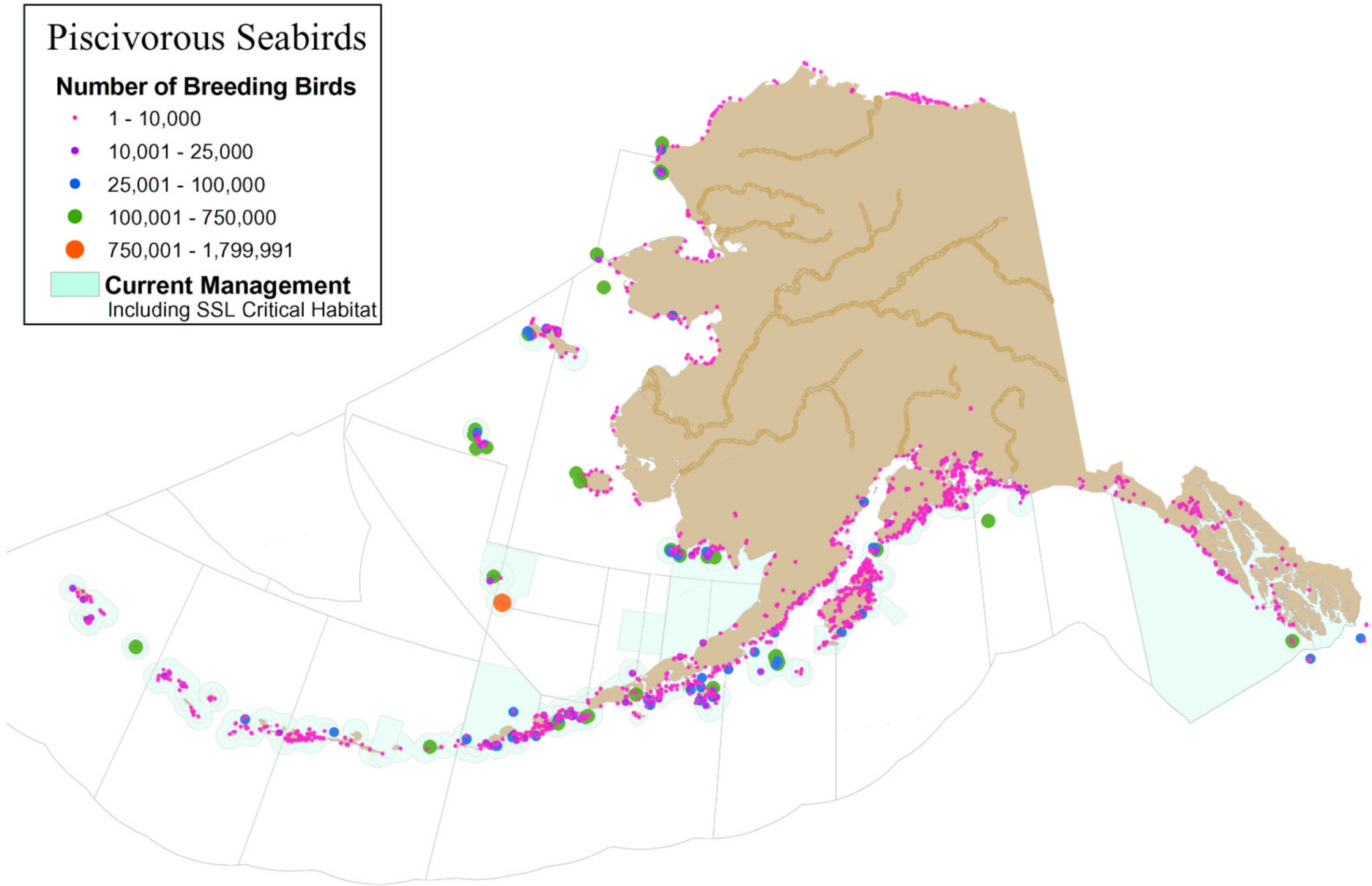



**Figure 8. SSL critical habitat and seabird colony map**

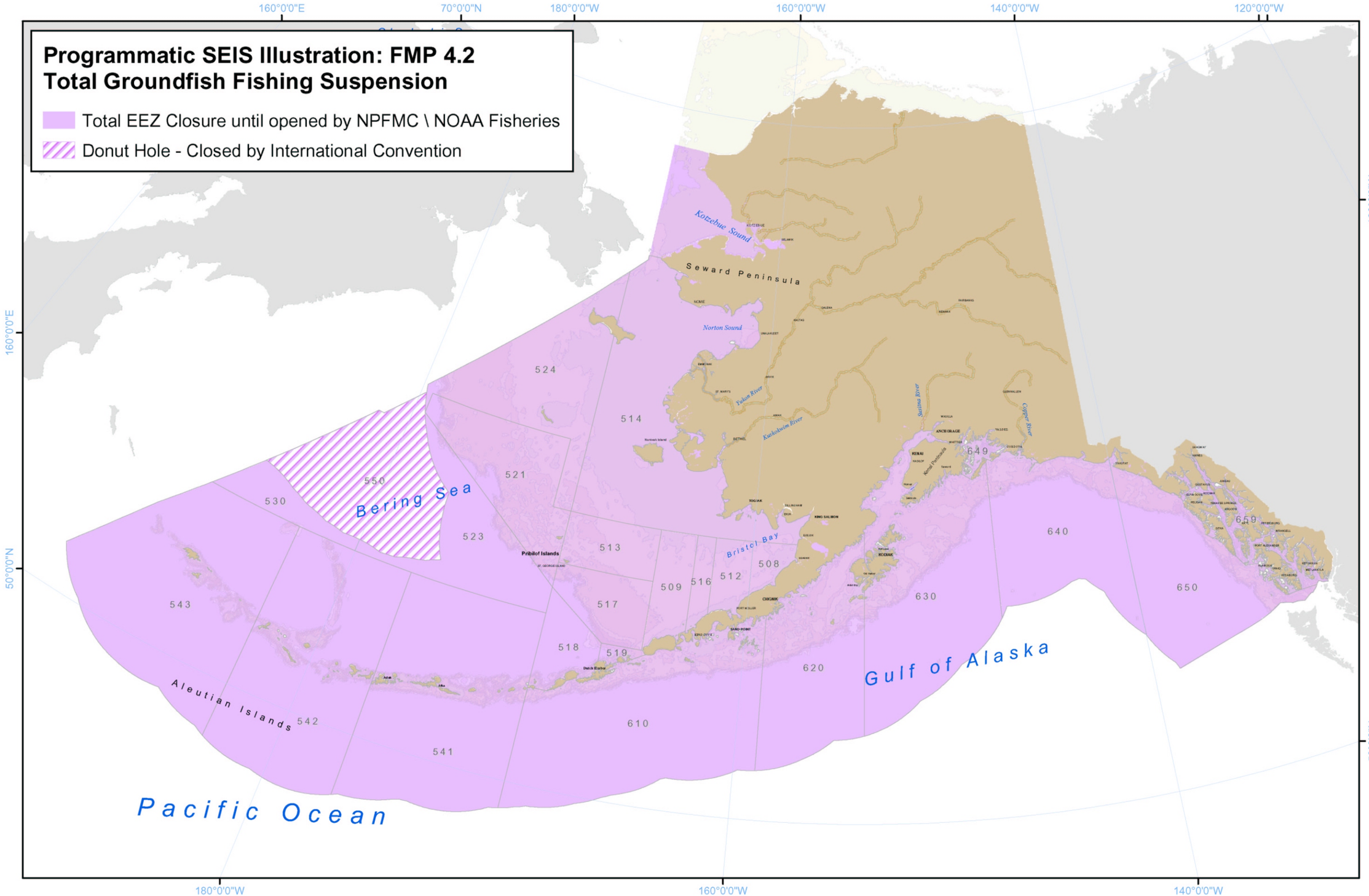
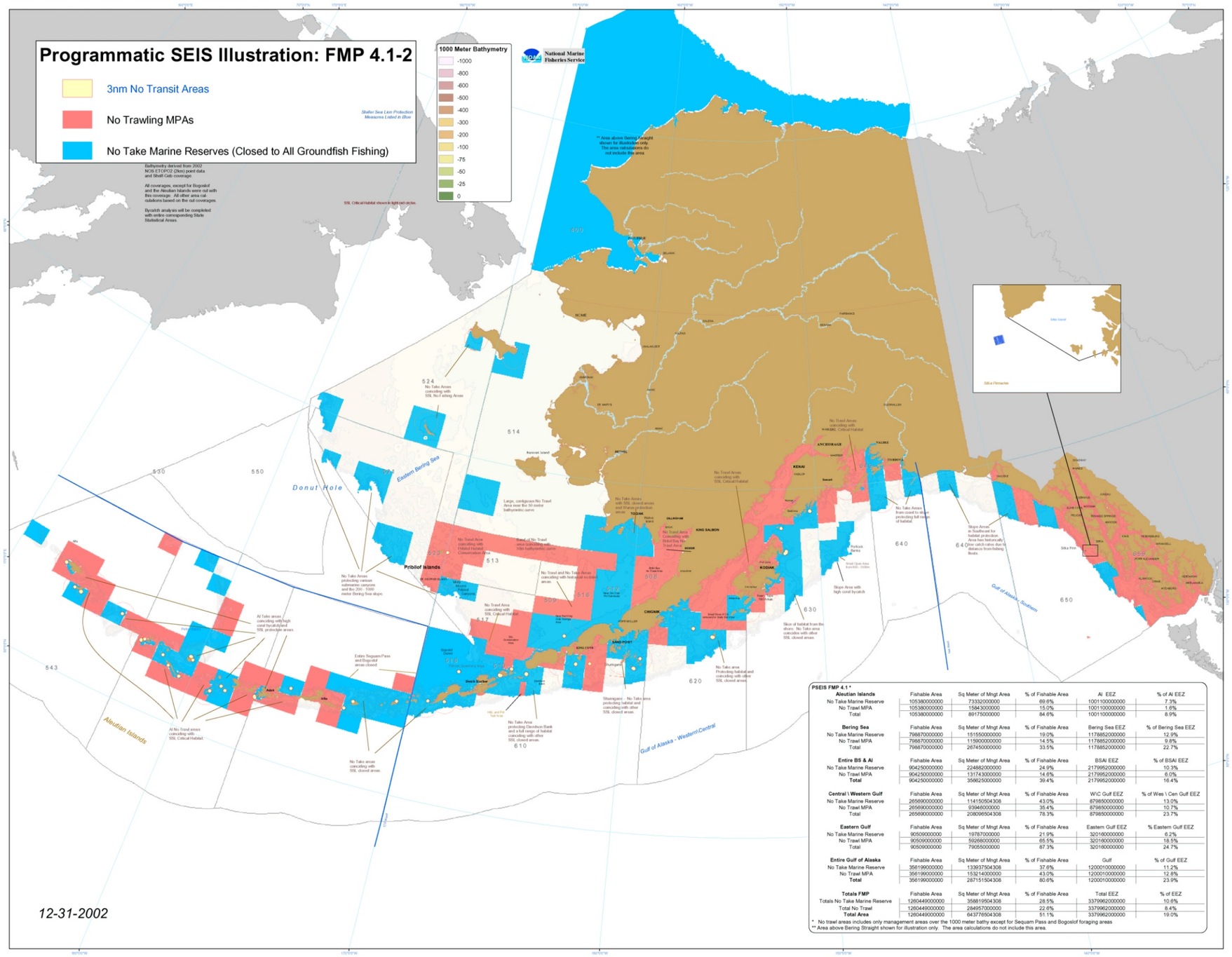



**Figure 9. FMP 4.2 map**




| PSEIS FMP 4.1 * | | | | | |
|---|---|---|---|---|---|
| **Aleutian Islands** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | AI EEZ | % of AI EEZ |
| No Take Marine Reserve | 105380000000 | 73332000000 | 69.6% | 1001100000000 | 7.3% |
| No Trawl MPA | 105380000000 | 15843000000 | 15.0% | 1001100000000 | 1.6% |
| Total | 105380000000 | 89175000000 | 84.6% | 1001100000000 | 8.9% |
| **Bering Sea** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | Bering Sea EEZ | % of Bering Sea EEZ |
| No Take Marine Reserve | 798870000000 | 151550000000 | 19.0% | 1178852000000 | 12.9% |
| No Trawl MPA | 798870000000 | 115900000000 | 14.5% | 1178852000000 | 9.8% |
| Total | 798870000000 | 267450000000 | 33.5% | 1178852000000 | 22.7% |
| **Entire BS & AI** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | BSAI EEZ | % of BSAI EEZ |
| No Take Marine Reserve | 904250000000 | 224882000000 | 24.9% | 2179952000000 | 10.3% |
| No Trawl MPA | 904250000000 | 131743000000 | 14.6% | 2179952000000 | 6.0% |
| **Total** | 904250000000 | 356625000000 | 39.4% | 2179952000000 | 16.4% |
| **Central \ Western Gulf** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | W\C Gulf EEZ | % of Wes \ Cen Gulf EEZ |
| No Take Marine Reserve | 265690000000 | 114150504308 | 43.0% | 879850000000 | 13.0% |
| No Trawl MPA | 265690000000 | 93946000000 | 35.4% | 879850000000 | 10.7% |
| Total | 265690000000 | 208096504308 | 78.3% | 879850000000 | 23.7% |
| **Eastern Gulf** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | Eastern Gulf EEZ | % Eastern Gulf EEZ |
| No Take Marine Reserve | 90509000000 | 19787000000 | 21.9% | 320160000000 | 6.2% |
| No Trawl MPA | 90509000000 | 59268000000 | 65.5% | 320160000000 | 18.5% |
| Total | 90509000000 | 79055000000 | 87.3% | 320160000000 | 24.7% |
| **Entire Gulf of Alaska** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | Gulf | % of Gulf EEZ |
| No Take Marine Reserve | 356199000000 | 133937504308 | 37.6% | 1200010000000 | 11.2% |
| No Trawl MPA | 356199000000 | 153214000000 | 43.0% | 1200010000000 | 12.8% |
| **Total** | 356199000000 | 287151504308 | 80.6% | 1200010000000 | 23.9% |
| **Totals FMP** | Fishable Area | Sq Meter of Mngt Area | % of Fishable Area | Total EEZ | % of EEZ |
| Totals No Take Marine Reserve | 1260449000000 | 358819504308 | 28.5% | 3379962000000 | 10.6% |
| Total No Trawl | 1260449000000 | 284957000000 | 22.6% | 3379962000000 | 8.4% |
| **Total Area** | 1260449000000 | 643776504308 | 51.1% | 3379962000000 | 19.0% |

* No trawl areas includes only management areas over the 1000 meter bathy except for Sequam Pass and Bogoslof foraging areas
** Area above Bering Straight shown for illustration only. The area calculations do not include this area.

**Figure 10. FMP 4.1 map**