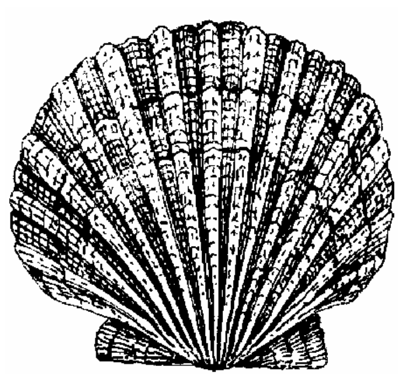
Fishery Management Plan for the Scallop Fishery off Alaska



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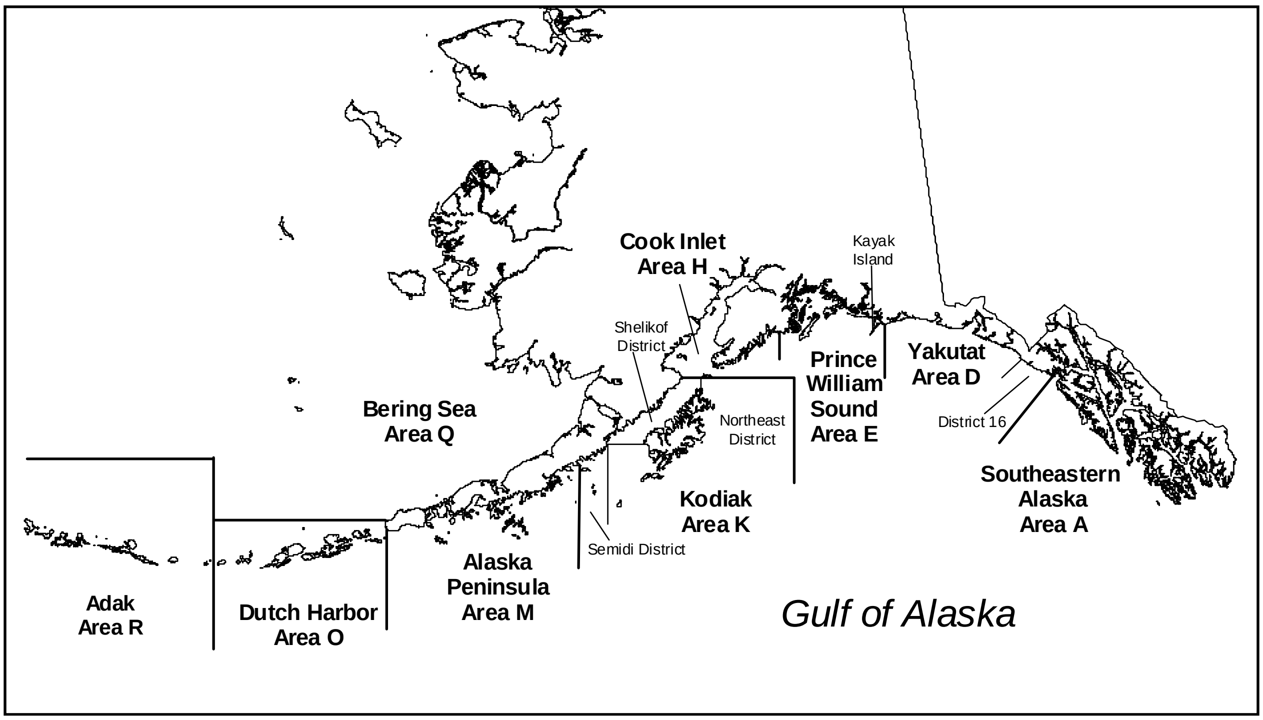
Executive Summary

This Fishery Management Plan (FMP) governs scallop fisheries in federal waters off the State of Alaska. The FMP management unit is the U.S. exclusive economic zone (EEZ) of the Bering Sea, Aleutian Islands, and the Gulf of Alaska, and includes weathervane scallops and other scallop species not currently exploited. The GOA is defined as the U.S. EEZ of the North Pacific Ocean, exclusive of the Bering Sea, between the eastern Aleutian Islands at 170°W longitude and Dixon Entrance at 132°40'W longitude. The BSAI is defined as the U.S. EEZ south of the Bering Strait to the Alaska Peninsula and Aleutian Islands and extending south of the Aleutian Islands west of 170°W long.

Alaska weathervane scallop fishing registration areas



This FMP was approved on July 26, 1995, which established a one-year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. This FMP has since been amended several times, initially in order to establish a State-Federal management regime, then to address several Federal requirements under the Magnuson Stevens Act as well as to address issues such as overcapacity in the fishery. The scallop fishery is jointly managed by the National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADF&G) under this FMP.

Management measures in this FMP fall into two categories: Category 1 measures are those delegated to the State for implementation, while Category 2 measures are limited access management measures which are fixed in the FMP, implemented by Federal regulation, and require and FMP amendment to change. Category 1 and 2 measures are listed below.

CATEGORY 1 (Delegated to the State)	**CATEGORY 2 (Fixed in FMP, Implemented by Federal Regulation)**
Guideline Harvest Levels	License limitation program
Registration Areas, Districts, Subdistricts and Sections	Optimum Yield specification
Gear Limitations	Overfishing specification
Crew and Efficiency Limits	EFH/HAPC designation
Fishing Seasons	
Observer Requirements	
Prohibited Species and Bycatch Limits	
Recordkeeping and Reporting Requirements	
In-season Adjustments	
Closed Areas	
Other	

This version of the FMP has been revised to remove or update obsolete references to management measures, outdated catch information and other scientific information. The FMP has also been reorganized to provide readers with a clear understanding of the Scallop fishery and conservation and management measures promulgated by this FMP.

Chapter 1 Introduction

The scallop fishery in Alaska's Exclusive Economic Zone (EEZ; 3-200 miles offshore) is jointly managed by the state and federal government under the FMP. Most aspects of scallop fishery management are delegated to the State of Alaska, while limited access and other federal requirements are under jurisdiction of the federal government. The FMP was developed by the North Pacific Fishery Management Council under the Magnuson Stevens Act and approved by NMFS on July 26, 1995.

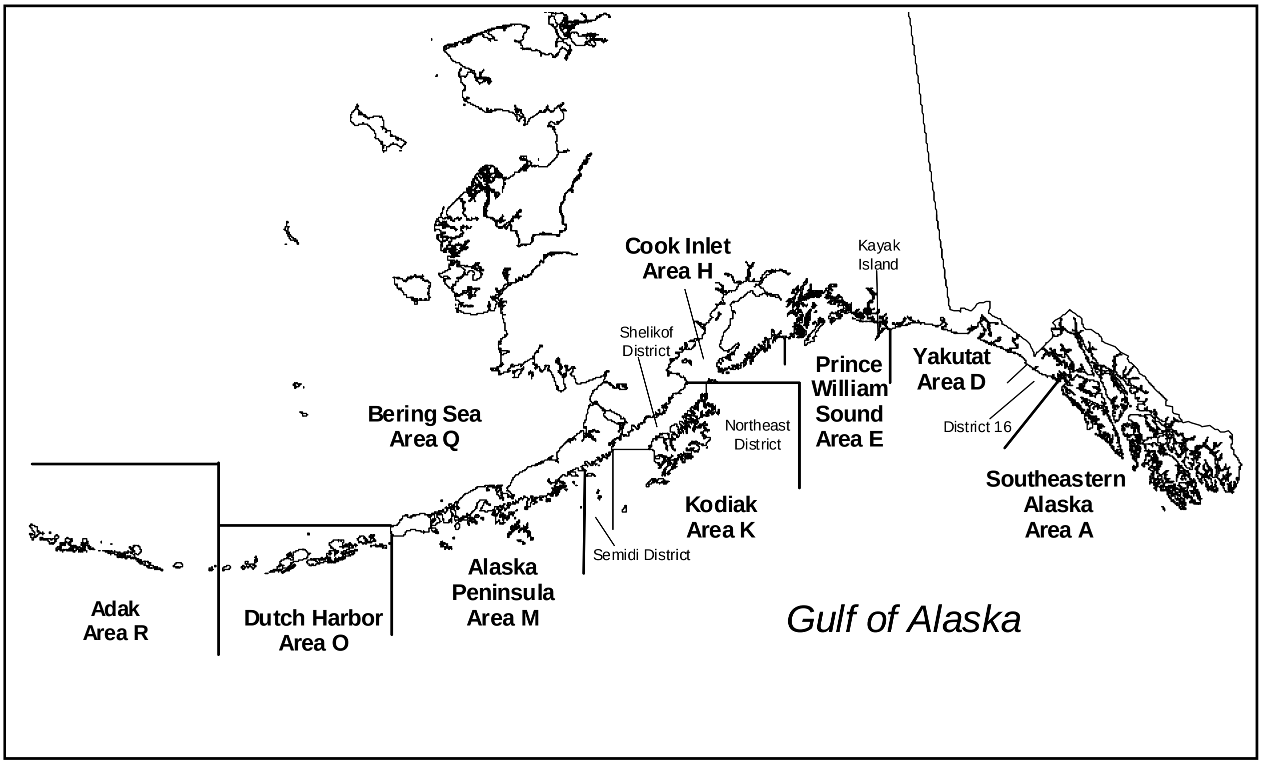


Figure 1 Alaska weathervane scallop fishing registration areas

Although the FMP covers all scallop stocks off the coast of Alaska including weathervane scallops (*Patinopecten caurinus*), pink or reddish scallops (*Chlamys rubida*), spiny scallops (*Chlamys hastata*), and rock scallops (*Crassadoma gigantea*), the weathervane scallop is the only commercially exploited stock at this time. Commercial fishing for weathervane scallops occurs in the Gulf of Alaska, Bering Sea, and Aleutian Islands.

1.1 Amendments to the Fishery Management Plan

The original FMP authorized an interim closure of Federal waters to fishing for scallops. The intent of the FMP was to prevent an unregulated and uncontrolled fishery for scallops while a Federal management regime was established to authorize and manage the fishery. Amendments 1 through 3 to the FMP established the specifics of the State-Federal management regime. Subsequent amendments to the FMP established a license limitation program, refined overfishing levels, designated EFH and AFA sideboard measures and modified aspects of the FMP to better manage the fishery.

Amendment 1: State-Federal Management Regime

Amendment 1 was approved by NMFS on July 10, 1996 (61 FR 38099). Amendment 1 established a joint State- Federal management regime under which NMFS implemented Federal scallop regulations that duplicated most State scallop regulations, including definitions of scallop registration areas and districts, scallop fishing seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, in-season adjustments, and observer coverage requirements. This joint State-Federal management regime was designed as a temporary measure to prevent unregulated fishing in Federal waters until changes in the Magnuson-Stevens Act would enable the Council to delegate management of the fishery to the State. Federal and State waters were re-opened to fishing for scallops on August 1, 1996.

Amendment 2: Vessel Moratorium

Amendment 2 to the FMP, establishing a temporary moratorium on the entry of new vessels into the scallop fishery in Federal waters off Alaska was approved on April 11, 1997 (62 FR 17749). To qualify its owner for a moratorium permit, a vessel must have made a legal landing of scallops during 1991, 1992, or 1993, or during at least 4 separate years from 1980 through 1990. The moratorium was intended to remain in effect through June 30, 2000, or until replaced by a permanent limited access system. Eighteen vessel owners qualified for moratorium permits under the Federal vessel moratorium.

Amendment 3: Delegate Management Authority to the State

Amendment 3 delegated to the State the authority to manage all aspects of the scallop fishery in Federal waters, except limited access, including the authority to regulate vessels not registered under the laws of the State. The final rule implementing Amendment 3 was published on July 17, 1998 (63 FR 38501). Amendment 3 simplified scallop management in the Federal waters off Alaska by eliminating the unnecessary duplication of regulations at the State and Federal levels.

Amendment 4: License Limitation Program

In December 1996, the Council initiated analysis of a license limitation program for the scallop fishery. An LLP was proposed to limit access to the fishery, because re-entry of latent capacity would adversely affect the economic viability of the current participants in the fishery.

The Council adopted an LLP, which limited the fishery to a total of 9 licenses. Only one license was issued for each qualifying vessel. Only those holders of moratorium permits who made legal landings of scallops from a vessel in two of the three years 1996, 1997, or 1998 received a license. Of the 9 licenses issued, 7 had no gear restrictions outside of Cook Inlet (except to comply with state regulations limiting dredge gear to no more than 2-15ft dredges) while 2 licenses were limited to the use of a single 6-ft dredge. The Council further adopted several options from the analysis, including no area endorsements and restrictions and limits on vessel replacement size. NMFS approved the LLP June 8, 2000 (65 FR 78110) and implemented the LLP for the 2001 scallop fishery.

Amendment 5: Description and Identification of Essential Fish Habitat.

On April 26, 1999, NMFS approved Amendment 5 to the FMP which implemented the Essential Fish Habitat (EFH) provisions contains in the Magnuson-Stevens Fishery Conservation and Management Act and 50 CFR 600.815. Amendment 5 describes and identifies EFH fish habitat for scallops and describes and identifies fishing and non-fishing threats to scallop EFH, research needs, habitat areas of particular concern, and EFH conservation and enhancement recommendations.

Amendment 6: Established overfishing levels for weathervane scallops

Amendment 6 established an overfishing level for weathervane scallops as a fishing rate ($F_{overfishing}$) in excess of the natural mortality rate M = 0.13. An Optimum Yield range was specified as 0-1.24 million pounds of shucked scallop meats. The upper bound of this range is the established MSY for weathervane scallops, and is based upon the average catch from 1990-1997 (excluding 1995). This amendment also added additional information to the FMP on bycatch data collection. NMFS approved amendment 6 on March 3, 1999 (64 FR 11390).

Amendment 7: Habitat Areas of Particular Concern (HAPC)

Amendment 7 identified specific sites as habitat areas of particular concern, and established management measures to reduce potential adverse effects of fishing. The sites in the BSAI are: Aleutian Islands Coral Habitat Protection Areas and the Alaska Seamount Habitat Protection Areas, in which the use of bottom contact gear is prohibited; and the Bowers Ridge Habitat Conservation Zone, in which the use of mobile bottom contact gear is prohibited. The sites in the GOA are: the Alaska Seamount Habitat Protection Areas (fourteen sites in the GOA management area listed in Appendix D) and three sites of GOA coral HAPCs (two on the Fairweather Grounds and one off Cape Ommaney) within which five smaller areas comprise the GOA Coral Habitat Protection Areas.

Amendment 8: Sideboard measures for AFA qualified vessels

Amendment 8 established sideboard measures for the AFA qualified vessels, whereby a limited amount of scallops could be taken by a vessel that was qualified as a Bering Sea pollock vessel under the American Fisheries Act. NMFS approved Amendment 8 on February 27, 2002 (67 FR 79692).

Amendment 9: Description and Identification of Essential Fish Habitat (EFH)

Amendment 9 refined and updated the description and identification of EFH for managed species and revised approach for identifying Habitat Areas of Particular Concern within EFH, by adopting a site-based approach. Amendment 9 also established a new area (Aleutian Islands Habitat Conservation Area) in which non-pelagic trawling is prohibited, to protect sensitive habitats from potential adverse effects of fishing.

Amendment 10: Modify License Limitation Program

The Council took final action in October 2004 to modify the existing gear restriction endorsement on two LLP licenses. The Council took final action on this amendment in October 2004, to approve the modification of the two gear restriction to allow the use of two dredges not more that 20 feet total in length. Regulations implementing this amendment were published on July 11, 2005 (70 FR 39965).

Amendment 11: Housekeeping

In April 2005, the Council adopted Amendment 11 to the FMP for the Scallop Fishery off Alaska. This action is a housekeeping amendment to update the FMP text to reflect current management of the scallop fishery and recent biological information.

Amendment 12: Aleutian Islands Habitat Conservation Area Revision

Amendment 12 revised the Aleutian Islands Habitat Conservation Area boundaries near Agattu and Buldir Islands. The amendment was approved on February 4, 2008 (73 FR 9035).

Amendment 13: Annual Catch Limits.

In October 2010, the Council adopted Amendment 13 to (1) revise the maximum sustainable yield and optimum yield to include all fishing mortality; (2) specify that the overfishing limit equals the maximum sustainable yield in the absence of a statewide estimate of spawning biomass for weathervane scallops; (3) specify an acceptable biological catch control rule to account for uncertainty in the overfishing limit; (4) set the annual catch limit equal to the acceptable biological catch; (5) specify accountability measures; and (6) create an ecosystem component category for non-target scallop species. NMFS approved Amendment 13 on September 30, 2011 (70 FR 61997).

Amendment 15: Revisions to EFH

Amendment 15, approved on October 31, 2012, revised Amendments 7 and 9 based on the outcome of the 2010 EFH 5-year review. The amendment revised EFH descriptions and identifications by species, and updated life history, distribution, and habitat association information; updated descriptions of EFH impacts from non-fishing activities, and EFH conservation recommendations for non-fishing activities; revised the timeline associated with the HAPC process to a 5-year timeline; and updated EFH research priority objectives.

1.2 Foreign Fishing

Because scallops only have been harvested by U.S. vessels in the past, and effort remains high, it is likely that the OY can be fully harvested by U.S. vessels and fully processed by U.S. processors in future years. Hence, no considerations have been made to allow a foreign fishery on Alaskan scallops.

Chapter 2 Management Policy and Objectives

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) is the primary domestic legislation governing management of the nation's marine fisheries. In 1996, the United States Congress reauthorized the Magnuson-Stevens Act to include, among other things, a new emphasis on the precautionary approach in U.S. fishery management policy. The Magnuson-Stevens Act contains ten national standards, with which all fishery management plans (FMPs) must conform and which guide fishery management. The national standards are listed in Section 2.1, and provide the primary guidance for the management of the groundfish fisheries.

Under the Magnuson-Stevens Act, the North Pacific Fishery Management Council (Council) is authorized to prepare and submit to the Secretary of Commerce for approval, disapproval or partial approval, a FMP and any necessary amendments, for each fishery under its authority that requires conservation and management. The Council conducts public hearings so as to allow all interested persons an opportunity to be heard in the development of FMPs and amendments, and reviews and revises, as appropriate, the assessments and specifications with respect to the optimum yield from each fishery (16 U.S.C. 1852(h)).

The Council has developed a management policy and objectives to guide its development of management recommendations to the Secretary of Commerce for the Scallop fishery. This management approach is described in Section 2.2.

This FMP covers all scallop stocks off the coast of Alaska including weathervane scallops (*Patinopecten caurinus*), pink or reddish scallops (*Chlmys rubida*), spiny scallops (*Chlamys hastata*), and rock scallops (*Crassadoma gigantea*). However, the weathervane scallop is the only commercially exploited scallop in Alaskan waters at this time.

2.1 National Standards for Fishery Conservation and Management

The Magnuson-Stevens Fishery Conservation and Management Act, as amended, sets out 10 national standards for fishery conservation and management (16 U.S.C. § 1851), with which all fishery management plans must be consistent.

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
2. Conservation and management measures shall be based upon the best scientific information available.
3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.
4. Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
5. Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
7. Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.
8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.
9. Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
10. Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

2.2 NPFMC Policy and Objectives

The objective of the FMP is to prevent localized overfishing of scallop stocks and protect the long term productivity of the resource to allow for the achievement of optimum yield on a continuing basis. This objective is based on the premise that uncontrolled fishing for scallops in Federal waters could result in irreversible damage to the resource's ability to recover in a reasonable period of time. Fishing on a stock at a level that severely compromises that stock's future productivity is counter to the goals of the Magnuson Act and seriously jeopardizes the opportunity to harvest optimum yield on a continuing basis under a future management regime that would authorize a regulated fishery for scallops in Federal waters. Conservative management of the scallop resource is warranted given (1) unprecedented activity of vessels fishing for scallops in Federal waters outside the jurisdiction of Alaska State regulations, (2) the harvesting and processing capacity of the scallop fleet, which, if allowed to fish unregulated in Federal waters, could exceed State harvest guidelines by several orders of magnitude, (3) inadequate data on stock status and biology, and (4) the vulnerability of the scallop resource to localized depletion.

The Council, in cooperation with the State, is committed to developing a long-range plan for managing the scallop fishery that will promote a stable regulatory environment for the seafood industry and maintain the health of the resources and environment. The management system conforms to the Magnuson-Stevens Act's national standards as listed in Section 2.1.

2.2.1 Management Goal

The management goal is to maximize the overall long-term benefit to the nation of scallop stocks by coordinated Federal and State management, consistent with responsible stewardship for conservation of the scallop resource and its habitats.

2.2.2 Management Objectives

Within the scope of the management goal, seven specific objectives have been identified. These relate to stock condition, economic and social objectives of the fishery, gear conflicts, habitat, weather and ocean conditions affecting safe access to the fishery, access of all interested parties to the process of revising this FMP and any implementing regulations, and necessary research and management. Each of these objectives requires relevant management measures. Several management measures may contribute to more than one objective, and several objectives may mesh in any given management decision on a case-by-case basis.

1. Biological Conservation Objective: Ensure the long-term reproductive viability of scallop populations.

To ensure the continued reproductive viability of each scallop population through protection of reproductive potential, management must prevent overfishing. Management measures also may be adopted to address other biological concerns such as restricting harvest of scallops during spawning periods and maintaining low bycatch of finfish and crab. The maintenance of adequate reproductive potential in each scallop stock will take precedence over economic and social considerations.

2. Economic and Social Objective: Maximize economic and social benefits to the nation over time.

Economic benefits are broadly defined to include, but are not limited to: profits, income, employment, benefits to consumers, and less tangible or less quantifiable social benefits such as the economic stability of coastal communities. To ensure that economic and social benefits derived for fisheries covered by this FMP are maximized over time, the following will be examined in the selection of management measures:

- The value of scallops harvested during the season for which management measures are considered,
- The future value of scallop stocks,
- Economic impacts on coastal communities.

This examination will be accomplished by considering, to the extent that data allow, the impact of management alternatives on the size of the catch during the current and future seasons and their associated prices, harvesting costs, processing costs, employment, the distribution of benefits among members of the harvesting, processing and consumer communities, management costs, and other factors affecting the ability to maximize the economic and social benefits as defined in this section.

Social benefits are tied to economic stability and impacts of commercial fishing associated with coastal communities. While social benefits can be difficult to quantify, economic indices may serve as proxy measures of the social benefits which accrue from commercial fishing. In 1984, 7% of total personal income or 27% of total personal income in the private sector in Alaska was derived from commercial fishing industries. On a statewide basis, shellfish accounted for 21% of the total exvessel value of commercial fish harvested in Alaska in 1984, however, the bulk of shellfish harvests were king and Tanner crab.

3. Gear Conflict Objective: Minimize gear conflict among fisheries.

Management measures developed for the scallop fisheries will take into account the interaction of those fisheries, and the people engaged in them, with other fisheries. To minimize gear conflict among fisheries, the compatibility of different types of fishing gear and activities on the same fishing grounds should be considered. Scallop fisheries are conducted with dredge gear. Many other fisheries in the fishery management unit are conducted with fixed gear (pot and hook-and-line). Fishing seasons, gear storage, and fishing areas may be arranged to eliminate, insofar as possible, conflicts between gear types and preemption of fishing grounds by one form of gear over another.

4. Habitat Objective: To protect, conserve, and enhance adequate quantities of essential fish habitat (EFH) to support scallop populations and maintain a healthy ecosystem

Habitat is defined as the physical, chemical, geological, and biological surroundings the support healthy, self-sustaining populations of living marine resources. Habitat includes both the physical component of the environment which attracts living marine resources (e.g. salt marshes, sea grass beds, coral reefs, intertidal lagoons, and near shore characteristics) and the chemical (e.g. salinity, benthic community) and biological characteristics (e.g. scallop life stage histories, oceanography) that are necessary to support living marine resources. The quality and availability of habitat supporting the scallop populations are important. Fishery managers should strive to ensure that those waters and substrate necessary to scallops for spawning, breeding, feeding, or growth to maturity are available. It is also important to consider the potential impact of scallop fisheries on other fish and shellfish populations. Scallop EFH is described in Appendix D of this FMP.

Those involved in both management and exploitation of scallop resources will actively review actions by other human users of the management area to ensure that their actions do not cause deterioration of habitat. Any action by a State or Federal agency potentially affecting scallop habitat in an adverse manner may be reviewed by the Council for possible action under the Magnuson-Stevens Act. The Council will also consider the effect on scallop habitat of its own management decisions in other fisheries.

5. Vessel Safety Objective: Provide public access to the regulatory process for vessel safety considerations.

Upon request, and when appropriate, the Council and the State shall consider, and may provide for, temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of vessels.

6. Due Process Objective: Ensure that access to the regulatory process and opportunity for redress are available to all interested parties.

In order to attain the maximum benefit to the nation, the interrelated biological, economic and social, habitat, and vessel safety objectives outlined above must be balanced against one another. A continuing dialogue between fishery managers, fishery scientists, fishermen, processors, consumers, and other interested parties is necessary to keep this balance. Insofar as is practical, management meetings will be scheduled around fishing seasons and in places where they can be attended by fishermen, processors, or other interested parties.

Access to the FMP development and regulatory process is available through membership in a Council work group, testimony on the record before the Council's Advisory Panel or SSC, or before the Council itself, testimony before the Board, conversations with members of the plan team or officials of regulatory agencies, and by commenting on the FMP, any subsequent amendments and any regulations proposed for their implementation.

This FMP defers much of day-to-day scallop management to the State. Means of access to the regulatory process at the State level and of redress of perceived wrongs by the State are necessary.

7. Research and Management Objective: Provide fisheries research, data collection, and analysis to ensure a sound information base for management decisions.

Necessary data must be collected and analyzed in order to measure progress relative to other objectives and to ensure that management actions are adjusted to reflect new knowledge. Achieving the objective will require new and ongoing research and analysis relative to stock conditions, dynamic feedback to market conditions, and adaptive management strategies.

An annual Stock Assessment Fishery Evaluation (SAFE) report discussing current biological and economic status of the fisheries, guideline harvest ranges, and support for different management decisions or changes in harvest strategies will be prepared by the State (ADF&G lead agency), with NMFS and scallop plan team input when appropriate. Such information will be made available to the public.

The management program authorized under this FMP conforms to the Magnuson Act's national standards as listed in section 2.1. Under this FMP, the prevention of overfishing of the Alaska scallop stocks and the maintenance of adequate reproductive potential for the scallop resource takes precedence over other economic, social, management and research considerations.

2.3 Procedures for FMP Implementation (Federal/State)

A primary objective of the FMP is to establish and maintain consistent management efforts at the State and Federal levels. To the extent practicable, NMFS will coordinate with ADF&G to maintain uniform management measures throughout the EEZ that are consistent with the objectives of the FMP and the Magnuson Act. Nothing in this FMP is intended to preempt State of Alaska scallop regulations set out under Chapter 38 of the Alaska Administrative Code for vessels fishing for scallops in Federal waters off Alaska which are registered under the laws of the State.

The Secretary (through the Council and NMFS) and the State of Alaska have established the following protocol which describes the roles of the Federal and State governments in managing the scallop fishery off Alaska.

1. The Council will maintain the FMP (and develop future amendments) to govern management of the scallop fisheries in Federal waters off Alaska. The FMP prescribes objectives and any management measures found by the Secretary to be necessary for effective management. The State will promulgate regulations applicable to all vessels fishing for scallops in Federal waters that are consistent with the FMP, Magnuson-Stevens Act, and other applicable Federal law. The FMP contains two categories of management measures: (1) Category 1 measures are general management measures delegated to the State for implementation that may be freely adopted or modified by the State, subject to other Federal law, and (2) Category 2 measures are management measures that are fixed in the FMP, implemented by Federal regulation and require an FMP amendment to change.
2. If at any time the Secretary determines that a State law or regulation applicable to a vessel fishing for scallops in Federal waters is not consistent with the FMP, the Secretary shall promptly notify the State and the Council of such determination and provide an opportunity for the State to correct any inconsistencies identified in the notification. If, after notice and opportunity for corrective action, the State does not correct the inconsistencies identified by the Secretary, the delegating of authority granted to the State under this FMP shall not apply until the Secretary and the Council find that the State has corrected the inconsistencies.
3. ADF&G will have responsibility for developing the information upon which to base State fishing regulations, with continued assistance from NMFS. In carrying out this responsibility, ADF&G will consult actively with the NMFS (Alaska Regional Office and Alaska Fisheries Science Center), NOAA General Counsel, the plan team, and other fishery management or research agencies in order to prevent duplication of effort and assure consistency with the Magnuson-Stevens Act, the FMP, and other applicable Federal law.
4. An annual area management report discussing current biological and economic status of the fisheries, guideline harvest ranges, and support for different management decisions or changes in harvest strategies will be prepared by the State (ADF&G lead agency), with NMFS and scallop plan team input incorporated as appropriate. This report will be available for public review.
5. Federal enforcement agents (NOAA) and the U.S. Coast Guard (DOT) shall work in cooperation with the State to enforce scallop fishing regulations in the EEZ off Alaska.

Chapter 3 Conservation and Fishery Management Measures

Two categories of management measures are described in the FMP (Table 1): Category 1 measures are general management measures delegated to the State for implementation. These measures may be freely adopted or modified by the State, subject to other Federal law. Category 2 measures are management measures that are fixed in the FMP, implemented by Federal regulation and require an FMP amendment to change.

The following description of management measures is not intended to limit the State government to only these measures. However, implementation of other management measures not described in the FMP must be consistent with the FMP, the Magnuson-Stevens Act, and other applicable Federal law. Although specific strategies for attainment of objectives in the FMP are not described, management measures described in this chapter are all derived to attain one or more of those objectives.

Table 1 Management measure categories in the Scallop FMP

CATEGORY 1 (Delegated to the State)	CATEGORY 2 (Fixed in FMP, Implemented by Federal Regulation)
Guideline Harvest Levels	License Limitation Program
Registration Areas, Districts, Subdistricts and Sections	Optimum Yield Specification
Gear Limitations	Overfishing specification
Crew and Efficiency Limits	EFH/HAPC designation
Fishing Seasons	
Observer Requirements	
Prohibited Species and Bycatch Limits	
Recordkeeping and Reporting Requirements	
In-season Adjustments	
Closed Areas	
Other	

3.1 Federal Management Measures

Federal management measures under this FMP are considered category 2 measures. These are measures which are fixed in the FMP and require an amendment to change. Since the FMP was implemented it has been amended several times, as described previously in section 1.1. Category 2 measures are implemented by Federal regulation.

3.1.1 Optimum Yield and Overfishing

Under the Magnuson-Stevens Act, a fishery management plan for scallops must specify an optimum yield (OY) for the scallop fishery. The OY for a fishery means the amount of fish which will provide the greatest overall benefit to the nation, with particular reference to food production and recreational activities. The OY is specified on the basis of the maximum sustainable yield from the fishery, as modified by any relevant economic, social, or ecological factors. The national standard 1 guidelines (50

CFR 600.310) state that the most important limitation on the specification of OY is that the choice of OY, and the conservation and management measures proposed to achieve it, must prevent overfishing. If a stock or stock complex becomes overfished, OY provides for rebuilding to the MSY level.

Overfishing is a level of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis. The definition of overfishing for a stock or stock complex may be expressed in terms of maximum level of fishing mortality or minimum stock size threshold. Overfishing must be defined in a way to enable the Council and the Secretary to monitor and evaluate the condition of the stock or stock complex relative to the definition. Overfishing definitions must be based on the best scientific information available and reflect appropriate consideration of risk. Risk assessments should take into account uncertainties in estimating harvest levels, stock conditions, or the effects of environmental factors.

3.1.1.1 Assessment of the available scientific data to determine Optimum Yield

The State of Alaska's draft fishery management plan for scallops (Kruse 1994) summarizes much of the scientific data available on Alaska scallop life history traits and other biological parameters that should be considered in assessing appropriate concepts of MSY, OY, and overfishing for the scallop fishery. Pertinent portions of the State's management plan that address management concerns regarding recruitment overfishing and sustainable yield are incorporated and/or paraphrased in this section of the FMP.

<u>Recruitment Overfishing</u>

Definition. It is widely accepted that fishery harvest levels should be prescribed in ways to prevent "recruitment overfishing," the condition that occurs when stocks are reduced to levels too low to produce adequate numbers of young scallops—the future recruits to the fishery (Gulland 1983). Recruitment is a prerequisite for maintenance of a viable population and is needed for sustainable harvests that support long-term economic benefits from a fishery.

Worldwide History of Scallop Overfishing. Although there are a number of cases of scallop fisheries that have been sustainable over long time periods, overfishing has occurred in many scallop fisheries worldwide. Stock recovery has been either slow or non-existent. Attempts to develop aquaculture in many countries are largely attributable to the collapse of natural populations. Kruse (1994) provides numerous examples of scallop overfishing around the world.

Implications of Stock Structure. Prevention of overfishing requires knowledge about a species' stock structure and the biological productivity of each stock. For species with populations that are well-connected by extensive larval drift, risk of overfishing is relatively low at least on an area-specific level. In such cases, local depletions can be replenished by settlement of larvae carried by ocean currents from spawning stocks located elsewhere. However, a growing body of evidence indicates that many benthic invertebrates such as scallops exist as a number of discrete, self-sustaining populations. To prevent overfishing for species with such a population structure, it is necessary to manage each stock separately (Caddy 1989; Fevolden 1989; Sinclair et al. 1985.)

Unfortunately, the stock structure of weathervane scallops in Alaska is not well understood. Studies of genetic structure and comparative population characteristics (e.g., growth rate, gonadal somatic index) are needed to resolve uncertainties. In the absence of such information, a reasonable and conservative approach is to assume that each major fishing area compromises a separate stock (Caddy 1989; Sinclair et al. 1985). However, even with this approach, the possibility exists that multiple self-sustaining populations exist within a fishing area. For example, the apparent existence of separate self-sustaining populations of sea scallops on the Northern Edge and Northeast Peak of Georges Bank (Tremblay and Sinclair 1992; McGarvey et al. 1993) is somewhat unexpected given prevailing ocean currents and proximity of these areas to other scallop fishing grounds on Georges Bank.

Importance of Spawning Stock Biomass. Even after scallop stocks have been defined, overfishing will occur unless fishing mortality is limited to a level commensurate with the productivity of each stock. Worldwide, scallop populations are characterized by recruitment variability. Often, scallop populations are dominated by a few strong year classes that are separated by long periods of poor recruitment. Potential stock-recruitment relationships have not been well studied for scallops. A study by McGarvey et al. (1993) provides a rare example with evidence of a relationship between spawning stock (total egg production) and recruitment for sea scallops on Georges Bank. In that instance, higher egg production was directly related to higher recruitment.

Conversely, it is often assumed that scallop recruitment is linked to environmental conditions (Hanock 1973). However, even when recruitment of a marine species is primarily driven by environmental effects, it is commonly held that parental spawning biomass affects recruitment, at least at low population sizes. Peterson and Summerson (1992) showed that the bay scallop (*Argopecten irradians concentricus*) was recruitment-limited due to reduced abundance of adults caused by a red tide (*Ptychodiscus brevis*) outbreak. In relating their findings to fishery management, the authors noted that a common assumption of shellfish fisheries management was that fishing pressure on adults did not adversely affect subsequent recruitment. Peterson and Summerson (1992) concluded that this assumption was unjustified.

<u>Sustainable Yield</u>

Ideally, an appropriate harvest rate is developed from yield models based on a species' life history traits and other biological parameters. Annual catches are specified by applying these harvest rates to annual biomass estimates derived from stock assessment surveys. Unfortunately, limited information on biological productivity is available for weathervane scallops to promote the conservation of stocks and sustained yields of the fishery. Biomass estimates are unavailable and yield models have not been developed.

In Alaska, some biological data was collected during the early years of the fishery (Haynes and Powell 1968; Hennick 1970b, 1973), although it has been summarized more recently by Kaiser (1986). In the early 1950s, the Bureau of Commercial Fisheries began systematic surveys to determine whether commercial quantities were available. The only assessment survey conducted between 1972 and 1996 occurred in 1984 in lower Cook Inlet (Hammarstrom and Merritt 1985). Likewise, until implementation of the State's onboard observer program in 1993, there was no routine biological or fishery sampling conducted on weathervane scallops in Alaska.

Implications of Natural Mortality Rate. Natural mortality is one of the biological reference points commonly used in fisheries management to establish appropriate exploitation rates (Clark 1991). The longevity (28 years) of weathervane scallops in Alaska implies that this species experiences a very low natural mortality rate (M = 0.13 or 12% annual mortality). The biological reference point obtained by setting instantaneous fishing mortality F equal to M implies that scallop harvest rates should not exceed 12% annually on any given stock. Unfortunately, other potentially useful benchmarks that would bear on the choice of appropriate exploitation rates for weathervane scallops are not presently available.

The biological reference point, F=M=0.13 implies that weathervane scallop stocks are at greater risk of overfishing than red king crabs (*Paralithodes camtschaticus*) and Tanner crabs (*Chionoecetes bairdi*) for which M=0.2 and M=0.3, respectively (NPFMC 1998). Also, unlike many crab stocks off Alaska, few stock assessments of weathervane scallop biomass have been made. Given these two observations, maintenance of healthy weathervane scallop stocks poses a serious challenge to fishery managers.

Implications of Recruitment Variability. Large annual fluctuations in recruitment that are typical of scallop populations have management implications. Weathervane scallops spawn annually after reaching maturity at age 3 or 4. This feature of multiple spawning (*iteroparity*) is likely to be an evolutionary response to environmentally-induced recruitment variations (Murphy 1968). Iteroparous species with highly variable recruitment are particularly vulnerable to overfishing when high levels of harvest create a recruit-only fishery.

Murphy (1967) simulated the effects of fishing on Pacific sardine (*Sarinops sagax*) age structure so that the population approached a single reproducing age class. Compared to an unfished population with a protracted age structure, abundance of the fished population was much lower and more variable. The fished population recovered slowly even when fishing was terminated and had a higher probability of extinction than the unfished population.

These results led Murphy (1967) to assert the need to maintain diverse age structure in populations with long life spans that experience environmentally driven recruitment. The same advice was advanced by Leaman (1991) for long-lived rockfishes (*Sebastes*). By comparison of scallop longevity estimates (Orensanz et al. 1991), weathervane scallops, with a maximum age of 28 (Hennick 1973), may be the longest-lived scallop species in the world. That is, the advice of Murphy (1967, 1968) and Leaman (1991) is apropos.

Sustainability of Weathervane Scallop Harvests. Changes in the Alaskan scallop fishery through 1992 raised concerns that harvests may not be sustainable on a local or regional level for several reasons. First, landings during the early 1990s were 2-3 times higher than the long-term average harvest taken over a 20-year period during the 1970s and 1980s. In fact, these harvests were at levels comparable to those taken in the late 1960s and early 1970s, which proved to not be sustainable by the fishery. Reduced scallop abundance was at least partly responsible for the fishery collapse in the 1970s. Second, high harvests in the early 1990s were at least partly attributable to shifts in fishing effort to new scallop beds. Third, during 1992 limited inseason catch reports from some areas indicated that small scallops constituted an increased portion of landings as had occurred prior to the fishery decline in the mid-1970s. Last, misreporting was suspected; widespread misreporting could seriously compromise historical catch data upon which assessments of sustainable harvests are based.

3.1.1.2 Specification of OY and Overfishing

The following reference points are specified for weathervane scallops in accordance with the national standard 1 guidelines (50 CFR 600.310).

Maximum Sustainable Yield (MSY). MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. The long-term average stock size obtained by fishing year after year at this rate under average recruitment may be a reasonable proxy for the MSY stock size, and the long-term average catch so obtained is considered a reasonable proxy for MSY

MSY for weathervane scallops is 1.284 million lbs. (582 metric tons) of shucked meats. MSY is estimated based on the average retained catch from 1990-1997, (1995 data is not included as the fishery was closed most of the year), which is 1,240,000 lbs. (562.46 metric tons) of shucked meats, plus an amount equivalent to estimates of the additional fishing mortality during the 1990-1997 period (excluding 1995). Additional fishing mortality includes discard mortalities from the directed scallop fishery, the groundfish fisheries, and total mortality from agency surveys.

The time period from 1990 to 1997 reflects prevailing ecological conditions. The fishery was fully capitalized during this time period, and all areas of the state where scallops could be harvested were being exploited. Prior to that time period, vessels moved into and out of the scallop fishery, in part in response to economic opportunities available in other fisheries (Shirley and Kruse, 1995). However, since 1993, the fishery has been somewhat limited by crab bycatch limits, closure areas, and season length. As a consequence, a stable period during the history of this fishery does not exist. MSY estimation by averaging catches is problematic, however, a better solution does not exist at this point.

MSY Control Rule (F_{msy}). The MSY control rule is a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. In choosing an MSY control rule, the Council isguided by the characteristics of the fishery, the FMP's objectives, and the best scientific information available. In any MSY control rule, a given stock size is associated with a given level of fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY. The MSY control rule is based on natural mortality, using the estimate of M = 0.13, the MSY control rule F_{msy} equals M, or $F_{msy} = 0.13$. *MSY Stock Size (B_{msy}).* The MSY stock size is the long term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, associated with the production of MSY. It is the stock size that would be achieved under an appropriate MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required.

As noted earlier, MSY for weathervane scallops is established at 1.284 million lbs. (582 mt) of shucked meats. Therefore, MSY stock size is estimated as MSY/M = 9.87 million lbs. (4,477 mt) of shucked meat biomass. In terms of whole animals (including shells and gurry) B_{msy} would be 98.7 million lbs. (44,760 mt), as expanded by a product recovery rate of 10%. This assumes that the stock was at B_{msy} and that catches were at MSY during 1990-1997 period, and that the logistic equation holds.

Minimum Stock Size Threshold (MSST). The (MSST), to the extent possible, should equal whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. Should the actual size of the stock or stock complex in a given year fall below MSST, the stock or stock complex is considered overfished. The MSST should be expressed in terms of spawning biomass or other measure of reproductive capacity. Based on the national standard guidelines, a MSST for weathervane scallops is established based on ½ MSY stock size = $½B_{msy} = 4.93$ million lbs. (2,236 mt) of shucked meats.

Overfishing Control Rule ($F_{overfishing}$). The national standard guidelines define the terms "overfishing" to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. The overfishing rate is established for weathervane scallop as a fishing rate in excess of the natural mortality rate. Hence, $F_{overfishing} = M = 0.13$.

Overfishing Limit (OFL). The OFL will be used to determine if overfishing occurs in a given year. Overfishing occurs if the total catch exceeds the OFL. If an estimate of the statewide weathervane scallop spawning biomass is available, the overfishing control rule would be applied to that estimate of spawning biomass to determine the OFL. In the absence of an estimate of the statewide weathervane scallop spawning biomass, the default OFL is the MSY of 1.284 million lbs. (582 mt) of shucked meats.

Optimum Yield (OY). Optimum yield should be established on the basis of MSY. OY is upper bounded by $MSY = F_{msy} B_{msy} = M B_{msy}$ (= 1.284 million lbs or 582 mt.). Hence, a numerical range for OY of 0-1.284 million lbs. (582 mt) can thus be established for Alaska weathervane scallops. Sufficient conservatism is built into establishing an annual OY cap of 1.284 million lbs. (582 mt) of shucked meats for the following reasons:

1. the years of averaging include years when no fishing occurred in the Bering Sea, but obviously some sustainable harvest was possible;
2. the period of averaging includes other areas and years when the harvest was constrained by fishery controls, such as recently by bycatch PSCs, and therefore the resulting catch underestimates the productivity of scallop stocks;
3. substantial areas are closed to scallop dredging due to concerns about bycatch, yet these areas have substantial productivity;

4. closed areas can almost be thought of as marine refuges and potential yields from these areas are not factored into MSY estimates;
5. there are years during the history of the fishery when effort was low due to market (not abundance) conditions;
6. $F_{30\%}$ is probably a better estimator of $F_{overfishing}$ than is F=M, yet $M<F_{30\%}$ so the overfishing rule is conservative; and
7. in years of good recruitment, the stocks are likely greater than B_{msy}, thus we will fish at $F<F_{overfishing}$ to achieve OY=MSY (recall MSY = F_{msy} B_{msy}, so if $B>B_{msy}$, then $F<F_{msy}$).

In the future, better quantitative estimates of appropriate scallop yields by area may be generated using assessment surveys and stock assessment models. At such time, MSY and OY would be re-estimated and the FMP amended.

Acceptable biological catch (ABC). The ABC is a level of annual catch of a stock that is set below the OFL and accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty. The maximum ABC is calculated from the ABC control rule. Annually, the Council's Scientific and Statistical Committee will set a statewide ABC for the weathervane scallop fishery prior to the beginning of the fishing season. The Scientific and Statistical Committee may set an ABC lower than the maximum ABC, but it must provide an explanation for setting the ABC below the maximum ABC.

ABC Control Rule. The ABC control rule is the specified approach for setting the maximum ABC for weathervane scallops. The ABC control rule calculates a statewide maximum ABC at 90 percent of the OFL, which provides a 10 percent buffer to account for scientific uncertainty in the estimation of the OFL.

Lacking a stock assessment model, the sources of scientific uncertainty in the weathervane scallop OFL estimate are not directly quantifiable at this time. The 10 percent buffer incorporates scientific uncertainty and limits the risk of overfishing occurring in the weathervane scallop fishery.

Annual catch limit (ACL). The ACL is the level of annual catch of a stock that serves as the basis for invoking accountability measures. For weathervane scallops, the ACL will be set equal to the ABC. Measures to ensure accountability with the ACL are described in section 3.2 of this FMP.

3.1.2 Limited Access Management

A system for limiting access, which is an optional measure under section 303(b) of the Magnuson-Stevens Act, is a type of allocation of fishing privileges that may be used to promote economic efficiency or conservation. For example, "*limited access may be used to combat overfishing, overcrowding, or overcapitalization in a fishery to achieve OY*" (50 CFR 600.330(c)). The Magnuson-Stevens Act (Section 3(28)) further defines"... The "optimum" with respect to the yield from a fishery, means the amount of fish which -- (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (B) is prescribed on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant social, economic, or ecological factor; and (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

As of 2001, a Federal scallop license is required for vessels participating in all scallop fisheries in the EEZ off Alaska. NPFMC created the scallop LLP to limit the number of participants and reduce fishing capacity in the scallop fishery. The LLP license is required on board any vessel deployed in the weathervane scallop fishery in federal waters off Alaska. NMFS granted 7 vessel owners licenses to fish statewide (outside of the Cook Inlet Registration Area) utilizing two 15-foot dredges. Additionally, NMFS granted two vessel owners licenses to fish statewide utilizing a single 6-foot dredge. Amendment

10 to the FMP to modified this restriction such that these vessels are allowed to fish utilizing two 10-foot dredges or two dredges with a combined width of no more than 20 feet. All 9 licenses allow vessel owners to fish inside Cook Inlet with a single 6-foot dredge.

3.1.2.1 Elements of the License Limitation Program

1. Qualification Criteria. A license authorizes the license holder to use a vessel from which directed fishing for scallops can be conducted. A license was issued to a moratorium permit holder who made legal landing of scallops in each of any 2 years in the period from January 1, 1996 through October 9, 1998. Licenses are not vessel specific.
2. License Recipients. Licenses were issued to U.S. Citizens, or U.S. business (corporation, partnership, or other association) that satisfy the above qualification criteria.
3. Who May Purchase Licenses. Licenses may be transferred only to “persons” defined as those “eligible to document a fishing vessel” under Chapter 121, Title 46, U.S.C. Licenses may not be leased.
4. Area Endorsements. The licenses have no area endorsements. All licenses are statewide. However, some licenses (2) are restricted for use with two dredges with a combined width of no more than 20 feet (6.1 m).
5. Vessel Length. No increases in vessel length will be allowed. A license is designated with a MLOA that limits the length of a vessel that could be used by the license holder.
6. License Ownership Caps. No person could hold more than 2 scallop licenses at once unless that person is initially issued more than 2 licenses, in which case the person can hold the number of licenses initially issued. However, a person who has more than 2 scallop licenses could not receive a scallop license by transfer until the number of scallop licenses which that person has is less than 2. After obtaining transfer eligibility by dropping below 2 licenses, the person could not again exceed 2 licenses, regardless of his or her earlier status of being allowed to exceed 2 licenses on initial issuance.
7. Appeals. The appeals process is established in Federal Regulations at 50 CFR 679.43.

3.1.3 Essential Fish Habitat and Habitat Areas of Particular Concern

3.1.3.1 Description of Essential Fish Habitat

Section 303(a)(7) of the Magnuson-Stevens Act requires FMPs to describe and identify Essential Fish Habitat (EFH), minimize to the extent practicable adverse effects of fishing on EFH, and identify other actions to conserve and enhance EFH. This FMP describes scallop EFH in text, maps EFH distributions, and includes information on habitat and biological requirements for each life history stage of the species. Appendix D contains this required information, as well as identifying an EFH research approach.

3.1.3.2 Description of Habitat Areas of Particular Concern

The EFH regulations at 50 CFR 600.815(a)(8) provide the Councils with guidance to identify habitat areas of particular concern (HAPCs). HAPCs are meant to provide greater focus to conservation and management efforts and may require additional protection from adverse effects. FMPs should identify specific types or areas of habitat within EFH as HAPCs based on one or more of the following considerations:

1. the importance of the ecological function provided by the habitat;
2. the extent to which the habitat is sensitive to human-induced environmental degradation;

3. whether, and to what extent, development activities are, or will be, stressing the habitat type; or
4. the rarity of the habitat type.

Proposed HAPCs, identified on a map, must meet at least two of the four considerations established in 50 CFR 600.815(a)(8), and rarity of the habitat is a mandatory criterion. HAPCs may be developed to address identified problems for FMP species, and they must meet clear, specific, adaptive management objectives.

The Council will initiate the HAPC process by setting priorities and issuing a request for HAPC proposals. Any member of the public may submit a HAPC proposal. HAPC proposals may be solicited every 5 years, to coincide with the EFH 5-year review, or may be initiated at any time by the Council. The Council will establish a process to review the proposals. The Council may periodically review existing HAPCs for efficacy and considerations based on new scientific research.

In 2005, the Council identified the following areas as HAPCs within EFH:

- Alaska Seamount Habitat Protection Areas
- Bowers Ridge Habitat Conservation Zone
- GOA Coral

Maps of these HAPCs, as well as their coordinates, are contained in Appendix D.

3.1.3.3 Conservation and Enhancement Recommendations for EFH and HAPC

Appendix D identifies fishing and non-fishing threats to EFH. Conservation and enhancement recommendations for non-fishing threats to EFH and HAPCs are described therein.

In order to protect EFH from fishing threats, the Council established the following areas:

- Aleutian Islands Habitat Conservation Area
- Aleutian Islands Coral Habitat Protection Areas
- GOA Slope Habitat Conservation Areas

Maps of these areas, as well as their coordinates, are contained in Appendix D. In addition, the Council established restrictions for these areas as described below.

Aleutian Islands Habitat Conservation Area

The use of nonpelagic trawl gear, as described in 50 CFR part 679, is prohibited year-round in the Aleutian Islands Habitat Conservation Area, except for the designated areas open to nonpelagic trawl gear fishing.

Aleutian Islands Coral Habitat Protection Areas

The use of bottom contact gear, as described in 50 CFR part 679, and anchoring by federally permitted fishing vessels is prohibited in the Aleutian Islands Coral Habitat Protection Areas.

GOA Slope Habitat Conservation Areas

The use of nonpelagic trawl gear in the GOA Slope Habitat Conservation Areas by any federally permitted fishing vessel, as described in 50 CFR part 679, is prohibited.

In order to minimize adverse effects of fishing, the Council also established restrictions for HAPCs. These restrictions are described below.

Alaska Seamount Habitat Protection Areas

The use of bottom contact gear and anchoring by a federally permitted fishing vessel, as described in 50 CFR part 679, is prohibited in the Alaska Seamount Habitat Protection Area.

Bowers Ridge Habitat Conservation Zone

The use of mobile bottom contact gear, as described in 50 CFR part 679, is prohibited in the Bowers Ridge Habitat Conservation Zone.

GOA Coral Habitat Protection Areas within GOA Coral HAPC

The GOA Coral Habitat Protection Areas are five specific areas within the larger GOA Coral HAPC. Maps of these areas, as well as their coordinates, are in Appendix D. The use of bottom contact gear and anchoring, as described in 50 CFR part 679, is prohibited in these areas.

3.1.3.4 Review of EFH

To address regulatory guidelines for review and revision of EFH FMP components, the Council will conduct a complete review of all the EFH components of the FMP once every 5 years and will amend the FMP as appropriate to include new information.

Additionally, the Council may solicit proposals for HAPCs and/or conservation and enhancement measures to minimize the potential adverse effects of fishing. Any proposal endorsed by the Council would be implemented by FMP amendment. HAPC proposals may be solicited every 5 years, coinciding with the EFH 5-year review, or may be initiated at any time by the Council.

3.2 Management Measures Delegated to the State of Alaska

The following Category 1 management measures are measures delegated to the State of Alaska for implementation.

3.2.1 Setting harvest limits

The FMP authorizes the State of Alaska to set guideline harvest ranges (GHRs) and guideline harvest levels (GHLs) under State regulations. GHRs and GHLs are harvest limits that corresponds to the total allowable catch (TAC) used in groundfish FMPs for the Gulf of Alaska and Bering Sea and Aleutian Islands Management Areas. GHRs are hard caps established in State of Alaska regulations for each registration area and are not to be exceeded. Each year, the sum of upper end values of the scallop GHRs established for each fishing area will fall within the OY range specified in this FMP.

GHLs are pre-season targets set for each fishing area (registration area, district, or statistical area) prior to each season. The State establishes the annual GHL for each scallop management area at a level sufficiently below the ACL so that total catch (directed fishery removals plus all fishery discard mortality) does not exceed the ACL. As an accountability measure, if an ACL is exceeded, the overage will be accounted for through a downward adjustment to the GHL for the following fishing season by an amount sufficient to remedy the biological consequences of the overage.

In scallop Registration Areas D (Yakutat), E (Prince William Sound), H (Cook Inlet), K (Kodiak), M (Alaska Peninsula), Q (Bering Sea), O (Dutch Harbor), and R (Adak), GHLs are established by ADF&G each year prior to the opening of the fishing season. Scallop seasons are not opened in Area A (Southeastern Alaska). Specifying harvest limits in terms of ranges allows the State to make inseason management decisions based on observer data obtained from the fishery as it occurs. Areas or parts of areas may be closed before the upper end of the GHL is reached due to concerns about fishery performance, bycatch rates, or localized depletion.

In Scallop Registration Areas K, M, O, Q, and R, ADF&G also establishes crab bycatch limits (CBLs) for red king crab and Tanner crab species each year prior to the season. Scallop fishing is closed in any area where these limits are attained regardless of the amount of scallops harvested. Bycatch of crab and other prohibited species is closely monitored by ADF&G in all fishing areas of the state.

GHRs and GHLs are the result of a process which includes evaluation of the effects of different harvest levels on the seven objectives of management listed previously in this FMP; however, GHRs and GHLs will most frequently be used as management measures to achieve the first two objectives. The first concern in setting GHRs and GHLs is to prevent overfishing. Because the maintenance of adequate reproductive potential takes precedence over economic and social considerations, the upper end of the GHR serves as an upper bound constraint on harvest. Economic benefits such as profits, personal income, employment, benefits to consumers, and less tangible or less quantifiable social benefits such as the economic stability of coastal communities, are considered secondarily to the prevention of overfishing. GHRs reflect uncertainty in stock status and in estimates of socioeconomic benefits.

The process of setting appropriate GHRs and GHLs which prevent overfishing and maximize socioeconomic benefits includes collection and analysis of biological, economic, social, and other data. Available information on scallop resources in Alaska's different registration areas varies in quantity and in quality, and consequently, procedures for determining GHRs and GHLs vary as well. Data collected through the State's onboard observer program, which requires 100% coverage outside of Cook Inlet, is a mainstay of information for GHR and GHL analyses.

NMFS and the Council will, to the extent possible, coordinate with ADF&G in the establishment of GHRs, GHLs and CBLs that are consistent with current Federal and State regulations. GHRs and CBLs will apply to both Federal and State waters, so that scallop fisheries in each registration area are managed as a cohesive unit. GHRs, GHLs and CBLs are periodically reviewed by the Council to assure compliance with this FMP, the Magnuson-Stevens Fishery Conservation and Management Act, and all applicable federal laws.

This FMP authorizes the commercial harvest of scallops species listed in Chapter 4.0 of this plan. It is prohibited for a person to take or retain scallops in any registration area unless the season for that species within those waters is open. It is prohibited for a person to possess, purchase, barter, sell, or transport scallops if that person knows or has reason to know that such shellfish were taken or possessed in contravention of this FMP.

3.2.2 Guideline Harvest Ranges (GHRs)

Annual scallop GHL will be specified by registration area for the time period extending from July 1 through June 30 of the following year. Official announcements on GHL will be available to the public approximately one month prior to season openings.

3.2.2.1 Registration Areas D, E, H, K, M, Q and O

Annual scallop GHRs for registration areas D, E, H, K, M, Q, O, and R shall be established as a weight in pounds of shucked scallop meats based on a review of the following:

1. Assessments of the biological condition of scallop populations in each area, including where available, assessment survey results, updated estimates of MSY, historical catch trends, recent fishery performance, size and/or age structure of recent harvests, assessments of alternative harvesting strategies, and relevant information relating to changes in scallop markets.
2. Socioeconomic considerations consistent with the goals and objectives of the FMP.

3.2.3 Gear Limitations

Gear limitations may include restrictions on the number and width of dredges that may be deployed by vessels fishing in a particular area and minimum ring sizes for dredges to prevent the taking of undersize scallops. Gear restrictions will be specified in State regulations. The following gear restrictions apply to the taking of scallops under this FMP:

1. A vessel fishing for weathervane scallops (*Patinopectin caurinus*) may use or carry only scallop dredges with rings having an inside diameter of four inches (10.16 cm) or larger.
2. No more than two scallop dredges may be operated at one time from a vessel, and the opening of a scallop dredge may not be more than 15 feet (4.57 meters) wide.
3. In the Kamishak, Southern, and Central Districts of Scallop Registration Area H, scallops may be taken only with a single dredge. The opening of a dredge may not be more than six feet (1.87 meters) in width.

3.2.4 Crew and Efficiency limits

Efficiency limits may be necessary to prevent excess capacity in the Alaska scallop fishery. These limits may include prohibitions on automatic shucking machines and restrictions on the number of crew on board a vessel engaged in fishing for scallops. Efficiency limits currently specified in State regulations include:

1. Scallops may be shucked by hand only. No mechanical shucking machines may be on board any vessel fishing for scallops off Alaska.
2. A vessel fishing for scallops may have on board no more than 12 crew members. Crew members are all persons involved with vessel operations, including captains, mates, engineers, cooks, deckhands, and processing workers. ADF&G and NMFS onboard fishery observers are not considered crew members for purposes of this limit..

3.2.5 Fishing Seasons

Fishing seasons will be specified in State regulation to achieve various management objectives that may include: (1) limiting fishing during spawning periods; (2) timing fishing seasons to achieve the highest possible product quality; (3) limiting gear conflicts with other fisheries; and (4) increasing vessel safety.

Under current regulations, scallops may be taken in Areas D, E, K, M, Q, O, and R from 12:01 a.m. July 1 to 11:59 p.m. February 15. Scallops may be taken in the Kamishak District of Scallop Registration Area H from 12:01 a.m. August 15 to 11:59 p.m. October 31.

Scallop fishing seasons are subject to changes, closures, and other provisions of the FMP and State regulations.

3.2.6 Inseason Adjustments

The State may make inseason adjustments to GHLs, fishing seasons, bycatch limits, and may close areas in State and Federal waters to scallop fishing. In making such adjustments, the State may consider all available data on factors such as: (1) overall fishing effort; (2) catch per unit effort and rate of harvest; (3) rate of bycatch; (4) relative scallop abundance; (5) attainment of the upper end of GHRs or bycatch limits; (6) general information on stock condition; (7) timeliness and accuracy of catch reporting; and (8) other factors that affect the State's ability to meet objectives of the FMP.

All inseason adjustments will be recorded and justified in writing. These justifications are attached to the emergency order and will be made available to the public.

3.2.7 Closed areas

State regulations implementing the FMP may include time and area closures designed to minimize bycatch and protect habitat. Existing State regulations close most areas that are also closed to bottom trawling to protect crab and other sensitive habitat. Closed areas will be specified in regulations. Existing closures in Alaskan coastal waters are shown in Figure 2.

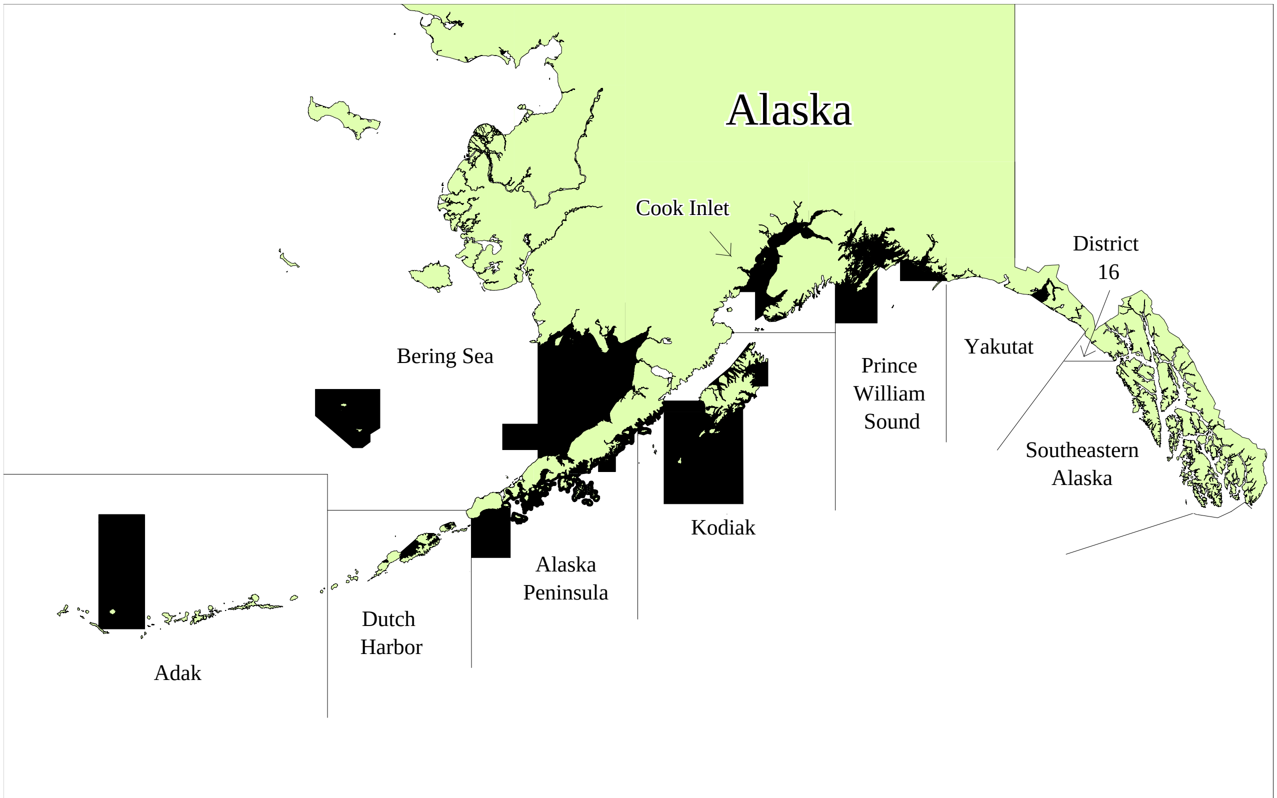


Figure 2 Alaska coastal areas closed to scallop fishing

3.2.8 Notices of closure

When the State determines that the upper end of a GHR or a CBL will be reached, the State will publish an Emergency Order giving notice of season closure.

3.2.9 Prohibited Species and Bycatch Limits

State regulations may prohibit vessels fishing under this FMP from retaining certain species identified as prohibited including salmon, halibut, king crab, Tanner crab, and herring. Species identified as prohibited must be avoided while fishing and must be immediately returned to the sea with a minimum of injury when caught and brought aboard. Prohibited species bycatch limits may be established for specified areas or subareas to limit bycatch of prohibited species in the scallop fishery.

3.2.10 Crab bycatch limits (CBLs)

Annual CBLs may be specified for red king crab and Tanner crab species in each registration area or district thereof. Table 2details the CBLs by area. These are subject to change by the Board of Fisheries.

Time period for CBLs. Annual CBLs will be specified for the time period from July 1 through June 30 of the following year.

Table 2 Statewide crab bycatch limits, in percent of the crab abundance estimate or number of crab.

Scallop Registration Areas	Red King Crab	C. bairdi	C. opilio
Yakutat (D)			
District 16	NA	NA	NA
Remainder of Area D	NA	NA	NA
Prince William Sound (E)			
Eastern Section of outside District	NA	0.5%[a]	NA
Cook Inlet (H)			
Kamishak District	0.5%[a]	60 crabs[a]	NA
Outer/Easter/Barren Island Districts	NA	NA	NA
Kodiak (K)			
Shelikof District	0.5% or 1.0%	0.5% or 1.0%	NA
Northeast District	0.5% or 1.0%	0.5% or 1.0%	NA
Semidi District	Regulated inseason	Regulated inseason	NA
Alaska Peninsula (M)	0.5% or 1.0%	0.5% or 1.0%	NA
Bering Sea (Q)	500 crabs[a]	Three Tier Approach	Three Tier Approach
Dutch Harbor (O)	0.5% or 1.0%	0.5% or 1.0%	NA
Adak (R)	50[b]	10,000[b]	NA

NA= Not applicable

[a]Fixed CBL

[b]Bycatch limit set to allow scallop fleet adequate opportunity to explore and harvest scallop stocks while protecting the crab resource.

3.2.11 Observer Requirements and At-Sea Catch Sampling

Observer coverage requirements may be specified in State regulations. The State may place observers aboard scallop fishing and/or processing vessels to obtain fishery performance and biological data. Scallop vessels fishing in the GOA or BSAI must carry an ADF&G-certified scallop observer when asked to do so. No one shall forcibly assault, resist, impede, intimidate, or interfere with an observer placed aboard a fishing vessel under this FMP.

The State of Alaska currently requires 100% onboard observer coverage for all vessels fishing for scallops outside the Cook Inlet Registration Area as a condition for obtaining a permit. The focus of the scallop observer program is to monitor bycatch and to collect biological and fishery data relating to the weathervane scallop. The sampling program is designed to answer questions necessary for successful management of the resource.

The scallop observer program collects a variety of biological data on a daily basis. Each fishing day, the observer's goal is to sample a single dredge from one tow for species haul composition and a single dredge from 5 different tows for crab and halibut bycatch and discarded scallop catch. Haul composition sampling documents all species caught in the dredge by weight. For bycatch samples, observers identify, count, measure, classify, and record the number and condition of crab and halibut caught in the dredge. The discarded scallop catch is collected and weighed, and a subsample is examined to determine the weight and number of broken and intact scallops. Shell heights are measured from samples of both retained and discarded scallops, and shells are collected for age determination.

Observers report scallop harvest, number of tows, area fished, and crab bycatch to ADF&G at minimum three times per week during the season by radio or email; these data are used extensively by ADF&G for inseason fishery management. ADF&G Reports summarize all data collected by the observer program and are made available to the public (e.g., Barnhart and Rosenkranz, 2003).

3.2.12 Recordkeeping and Reporting Requirements

The State may implement recordkeeping and reporting requirements as necessary to meet the management objectives of the FMP. As the scallop fishery has grown over the years, so has our knowledge of the species. Information gained through scientific surveys, research, and fishermen's observations have all led to a better understanding of the biology, environmental requirements, and behavior of Alaska’s scallop stocks. Because management decisions are made inseason based on fishery data from the fleet, the State’s catch and processing reporting requirements are an important component in achieving the management objectives of the FMP.

NMFS should coordinate with ADF&G to the extent possible to gather data needed to improve understanding of scallop stock dynamics and the effect of exploitation on the stock’s capacity to produce MSY on a continuing basis. Useful data would include information on: (1) stock abundance and size/age structure; (2) scallop biology, life history, and stock production parameters; (3) analyses of population thresholds and recruitment overfishing; (4) estimation of optimum dredge ring size or minimum shell height based on studies of rates of growth and mortality; (5) investigations of exploitation rates and alternative management strategies; (6) genetic stock structure; and (7) new gear designs to reduce bycatch and to minimize adverse effects on bottom habitat. These objectives may be attained, in part, through use of data collected by the scallop observer program. However, stock assessments and other scallop research will be dependent on Federal funding, State of Alaska general fund appropriations, or future amendments to the FMP that would authorize experimental fishing under Federal permit conditions.

3.2.13 Other

As previously noted, the State of Alaska is not limited solely to the management measures described in this FMP. However, implementation of additional management measures not described here must be consistent with the FMP, the Magnuson-Stevens Act, and other applicable Federal law.

Chapter 4 Description of Stocks and Fishery

4.1 Geographic description of the management area

The management areas covered under the FMP includes all Federal waters of the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands area (BSAI). The GOA is defined as the U.S. exclusive economic zone (EEZ) of the North Pacific Ocean, exclusive of the Bering Sea, between the eastern Aleutian Islands at 170°W. longitude and Dixon Entrance at 132°40'W. longitude. The BSAI is defined as the U.S. EEZ south of the Bering Strait to the Alaska Peninsula and Aleutian Islands and extending south of the Aleutian Islands west of 170° W. longitude.

4.1.1 Registration Areas, District, Subdistrict, and Section Boundaries

This FMP adopts existing State registration areas. The management unit historically has been divided by the State into nine scallop registration areas composed of the Federal waters and adjacent State waters described in each area (Appendix B). Registration areas may be further divided into fishing districts, subdistricts, and sections for purposes of management. For the purpose of scallop management, the State has divided the Yakutat, Cook Inlet, and Kodiak Registration Areas into districts.

Registration areas are characterized by relatively homogeneous established fisheries on scallop stocks. State regulations require vessels to register for fishing in these areas, and may require vessels to register for specific fishing districts within a registration area. Registration requirements allow estimation of fishing effort and the rate at which the resource will be harvested. Existing Registration Areas and districts are shown in Figure 3 and defined in Appendix B.

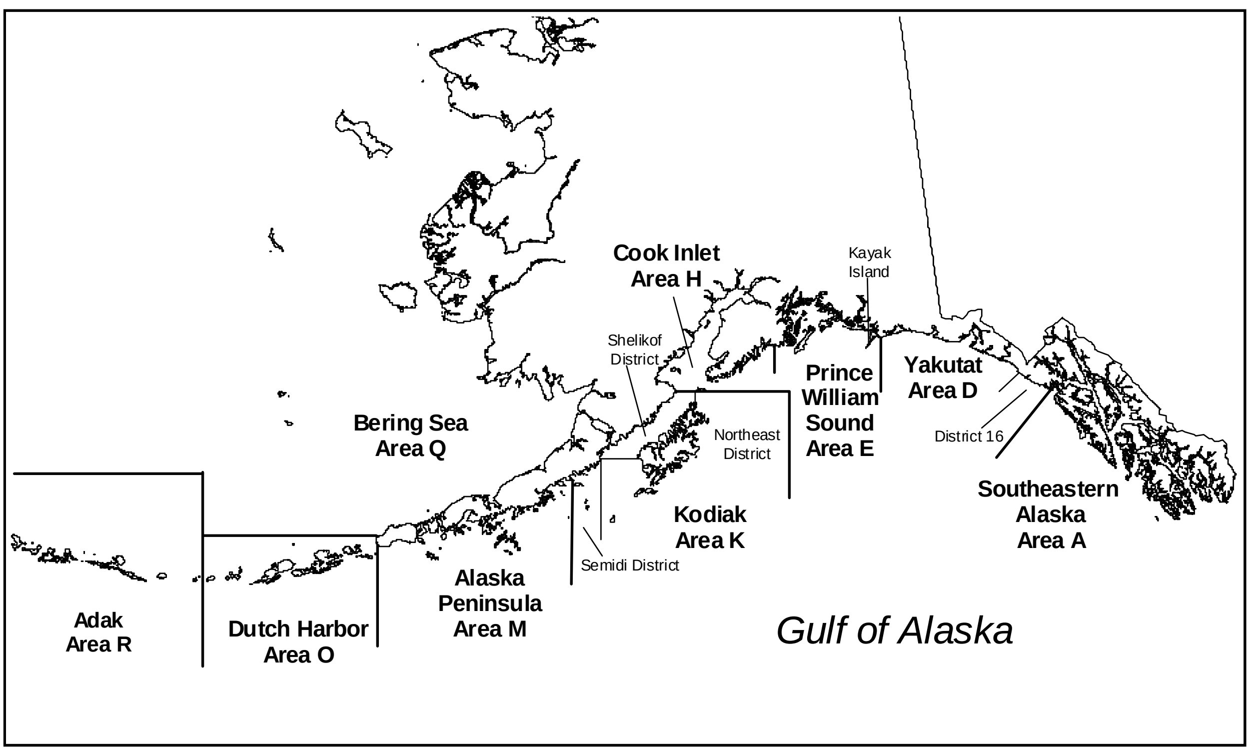


Figure 3 Alaska weathervane scallop registration areas

4.2 Physical characteristics of the management area

The continental shelf parallels the southeastern Alaska coast and extends around the GOA. Total area of continental shelf in the GOA is about 160,000 square km, which is more than the shelf area in the Washington-California region but less than 25% of the eastern Bering Sea Shelf. Between Canada and Cape Spencer the Continental Shelf is narrow and rough. North and west of Cape Spencer it is broader. Although its width is less than 10 miles at some points, it is generally 30 to 60 miles wide. As it curves westerly from Cape Spencer towards Kodiak Island it extends some 50 miles seaward, making it the most extensive shelf area south of the Bering Sea. West of Kodiak Island and proceeding along the Alaska Peninsula toward the Aleutian Islands, the shelf gradually becomes narrow and rough again. More detailed information on the Alaskan shelf can be found in Sharma (1979).

Coastal waters overlying the continental shelf are subject to considerable seasonal influences. Winter cooling, accompanied by turbulence and mixing due to major storms results in a uniform cold temperature in the upper 100 m. Seasonal changes in temperature and salinity diminish with increasing depth and distance from shore. Along the outer shelf and upper slope, bottom water temperatures of 4 to 5° C persist year-round throughout the periphery of the GOA. With further increase in depth, water temperature shows no significant seasonal change but gradually decreases with depth, reaching 2° C or less at greater depths. The water circulation pattern in both the eastern Bering Sea and Gulf of Alaska is a counterclockwise gyre (Sharma 1979). Inshore current flow patterns are affected by weather, tides, and topography.

All commercial fisheries for Alaskan scallops take place in relatively shallow waters (< 200 m) of the continental shelf. Weathervane scallops are found at depths ranging from intertidal waters to depths of 300 m (Foster 1991), but abundance tends to be greatest between depths of 45-130 m on substrates consisting of mud, clay, sand, or gravel (Hennick 1973). Although weathervane scallops are widely distributed along the shelf, the highest densities in Alaska have been found to occur in discrete areas. Areas fished during the 2003/2004 scallop fishery included beds in the Bering Sea, off the Alaska Peninsula, in Shelikof Strait, on the east side of Kodiak Island, and along the Gulf coast from Yakutat to Kayak Island (Figure 4).

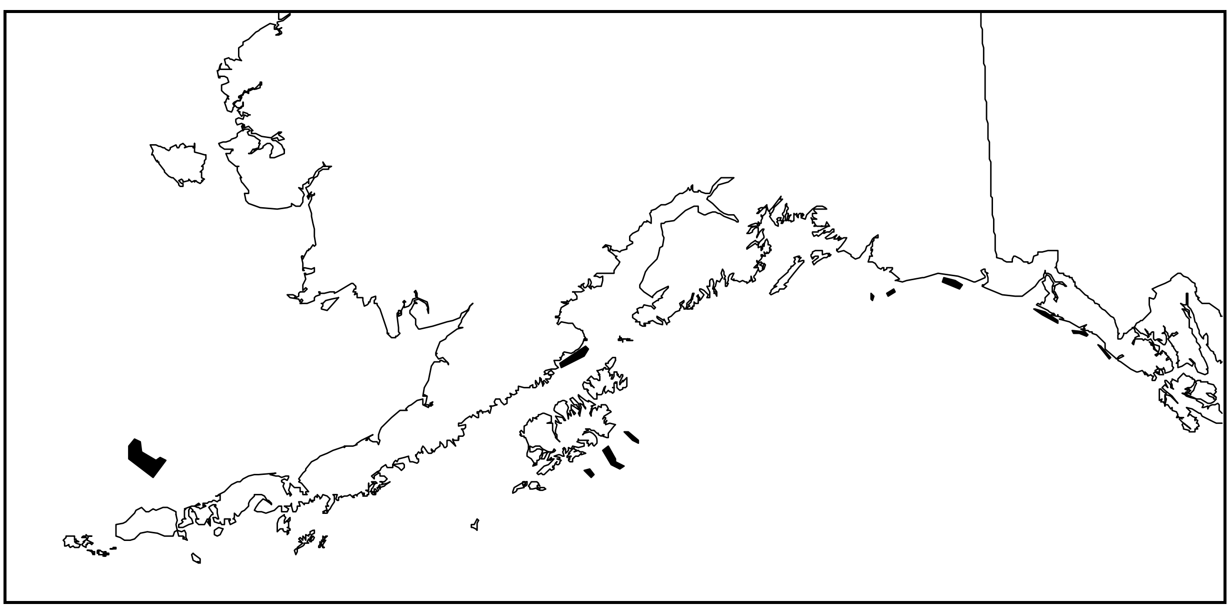


Figure 4 Scallop fishing locations outside Cook Inlet during the 2003/04 season

4.3 Description of Stocks and Fishery

This FMP covers all scallop stocks off the coast of Alaska including weathervane scallops *Patinopecten caurinus*, rock scallops *Crassadoma gigantea*, pink scallops *Chlamys rubida*, spiny scallops *Chlamys hastata*, *Chlamys behringiana*, and *Chlamys albida*.

Weathervane scallops are "in the fishery" as they are targeted and retained for commercial sale. Rock scallops and the *Chlamys* species are managed under this FMP as Ecosystem Component (EC) species in section 4.3.5.

4.3.1 General Biology

Weathervane scallops are distributed from Point Reyes, California to the Pribilof Islands, Alaska. The highest densities in Alaska are found along the eastern gulf coast from Cape Spencer to Cape St. Elias, around Kodiak Island, and in the Bering Sea.

The weathervane scallop is a bivalve with a single adductor muscle, a socket-like hinge, and distinct dorsal and ventral valves. Scallops have limited swimming ability achieved through hydraulic water pressure due to clapping the valves together. Numerous eyes (ocelli) are located on stalks along the outer mantle. Scallops are non-burrowing filter feeders that subsist primarily on phytoplankton.

Although weathervane scallops are currently the only species commercially harvested in Alaska, several other scallop species found in the EEZ off Alaska have commercial potential. These scallops are related to the Icelandic scallop *Chlamys islandica* of the North Atlantic and grow to smaller sizes than weathervane scallops; *Chlamys behringiana* inhabit the Chukchi Sea to the Western Bering Sea, *Chlamys albida* are distributed from the Bering Sea and Aleutian Islands to the Japan Sea, pink scallops range from California to the Pribilof Islands, and spiny scallops are found in coastal regions from California to the Gulf of Alaska. Little is known about the biology of these scallop species. *Chlamys* species occupy different habitats and have different growth characteristics than weathervane scallops. Pink scallops are found to depths of 200 m in areas with soft bottom, whereas spiny scallops occur in shallower (<150 m) areas characterized by hard bottoms and strong currents. Spiny scallops grow to slightly larger sizes (75 mm shell height, SH) than pink scallops (60 mm SH). Both species mature at age 2 (~35 mm SH) and are characterized by a high natural mortality rate and maximum age of about 6 years. Spiny scallops are autumn spawners (August–October), whereas pink scallops are winter spawners (January–March; Bourne and Harbo 1987).

Rock scallops *Crassadoma gigantea* range from Mexico to Unalaska Island. The abundance of this species is not known, and a commercial fishery has never been developed. Because they attach themselves to rocks, they cannot be captured efficiently with trawls or dredges. As suggested by the species name, these scallops attain a large size (up to 250 mm SH) and exhibit fast growth rates. Rock scallops are found in relatively shallow areas (0–80 m) with strong currents. Distribution of this species appears to be discontinuous and abundance in most areas is low. Rock scallops may spawn during two distinct periods, one in autumn (October–January) and one during spring–summer (March–August; Jacobsen 1977).

4.3.2 Reproduction and early life history

Scallop sexes are in general separate, although one case of hermaphroditism in weathervane scallops has been observed (Hennick 1971). Mature male and female scallops are distinguishable through gonad coloration, with pink or orange-red gonads in females and white gonads in males (Haynes and Powell 1968; Robinson and Breese 1984). Although spawning times vary with latitude and depth (Robinson and Breese 1984; MacDonald and Bourne 1987; Starr and McCrae 1983), weathervane scallops in Alaska appear to mature in mid-December to late January and spawn in May through July (Hennick 1970a).

Scallops develop through egg, larval, juvenile, and adult life stages. Eggs and spermatozoa are released into the water, where the eggs may be fertilized (Cragg and Crisp 1991). After a few days, eggs hatch and larvae rise into the water column to drift with ocean currents. Larvae are pelagic for about one month until metamorphosis to the juvenile stage (Bourne 1991). Post-larval scallops settle to the bottom and may attach to a hard surface with byssal threads. Young juveniles may remain attached or become mobile; within a few months, the shell develops pigmentation and juveniles resemble adults in appearance.

Most weathervane scallops mature by age 3 at about 76 mm SH, and virtually all scallops are mature by age 4 (Haynes and Powell 1968; Hennick 1970b, 1973). Growth is most rapid during the first 10-11 years (Hennick 1973). However, growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. For example, average maximum size is about 190 mm SH off the east side of Kodiak Island and only 144 mm SH for the Cape Fairweather-Cape St. Elias area; the largest recorded specimen measured was 250 mm SH (Hennick 1973). Although increasing with age and size, scallop meat weight varies seasonally, with yields declining during the spawning season and increasing during the growing season. Adductor weights of weathervane scallops apparently vary among regions as well, with the west side of Kodiak Island producing the largest meats relative to shell size (Jeff Barnhart, ADF&G, unpublished data).

4.3.3 Longevity and natural mortality

Weathervane scallops can live 28 years or more (Hennick 1973). A median instantaneous natural mortality rate of M=0.13 was estimated by Kruse and Funk (1995). Their estimate was based on data presented in published papers (Kaiser 1986; Hennick 1973) and various methodology, including growth parameter analysis (Alverson and Carney 1975), catch curve analysis (Robson and Chapman 1961), and maximum age (Hoenig 1983; Beverton 1963). Little is known about the causes of natural mortality for scallops. Scallops are likely prey for various fish and invertebrates during the early part of their life cycle. Flounders (*Pleuronectides* spp.) are known to prey on juvenile weathervane scallops, and seastars (Stelleroidea) may also be important predators (Bourne 1991).

4.3.4 Stock Structure and Productivity

The stock structure of weathervane scallops has not been studied. Until recently, benthic ecologists generally believed that invertebrate species such as scallops have open populations that are interconnected between geographically distinct areas through advection of pelagic larvae. However, a growing body of evidence (e.g., Sinclair 1988; Orensanz et al. 1991) suggests that some invertebrate populations are comprised of multiple discrete, self-sustaining units. Sinclair et al. (1985) suggested that populations of 3 species of scallops in the North Atlantic Ocean were organized this way; between Virginia and Newfoundland, at least 19 discrete concentrations of Atlantic scallops were identified. Fevolden (1989) provided strong evidence for restricted gene flow among different concentrations of Iceland scallops in the northeast Atlantic Ocean and concluded that scallops sampled from different areas should be treated as discrete genetic units for management purposes. Caddy (1989) asserted that it is reasonable to assume that historically maintained centers of scallop concentrations are self-sustaining populations. Further, he recommended that these commercially important scallop beds should compose the unit stock upon which management measures are based. He also noted that a scallop fishing ground may contain several beds of high scallop density surrounded by low-density scallop fishing areas.

4.4 Present Condition and Abundance

ADF&G establishes GHRs and manages weathervane scallop harvests conservatively in each fishing area based on the best data currently available. The Scallop Plan Team reviews management practices regularly and updates the scallop SAFE report with recent abundance survey information and fishery performance data. Due to the absence of scallop biomass estimates for many fishing areas, OY and MSY are set for the statewide stock as a whole; harvest levels have averaged 39% to 66% of MSY since inception of the observer program in 1993 (Figure 5), and the stock is not overfished.

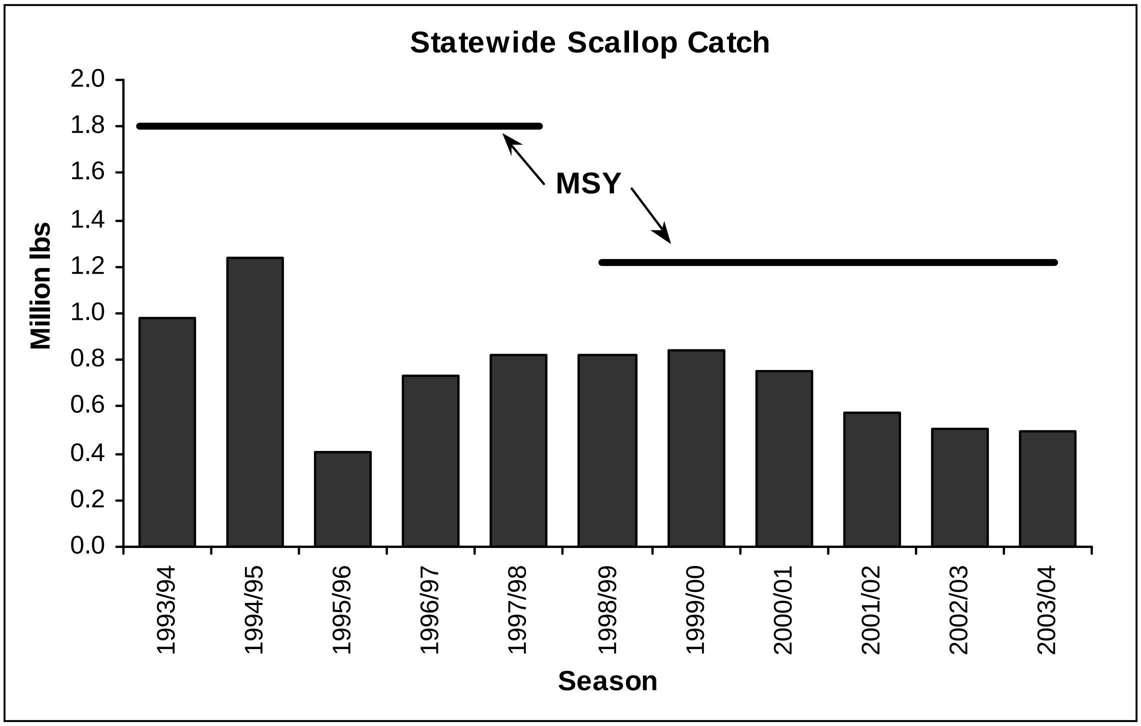


Figure 5 Statewide scallop harvest (pounds shucked scallop meats) and MSY levels from the FMP

The State of Alaska Scallop Fishery Management Plan established 9 scallop registration areas in Alaska for vessels commercially fishing for scallops (Figure 1). These include the Southeastern Alaska Registration Area (Area A); Yakutat Registration Area (Area D and District 16); Prince William Sound Registration Area (Area E); Cook Inlet Registration Area (Area H); Kodiak Registration Area (Area K), which is subdivided into the Northeast, Shelikof and Semidi Districts; Alaska Peninsula Registration Area (Area M); Dutch Harbor Registration Area (Area O); Bering Sea Registration Area (Area Q); and Adak Registration Area (Area R). Scallop seasons are not opened in Area A, and effort occurred in Area R in 1995 only. Stocks in each area are independently assessed with methods that vary by region.

ADF&G conducts biennial dredge surveys in the Kamishak District of the Cook Inlet Registration Area and near Kayak Island in the Prince William Sound Registration Area. For registration areas without surveys, stocks are assessed and managed based on extensive data sets collected by the scallop observer program. These data consist of scallop catch and fishing effort, including total harvest, CPUE, fishing locations, size structure of the catch, and crab bycatch. Confidential spatially explicit observer data is examined in detail each year when GHRs are set. ADF&G personnel have developed methodology for fishery-independent video surveys of scallop stocks in the highest-producing beds that should provide biomass estimates for additional areas in the future.

GHRs for registration areas where scallop fishing traditionally occurred were first established by the State of Alaska in 1993 under the Interim Management Plan for Commercial Scallop Fisheries in Alaska. The upper limit of the GHR (pounds of shucked meats) from traditional areas included Yakutat (250,000 pounds), Prince William Sound (50,000), Kamishak District of Cook Inlet (20,000 pounds), Kodiak (400,000 pounds), and Dutch Harbor (170,000) pounds. The combined upper limits of the GHRs totaled 890,000 pounds of shucked meats. GHRs for each area were determined by averaging historic catches from 1969 to 1992 excluding years when either no fishing or a “fishing-up effect” occurred (Barnhart 2003). Production may be over-estimated by using data from “fishing-up” periods, when catches exceed sustainable levels as a newly established fishery removes older individuals from a population and exploits marginal beds that may rebuild slowly.

Prior to the August 1, 1996 opening of the weathervane scallop fishery, ADF&G established GHRs for non-traditional registration areas. GHR upper limits were established for the Alaska Peninsula (200,000 pounds), Bering Sea (600,000 pounds), District 16 (35,000 pounds) and Adak (75,000 pounds). Historic high catches for each registration area were established as the GHR upper limit. The combination of GHRs from traditional and non-traditional areas totaled 1.8 million pounds of shucked scallop meats, which was defined as MSY in Amendment 1 to the FMP.

In 1998, the scallop plan team recommended a more conservative approach, defining MSY as 1.24 million pounds of shucked scallop meats based on average landings from 1990–1997, excluding 1995 when the fishery was closed most of the year. Subsequently, MSY was established in Amendment 6 of the FMP at 1.24 million pounds and optimum yield (OY) as a range from 0 to 1.24 million pounds. To accommodate the lower limits the department reduced the upper end of the GHR in Kodiak from 400,000 to 300,000 pounds, in Dutch Harbor from 170,000 to 110,000 pounds, and in the Bering Sea from 600,000 to 400,000 pounds.

Vessel participation and total catch by registration area and year are published in the annually updated Stock Assessment and Fishery Evaluation (SAFE) Report compiled by the Scallop Plan Team of the North Pacific Fishery Management Council. Copies of the SAFE Report are available through the Council office. With the exception of Kodiak, Prince William Sound and Cook Inlet (except recent years), catches have been well below state GHRs for each area. The Alaska Department of Fish and Game has obtained release forms signed by vessel operators in order to display confidential catch information. Whenever possible, unless otherwise indicated as “confidential”, catch records have been made available for publication by the State.

4.3.5 Ecosystem Component

Rock scallops and the *Chlamys* species are non-target scallops and classified as EC species. The following factors were considered, per the National Standard 1 Guidelines, in classifying these non-target species as an EC species:

(A) These scallop species are not the target of commercial exploitation or retention by commercial fisheries;

(B) None of the non-target scallop species are generally retained for sale or personal use;

(C) The best available scientific information indicates that none of the non-target scallop species are overfished or subject to overfishing; and

(D) The best available scientific information indicates that none of the non-target stocks are likely to become subject to overfishing or overfished in the absence of conservation and management measures.

In accordance with NS 1 Guidelines, reference points and status determination criteria are not specified for the EC species. However, these species are monitored to ensure they are not targeted and that incidental catch does not reach a point where there are concerns for the sustainability of these stocks. Evaluation of EC species bycatch in the weathervane scallop fishery occurs annually through the existing Stock Assessment and Fishery Evaluation (SAFE) report process. The SAFE report annually summarizes best available scientific information on EC species.

Before a commercial fishery for an EC species could occur in Federal waters, the FMP must be amended to move an EC species in to the fishery for targeted commercial fishing and specify biological reference points for that species.

4.5 Ecological Relationships

Scallop predators have not been well studied. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

4.6 Habitat of managed stocks

Appendix D describes the habitat of the GOA and BSAI management areas for scallops, defines essential fish habitat for scallops, describes habitat areas of particular concerns, and provides habitat conservation and enhancement recommendations.

4.7 Fishing Activities Affecting the Scallop Stocks

4.7.1 History of exploitation

Since the early 1980s, between 4 and 20 vessels annually have participated in the Alaska scallop fishery. Gross earnings experienced by the fleet during this same period of time has ranged from almost $.9 million in 1983 to about $7 million in 1992. Between 1969 and 1991, about 40% of the annual landings of scallops from waters off Alaska were comprised of scallops harvested from State waters. Table 3 shows the percent of scallop harvest caught in federal waters versus state waters from 1998/99 through the 2003/04 regulatory season. GHRs are set for a regulatory area, regardless of state or federal jurisdiction within that area. Examining the percentage of harvest between state and federal areas gives an indication of where the harvest is primarily being taken, although this is not necessarily an indication of the biological availability of the resource. The State of Alaska has managed the scallop fishery in State and Federal waters, consistent with section 306(a)(3) of the Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.), which allows a state to directly regulate any fishing vessel outside state waters if the vessel is registered under the law of that state.

Table 3 Percent of scallop meats caught in federal and state waters

Registration Area	District	Federal/State Waters	Percent of Harvest by State/Federal Water[a,b]					
			1998/99	1999/2000	2000/01	2001/02	2002/03	2003/04
D	**D**	**FED**	**65%**	**70%**	**80%**	**64%**	**78%**	**56%**
		STATE	**35%**	**30%**	**20%**	**36%**	**22%**	**44%**
	D Total		100%	100%	100%	100%	100%	100%
	D16	**FED**	**28%**	**55%**	**13%**	**28%**	**100%**	**83%**
		STATE	**72%**	**45%**	**87%**	**72%**	**-**	**17%**
	D16 Total		100%	100%	100%	100%	100%	100%
E	**E**	**FED**	**68%**	**30%**	**100%**	**100%**	**100%**	**100%**
		STATE	**32%**	**70%**	**-**	**-**	**-**	**-**
	E Total		100%	100%	100%	100%	100%	100%
H	**H**	**FED**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	H Total		100%	100%	100%	100%	100%	100%
K	**KNE**	**FED**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	KNE Total		100%	100%	100%	100%	100%	100%
	KSH	**FED**	**69%**	**74%**	**70%**	**51%**	**61%**	**70%**
		STATE	**31%**	**26%**	**30%**	**49%**	**39%**	**30%**
	KSH Total		100%	100%	100%	100%	100%	100%
	Semidi	**FED**	**56%**	**-**	**-**	**-**	**-**	**-**
		STATE	**44%**	**100%**	**-**	**-**	**-**	**-**
	Semidi Total		100%	100%	-	-	-	-
M	**M**	**FED**	**100%**	**100%**	**100%**	**-**	**-**	**-**
		STATE	**0%**	**0%**	**-**	**-**	**-**	**-**
	M Total		100%	100%	100%	-	-	-
O	**O**	**FED**	**0%**	**4%**	**-**	**-**	**4%**	**-**
		STATE	**100%**	**96%**	**-**	**-**	**96%**	**-**
	O Total		100%	100%	-	-	100%	-
Q	**Q**	**FED**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	Q Total		100%	100%	100%	100%	100%	100%

[a]0% indicates some fishing occurred, an insignificant amount was caught

[b]- designation indicates no fishing occurred

The Alaska Department of Fish and Game (ADF&G) initiated development of a management plan for the scallop fishery in response to overfishing concerns resulting from recent changes in the weathervane scallop fishery off Alaska. Weathervane scallops possess biological traits (e.g., longevity, low natural mortality rate, and variable recruitment) that render them vulnerable to overfishing. Record landings occurred in the late 1960s (about 1.8 million pounds shucked scallop meat), followed by a significant decline in catch through the 1970s and 1980s when landed catch ranged between 0.2 and 0.9 million pounds. The ADF&G believes this decline is due, in part, to reduced abundance of scallop stocks (Kruse, 1994). Landings since 1989 have increased to near record levels. During this period, the number of vessels fishing for scallops has not increased (about 10–15 vessels annually), although an increase in fishing power is evidenced by a substantial increase in average vessel length (from 84 feet registered length in 1981 to 110 feet in 1991), a predominance of full-time scallop vessels, and an increased number of deliveries. Until 1993, the State did not have a data collection program, although some indication exists that overfishing, or at least localized depletion may have occurred. Data voluntarily submitted by participants in the scallop fishery during the early 1990s showed that an increase in meat counts per pound has occurred, indicating that smaller scallops now account for a greater proportion of the harvest. These data also suggest that catch per unit of effort in traditional fishing grounds has decreased.

Limited age data suggest that the scallop stock historically exploited off west Kodiak Island experienced an age-structure shift from predominately age 7 and older scallops in the late 1960s to an age structure predominated by scallops less than age 6 during the early 1970s. This shift indicated that harvest amounts had exceeded sustainable levels. Changes in fleet distribution from historical fishing grounds primarily in State waters to previously unfished grounds in the EEZ compounded management concerns.

In response to these concerns, the ADF&G implemented a management plan for the scallop fishery in 1993-94 that established a total of nine fishery registration areas corresponding to the Southeastern, Yakutat, Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula, Dutch Harbor, Adak, and Bering Sea portions of the State. To prevent overfishing and maintain reproductive potential of scallop stocks, ADF&G established a guideline harvest range (GHR) for each of the traditional weathervane scallop fishing areas. In the absence of biomass estimates needed to implement an exploitation rate harvest strategy, the upper limit of the GHRs are specified as the long-term productivity (catch) from each of the traditional harvest areas. The ADF&G may adjust GHRs based on changes in stock status, such as shifts in population size/age structure coupled to changes in area-specific catch-per-unit-effort. If a GHR for a registration area is not specified, ADF&G may authorize fishing for weathervane or other scallop species under special use permits that generally include location and duration of harvests, gear limitations and other harvest procedures, periodic reporting or logbook requirements, requirements for onboard observers, and scallop catch or crab bycatch limits.

The ADF&G also has implemented king and Tanner crab bycatch limits to constrain the mortality of Tanner crab and king crab incidentally taken by scallop dredge gear. Generally, crab limits are set at 1% of the total crab population for those management areas where crab stocks are healthy enough to support a commercial fishery. In areas closed to commercial fishing for crab, the crab bycatch limits for the scallop fishery are set at 0.5% of the total crab population.

Specified waters are closed to fishing for scallops to prevent scallop dredging in biologically critical habitat areas, such as locations of high bycatch of crab or nursery areas for young fish and shellfish. State regulations also require each vessel to carry an observer at all times to provide timely data for monitoring scallop catches relative to GHRs and for monitoring crab bycatch. Observers also collect scientific data on scallop catch rates, size distribution and age composition. This information is required by ADF&G for potential adjustment of GHRs based on changes in stock status and productivity.

Last, ADF&G regulations establish gear specifications to minimize the catch of undersized scallops and efficiency controls to reduce the economic feasibility of harvesting scallops much smaller than sizes associated with optimum yield. Current efficiency controls include a ban on automatic shucking machines and a crew limit of 12 persons.

4.7.2 Commercial Fishery

The weathervane scallop fishery is prosecuted with standard New Bedford style scallop dredges. On average, fully-rigged[1] dredges weigh the following: a 6ft dredge weighs between 900-1200 pounds (J. Barnhart, ADF&G pers. comm.); an 8ft dredge weights between 1500-1600 pounds (J. Barnhart,

[1] Fully-rigged dredge ready to fish includes ring bag, club stick and attachments

ADF&G, pers. comm.); and a 15ft dredge weighs approximately 2,600 pounds. The frame design provides a rigid, fixed dredge opening. Attached to and directly behind the frame is a steel ring bag consisting of 4-inch (inside diameter) rings connected with steel links. A sweep chain footrope is attached to the bottom of the mesh bag. The top of the bag consists of 6-inch stretched mesh polypropylene netting which helps hold the bag open while the dredge is towed along the ocean floor. A club stick attached to the end of the bag helps maintain the shape of the bag and provides for an attachment point to dump the dredge contents on deck. Steel dredge shoes that are welded onto the lower corners of the frame bear most of the dredge's weight and act as runners, permitting the dredge to move easily along the substrate. Each dredge is attached to the boat by a single steel wire cable operated from a deck winch.

All vessels fishing inside the Cook Inlet Registration Area are limited to a single dredge not more than 6 feet in width. Unless otherwise restricted by the LLP, vessels fishing in the remainder of the state may simultaneously operate a maximum of 2 dredges that are 15 feet or less in width. Vessels used in the weathervane scallop fishery range in size from 58 feet to 124 feet length overall with a maximum of 850 horsepower.

Federal LLP permits have been voluntarily consolidated by the fleet through an industry cooperative. Three larger vessels with LLP permits, including one limited by American Fisheries Act (AFA) sideboards, participate in the federal water portion of the fishery and harvest the majority of the scallop quota in the federal (statewide) fishery outside of Cook Inlet. Three smaller vessels with LLP permits participate primarily in the Cook Inlet fishery. Occasionally, one of the smaller vessels participates in the scallop fishery outside of Cook Inlet.

In 1997, the Alaska legislature approved legislation (AS 16.43.906) establishing a scallop vessel moratorium in state waters (0-3 miles). In 2001, the legislature authorized a 3-year extension of the moratorium, due to expire July 1, 2004. During the 2002 legislative session, passage of HB206 resulted in changes to the state's limited entry statutes. These changes authorized use of a vessel-based limited entry program in the weathervane scallop fishery. However, vessel entry permits issued for the statewide weathervane scallop fishery will expire on December 31, 2008 unless statutory authority is extended. Prior to the July 1, 2004 expiration of the state vessel moratorium, a vessel permit limited entry system for the statewide weathervane scallop fishery was in place. Eight vessel owners received permits to fish for weathervane scallops in state waters.

4.7.2.1 Voluntary Scallop Cooperative

In May 2000, six of the nine LLP owners formed the North Pacific Scallop Cooperative under authority of the Fishermen's Cooperative Marketing Act, 48 Stat. 1213 (1934), 15 U.S.C. Sec. 521. The cooperative regulates individual vessel allocations within the GHR and caps under the terms of their cooperative contract. The purpose of the cooperative was to slow the race for fish enabling participants to develop better techniques for bycatch avoidance, as well as to improve efficiency in targeting scallops.

According to members of the cooperative, the cooperative members negotiate allocations of scallops and crab bycatch among members annually and enforce those allocations through provisions in the cooperative contract. Participants must stop fishing once they have reached either their scallop allowance or crab caps. The cooperative contract gives co-op members the authority to seek injunctive relief if a member fails to cease fishing once their allocation is met.

According to cooperative members, some owners opted to remove their boats from the fishery due to decreased profitability in the scallop fishery in recent years. The catch history associated with those permits is then fished by the remaining vessels in the cooperative. Since formation of the cooperative, fewer vessels participate and fishing effort occurs over a longer time period each season.

4.7.3 Subsistence Fishery

There has been no known subsistence fishery for scallops.

4.7.4 Recreational Fishery

Anecdotal reports by ADF&G managers have indicated that some limited fishing for scallops by scuba divers in Southeast has occurred. Scallop dredges are legal personal use gear. Limited recreational harvest by longline fishermen, and by a personal use dredge in Prince William Sound has occurred.

4.8 Economic and Socioeconomic Characteristics

An overview of historic Alaska weathervane scallop harvest and wholesale revenue is presented in Table 4. This data is reprinted from Kruse et al. (in press). Vessel participation and numbers of landings in this fishery have varied considerably over time. Participation increased rapidly from an historic low of 2 vessels in 1967 to 19 in both 1968 and 1969. Similarly, only 6 landings occurred in 1967 but by 1969, 157 landings were made and that year is the historical peak in participation, landings, and catch and among the years with highest first wholesale gross revenue.

Following 1969, participation, landing, and catch trended downward through 1976. In 1977 and 1978 the fishery was open but fishermen opted not to fish. In 1980 there were 8 participants making 56 landings totaling more than 600,000 pounds of scallop meats. In the following years, participation, landings, and catch trended upwards until 1983 before cycling downward. There followed an upward trend in landings and catch through the mid 1990s. Since the mid 1990s, participation, landings, and catch have stabilized somewhat with catch consistently between 500,000 lbs and 850,000 pounds each year. Vessel participation has been limited in recent years by the formation of the voluntary cooperative in May 2000 and the implementation of the LLP in 2001. The federal LLP limits the participation to 9 permit holders. Since 2000 no more than 8 vessels have participated and in recent years it has been even fewer.

Table 4 also provides historical statewide average price per pound of landed scallop meats as well as a consumer price index based inflation adjusted price. Total gross revenue is then calculated using landed pounds of meats multiplied by the adjusted price. Adjusted price converts the landed prices by year to year 2002/03 values so that comparisons can be made in present day dollar values, after accounting for inflation. It is important to note that landed scallop meats have been processed (shucked) and frozen at sea. Thus, although landed price is often referred to as an ex-vessel price, it is actually a first wholesale price in that the landed product is a primary processed product. Thus, gross revenue is identified as first wholesale value here.

Adjusted price generally trended upwards during the late 1960s and through the 1970s. Following the three years of closure, prices rose dramatically to nearly $7.5 per pound, possibly in response to shortage caused by the closures. Historic prices peaked in 1983 at $8.56 per pound before trending downward through the mid 1990s, upward during the late 1990s and then back downward from 1999 through 2002/03 when adjusted prices averaged $5.25 per pound. This trend may be directly related to U.S. east coast scallop stock conditions and related market prices and the dependence of market prices in the Alaska scallop fishery on east coast markets is a topic for further research.

First wholesale revenue in this fishery has varied considerably over the years as both price and landings have varied. The peak value in the fishery occurred in 1992 when about $8.8 million was earned. Since that time, total first wholesale revenue in the fishery has trended downward along with landings, catch, and prices. In 2002/03, the fishery yielded about $2.7 million in total first wholesale revenue.

Table 4 Historic Statewide Commercial Weathervane Scallop Revenue Statistics, 1967–2002/03

Year	Number of Vessels	Number of Landings[a]	Catch (lbs meats)[b]	Average Price/lb.	Inflation Factor	Adjusted Price	1st Wholesale Value
1967	2	6	778[c]	$0.70	0.219	$3.20	$2,487
1968	19	125	1,677,268	$0.85	0.228	$3.73	$6,252,973
1969	19	157	1,849,947	$0.85	0.238	$3.57	$6,606,954
1970	7	137	1,440,338	$1.00	0.249	$4.02	$5,784,490
1971	5	60	931,151	$1.05	0.260	$4.04	$3,760,418
1972	5	65	1,167,034	$1.15	0.268	$4.29	$5,007,795
1973	5	45	1,109,405	$1.20	0.285	$4.21	$4,671,179
1974	3	29	504,438	$1.30	0.313	$4.15	$2,095,110
1975	4	56	435,672	$1.40	0.339	$4.13	$1,799,235
1976	7	21	264,788	$1.59	0.359	$4.43	$1,172,738
1977, 1978				**No Effort**			
1979	1	4	24,826	NA	NA	NA	NA
1980	8	56	616,717[c]	$3.60	0.484	$7.44	$4,587,151
1981	18	101	924,441	$4.00	0.529	$7.56	$6,990,102
1982	13	120	913,996	$3.25	0.561	$5.79	$5,294,986
1983	5	30	192,310	$5.00	0.584	$8.56	$1,646,490
1984	6	52	383,512	$4.00	0.607	$6.59	$2,527,262
1985	7	47	615,564	$4.00	0.627	$6.38	$3,927,043
1986	8	74	667,258	$4.25	0.639	$6.65	$4,437,944
1987	4	54	599,947[d]	$3.45	0.661	$5.22	$3,131,342
1988	4	47	341,070	$3.68	0.685	$5.37	$1,832,318
1989	7	55	534,763	$3.87	0.714	$5.42	$2,898,505
1990	9	144	1,481,136	$3.43	0.750	$4.57	$6,773,729
1991	6	136	1,136,649	$3.82	0.777	$4.92	$5,588,159
1992	8	136	1,785,673	$3.96	0.796	$4.97	$8,883,499
1993[e]	7	51	568,077	$5.15	0.816	$6.31	$3,585,290
1993/94	15	111	984,583	$5.15	0.816	$6.31	$6,213,974
1994/95	15	104	1,240,775	$5.79	0.833	$6.95	$8,624,354
1995/96	10	29	410,743[d]	$6.05	0.853	$7.09	$2,910,834
1996/97	9	30	732,424	$6.30	0.876	$7.19	$5,267,433
1997/98	9	31	818,913	$6.50	0.895	$7.26	$5,947,413
1998/99	8	35	822,096	$6.40	0.908	$7.05	$5,794,509
1999/00	10	22	837,971	$6.25	0.927	$6.74	$5,649,751
2000/01	8	20	750,617	$5.50	0.958	$5.74	$4,309,388
2001/02	6	26	572,838	$5.25	0.984	$5.34	$3,056,300
2002/03	6	28	509,455	$5.25	1.000	$5.25	$2,674,639

Notes: a: Prior to and including 1995, number of landings equals number of fish tickets. After 1995, the number of landings equals number of deliveries (off-loads). A delivery typically includes multiple tickets, normally one per week. b: Pounds of shucked scallop meats. c: Unshucked scallop deliveries were converted to shucked meats using a 10% conversion factor. d: Harvest includes those taken by a single vessel outside the jurisdiction of the State of Alaska in excess of the allowable limit. e: January 1 through June 30

4.9 Fishing Communities

Table 5 lists the landings (in number of offloads) of weathervane scallops by ports from 1990–2003. Alaskan ports which have landed scallops during this time period are: Cordova, Dutch Harbor, Homer, Kodiak, Ketchikan, Petersburg, Pelican, Seldovia, Seward, Sitka, Sand Point and Yakutat. Communities outside of Alaska include Bellingham, WA and Seattle, WA.

An overview of major demographic characteristics of these communities as well as their connections with North Pacific fisheries are provided in Appendix F. Additional information may be found in Sepez et al. 2004.

Table 5 Statewide weathervane scallop landings by port, 1990–2003

(Landings are indicated by the number of offloads at a specific port.)

Port	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Landings
Bel/Sea, WA												1	3	1	5
Cordova	1		6	1		1		1	1	1	8				20
Dutch Harbor	12	13	8	32	27	1		14	4	3	2	4	4	3	127
Homer	2			15	12	2	11	7	12	4	8	6	7	13	99
Kodiak	70	48	49	64	44	6	15	14	15	12	6	8	9	10	370
Ketchikan	1														1
Petersburg	2														2
Pelican				3											3
Seldovia														1	1
Seward	5		1	3	4	2	7	5	20	21	10	3			81
Sitka	8	24	15	6	2	2								1	58
Sand Point										1					1
Yakutat	22	16	34	3	5	3	4	6	10	3	3	12	7	2	130
At Sea												1	1	4	6
Total Landings	123	101	113	127	94	17	37	47	62	45	37	35	31	35	904

Chapter 5 Relationship to Applicable Law and Other Fisheries

This FMP is consistent with the Magnuson-Stevens Act (16 USC 1851), including the ten National Standards and other applicable law. Under the Federal FMP initiated in 1995, all management measures, except limited access and MSA requirements, are delegated to the State of Alaska. ADF&G management of the weathervane scallop fishery covers both state and federal waters off Alaska.

Chapter 6 Reference Material

6.1 Sources of Available Data

Additional sources of information on Scallop fisheries may be found on the following web sites:

National Marine Fisheries Service:
http://www.fakr.noaa.gov/sustainablefisheries/scallop/default.htm
North Pacific Fishery Management Council:
http://www.fakr.noaa.gov/npfmc/fmp/scallop/scallop.htm
Alaska Department of Fish and Game, Division of Commercial Fisheries:
http://www.cf.adfg.state.ak.us/geninfo/shellfsh/shelhome.php

6.2 Management & Enforcement Considerations

This section provides information on the management and enforcement considerations for the scallop fishery off Alaska. Management and enforcement consideration include the personnel included in managing the fisheries, data collection, research and stock evaluation and assessment, and the related costs of each. Additional information on the management of the fishery may be obtained from ADF&G.

Enforcement of regulations in the scallop fishery is accomplished by a range of state and federal responsibilities. This includes the NOAA enforcement of federal LLP permits, the role of the U.S. Coast Guard as well as the service provided in monitoring compliance by trained scallop observers.

The Alaska Board of Fisheries has specific findings and regulations with respect to the scallop observer program and the role of observers in monitoring and data collection during the fishery. These are laid out in 5 AAC 39.141 and are excerpted below:

(a) The Board of Fisheries finds that in particular fisheries observers on board fishing vessels would generally enhance primarily by facilitating information gathering, and by improving regulatory compliance. Onboard observers may be the only practical fishery monitoring, data gathering, or enforcement mechanism in some Alaska fisheries where a large component of vessels, such as catcher-processors and floating processors, rarely or never enter Alaskan ports.

(b) Every onboard observer shall have free and unobstructed access to inspect the catch, equipment, gear, or operations of the fishing vessel or tender to which the observer is assigned.

(c) Onboard observes are not required to obtain criminal or administrative search warrants to conduct their duties.

(d) Onboard observers shall carry out such scientific and other duties as deemed necessary or appropriate to manage, protect, maintain, improve, and extend the fish and aquatic plant resources of the state.

(e) Onboard observers shall have free and unobstructed access to loran or GPS coordinates, at random, at least twice in each 24-hour period. However, an observer shall have access to loran or GPS coordinates at any time if the observer suspects illegal activities. These loran or GPS observations are not to interfere with normal operations of the vessel.

Observers are not enforcement agents. They are trained to document the incident in writing and with photographs and turn it over to ADF&G as soon as they return to port. Observers may be required to testify in court.

6.2.1 Management and Enforcement Activities: Description and Cost Estimates

6.2.1.1 Cooperative Management of Statewide Weathervane Scallop Fisheries

This project is funded by a NOAA grant for the continued Cooperative management between the Council, NMFS, the BOF and ADF&G for the weathervane scallop fishery in the EEZ off Alaska under a federal FMP.

Federal support is provided to the state to cover additional costs incurred to meet federal oversight and FMP objectives. This includes management and reporting responsibilities required by the FMP. These additional requirements, beyond those required under a wholly state managed program, require additional staff to coordinate with Council and NMFS personnel, travel to public meetings, aid in FMP amendment analyses, provide information to assure public process, achievement of OY and meet compliance with federal laws. Alaska has developed a comprehensive system for managing the scallop fisheries both within state waters and the U.S. EEZ. This system represents the acquired expertise of numerous state employees across the management regions of the state. The benefits of cooperative management provides: (1) some financial relief to the state for incurred costs of federal compliance; (2) significant cost savings to the NMFS, which does not have to duplicate and develop an extensive new management program to meet FMP requirements needed if they were to assume management under the federal program; and (3) scallop fisheries managed to optimum yields.

Cost: $259,000 including indirect charges

6.2.1.2 Scallop Stock Assessment

Central Region. Cook Inlet and Prince William Sound weathervane scallop stock assessment.

Cost: $83,000 including indirect charges

Statewide. Three year rotating schedule between the Yakutat Registration Area, Kodiak

Registration Area and Bering Sea Registration Area.

Cost: $72,000

6.2.1.3 Other Management-related Costs

Approximately 11 biologists and technicians, in three administrative regions of Alaska, whose salaries, office space and associated costs are not covered in the Cooperative Management grant, are involved with some aspect of the weathervane scallop fishery. This includes briefing and debriefing onboard observers, management of the fishery, preparing for and attending Alaska Board of Fisheries meetings, and other duties.

6.2.1.4 Enforcement Costs

The primary purpose of the onboard scallop observer program is to collect biological and fishery-based data, monitor bycatch, and provide for regulatory enforcement. Beyond that, the Alaska State Troopers have been involved with enforcement activities involving scallop vessels. These activities range from routine inspections to case work.

Cost: The cost range is 1 man-hour to 35 man-hours per year.

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Appendix A: History of the Alaska Scallop Fishery and FMP

Alaskan weathervane scallop *Patinopecten caurinus* populations were first evaluated for commercial potential in the early 1950s by both government and private sector research. However, it was not until the late 1960s as catches declined in the U.S. and Canadian scallop fisheries on Georges Bank that interest in a fishery off Alaska began to take shape. Initial commercial fishing effort took place in 1967 when two vessels harvested weathervane scallops from fishing grounds off the eastside of Kodiak Island. By the following year, 19 vessels consisting of New England type scallop vessels, converted Alaskan crab boats, salmon seiners, halibut longliners, and shrimp trawlers entered the fishery.

From the inception of the fishery in 1967 through mid May 1993, the scallop fishery was passively managed employing minimal management measures. Closed waters and seasons were established to protect crabs and crab habitat. As catches declined in one bed vessels moved to better grounds. While this may have been generally acceptable for a sporadic low intensity fishery, increased participation led to boom and bust cycles (Barnhart 2003).

In the early 1990s, the Alaska weathervane scallop fishery expanded rapidly with an influx of scallop boats from the East Coast of the United States. Concerns about bycatch (in particular crab bycatch) and overharvest of the scallop resource prompted the Commissioner of ADF&G, under 5 AAC 39.210, to designate the weathervane scallop fishery a high impact emerging fishery on May 21, 1993. This action required ADF&G to close the fishery and implement an interim management plan prior to reopening. The interim management plan contained provisions for king and Tanner crab bycatch limits (CBLs) for most areas within the Westward Region. Since then, crab bycatch limits have been established for the Kamishak District of the Cook Inlet Registration Area and the Prince William Sound Registration Area. The commissioner adopted the regulations and opened the fishery on June 17, 1993, consistent with the measures identified in the interim management plan. The interim management plan included a provision for 100% onboard observer coverage to monitor crab bycatch and to collect biological and fishery-based data. In March 1994, the Alaska Board of Fisheries (BOF) adopted the interim regulations identified as the Alaska Scallop Fishery Management Plan, 5 AAC 38.076.

From 1967 until early 1995, all vessels participating in the Alaska scallop fishery were registered under the laws of the State of Alaska. Scallop fishing in both state and federal waters was managed under state jurisdiction. In January 1995, the captain of a scallop fishing vessel home-ported in Norfolk, Virginia returned his 1995 scallop interim use permit card to the State of Alaska Commercial Fisheries Entry Commission in Juneau and proceeded to fish scallops in the EEZ with total disregard to harvest limits, observer coverage, and other management measures. In response to this unanticipated event, federal waters in the EEZ were closed to scallop fishing by emergency rule on February 23, 1995. The initial emergency rule was in effect through May 30, 1995, and was extended for an additional 90 days through August 28, 1995. The intent of the emergency rule was to control the unregulated scallop fishery in federal waters until an FMP could be implemented closing the fishery. Prior to August 28, NPFMC submitted a proposed FMP which closed scallop fishing in the EEZ for a maximum of one year, with an expiration date of August 28, 1996. The final rule implementing Amendment 1 to the FMP was filed July 18, 1996 and published in the Federal Register on July 23, 1996. It became effective August 1, 1996, allowing the weathervane scallop fishery to reopen in the EEZ. Scallop fishing in state waters of the Westward Region was delayed until August 1, 1996 to coincide with the opening of the EEZ. The state continued as the active manager of the fishery with in-season actions duplicated by the federal system (Barnhart 2003).

In March 1997, the NMFS approved Amendment 2, a vessel moratorium under which 18 vessels qualified for federal moratorium permits to fish weathervane scallops in federal waters off Alaska. The vessel moratorium remained in effect until June 30, 2000. A vessel qualified for inclusion in the moratorium program if it made a legal landing of scallops during 1991, 1992 or 1993; or during at least 4 separate years from 1980 through 1990. The moratorium permit program was superseded by the scallop license limitation program.

By February 1999, the Council recommended replacing the federal moratorium program with an LLP, which became Amendment 4 to the FMP. The Council's goal was to reduce capacity to approach a sustainable fishery with maximum net benefits to the Nation, as required by the Magnuson-Stevens Act.

NPFMC's preferred alternative created a total of nine licenses with no area endorsements; each vessel permitted to fish statewide. However, vessels that fished exclusively in the Cook Inlet Registration Area during the qualifying period are limited to fishing a single 6-foot dredge, which was the existing gear restriction in Cook Inlet during the qualifying period. This gear restriction has recently been reevaluated by the Council under Amendment 10 to the FMP.

Appendix B: Geographical Coordinates of Areas Described in the FMP

B.1 Scallop Registration Areas

For the purpose of managing the scallop fishery, the FMP area is divided into nine scallop registration areas (Figure 4) composed of the Federal waters and adjacent State waters described in each area. These areas are identical to the State of Alaska scallop registration areas set out at 5 AAC 38.076(b). The Yakutat, Cook Inlet, and Kodiak Registration Areas are further divided into districts.

Registration Area A (Southeastern Alaska) has as its southern boundary the International Boundary at Dixon Entrance, and as its northern boundary Loran-C line 7960-Y-29590, which intersects the western tip of Cape Fairweather at 58° 47' 58" N. lat., 137° 56' 30" W. long., except for ADF&G District 16 defined as all waters north of a line projecting west from the southernmost tip of Cape Spencer and south of a line projecting southwest from the westernmost tip of Cape Fairweather.

Registration Area D (Yakutat) has as its western boundary the longitude of Cape Suckling (143° 53' W. long.), and as its southern boundary Loran-C line 7960-Y-29590, which intersects the western tip of Cape Fairweather at 58° 47' 58" N. lat., 137° 56' 30" W. long., and ADF&G District 16 defined as all waters all waters north of a line projecting west from the southernmost tip of Cape Spencer and south of a line projecting southwest from the westernmost tip of Cape Fairweather.

Registration Area E (Prince William Sound) has as its western boundary the longitude of Cape Fairfield (148° 50' W. long.), and its eastern boundary the longitude of Cape Suckling (143° 53' W. long.).

Registration Area H (Cook Inlet) has as its eastern boundary the longitude of Cape Fairfield (148° 50' W. long.) and its southern boundary the latitude of Cape Douglas (58° 52' N. lat.).

Northern District: north of a line extending from Boulder Point at 60 46' 23" N. lat., to Shell Platform C, then to a point on the west shore at 60° 46' 23" N. lat.

Central District: all waters between a line extending from Boulder Point at 60° 46' 23" N. lat., to Shell Platform C, to a point on the west shore at 60° 46' 23" N. lat., and the latitude of Anchor Point Light (59° 46' 12" N. lat.).

Southern District: all waters enclosed by a line from Anchor Point Light west to 59° 46' 12" N. lat., 152° 20' W. long., then south to 59° 03' 25" N. lat., 152° 20' W. long., then in a northeasterly direction to the tip of Cape Elizabeth at 59° 09' 30" N. lat., 151° 53' W. long., then from the tip of Cape Elizabeth to the tip of Point Adam at 59° 15' 20" N. lat., 151° 58' 30" W. long.

Kamishak Bay District: all waters enclosed by a line from 59° 46' 12" N. lat., 153° 00' 30" W. long., then east to 59° 46' 12" N. lat., 152° 20' W. long., then south to 59° 03' 25" N. lat., 152° 20' W. long., then southwesterly to Cape Douglas (58° 52' N. lat.). The seaward boundary of the Kamishak Bay District is three nautical miles seaward from the shoreline between a point on the west shore of Cook Inlet at approximately 59° 46' 12" N. lat., 153° 00' 30" W. long., and Cape Douglas at approximately 58° 52' N. lat., 153° 15' W. long., including a line three nautical miles seaward from the shorelines of Augustine

Island and Shaw Island, and including the line demarking all state waters shown on National Oceanic and Atmospheric Administration nautical chart number 16640, 21st Ed., May 5, 1990.

Barren Island District: all waters enclosed by a line from Cape Douglas (58° 52' N. lat.) to the tip of Cape Elizabeth at 59° 09' 30" N. lat., 151° 53' W. long., then south to 58° 52' N. lat., 151° 53' W. long., then west to Cape Douglas.

Outer District: all waters enclosed by a line from the tip of Point Adam to the tip of Cape Elizabeth, then south to 58° 52' N. lat., 151° 53' W. long., then east to the longitude of Aligo Point (149° 44' 33" W. long.), then north to the tip of Aligo Point.

Eastern District: all waters east of the longitude of Aligo Point (149° 44' 33" W. long.), west of the longitude of Cape Fairfield (148° 50' W. long.), and north of 58° 52' N. lat.

Registration Area K (Kodiak) has as its northern boundary the latitude of Cape Douglas (58° 52' N lat.), and as its western boundary the longitude of Cape Kumlik (157° 27' W. long.).

Northeast District: all waters northeast of a line extending 168° from the easternmost tip of Cape Barnabas, east of a line from the northernmost tip of Inner Point to the southernmost tip of Afognak Point, east of 152° 30' in Shuyak Strait, and east of the longitude of the northernmost tip of Shuyak Island (152° 20' W. long.).

Southeast District: all waters southwest of a line extending 168° from the easternmost tip of Cape Barnabas and east of a line extending 222° from the southernmost tip of Cape Trinity.

Southwest District: all waters west of a line extending 222° from the southernmost tip of Cape Trinity, south of a line from the westernmost tip of Cape Ikolik to the southernmost tip of Cape Kilokak and east of the longitude of Cape Kilokak (156° 19' W. long.).

Semidi Island District: all waters west of 156° 19' W. long. at Cape Kilokak and east of the longitude of Cape Kumlik at 157° 27' W. long.

Shelikof District: all waters north of a line from the westernmost tip of Cape Ikolik to the southernmost tip of Cape Kilokak, west of a line from the northernmost tip of Inner Point to the southernmost tip of Afognak Point, west of 152° 30' W. long., in Shuyak Strait, and west of the longitude of the northernmost tip of Shuyak Island (152° 20' W. long.).

Registration Area M (Alaska Peninsula) has as its eastern boundary the longitude of Cape Kumlik (157° 27' W. long.), and its western boundary the longitude of Scotch Cap Light. The registration area also includes all waters of Bechevin Bay and Isanotski Strait south of a line from the easternmost tip of Chunak Point to the westernmost tip of Cape Krenitzen.

Registration Area O (Dutch Harbor) has as its northern boundary the latitude of Cape Sarichef (54° 36' N. lat.), as its eastern boundary the longitude of Scotch Cap Light, and as its western boundary 171° W. long., excluding the waters of Statistical Area Q.

Registration Area Q (Bristol Bay-Bering Sea) has as its southern boundary a line from Cape Sarichef (54° 36' N. lat.), to 54° 36' N. lat., 171° W. long., to 55° 30' N. lat., 171° W. long., to 55° 30' N. lat., 173° 30' E. long., as its northern boundary the latitude of Point Hope (68° 21' N. lat.).

Registration Area R (Adak) has as its eastern boundary 171° W. long., and as its northern boundary 55° 30' N. lat.

Appendix C: Section 211 of AFA

American Fisheries Act (AFA) sideboard restrictions

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

While the AFA primarily affects the management of the BSAI pollock fishery, the Council is also directed to develop and recommend harvesting and processing sideboard restrictions for AFA catcher vessels that are fishing for scallops in the EEZ off Alaska. Section 211 of the AFA addresses sideboard protections for other fisheries off Alaska and this entire section of the AFA is incorporated into he AFA by reference. Scallop harvesting sideboard restrictions that are consistent with Section 211 of the AFA will be implemented through regulation or provided to the Board of Fish as recommendations. Any measure recommended by the Council that supersedes Section 211 of the AFA must be implemented by FMP amendment in accordance with the provisions of Section 213 of the AFA and the Magnuson-Stevens Act.

Limits on participation by AFA vessels. NMFS may issue regulations, as approved by the Council, which define the participation criteria for AFA vessels that wish to participate in the scallop fishery off Alaska.

Harvest limitations for AFA Vessels. The Council may provide scallop harvesting sideboard recommendations to the Board of Fisheries. The State of Alaska, through the Board of Fisheries, may issue regulations to establish an allowable harvest percentage of the GHL by AFA eligible vessels in any scallop fishery, and to govern the in-season management of any sideboard harvest levels established for AFA eligible vessels.

Appendix D: Essential Fish Habitat and Habitat Areas of Particular Concern

CONTENTS

1.0 OVERVIEW

Section 303(a)(7) of the Magnuson-Stevens Act requires that FMPs describe and identify Essential Fish Habitat (EFH), minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to conserve and enhance EFH. FMPs must describe EFH in text, map EFH distributions, and provide information on habitat and biological requirements for each life history stage of the species. This appendix contains all of the required EFH provisions of the FMP, including the requirement in EFH regulations (50 Code of Federal Regulations [CFR] 600.815(a)(2)(i)) that each FMP must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH.

In 2005 NMFS and the Council completed the Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS, NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to Section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: (1) describing and identifying EFH for Council managed fisheries, (2) adopting an approach to identify HAPCs within EFH, and (3) minimizing to the extent practicable the adverse effects of fishing on EFH. The Council's preferred alternatives from the EFH EIS were implemented through Amendment 7 to the FMP and corresponding amendments to the Council's other FMPs.

2.0 LIFE HISTORY FEATURES AND HABITAT REQUIREMENTS

This section describes habitat requirements and life histories of the scallops managed by this FMP. Information contained in this appendix details life history information for federally managed scallop species. Each species or species group is described individually; however, summary tables that denote habitat associations (Table 1), biological associations (Table 2), and predator and prey associations (Table 3) are also provided. In each section, a species-specific table summarizes habitat requirements.

Table 1. Summary of habitat associations for scallops.

		Nearshore				Shelf			Slope					Stratum Reference							Location				Pelagic			Physical Oceanography					Substrate													Structure										Community Associations							Oceano-graphic Properties			
						Inner	Middle	Outer	Upper	Inter-mediate		Lower	Basin																																																						
Species	**Life Stage**	Freshwater	Estuarine	Intertidal	Subtidal	1-50m	51-100m	101-200m	201-300m	301-500m	501-700m	701-1000m	1001-3000m	>3000m	Shallows	Island Pass	Bay/Fjord	Bank	Flat	Edge	Gully	Surafce	Near surface	Semi-demersal	Demersal	1-200m (epi)	201-1000m (meso)	>1000m (bathy)	Upwelling areas	Gyres	Thermo/pycnocline	Fronts	Edges (ice, bath)	Organic Debris	Mud	Sand	Gravel	Mud & sand	Mud & gravel	Sand & mud	Gravel & mud	Gravel & sand	Gravel & sand & mud	Gravel & mud & sand	Cobble	Rock	Bars	Sinks	Slumps\Rockfalls\Debris	Channels	Ledges	Pinnacles	Seamounts	Reefs	Vertical Walls	Man-made	Red King Crab	Tanner crab	Shrimps	Octopi	Flatfishes	Pacific cod	Benthic invertibrates	Temperature (Celsius)	Salinity (ppt)	Oxygen Conc (ppm)	**Life Stage**
Weathervane scallop	M					x	x	x								x	x								x				x	x					x	x	x	x	x	x	x	x	x	x													x	x	x	x	x	x	x	1-9.6			M
	LJ					x	x	x								x	x								x				x	x					x	x	x	x	x	x	x	x	x	x													x	x	x	x	x	x	x				LJ
	EJ					x	x	x																	x					x					x	x	x	x	x	x	x	x	x	x																							EJ
	L					x	x	x																		x																																										L
	E					x	x	x																	x																																											E

Table 2. Summary of biological associations for scallops.

Species	Life Stage	Age at Maturity: Female 50%	Age at Maturity: Female 100%	Age at Maturity: Male 50%	Age at Maturity: Male 100%	Fertilization/Egg Development: External	Internal	Oviparous	Ovo-viviparous	Viviparous	Spawning Behavior: Batch Spawner	Broadcast Spawner	Egg Case Deposition	Nest Builder	Egg/Young Guarder	Egg/Young Bearer	Spawning Season: January	February	March	April	May	June	July	August	September	October	November	December
Weathervane scallop	M					x						x									x	x	x					
	LJ																											
	EJ																											
	L																											
	E																											

(Reproductive Traits)

Table 3. Summary of predator and prey associations for scallops.

Predator to

Species	Life Stage	Algae	Plants	Plankton	Zooplankton	Diatoms	Sponges	Eusphausiid	Hydroids	Amphipoda	Copepods	Starfish	Polychaetes	Squid	Philodae (gunnels)	Bi-valves	Mollusks	Crustaceans	Ophiuroids (brittle stars)	Shrimps, mysidacae	Sand lance	Osmerid (eulachon)	Hering	Myctophid (lantern fishes)	Cottidae (sculpins)	Arrowtooth	Rockfish	Salmon	Pacific cod	Pollock	Halibut
Weathervane scallop	M			x	x	x																									
	LJ			x	x	x																									
	EJ			x	x	x																									
	L																														
	E																														

Prey of

Species	Life Stage	Jellyfish	Starfish	Chaetognaths (arrowworms	Crab	Herring	Salmon	Pollock	Pacific cod	Ling cod	Rockfish	Rock Sole	Flathead Sole	Yellowfin sole	Arrowtooth flounder	Hailbut	Salmon Shark	Northern Fur Seal	Harbor Seal	Steller sea lion	Dalls Porpoise	Beluga whale	Killer Whale	Minke whale	sea otters	Seabirds	Octopus	Skates	wolf eels	Terrerstrial Mammals
Weathervane scallop	M		x		x																				x		x	x	x	
	LJ		x		x				x			x	x	x	x	x									x		x	x	x	
	EJ		x		x				x			x	x	x	x	x									x		x	x	x	
	L																													
	E																													

2.1 Habitat Types in the Bering Sea, Aleutian Islands, and Gulf of Alaska

Bering Sea

The Bering Sea is a semi-enclosed, high-latitude sea. Of its total area of 2.3 million sq. km, 44% is continental shelf, 13% is continental slope, and 43% is deep-water basin. Its broad continental shelf is one of the most biologically productive areas of the world. The eastern Bering Sea (EBS) contains approximately 300 species of fish, 150 species of crustaceans and mollusks, 50 species of seabirds, and 26 species of marine mammals (Livingston and Tjelmeland 2000). However, commercial fish species diversity is lower in the EBS than in the Gulf of Alaska (GOA).

A special feature of the EBS is the pack ice that covers most of its eastern and northern continental shelf during winter and spring. The dominant circulation of the water begins with the passage of North Pacific water (the Alaska Stream) into the EBS through the major passes in the Aleutian Islands (AI) (Favorite et al. 1976). There is net water transport eastward along the north side of the AI and a turn northward at the continental shelf break and at the eastern perimeter of Bristol Bay. Eventually EBS water exits northward through the Bering Strait, or westward and south along the Russian coast, entering the western North Pacific via the Kamchatka Strait. Some resident water joins new North Pacific water entering Near Strait, which sustains a permanent cyclonic gyre around the deep basin in the central BS.

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

The distribution of benthic sediment types in the EBS shelf is related to depth (Figure 2). Considerable local variability is indicated in areas along the shore of Bristol Bay and the north coast of the Alaska Peninsula, as well as west and north of Bristol Bay, especially near the Pribilof Islands. Nonetheless, there is a general pattern whereby nearshore sediments in the east and southeast on the inner shelf (0 to 50 m depth) often are sandy gravel and gravelly sand. These give way to plain sand farther offshore and west. On the middle shelf (50 to 100 m), sand gives way to muddy sand and sandy mud, which continue over much of the outer shelf (100 to 200 m) to the start of the continental slope. Sediments on the central and northeastern shelf (including Norton Sound) have not been so extensively sampled, but Sharma (1979) reports that, while sand is dominant in places here, as it is in the southeast, there are concentrations of silt both in shallow nearshore waters and in deep areas near the shelf slope. In addition, there are areas of exposed relic gravel, possibly resulting from glacial deposits. These departures from a classic seaward decrease in grain size are attributed to the large input of fluvial silt from the Yukon River and to flushing and scouring of sediment through the Bering Strait by the net northerly current.

McConnaughey and Smith (2000) and Smith and McConnaughey (1999) describe the available sediment data for the EBS shelf. These data were used to describe four habitat types. The first, situated around the shallow eastern and southern perimeter and near the Pribilof Islands, has primarily sand substrates with a little gravel. The second, across the central shelf out to the 100 m contour, has mixtures of sand and mud. A third, west of a line between St. Matthew and St. Lawrence islands, has primarily mud (silt) substrates, with some mixing with sand (Figure 2). Finally, the areas north and east of St. Lawrence Island, including Norton Sound, have a complex mixture of substrates.

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

Three fronts, the outer shelf, mid-shelf, and inner shelf, follow along the 200-, 100-, and 50-m bathymetric contours, respectively; thus, four separate oceanographic domains appear as bands along the broad EBS shelf. The oceanographic domains are the deep water (more than 200 m), the outer shelf (200 to 100 m), the mid-shelf (100 to 50 m), and the inner shelf (less than 50 m).

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

Effects of a global warming climate should be greater in the EBS than in the GOA. Located further north than the GOA, the seasonal ice cover of the EBS lowers albedo effects. Atmospheric changes that drive the speculated changes in the ocean include increases in air temperature, storm intensity, storm frequency, southerly wind, humidity, and precipitation. The increased precipitation, plus snow and ice melt, leads to an increase in freshwater runoff. The only decrease is in sea level pressure, which is associated with the northward shift in the storm track. Although the location of the maximum in the mean wind stress curl will probably shift poleward, how the curl is likely to change is unknown. The net effect of the storms is what largely determines the curl, and there is likely to be compensation between changes in storm frequency and intensity.

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

Temperature anomalies in the EBS illustrate a relatively warm period in the late 1950s, followed by cooling (especially in the early 1970s), and then by a rapid temperature increase in the latter part of that decade. For more information on the physical environment of the EBS, refer to the Alaska Groundfish Fisheries Programmatic Supplemental EIS (NMFS 2004).

Aleutian Islands

The Aleutian Islands lie in an arc that forms a partial geographic barrier to the exchange of northern Pacific marine waters with EBS waters. The AI continental shelf is narrow compared with the EBS shelf, ranging in width on the north and south sides of the islands from about 4 km or less to 42 to 46 km; the shelf broadens in the eastern portion of the AI arc. The AI comprises approximately 150 islands and extends about 2,260 km in length.

Bowers Ridge in the AI is a submerged geographic structure forming a ridge arc off the west-central AI. Bowers Ridge is about 550 km long and 75 to 110 km wide. The summit of the ridge lies in water approximately 150 to 200 m deep in the southern portion deepening northward to about 800 to 1,000 m at its northern edge.

The AI region has complicated mixes of substrates, including a significant proportion of hard substrates (pebbles, cobbles, boulders, and rock), but data are not available to describe the spatial distribution of these substrates.

The patterns of water density, salinity, and temperature are very similar to the GOA. Along the edge of the shelf in the Alaska Stream, a low salinity (less than 32.0 ppt) tongue-like feature protrudes westward. On the south side of the central AI, nearshore surface salinities can reach as high as 33.3 ppt, as the higher salinity EBS surface water occasionally mixes southward through the AI. Proceeding southward, a minimum of approximately 32.2 ppt is usually present over the slope in the Alaska Stream; values then rise to above 32.6 ppt in the oceanic water offshore. Whereas surface salinity increases toward the west as the source of fresh water from the land decreases, salinity values near 1,500 m decrease very slightly. Temperature values at all depths decrease toward the west.

Climate change effects on the AI area are similar to the effects described for climate change in the EBS. For more information on the physical environment of the AI, refer to the Alaska Groundfish Fisheries Programmatic Supplemental EIS (NMFS 2004).

Gulf of Alaska

The GOA has approximately 160,000 km^2 of continental shelf, which is less than 25% of the EBS shelf (Figure 1). The GOA is a relatively open marine system with land masses to the east and the north. Commercial species are more diverse in the GOA than in the EBS, but less diverse than in the Washington-California region. The most diverse set of species in the GOA is the rockfish group; 30 species have been identified in this area.

The dominant circulation in the GOA (Musgrave et al. 1992) is characterized by the cyclonic flow of the Alaska gyre. The circulation consists of the eastward-flowing Subarctic Current system at approximately 50º N and the Alaska Coastal Current (Alaska Stream) system along the northern GOA. Large seasonal variations in the wind-stress curl in the GOA affect the meanders of the Alaska Stream and nearshore eddies. The variations in these nearshore flows and eddies affect much of the region’s biological variability.

The GOA has a variety of seabed types such as gravely sand, silty mud, and muddy to sandy gravel, as well as areas of hardrock (Hampton et al. 1986) (Figure 1). Investigations of the northeast GOA shelf (less than 200 meters [m]) have been conducted between Cape Cleare (148º W) and Cape Fairweather (138º W) (Feder and Jewett 1987). The shelf in this portion of the GOA is relatively wide (up to 100 km). The dominant shelf sediment is clay silt that comes primarily from either the Copper River or the Bering and Malaspina glaciers. When the sediments enter the GOA, they are generally transported to the west. Sand predominates nearshore, especially near the Copper River and the Malaspina Glacier. Most of the western GOA shelf (west of Cape Igvak) consists of slopes characterized by marked dissection and steepness. The shelf consists of many banks and reefs with numerous coarse, clastic, or rocky bottoms, as well as patchy bottom sediments. In contrast, the shelf near Kodiak Island consists of flat relatively shallow banks cut by transverse troughs. The substrate in the area from Near Strait and close to Buldir Island, Amchitka, and Amukta Passes is mainly bedrock outcrops and coarsely fragmented sediment interspersed with sand bottoms.

Temperature anomalies in the GOA illustrate a relatively warm period in the late 1950s, followed by cooling (especially in the early 1970s), and then by a rapid temperature increase in the latter part of that decade. Subsurface temperature anomalies for the coastal GOA also show a change from the early 1970s into the 1980s, similar to that observed in the sea surface (U.S. GLOBEC 1996). In addition, high latitude temperature responses to El Niño southern oscillation events can be seen, especially at depth, in 1977, 1982, 1983, 1987, and the 1990s. Between these events, temperatures in the GOA return to cooler and more neutral temperatures. The 1997/98 El Niño southern oscillation event, one of the strongest recorded this century, has significantly changed the distribution of fish stocks off California, Oregon, Washington, and Alaska. The longer-term impacts of this event remain to be seen.

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

On a larger scale, evidence of biological responses to decadal-scale climate changes is also found in the coincidence of global fishery expansions or collapses of similar species complexes. For example, salmon stocks in the GOA and the California Current are out of phase. When salmon stocks do well in the GOA, they do poorly in the California Current and vice versa (Hare and Francis 1995, Mantua et al. 1997). For more information about the GOA physical environment, refer to the final programmatic groundfish SEIS (NMFS 2004).

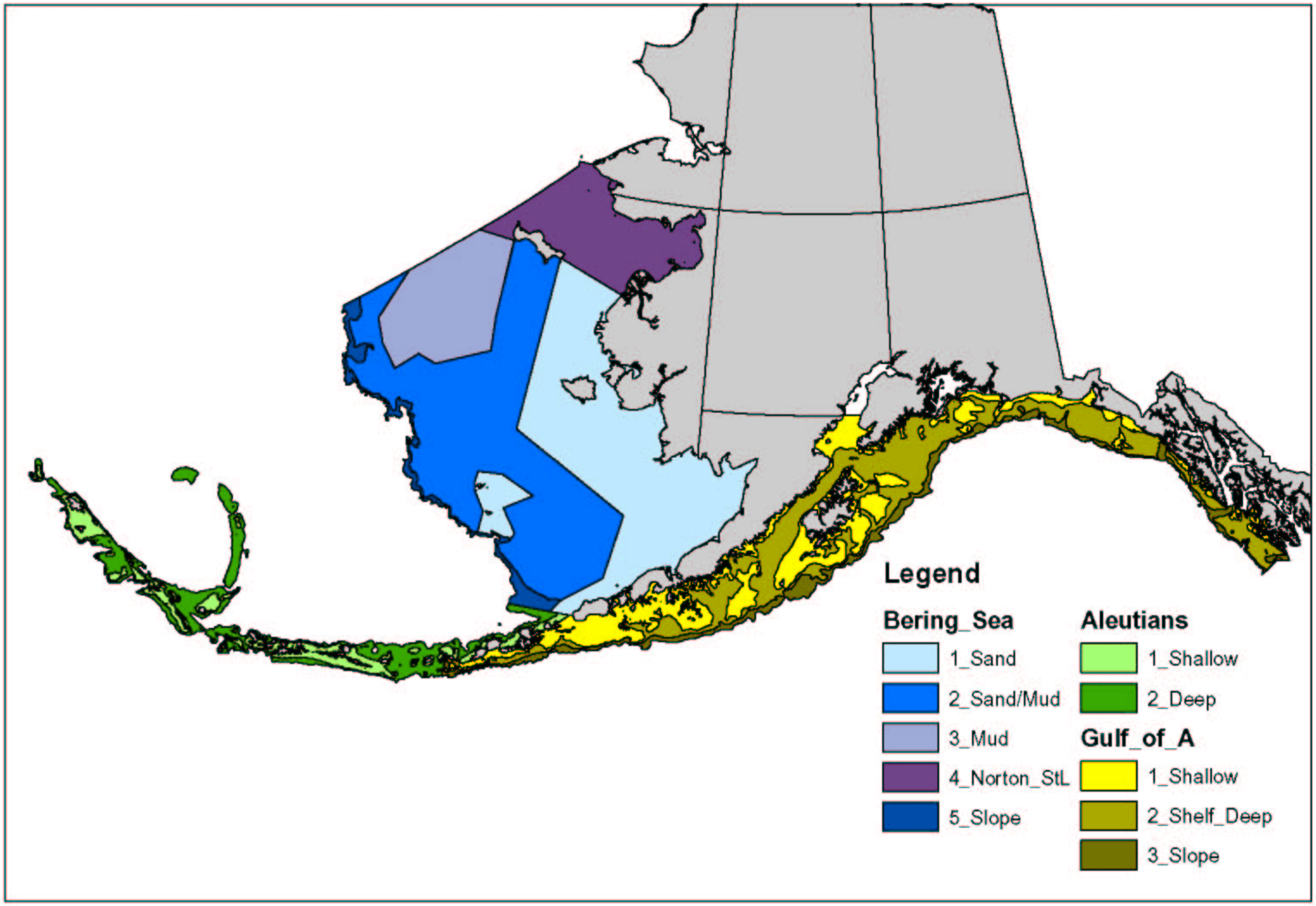

Figure 1 **Surficial sediment textural charateristics (Append B, NMFS 2005) for the continental shelf. Source: Naidu 1988**

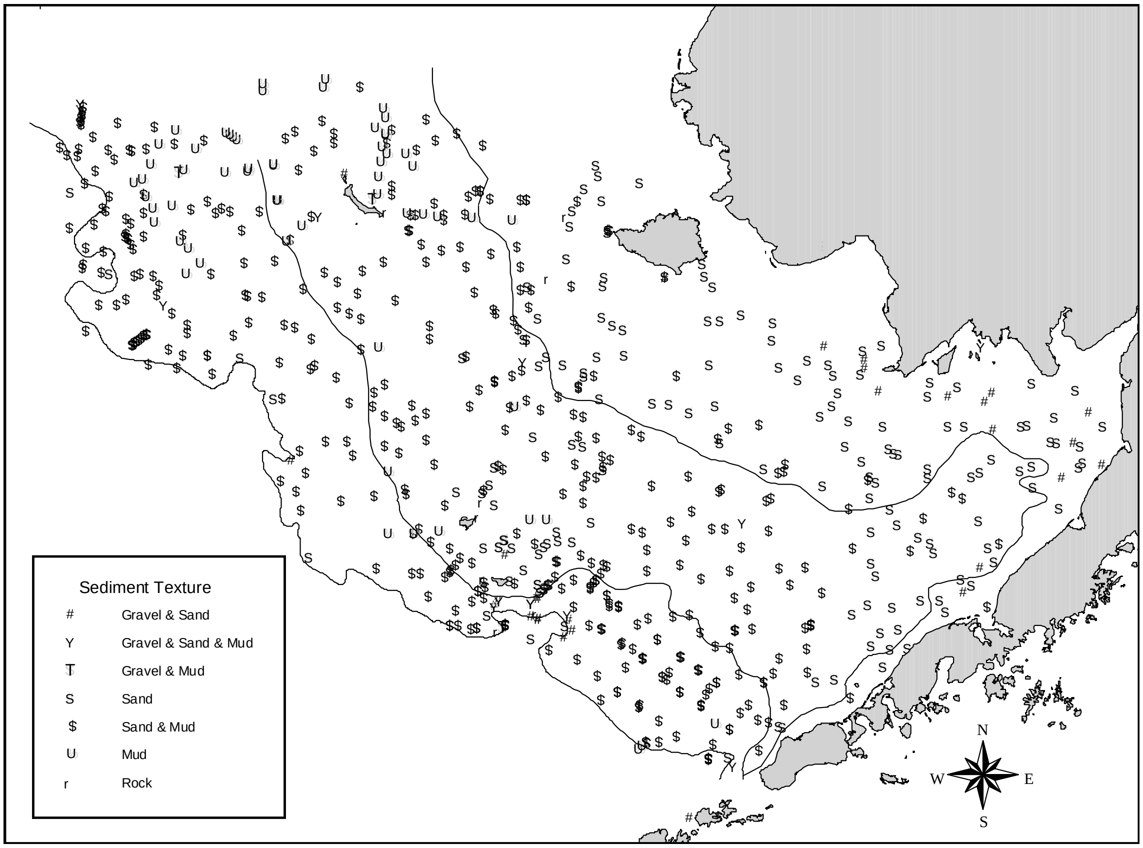

Figure 2 Distribution of Bering Sea Sediments. Source: Smith and McConnaughey 1999

2.2 Habitat Description for Weathervane Scallops *(Patinopecten caurinus)*

Life History and General Distribution

Weathervane scallops are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the BS, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40 to 130 m on beds of mud, clay, sand, and gravel. Beds tend to be elongated along the direction of current flow. A combination of large-scale (overall spawning population size and oceanographic conditions) and small-scale (site suitability for settlement) processes influence recruitment of scallops to these beds. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom.

Several other species of scallops found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, *Chlamys rubida*, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2 and spawn in the winter (January to March). Maximum age for this species is 6 years. Spiny scallops, *Chlamys hastata*, are found in coastal regions from California to the GOA. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August to October). Rock scallops, *Crassadoma gigantea*, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0 to 80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October to January), and one in the spring-summer (March to August).

Fishery

The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since 1995. The FMP controls the fishery through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring. Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only two dredges may be used at any one time. In the Kamishak District of Cook Inlet, only one dredge with a 6-foot maximum width is allowed. Dredges are required to have rings with a 4-inch minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons, and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to the groundfish FMPs.

Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in

1978. Prices and demand for scallops have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island, and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970s. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990s occurred with new exploitation in the BS.

Relevant Trophic Information

Scallop predators have not been well studied. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and octopus and sea stars are also important predators.

Approximate Upper Size Limit of Juvenile Scallops (in cm): Weathervane scallops begin to mature by age 2 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years or more. The natural mortality rate is thought to be about 15% annually (M = 0.16).

Habitat and Biological Associations

Scallops are found from intertidal waters and to 300 m. Abundance tends to be greatest between 40 and 130 m on beds of mud, clay, sand, and gravel (Hennick 1973). Weathervane scallops are associated with other benthic species, such as red king crabs, Tanner crabs, shrimps, octopi, flatfishes, Pacific cod, and other species of benthic invertebrates and fishes.

SPECIES: Weathervane Scallops off Alaska

Stage - EFH Level	Duration or Age	Diet/ Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	several days	None	May–July	inner and middle continental shelf	demersal		unknown	
Larvae	2–3 weeks		May–August	inner, middle, and outer continental shelf	pelagic		unknown	
Early juveniles	Age 0 to Age 3		August +	inner, middle, and outer continental shelf	demersal	mud, sand, gravel, sandy mud, muddy sand	unknown	
Late Juveniles/ Adults	Age 3 - 28		Spawning May–July	inner, middle, and outer continental shelf	demersal	mud, sand, gravel, sandy mud, muddy sand	unknown	

Note, inner continental shelf = 1–50 m, middle continental shelf = 50–100 m, outer continental shelf = 100–200 m.

2.2.1 Literature References

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3.0 ESSENTIAL FISH HABITAT

Essential Fish Habitat (EFH) means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: “waters” includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle.

EFH for groundfish species is determined to be the general distribution of a species described by life stage. General distribution is a subset of a species’s total population distribution and is identified as the distribution of 95% of the species population for a particular life stage, if life history data are available for the species. Where information is insufficient and a suitable proxy cannot be inferred, EFH is not described. General distribution is used to describe EFH for all stock conditions whether or not higher levels of information exist, because the available higher level data are not sufficiently comprehensive to account for changes in stock distribution (and thus habitat use) over time.

EFH is described for FMP-managed species by life stage as general distribution using new guidance from the EFH Final Rule (67 FR 2343), including the EFH Level of Information definitions. New analytical tools are used and recent scientific information is incorporated for each life history stage from updated scientific habitat assessment reports. EFH descriptions include both text (see section 3.1) and a map (see section 3.2), if information is available for a species’s particular life stage.

EFH descriptions are interpretations of the best scientific information. In support of this information, a thorough review of FMP species is contained in the Environmental Impact Statement for Essential Fish Habitat Identification and Conservation (NMFS 2005) (EFH EIS) in Section 3.2.1, Biology, Habitat Usage, and Status of Magnuson-Stevens Act Managed Species and detailed by life history stage in Appendix F: EFH Habitat Assessment Reports. This EIS was supplemented in 2010 by a 5-year review, which re-evaluated EFH descriptions and fishing and non-fishing impacts on EFH in light of new information (NPFMC and NMFS 2010). The EFH descriptions are risk averse, supported by scientific rationale, and account for changing oceanographic conditions and regime shifts.

3.1 Description of Essential Fish Habitat

EFH descriptions are based on the best available scientific information. In support of this information, a thorough review of FMP species is contained in this Appendix and in the EFH EIS (NMFS 2005). A summary of the habitat information levels for each species, as described in the EFH regulations at 50 CFR 600.815(a)(1)(iii), is listed in the table below.

EFH Information Levels for Alaska Scallops

Scallop Species	Eggs	Larvae	Early Juvenile	Late Juvenile	Adult	
Weathervane scallop	x	x	x	1	1	

x - No information available.

<u>EFH Description for Weathervane Scallops</u>

Eggs—No EFH Description Determined
Insufficient information is available.

Larvae—No EFH Description Determined
Insufficient information is available.

Early Juveniles—No EFH Description Determined
Insufficient information is available.

Late Juveniles
EFH for late juvenile weathervane scallops is the general distribution area for this life stage, located in the sea floor along the inner (1 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf in concentrated areas of the GOA and BSAI where there are substrates of clay, mud, sand, and gravel that are generally elongated in the direction of current flow, as depicted in Figure 3.

Adults
EFH for adult weathervane scallops is the general distribution area for this life stage, located in the sea floor along the inner (1 to 50 m), middle (50 to 100 m) and outer (100 to 200 m) shelf in concentrated areas of the GOA and BSAI where there are substrates of clay, mud, sand, and gravel that are generally elongated in the direction of current flow, as depicted in Figure 3.

<u>EFH Description for Other Species of Scallops</u>

Information is insufficient or lacking to describe EFH for any life stage of pink, spiny, and rock scallops.

3.2 Maps of Essential Fish Habitat

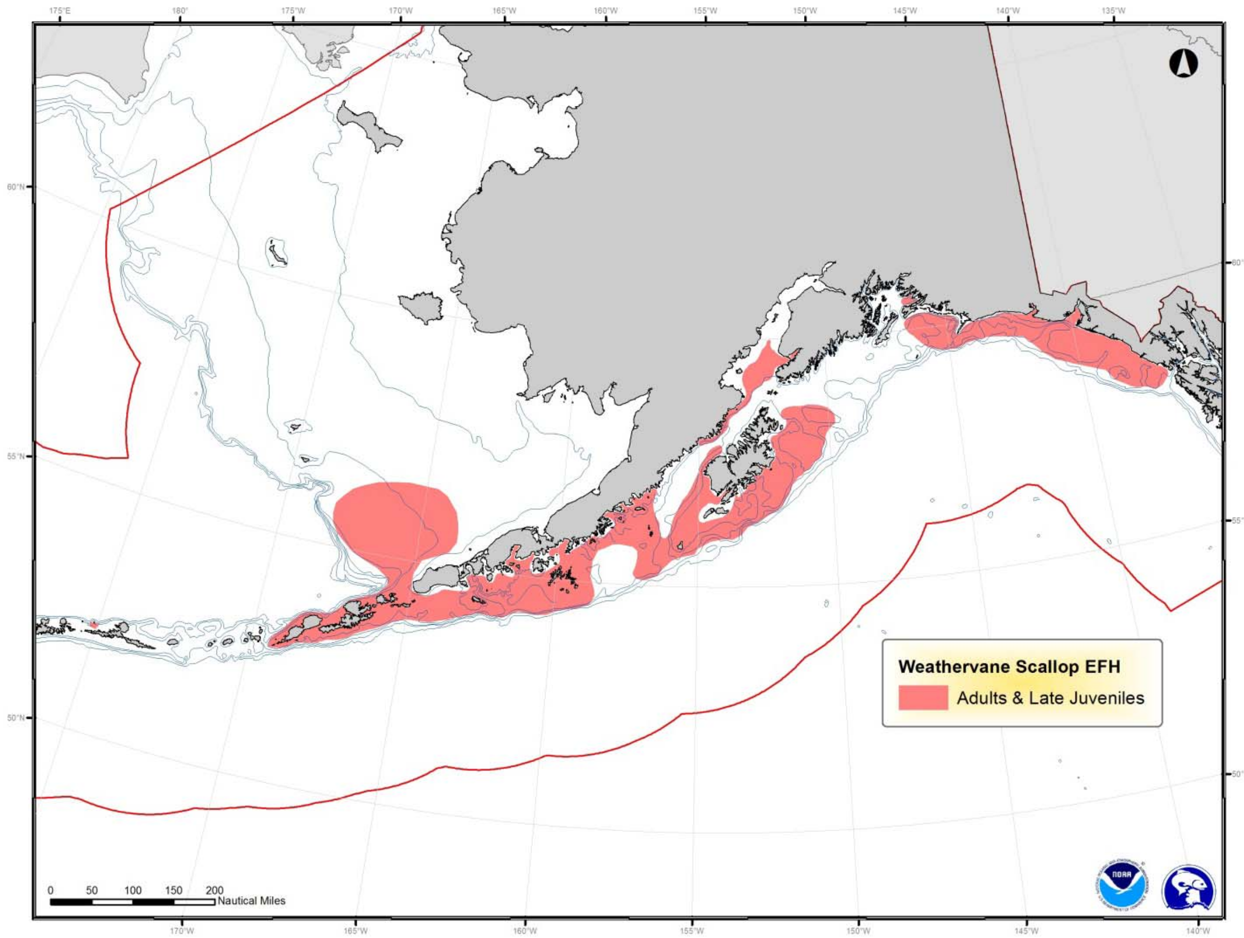

Figure 3 EFH Distribution for Late Juveniles/Adult Weathervane Scallop

3.3 Habitat Areas of Particular Concern

Habitat Areas of Particular Concern (HAPCs) are specific sites within EFH that are of particular ecological importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible to degradation or development. HAPCs are meant to provide greater focus to conservation and management efforts, and may require additional protection from adverse effects.

3.3.1 HAPC Process

The Council may designate specific sites as HAPCs and may develop management measures to protect habitat features within HAPCs.

50 CFR 600.815(a)(8) provides guidance to the regional fishery management councils in identifying HAPCs. FMPs should identify specific types or areas of habitat within EFH as habitat areas of particular concern based on one or more of the following considerations:

- (i) The importance of the ecological function provided by the habitat.
- (ii) The extent to which the habitat is sensitive to human-induced environmental degradation.
- (iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type.
- (iv) The rarity of the habitat type.

Proposed HAPCs, identified on a map, must meet at least two of the four considerations established in 50 CFR 600.815(a)(8), and rarity of the habitat is a mandatory criterion. HAPCs may be developed to address identified problems for FMP species, and they must meet clear, specific, adaptive management objectives.

The Council will initiate the HAPC process by setting priorities and issuing a request for HAPC proposals. Any member of the public may submit a HAPC proposal. HAPC proposals may be solicited every 5 years, to coincide with the EFH 5-year review, or may be initiated at any time by the Council. The Council will establish a process to review the proposals. The Council may periodically review existing HAPCs for efficacy and considerations based on new scientific research.

3.3.2 Designation of HAPCs

In 2005, the Council identified the following areas as HAPCs within EFH:

- Alaska Seamount Habitat Protection Areas
- Bowers Ridge Habitat Conservation Zone
- GOA Coral

Maps of these areas, as well as their coordinates, and any fishing restrictions that apply in these areas, are described in Section 3.4.

3.4 EFH Conservation and HAPC Restrictions

The Council established the Aleutian Islands Habitat Conservation Area, the Aleutian Islands Coral Habitat Protection Areas, and the GOA Slope Habitat Conservation Area to protect EFH from fishing threats. The Council also established Habitat Areas of Particular Concern (HAPCs) within EFH to protect those areas from fishing threats: the Alaska Seamount Habitat Protection Areas, the Bowers Ridge Habitat Conservation Zone, and the GOA Coral Habitat Protection Area (NPFMC 2005). Maps of these areas, as well at the coordinates, are provided below.

3.4.1 Aleutian Islands Coral Habitat Protection Areas

The use of bottom contact gear, as described in 50 CFR part 679, is prohibited year-round in the Aleutian Islands Coral Habitat Protection Areas, see Figure 4. Anchoring by a federally permitted fishing vessel, as described in 50 CFR part 679, is also prohibited. The coordinates for the areas are listed in the table below.

Area Number	Name	Latitude			Longitude		
1	Great Sitkin Is	52	9.56	N	176	6.14	W
	Great Sitkin Is	52	9.56	N	176	12.44	W
	Great Sitkin Is	52	4.69	N	176	12.44	W
	Great Sitkin Is	52	6.59	N	176	6.12	W
2	Cape Moffett Is	52	0.11	N	176	46.65	W
	Cape Moffett Is	52	0.10	N	176	53.00	W
	Cape Moffett Is	51	55.69	N	176	53.00	W
	Cape Moffett Is	51	55.69	N	176	48.59	W
	Cape Moffett Is	51	57.96	N	176	46.52	W
3	Adak Canyon	51	39.00	N	177	0.00	W
	Adak Canyon	51	39.00	N	177	3.00	W
	Adak Canyon	51	30.00	N	177	3.00	W
	Adak Canyon	51	30.00	N	177	0.00	W
4	Bobrof Is	51	57.35	N	177	19.94	W
	Bobrof Is	51	57.36	N	177	29.11	W
	Bobrof Is	51	51.65	N	177	29.11	W
	Bobrof Is	51	51.71	N	177	19.93	W
5	Ulak Is	51	25.85	N	178	59.00	W
	Ulak Is	51	25.69	N	179	6.00	W
	Ulak Is	51	22.28	N	179	6.00	W
	Ulak Is	51	22.28	N	178	58.95	W
6	Semisopochnoi Is	51	53.10	N	179	53.11	E
	Semisopochnoi Is	51	53.10	N	179	46.55	E
	Semisopochnoi Is	51	48.84	N	179	46.55	E
	Semisopochnoi Is	51	48.89	N	179	53.11	E

Note: Each area is delineated by connecting the coordinates in the order listed by straight lines. The last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. The projected coordinate system is North American Datum 1983, Albers.

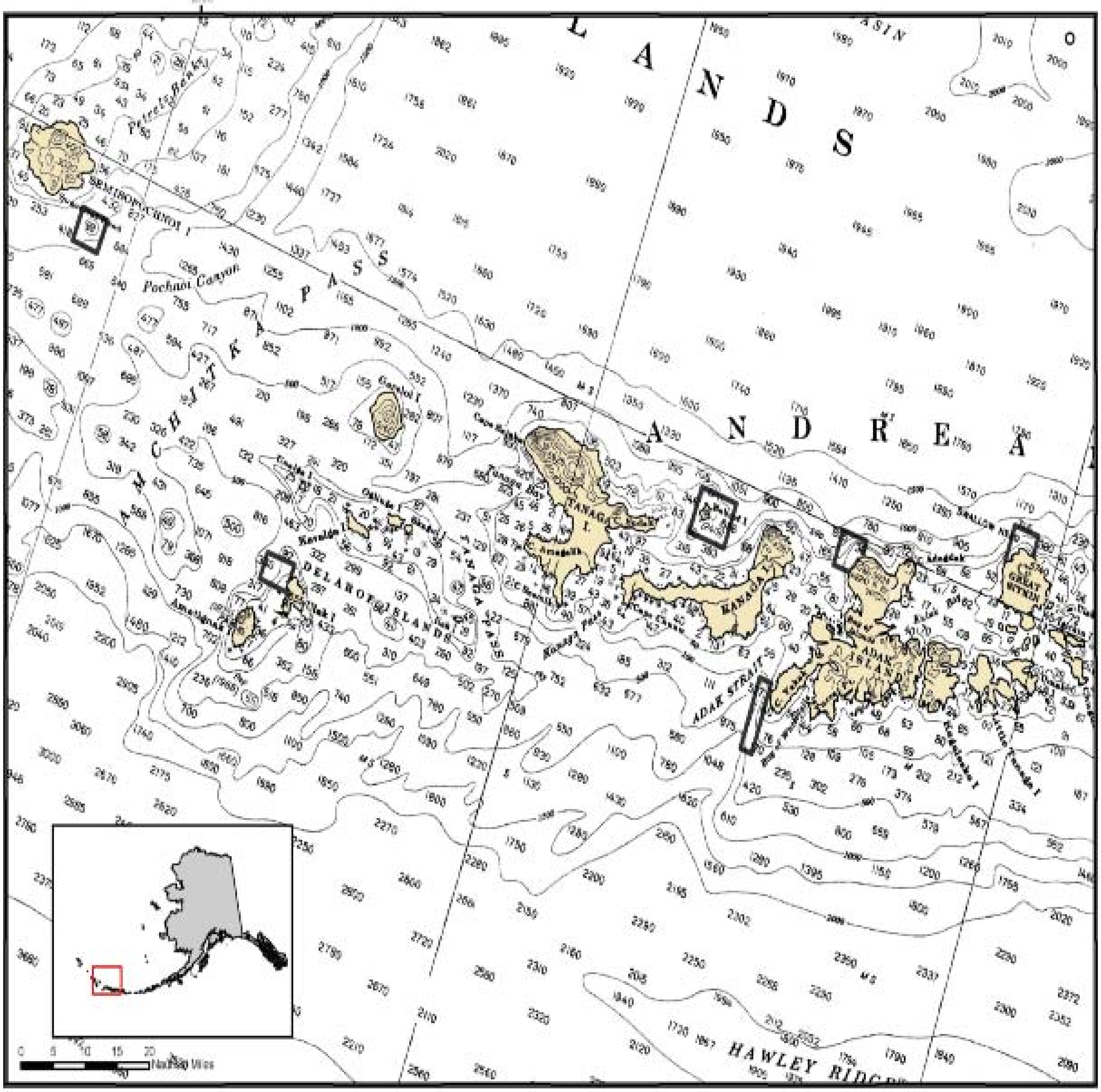

Figure 4 Aleutian Islands Coral Habitat Protection Areas

3.3.2 Aleutian Islands Habitat Conservation Area

Nonpelagic trawl gear fishing is prohibited year-round in the Aleutian Islands Habitat Conservation Area, except for designated areas open to nonpelagic trawl gear. The Aleutian Islands Habitat Conservation Area is defined as the entire Aleutian Islands groundfish management subarea, as defined in 50 CFR 679. Areas open to nonpelagic trawl gear fishing in the Aleutian Islands are delineated by the table below and shown in Figure 5.

Name	Latitude			Longitude			Footnote
Islands of 4 Mountains North	52	54.00	N	170	18.00	W	
	52	54.00	N	170	24.00	W	
	52	42.00	N	170	24.00	W	
	52	42.00	N	170	18.00	W	
Islands of 4 Mountains West	53	12.00	N	170	0.00	W	
	53	12.00	N	170	12.00	W	
	53	6.00	N	170	12.00	W	
	53	6.00	N	170	30.00	W	
	53	0.00	N	170	30.00	W	
	53	0.00	N	170	48.00	W	
	52	54.00	N	170	48.00	W	
	52	54.00	N	170	54.00	W	
	52	48.00	N	170	54.00	W	
	52	48.00	N	170	30.00	W	
	52	54.00	N	170	30.00	W	
	52	54.00	N	170	24.00	W	
	53	0.00	N	170	24.00	W	
	53	0.00	N	170	0.00	W	
Yunaska I South	52	24.00	N	170	30.00	W	
	52	24.00	N	170	54.00	W	
	52	12.00	N	170	54.00	W	
	52	12.00	N	170	30.00	W	
Amukta I North	52	54.00	N	171	6.00	W	
	52	54.00	N	171	30.00	W	
	52	48.00	N	171	30.00	W	
	52	48.00	N	171	36.00	W	
	52	42.00	N	171	36.00	W	
	52	42.00	N	171	12.00	W	
	52	48.00	N	171	12.00	W	
	52	48.00	N	171	6.00	W	
Amukta Pass North	52	42.00	N	171	42.00	W	
	52	42.00	N	172	6.00	W	
	52	36.00	N	172	6.00	W	
	52	36.00	N	171	42.00	W	
Amlia North/Seguam	52	42.00	N	172	12.00	W	
	52	42.00	N	172	30.00	W	
	52	30.00	N	172	30.00	W	
	52	30.00	N	172	36.00	W	
	52	36.00	N	172	36.00	W	
	52	36.00	N	172	42.00	W	
	52	39.00	N	172	42.00	W	
	52	39.00	N	173	24.00	W	

Name	Latitude			Longitude			Footnote
	52	36.00	N	173	30.00	W	
	52	36.00	N	173	36.00	W	
	52	30.00	N	173	36.00	W	
	52	30.00	N	174	0.00	W	
	52	27.00	N	174	0.00	W	
	52	27.00	N	174	6.00	W	
	52	23.93	N	174	6.00	W	1
	52	13.71	N	174	6.00	W	
	52	12.00	N	174	6.00	W	
	52	12.00	N	174	0.00	W	
	52	9.00	N	174	0.00	W	
	52	9.00	N	173	0.00	W	
	52	6.00	N	173	0.00	W	
	52	6.00	N	172	45.00	W	
	51	54.00	N	172	45.00	W	
	51	54.00	N	171	48.00	W	
	51	48.00	N	171	48.00	W	
	51	48.00	N	171	42.00	W	
	51	54.00	N	171	42.00	W	
	52	12.00	N	171	42.00	W	
	52	12.00	N	171	48.00	W	
	52	18.00	N	171	48.00	W	
	52	18.00	N	171	42.00	W	
	52	30.00	N	171	42.00	W	
	52	30.00	N	171	54.00	W	
	52	24.00	N	171	54.00	W	
	52	24.00	N	172	0.00	W	
	52	12.00	N	172	0.00	W	
	52	12.00	N	172	42.00	W	
	52	18.00	N	172	42.00	W	
	52	18.00	N	172	37.13	W	2
	52	18.64	N	172	36.00	W	
	52	24.00	N	172	36.00	W	
	52	24.00	N	172	12.00	W	6
Amlia North/Seguam donut	52	33.00	N	172	42.00	W	5
	52	33.00	N	173	6.00	W	5
	52	30.00	N	173	6.00	W	5
	52	30.00	N	173	18.00	W	5
	52	24.00	N	173	18.00	W	5
	52	24.00	N	172	48.00	W	5
	52	30.00	N	172	48.00	W	5
	52	30.00	N	172	42.00	W	5, 7

Name	Latitude			Longitude			Footnote
Atka/Amlia South	52	0.00	N	173	18.00	W	
	52	0.00	N	173	54.00	W	
	52	3.08	N	173	54.00	W	2
	52	6.00	N	173	58.00	W	
	52	6.00	N	174	6.00	W	
	52	0.00	N	174	18.00	W	
	52	0.00	N	174	12.00	W	
	51	54.00	N	174	12.00	W	
	51	54.00	N	174	18.00	W	
	52	6.00	N	174	18.00	W	
	52	6.00	N	174	21.86	W	1
	52	4.39	N	174	30.00	W	
	52	3.09	N	174	30.00	W	1
	52	2.58	N	174	30.00	W	
	52	0.00	N	174	30.00	W	
	52	0.00	N	174	36.00	W	
	51	54.00	N	174	36.00	W	
	51	54.00	N	174	54.00	W	
	51	48.00	N	174	54.00	W	
	51	48.00	N	173	24.00	W	
	51	54.00	N	173	24.00	W	
	51	54.00	N	173	18.00	W	
Atka I North	52	30.00	N	174	24.00	W	
	52	30.00	N	174	30.00	W	
	52	24.00	N	174	30.00	W	
	52	24.00	N	174	48.00	W	
	52	18.00	N	174	48.00	W	
	52	18.00	N	174	54.00	W	
	52	12.00	N	174	54.00	W	
	52	12.00	N	175	18.00	W	
	52	1.14	N	175	18.00	W	1
	52	2.19	N	175	12.00	W	
	52	6.00	N	175	12.00	W	
	52	6.00	N	174	55.51	W	1
	52	6.00	N	174	54.04	W	
	52	6.00	N	174	48.00	W	
	52	12.00	N	174	48.00	W	
	52	12.00	N	174	26.85	W	1
	52	12.94	N	174	18.00	W	
	52	16.80	N	174	18.00	W	1
	52	17.06	N	174	18.00	W	
	52	17.64	N	174	18.00	W	1
	52	18.00	N	174	19.12	W	

Name	Latitude			Longitude			Footnote
	52	18.00	N	174	20.04	W	1
	52	19.37	N	174	24.00	W	
Atka I South	52	0.68	N	175	12.00	W	2
	52	0.76	N	175	18.00	W	
	52	0.00	N	175	18.00	W	
	52	0.00	N	175	12.00	W	
Adak I East	52	12.00	N	176	36.00	W	
	52	12.00	N	176	0.00	W	
	52	2.59	N	176	0.00	W	1
	52	1.79	N	176	0.00	W	
	52	0.00	N	176	0.00	W	
	52	0.00	N	175	48.00	W	
	51	57.74	N	175	48.00	W	1
	51	55.48	N	175	48.00	W	
	51	54.00	N	175	48.00	W	
	51	54.00	N	176	0.00	W	1
	51	53.09	N	176	6.00	W	
	51	51.40	N	176	6.00	W	1
	51	49.67	N	176	6.00	W	
	51	48.73	N	176	6.00	W	1
	51	48.00	N	176	6.36	W	
	51	48.00	N	176	9.82	W	1
	51	48.00	N	176	9.99	W	
	51	48.00	N	176	16.19	W	1
	51	48.00	N	176	24.71	W	
	51	48.00	N	176	25.71	W	1
	51	45.58	N	176	30.00	W	
	51	42.00	N	176	30.00	W	
	51	42.00	N	176	33.92	W	1
	51	41.22	N	176	42.00	W	
	51	30.00	N	176	42.00	W	
	51	30.00	N	176	36.00	W	
	51	36.00	N	176	36.00	W	
	51	36.00	N	176	0.00	W	
	51	42.00	N	176	0.00	W	
	51	42.00	N	175	36.00	W	
	51	48.00	N	175	36.00	W	
	51	48.00	N	175	18.00	W	
	51	51.00	N	175	18.00	W	
	51	51.00	N	175	0.00	W	
	51	57.00	N	175	0.00	W	
	51	57.00	N	175	18.00	W	
	52	0.00	N	175	18.00	W	

Name	Latitude			Longitude			Footnote
	52	0.00	N	175	30.00	W	
	52	3.00	N	175	30.00	W	
	52	3.00	N	175	36.00	W	
Cape Adagdak	52	6.00	N	176	12.44	W	
	52	6.00	N	176	30.00	W	
	52	3.00	N	176	30.00	W	
	52	3.00	N	176	42.00	W	
	52	0.00	N	176	42.00	W	
	52	0.00	N	176	46.64	W	
	51	57.92	N	176	46.51	W	1
	51	54.00	N	176	37.07	W	
	51	54.00	N	176	18.00	W	
	52	0.00	N	176	18.00	W	
	52	0.00	N	176	12.00	W	
	52	2.85	N	176	12.00	W	1
	52	4.69	N	176	12.44	W	
Cape Kiguga/Round Head	52	0.00	N	176	53.00	W	
	52	0.00	N	177	6.00	W	
	51	56.06	N	177	6.00	W	1
	51	54.00	N	177	2.84	W	
	51	54.00	N	176	54.00	W	
	51	48.79	N	176	54.00	W	1
	51	48.00	N	176	50.35	W	
	51	48.00	N	176	43.14	W	1
	51	55.69	N	176	48.59	W	
	51	55.69	N	176	53.00	W	
Adak Strait South	51	42.00	N	176	55.77	W	
	51	42.00	N	177	12.00	W	
	51	30.00	N	177	12.00	W	
	51	36.00	N	177	6.00	W	
	51	36.00	N	177	3.00	W	
	51	39.00	N	177	3.00	W	
	51	39.00	N	177	0.00	W	
	51	36.00	N	177	0.00	W	
	51	36.00	N	176	57.72	W	3
Bay of Waterfalls	51	38.62	N	176	54.00	W	
	51	36.00	N	176	54.00	W	
	51	36.00	N	176	55.99	W	3
Tanaga/Kanaga North	51	54.00	N	177	12.00	W	
	51	54.00	N	177	19.93	W	
	51	51.71	N	177	19.93	W	
	51	51.65	N	177	29.11	W	
	51	54.00	N	177	29.11	W	

Name	Latitude			Longitude			Footnote
	51	54.00	N	177	30.00	W	
	51	57.00	N	177	30.00	W	
	51	57.00	N	177	42.00	W	
	51	54.00	N	177	42.00	W	
	51	54.00	N	177	54.00	W	
	51	50.92	N	177	54.00	W	1
	51	48.00	N	177	46.44	W	
	51	48.00	N	177	42.00	W	
	51	42.59	N	177	42.00	W	1
	51	45.57	N	177	24.01	W	
	51	48.00	N	177	24.00	W	
	51	48.00	N	177	14.08	W	4
Tanaga/Kanaga South	51	43.78	N	177	24.04	W	1
	51	42.37	N	177	42.00	W	
	51	42.00	N	177	42.00	W	
	51	42.00	N	177	50.04	W	1
	51	40.91	N	177	54.00	W	
	51	36.00	N	177	54.00	W	
	51	36.00	N	178	0.00	W	
	51	38.62	N	178	0.00	W	1
	51	42.52	N	178	6.00	W	
	51	49.34	N	178	6.00	W	1
	51	51.35	N	178	12.00	W	
	51	48.00	N	178	12.00	W	
	51	48.00	N	178	30.00	W	
	51	42.00	N	178	30.00	W	
	51	42.00	N	178	36.00	W	
	51	36.26	N	178	36.00	W	1
	51	35.75	N	178	36.00	W	
	51	27.00	N	178	36.00	W	
	51	27.00	N	178	42.00	W	
	51	21.00	N	178	42.00	W	
	51	21.00	N	178	24.00	W	
	51	24.00	N	178	24.00	W	
	51	24.00	N	178	12.00	W	
	51	30.00	N	178	12.00	W	
	51	30.00	N	177	24.00	W	
Amchitka Pass East	51	42.00	N	178	48.00	W	
	51	42.00	N	179	18.00	W	
	51	45.00	N	179	18.00	W	
	51	45.00	N	179	36.00	W	
	51	42.00	N	179	36.00	W	
	51	42.00	N	179	39.00	W	

Name	Latitude			Longitude			Footnote
	51	30.00	N	179	39.00	W	
	51	30.00	N	179	36.00	W	
	51	18.00	N	179	36.00	W	
	51	18.00	N	179	24.00	W	
	51	30.00	N	179	24.00	W	
	51	30.00	N	179	0.00	W	
	51	25.82	N	179	0.00	W	
	51	25.85	N	178	59.00	W	
	51	24.00	N	178	58.97	W	
	51	24.00	N	178	54.00	W	
	51	30.00	N	178	54.00	W	
	51	30.00	N	178	48.00	W	
	51	32.69	N	178	48.00	W	1
	51	33.95	N	178	48.00	W	
Amatignak I	51	18.00	N	178	54.00	W	
	51	18.00	N	179	5.30	W	1
	51	18.00	N	179	6.75	W	
	51	18.00	N	179	12.00	W	
	51	6.00	N	179	12.00	W	
	51	6.00	N	179	0.00	W	
	51	12.00	N	179	0.00	W	
	51	12.00	N	178	54.00	W	
Amchitka Pass Center	51	30.00	N	179	48.00	W	
	51	30.00	N	180	0.00	W	
	51	24.00	N	180	0.00	W	
	51	24.00	N	179	48.00	W	
Amchitka Pass West	51	36.00	N	179	54.00	E	
	51	36.00	N	179	36.00	E	
	51	30.00	N	179	36.00	E	
	51	30.00	N	179	45.00	E	
	51	27.00	N	179	48.00	E	
	51	24.00	N	179	48.00	E	
	51	24.00	N	179	54.00	E	
Petrel Bank	52	51.00	N	179	12.00	W	
	52	51.00	N	179	24.00	W	
	52	48.00	N	179	24.00	W	
	52	48.00	N	179	30.00	W	
	52	42.00	N	179	30.00	W	
	52	42.00	N	179	36.00	W	
	52	36.00	N	179	36.00	W	
	52	36.00	N	179	48.00	W	
	52	30.00	N	179	48.00	W	

Name	Latitude			Longitude			Footnote
	52	30.00	N	179	42.00	E	
	52	24.00	N	179	42.00	E	
	52	24.00	N	179	36.00	E	
	52	12.00	N	179	36.00	E	
	52	12.00	N	179	36.00	W	
	52	24.00	N	179	36.00	W	
	52	24.00	N	179	30.00	W	
	52	30.00	N	179	30.00	W	
	52	30.00	N	179	24.00	W	
	52	36.00	N	179	24.00	W	
	52	36.00	N	179	18.00	W	
	52	42.00	N	179	18.00	W	
	52	42.00	N	179	12.00	W	
Rat I/Amchitka I South	51	21.00	N	179	36.00	E	
	51	21.00	N	179	18.00	E	
	51	18.00	N	179	18.00	E	
	51	18.00	N	179	12.00	E	
	51	23.77	N	179	12.00	E	1
	51	24.00	N	179	10.20	E	
	51	24.00	N	179	0.00	E	
	51	36.00	N	178	36.00	E	
	51	36.00	N	178	24.00	E	
	51	42.00	N	178	24.00	E	
	51	42.00	N	178	6.00	E	
	51	48.00	N	178	6.00	E	
	51	48.00	N	177	54.00	E	
	51	54.00	N	177	54.00	E	
	51	54.00	N	178	12.00	E	
	51	48.00	N	178	12.00	E	
	51	48.00	N	178	17.09	E	1
	51	48.00	N	178	20.60	E	
	51	48.00	N	178	24.00	E	
	52	6.00	N	178	24.00	E	
	52	6.00	N	178	12.00	E	
	52	0.00	N	178	12.00	E	
	52	0.00	N	178	11.01	E	1
	52	0.00	N	178	5.99	E	
	52	0.00	N	177	54.00	E	
	52	9.00	N	177	54.00	E	
	52	9.00	N	177	42.00	E	
	52	0.00	N	177	42.00	E	
	52	0.00	N	177	48.00	E	

Name	Latitude			Longitude			Footnote
	51	54.00	N	177	48.00	E	
	51	54.00	N	177	30.00	E	
	51	51.00	N	177	30.00	E	
	51	51.00	N	177	24.00	E	
	51	45.00	N	177	24.00	E	
	51	45.00	N	177	30.00	E	
	51	48.00	N	177	30.00	E	
	51	48.00	N	177	42.00	E	
	51	42.00	N	177	42.00	E	
	51	42.00	N	178	0.00	E	
	51	39.00	N	178	0.00	E	
	51	39.00	N	178	12.00	E	
	51	36.00	N	178	12.00	E	
	51	36.00	N	178	18.00	E	
	51	30.00	N	178	18.00	E	
	51	30.00	N	178	24.00	E	
	51	24.00	N	178	24.00	E	
	51	24.00	N	178	36.00	E	
	51	30.00	N	178	36.00	E	
	51	24.00	N	178	48.00	E	
	51	18.00	N	178	48.00	E	
	51	18.00	N	178	54.00	E	
	51	12.00	N	178	54.00	E	
	51	12.00	N	179	30.00	E	
	51	18.00	N	179	30.00	E	
	51	18.00	N	179	36.00	E	
Amchitka I North	51	42.00	N	179	12.00	E	
	51	42.00	N	178	57.00	E	
	51	36.00	N	178	56.99	E	
	51	36.00	N	179	0.00	E	
	51	33.62	N	179	0.00	E	2
	51	30.00	N	179	5.00	E	
	51	30.00	N	179	18.00	E	
	51	36.00	N	179	18.00	E	
	51	36.00	N	179	12.00	E	
Pillar Rock	52	9.00	N	177	30.00	E	
	52	9.00	N	177	18.00	E	
	52	6.00	N	177	18.00	E	
	52	6.00	N	177	30.00	E	
Murray Canyon	51	48.00	N	177	12.00	E	
	51	48.00	N	176	48.00	E	
	51	36.00	N	176	48.00	E	

Name	Latitude			Longitude			Footnote
	51	36.00	N	177	0.00	E	
	51	39.00	N	177	0.00	E	
	51	39.00	N	177	6.00	E	
	51	42.00	N	177	6.00	E	
	51	42.00	N	177	12.00	E	
Buldir	52	6.00	N	177	12.00	E	
	52	6.00	N	177	0.00	E	
	52	12.00	N	177	0.00	E	
	52	12.00	N	176	54.00	E	
	52	9.00	N	176	54.00	E	
	52	9.00	N	176	48.00	E	
	52	0.00	N	176	48.00	E	
	52	0.00	N	176	36.00	E	
	52	6.00	N	176	36.00	E	
	52	6.00	N	176	24.00	E	
	52	12.00	N	176	24.00	E	
	52	12.00	N	176	12.00	E	
	52	18.00	N	176	12.00	E	
	52	18.00	N	176	30.00	E	
	52	24.00	N	176	30.00	E	
	52	24.00	N	176	0.00	E	
	52	18.00	N	176	0.00	E	
	52	18.00	N	175	54.00	E	
	52	6.00	N	175	54.00	E	
	52	6.00	N	175	48.00	E	
	52	0.00	N	175	48.00	E	
	52	0.00	N	175	54.00	E	
	51	54.00	N	175	54.00	E	
	51	54.00	N	175	36.00	E	
	51	42.00	N	175	36.00	E	
	51	42.00	N	175	30.00	E	
	51	36.00	N	175	30.00	E	
	51	36.00	N	175	36.00	E	
	51	30.00	N	175	36.00	E	
	51	30.00	N	175	42.00	E	
	51	36.00	N	175	42.00	E	
	51	36.00	N	176	0.00	E	
	52	0.00	N	176	0.00	E	
	52	0.00	N	176	6.00	E	
	52	6.00	N	176	6.00	E	
	52	6.00	N	176	12.00	E	
	52	0.00	N	176	12.00	E	

Name	Latitude			Longitude			Footnote
	52	0.00	N	176	30.00	E	
	51	54.00	N	176	30.00	E	
	51	54.00	N	177	0.00	E	
	52	0.00	N	177	0.00	E	
	52	0.00	N	177	12.00	E	
Buldir donut	51	48.00	N	175	48.00	E	5
	51	48.00	N	175	42.00	E	5
	51	45.00	N	175	42.00	E	5
	51	45.00	N	175	48.00	E	5, 7
Buldir Mound	51	54.00	N	176	24.00	E	
	51	54.00	N	176	18.00	E	
	51	48.00	N	176	18.00	E	
	51	48.00	N	176	24.00	E	
Buldir West	52	30.00	N	175	48.00	E	
	52	30.00	N	175	36.00	E	
	52	36.00	N	175	36.00	E	
	52	36.00	N	175	24.00	E	
	52	24.00	N	175	24.00	E	
	52	24.00	N	175	30.00	E	
	52	18.00	N	175	30.00	E	
	52	18.00	N	175	36.00	E	
	52	24.00	N	175	36.00	E	
	52	24.00	N	175	48.00	E	
Tahoma Canyon	52	0.00	N	175	18.00	E	
	52	0.00	N	175	12.00	E	
	51	42.00	N	175	12.00	E	
	51	42.00	N	175	24.00	E	
	51	54.00	N	175	24.00	E	
	51	54.00	N	175	18.00	E	
Walls Plateau	52	24.00	N	175	24.00	E	
	52	24.00	N	175	12.00	E	
	52	18.00	N	175	12.00	E	
	52	18.00	N	175	0.00	E	
	52	12.00	N	175	0.00	E	
	52	12.00	N	174	42.00	E	
	52	6.00	N	174	42.00	E	
	52	6.00	N	174	36.00	E	
	52	0.00	N	174	36.00	E	
	52	0.00	N	174	42.00	E	
	51	54.00	N	174	42.00	E	
	51	54.00	N	174	48.00	E	

Name	Latitude			Longitude			Footnote
	52	0.00	N	174	48.00	E	
	52	0.00	N	174	54.00	E	
	52	6.00	N	174	54.00	E	
	52	6.00	N	175	18.00	E	
	52	12.00	N	175	24.00	E	
Semichi I	52	30.00	N	175	6.00	E	
	52	30.00	N	175	0.00	E	
	52	36.00	N	175	0.00	E	
	52	36.00	N	174	48.00	E	
	52	42.00	N	174	48.00	E	
	52	42.00	N	174	33.00	E	
	52	36.00	N	174	33.00	E	
	52	36.00	N	174	24.00	E	
	52	39.00	N	174	24.00	E	
	52	39.00	N	174	0.00	E	
	52	42.00	N	173	54.00	E	
	52	45.16	N	173	54.00	E	1
	52	46.35	N	173	54.00	E	
	52	54.00	N	173	54.00	E	
	52	54.00	N	173	30.00	E	
	52	48.00	N	173	30.00	E	
	52	48.00	N	173	36.00	E	
	52	40.00	N	173	36.00	E	
	52	40.00	N	173	25.00	E	
	52	30.00	N	173	25.00	E	
	52	33.00	N	173	40.00	E	
	52	33.00	N	173	54.00	E	
	52	18.00	N	173	54.00	E	
	52	18.00	N	174	30.00	E	
	52	30.00	N	174	30.00	E	
	52	30.00	N	174	48.00	E	
	52	24.00	N	174	48.00	E	
	52	24.00	N	175	6.00	E	
Agattu South	52	18.00	N	173	54.00	E	
	52	18.00	N	173	24.00	E	
	52	9.00	N	173	24.00	E	
	52	9.00	N	173	36.00	E	
	52	6.00	N	173	36.00	E	
	52	6.00	N	173	54.00	E	
Attu I North	53	3.00	N	173	24.00	E	
	53	3.00	N	173	6.00	E	

Name	Latitude			Longitude			Footnote
	53	0.00	N	173	6.00	E	
	53	0.00	N	173	24.00	E	
Attu I West	52	54.00	N	172	12.00	E	
	52	54.00	N	172	0.00	E	
	52	48.00	N	172	0.00	E	
	52	48.00	N	172	12.00	E	
Stalemate Bank	53	0.00	N	171	6.00	E	
	53	0.00	N	170	42.00	E	
	52	54.00	N	170	42.00	E	
	52	54.00	N	171	6.00	E	

Note: Unless otherwise footnoted, each area is delineated by connecting in order the coordinates listed by straight lines. Except for the Amlia North/Seguam donut and the Buldir donut, each area delineated in the table is open to nonpelagic trawl gear fishing. The remainder of the entire Aleutian Islands subarea and the areas delineated by the coordinates for the Amlia North/Seguam and Buldir donuts are closed to nonpelagic trawl gear fishing, as specified at § 679.22. Unless otherwise noted, the last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. The projected coordinate system is North American Datum 1983, Albers.
[1]The connection of these coordinates to the next set of coordinates is by a line extending in a clockwise direction from these coordinates along the shoreline at mean lower-low water to the next set of coordinates.
[2]The connection of these coordinates to the next set of coordinates is by a line extending in a counter clockwise direction from these coordinates along the shoreline at mean lower-low water to the next set of coordinates.
[3]The connection of these coordinates to the first set of coordinates for this area is by a line extending in a clockwise direction from these coordinates along the shoreline at mean lower-low water to the first set of coordinates.
[4]The connection of these coordinates to the first set of coordinates for this area is by a line extending in a counter clockwise direction from these coordinates along the shoreline at mean lower-low water to the first set of coordinates.
[5] The area specified by this set of coordinates is closed to fishing with non-pelagic trawl gear.
[6] This set of coordinates is connected to the first set of coordinates listed for the area by a straight line.
[7]The last coordinate for the donut is connected to the first set of coordinates for the donut by a straight line.

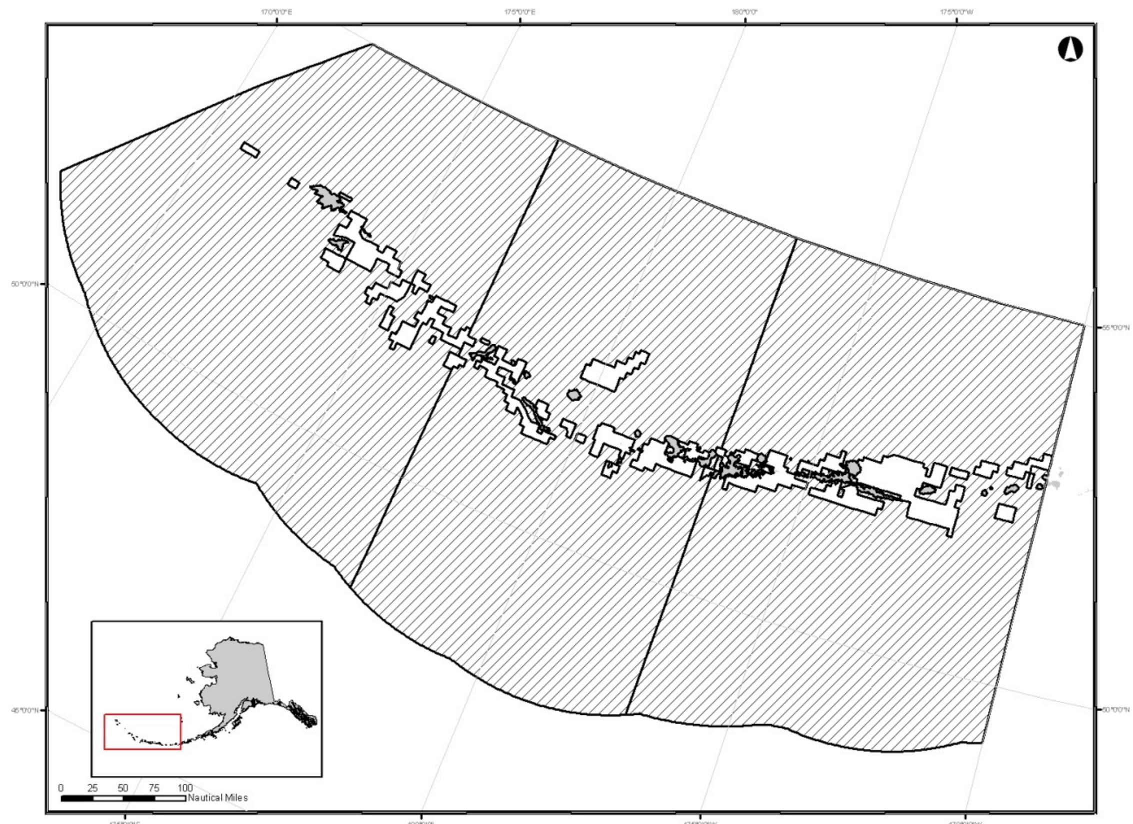

Figure 5 Aleutian Islands Habitat Conservation Area. Polygons are areas open to nonpelagic trawl gear.

3.4.3 GOA Slope Habitat Conservation Areas

Nonpelagic trawl gear fishing is prohibited in the GOA Slope Habitat Conservation Area. Coordinates for the area are listed in the table below. See Figure 6. Note: Each area is delineated by connecting the coordinates in the order listed by straight lines. The last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. Projected coordinate system is North American Datum 1983, Albers.

Area Number	Name	Latitude			Longitude		
1	Yakutat	58	47.00	N	139	55.00	W
	Yakutat	58	47.00	N	140	32.00	W
	Yakutat	58	37.00	N	140	32.00	W
	Yakutat	58	36.97	N	139	54.99	W
2	Cape Suckling	59	50.00	N	143	20.00	W
	Cape Suckling	59	50.00	N	143	30.00	W
	Cape Suckling	59	40.00	N	143	30.00	W
	Cape Suckling	59	40.00	N	143	20.00	W
3	Kayak Is	59	35.00	N	144	0.00	W
	Kayak Is	59	40.00	N	144	25.00	W
	Kayak Is	59	30.00	N	144	50.00	W
	Kayak Is	59	25.00	N	144	50.00	W
	Kayak Is	59	25.00	N	144	2.00	W
4	Middleton Is east	59	32.31	N	145	29.09	W
	Middleton Is east	59	32.13	N	145	51.14	W
	Middleton Is east	59	20.00	N	145	51.00	W
	Middleton IS east	59	18.85	N	145	29.39	W
5	Middleton Is west	59	14.64	N	146	29.63	W
	Middleton Is west	59	15.00	N	147	0.00	W
	Middleton Is west	59	10.00	N	147	0.00	W
	Middleton Is west	59	8.74	N	146	30.16	W
6	Cable	58	40.00	N	148	0.00	W
	Cable	59	6.28	N	149	0.28	W
	Cable	59	0.00	N	149	0.00	W
	Cable	58	34.91	N	147	59.85	W
7	Albatross Bank	56	16.00	N	152	40.00	W
	Albatross Bank	56	16.00	N	153	20.00	W
	Albatross Bank	56	11.00	N	153	20.00	W
	Albatross Bank	56	10.00	N	152	40.00	W
8	Shumagin Is	54	51.49	N	157	42.52	W
	Shumagin Is	54	40.00	N	158	10.00	W
	Shumagin Is	54	35.00	N	158	10.00	W
	Shumagin Is	54	36.00	N	157	42.00	W
9	Sanak Is	54	12.86	N	162	13.54	W
	Sanak Is	54	0.00	N	163	15.00	W
	Sanak Is	53	53.00	N	163	15.00	W
	Sanak Is	54	5.00	N	162	12.00	W
10	Unalaska Is	53	26.05	N	165	55.55	W
	Unalaska Is	53	6.92	N	167	19.40	W
	Unalaska Is	52	55.71	N	167	18.20	W
	Unalaska Is	53	13.05	N	165	55.55	W

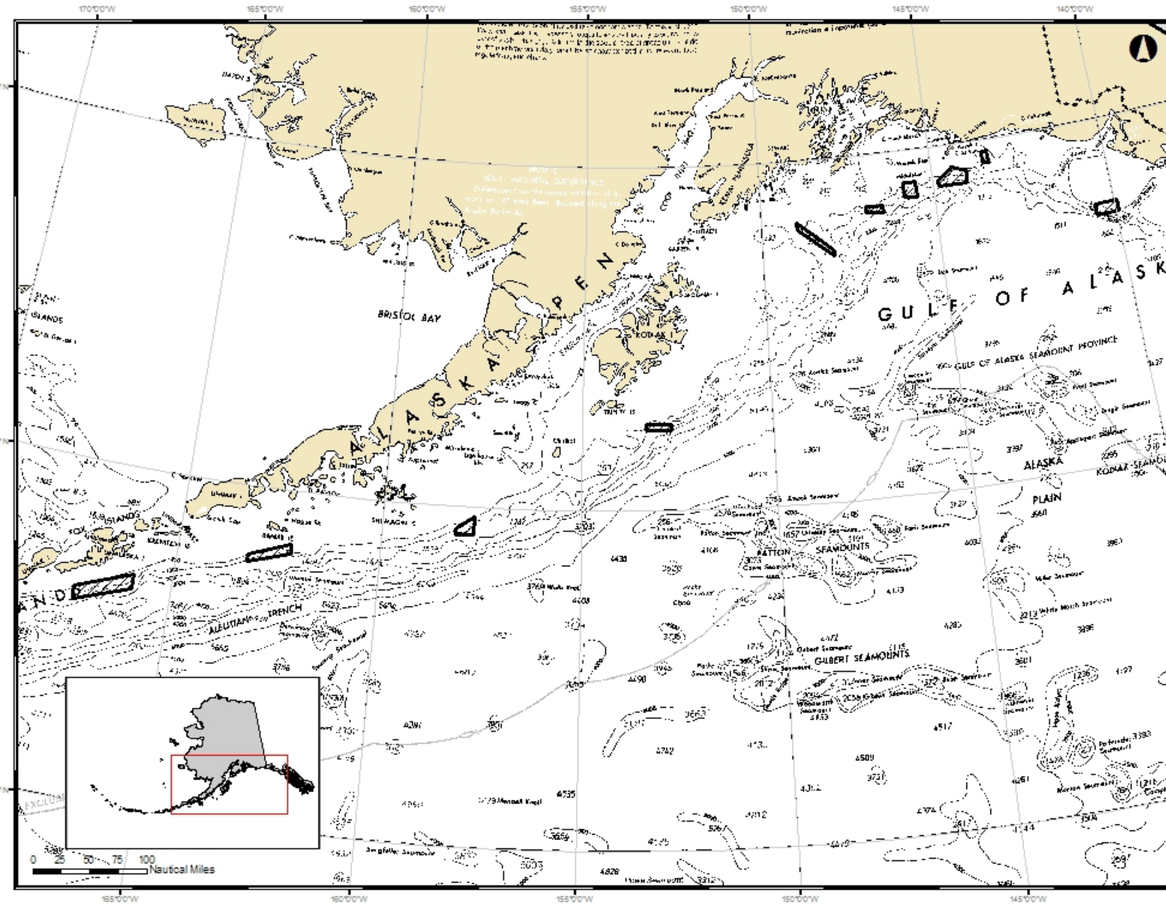

Figure 6 GOA Slope Habitat Conservation Areas are located within the thick line boxes.

3.4.4 Alaska Seamount Habitat Protection Areas

The use of bottom contact gear and anchoring by a federally permitted fishing vessel, as described in 50 CFR part 679, is prohibited year-round in the Alaska Seamount Habitat Protection Areas, see Figure 7. Coordinates for the Alaska Seamount Habitat Protection Areas are listed in the table below.

Area Number	Name	Latitude	Longitude
1	Dickins Seamount	54 39.00 N	136 48.00 W
	Dickins Seamount	54 39.00 N	137 9.00 W
	Dickins Seamount	54 27.00 N	137 9.00 W
	Dickins Seamount	54 27.00 N	136 48.00 W
2	Denson Seamount	54 13.20 N	137 6.00 W
	Denson Seamount	54 13.20 N	137 36.00 W
	Denson Seamount	53 57.00 N	137 36.00 W
	Denson Seamount	53 57.00 N	137 6.00 W
3	Brown Seamount	55 0.00 N	138 24.00 W

Area Number	Name	Latitude			Longitude		
	Brown Seamount	55	0.00	N	138	48.00	W
	Brown Seamount	54	48.00	N	138	48.00	W
	Brown Seamount	54	48.00	N	138	24.00	W
4	Welker Seamount	55	13.80	N	140	9.60	W
	Welker Seamount	55	13.80	N	140	33.00	W
	Welker Seamount	55	1.80	N	140	33.00	W
	Welker Seamount	55	1.80	N	140	9.60	W
5	Dall Seamount	58	18.00	N	144	54.00	W
	Dall Seamount	58	18.00	N	145	48.00	W
	Dall Seamount	57	45.00	N	145	48.00	W
	Dall Seamount	57	45.00	N	144	54.00	W
6	Quinn Seamount	56	27.00	N	145	0.00	W
	Quinn Seamount	56	27.00	N	145	24.00	W
	Quinn Seamount	56	12.00	N	145	24.00	W
	Quinn Seamount	56	12.00	N	145	0.00	W
7	Giacomini Seamount	56	37.20	N	146	7.20	W
	Giacomini Seamount	56	37.20	N	146	31.80	W
	Giacomini Seamount	56	25.20	N	146	31.80	W
	Giacomini Seamount	56	25.20	N	146	7.20	W
8	Kodiak Seamount	57	0.00	N	149	6.00	W
	Kodiak Seamount	57	0.00	N	149	30.00	W
	Kodiak Seamount	56	48.00	N	149	30.00	W
	Kodiak Seamount	56	48.00	N	149	6.00	W
9	Odessey Seamount	54	42.00	N	149	30.00	W
	Odessey Seamount	54	42.00	N	150	0.00	W
	Odessey Seamount	54	30.00	N	150	0.00	W
	Odessey Seamount	54	30.00	N	149	30.00	W
10	Patton Seamount	54	43.20	N	150	18.00	W
	Patton Seamount	54	43.20	N	150	36.00	W
	Patton Seamount	54	34.20	N	150	36.00	W
	Patton Seamount	54	34.20	N	150	18.00	W
11	Chirikof & Marchand Seamounts	55	6.00	N	151	0.00	W
	Chirikof & Marchand Seamounts	55	6.00	N	153	42.00	W
	Chirikof & Marchand Seamounts	54	42.00	N	153	42.00	W
	Chirikof & Marchand Seamounts	54	42.00	N	151	0.00	W
12	Sirius Seamount	52	6.00	N	160	36.00	W
	Sirius Seamount	52	6.00	N	161	6.00	W
	Sirius Seamount	51	57.00	N	161	6.00	W
	Sirius Seamount	51	57.00	N	160	36.00	W

Area Number	Name	Latitude			Longitude		
13	Derickson Seamount	53	0.00	N	161	0.00	W
	Derickson Seamount	53	0.00	N	161	30.00	W
	Derickson Seamount	52	48.00	N	161	30.00	W
	Derickson Seamount	52	48.00	N	161	0.00	W
14	Unimak Seamount	53	48.00	N	162	18.00	W
	Unimak Seamount	53	48.00	N	162	42.00	W
	Unimak Seamount	53	39.00	N	162	42.00	W
	Unimak Seamount	53	39.00	N	162	18.00	W
15	Bowers Seamount	54	9.00	N	174	52.20	E
	Bowers Seamount	54	9.00	N	174	42.00	E
	Bowers Seamount	54	4.20	N	174	42.00	E
	Bowers Seamount	54	4.20	N	174	52.20	E

Note: The area is delineated by connecting the coordinates in the order listed by straight lines. The last set of coordinates is connected to the first set of coordinates by a straight line. The projected coordinate system is North American Datum 1983, Albers.

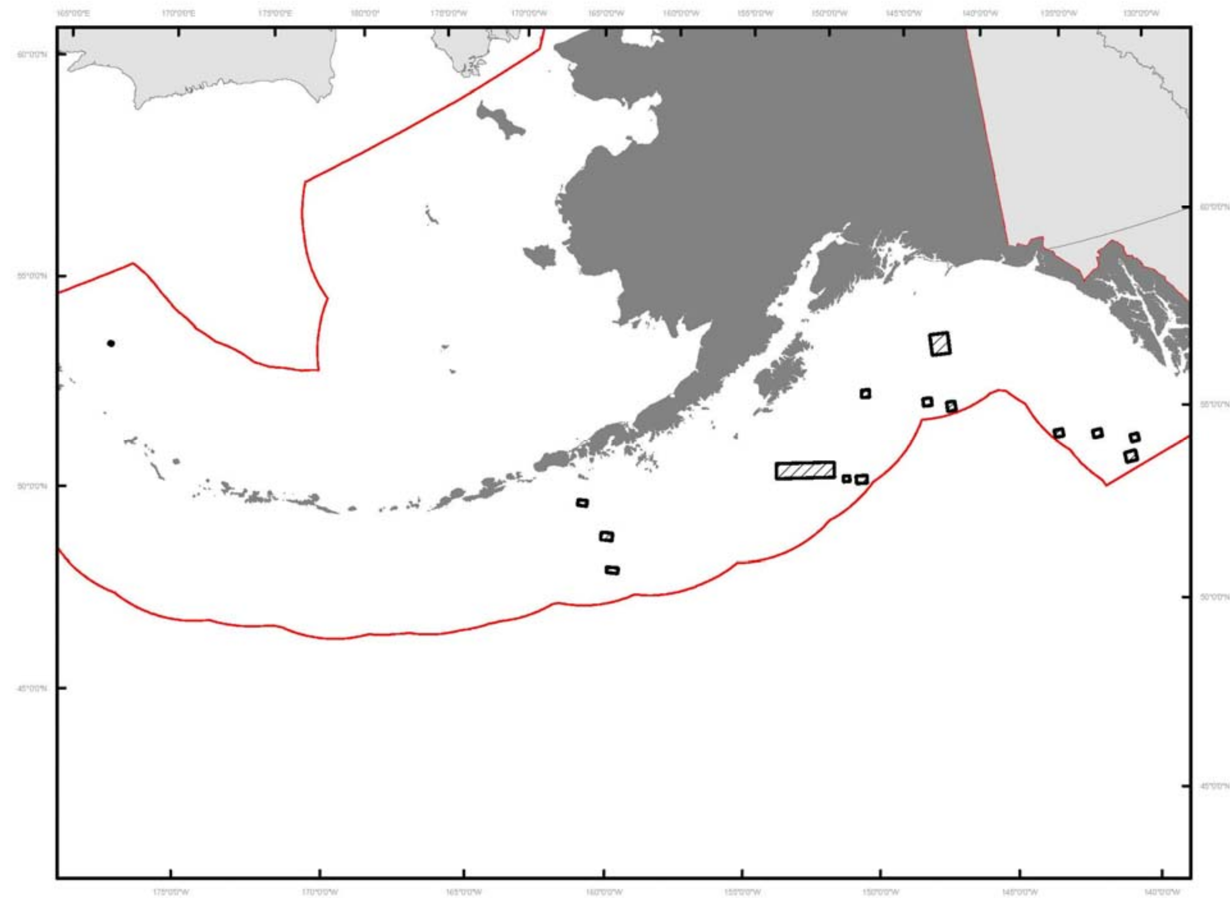

Figure 7 Alaska Seamount Habitat Protection Areas are located within the thick line boxes.

3.4.5 Bowers Ridge Habitat Conservation Zone

The use of mobile bottom contact gear, as described in 50 CFR part 679, is prohibited year-round in the Bowers Ridge Habitat Conservation Zone, see Figure 8. The areas are described in the table below.

Area Number	Name	Latitude			Longitude		
1	Bowers Ridge	55	10.50	N	178	27.25	E
	Bowers Ridge	54	54.50	N	177	55.75	E
	Bowers Ridge	54	5.83	N	179	20.75	E
	Bowers Ridge	52	40.50	N	179	55.00	W
	Bowers Ridge	52	44.50	N	179	26.50	W
	Bowers Ridge	54	15.50	N	179	54.00	W
2	Ulm Plateau	55	5.00	N	177	15.00	E
	Ulm Plateau	55	5.00	N	175	60.00	E
	Ulm Plateau	54	34.00	N	175	60.00	E
	Ulm Plateau	54	34.00	N	177	15.00	E

Note: Each area is delineated by connecting the coordinates in the order listed by straight lines. The last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. The projected coordinate system is North American Datum 1983, Albers.

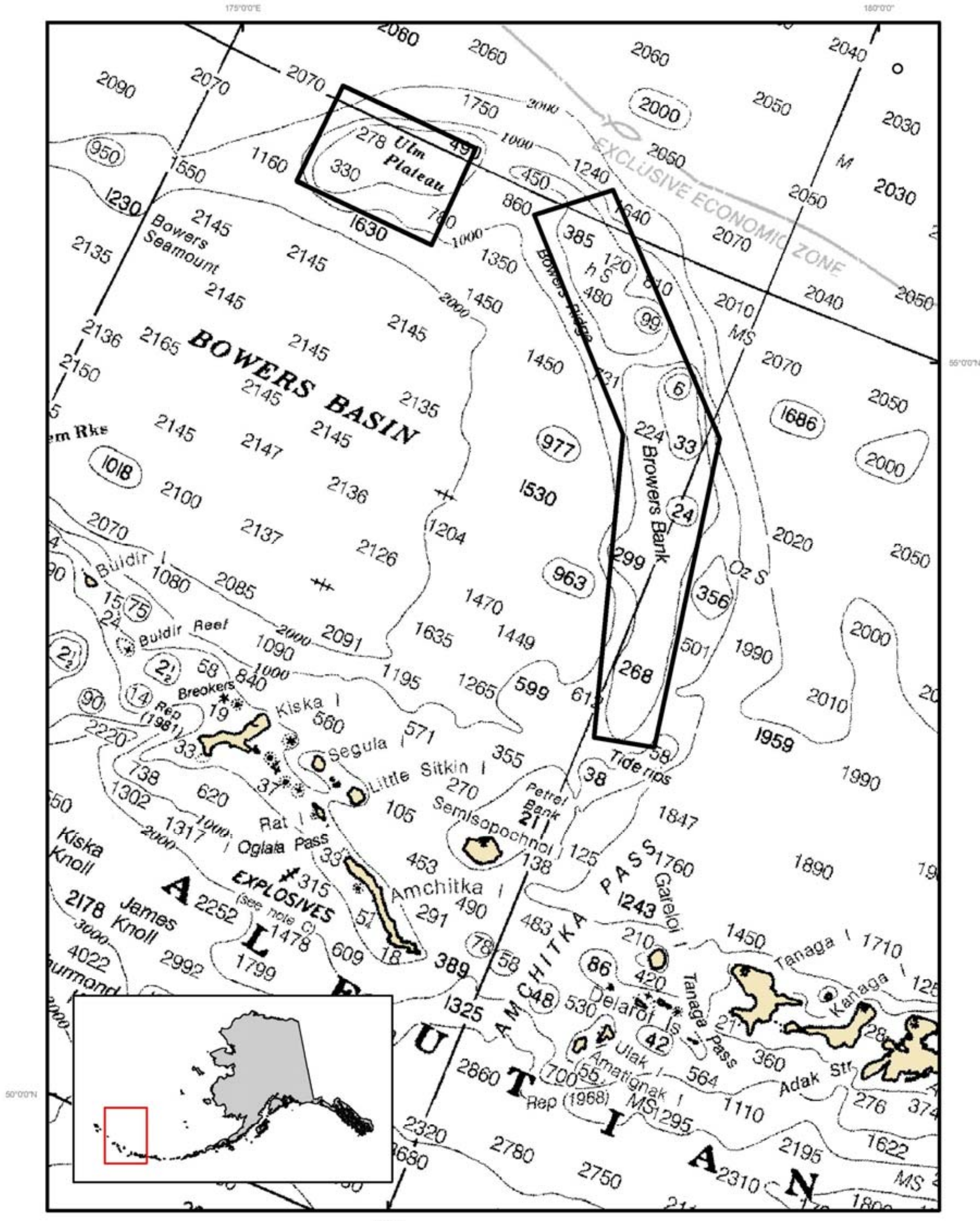

Figure 8 Bowers Ridge Habitat Conservation Zone

3.4.6 GOA Coral Habitat Areas of Particular Concern

The coordinates for the GOA Coral Habitat Areas of Particular Concern are listed in the table below. See Figures 9 and 10.

HAPC	Latitude	Longitude
Cape Ommaney	56° 12' 51" N 56° 12' 51" N 56° 09' 32" N 56° 09' 32" N	135° 07' 41" W 135° 05' 30" W 135° 05' 30" W 135° 07' 41" W
Fairweather Ground NW Area	58° 28' 10" N 58° 28' 10" N 58° 22' 00" N 58° 22' 00" N	139° 19' 44" W 139° 15' 42" W 139° 15' 42" W 139° 19' 44" W
Fairweather Ground Southern Area	58° 16' 00" N 58° 16' 00" N 58° 13' 10" N 58° 13' 10" N	139° 09' 45" W 138° 51' 34" W 138° 51' 34" W 139° 09' 45" W

3.4.6.1 GOA Coral Habitat Protection Areas

Within the GOA Coral HAPC are GOA Coral Habitat Protection Areas. Bottom contact gear fishing and anchoring are prohibited in the GOA Coral Habitat Protection Area. Coordinates for the area are listed in the table below. See Figures 9 and 10. Note: Each area is delineated by connecting the coordinates in the order listed by straight lines. The last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. Projected coordinate system is North American Datum 1983, Albers.

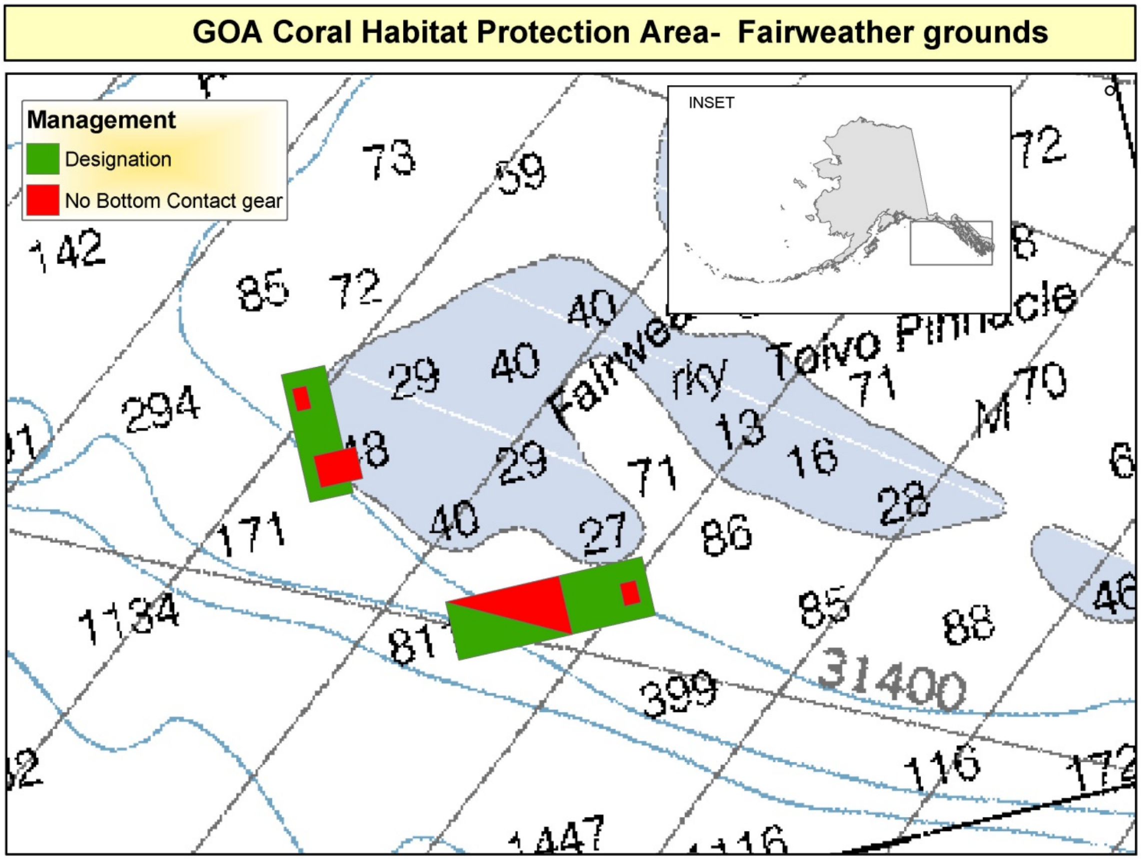

Figure 9 GOA Coral HAPC and GOA Coral Protect Areas in the Fairweather Grounds

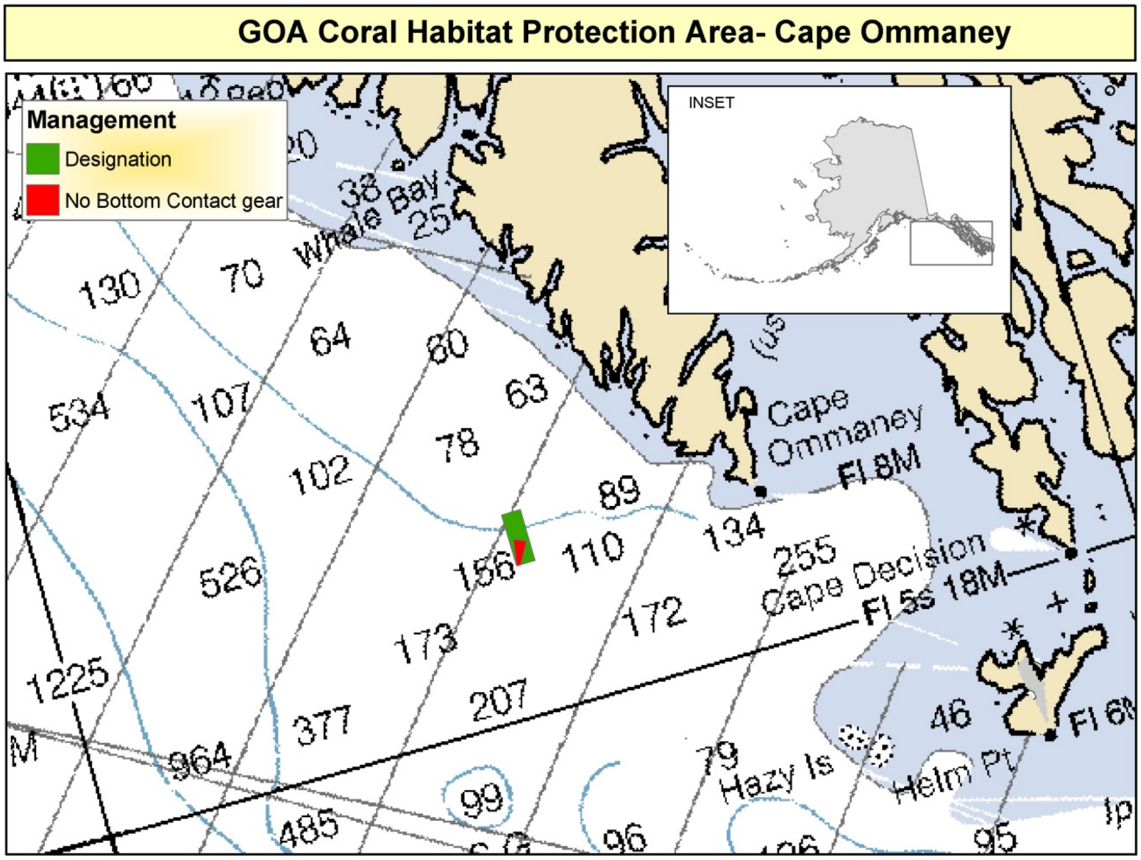

Figure 10 GOA Coral HAPC and GOA Coral Protect Areas near Cape Ommaney

3.4.7 HAPC Process

The Council may designate specific sites as HAPCs and may develop management measures to protect habitat features within HAPCs.

50 CFR 600.815(a)(8) provides guidance to the Councils in identifying HAPCs. FMPs should identify specific types or areas of habitat within EFH as habitat areas of particular concern based on one or more of the following considerations:

(i) The importance of the ecological function provided by the habitat.
(ii) The extent to which the habitat is sensitive to human-induced environmental degradation.
(iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type.
(iv) The rarity of the habitat type.

Proposed HAPCs, identified on a map, must meet at least two of the four considerations established in 50 CFR 600.815(a)(8), and rarity of the habitat is a mandatory criterion. HAPCs may be developed to address identified problems for FMP species, and they must meet clear, specific, adaptive management objectives.

The Council will initiate the HAPC process by setting priorities and issuing a request for HAPC proposals. Any member of the public may submit a HAPC proposal. HAPC proposals may be solicited every 3 years or on a schedule established by the Council. The Council may periodically review existing HAPCs for efficacy and considerations based on new scientific research.

Criteria to evaluate the HAPC proposals will be reviewed by the Council and the Scientific and Statistical Committee prior to the request for proposals. The Council will establish a process to review the proposals and may establish HAPCs and conservation measures (NPFMC 2005).

4.0 EFFECTS OF FISHING ON ESSENTIAL FISH HABITAT

This section addresses the requirement in EFH regulations (50 CFR 600.815(a)(2)(i)) that each FMP must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH. This evaluation must (1) describe each fishing activity, (2) review and discuss all available relevant information, and (3) provide conclusions regarding whether and how each fishing activity adversely affects EFH. Relevant information includes the intensity, extent, and frequency of any adverse effect on EFH; the type of habitat within EFH that may be affected adversely; and the habitat functions that may be disturbed.

In addition, the evaluation should (1) consider the cumulative effects of multiple fishing activities on EFH, (2) list and describe the benefits of any past management actions that minimize potential adverse effects on EFH, (3) give special attention to adverse effects on HAPCs and identify any EFH that is particularly vulnerable to fishing activities for possible designation as HAPCs, (4) consider the establishment of research closure areas or other measures to evaluate the impacts of fishing activities on EFH, (5) and use the best scientific information available, as well as other appropriate information sources.

This evaluation assesses whether fishing adversely affects EFH in a manner that is more than minimal and not temporary in nature (50 CFR 600.815(a)(2)(ii)). This standard determines whether Councils are required to act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable.

Much of the material supporting this evaluation is located in the following sections of the EFH EIS (NMFS 2005). These include:

- Descriptions of fishing activities (including gear, intensity, extent and frequency of effort) - Sections 3.4.1 and 3.4.2.
- Effects of fishing activities on fish habitat - Section 3.4.3.
- Past management actions that minimize potential adverse effects on EFH - Sections 2.2 and 4.3.
- Habitat requirements of managed species - Sections 3.2.1, 3.2.2, and Appendices D and F.
- Features of the habitat - Sections 3.1, 3.2.4 and 3.3.
- HAPCs - 2.2.2.7, 2.2.2.8, 2.3.2, and 4.2
- Cumulative effects of multiple fishing activities on EFH - Section 4.4.

Appendix B of the EFH EIS also contains a comprehensive, peer-reviewed analysis of fishing effects on EFH and detailed results for each managed species. This FMP incorporates by reference the complete analysis in Appendix B of the EFH EIS and summarizes below the results for scallops and the scallop fisheries.

An initial analysis, prepared by the Council indicated that groundfish fisheries represent all but a small fraction of the potential fishing effects on habitat and that scallop fisheries have a negligible effect on EFH (Witherell 2002). For the scallop fisheries, the analysis found that although the effects of this gear on benthic habitats are greater than for other gear types, the fishery occurs in areas and habitat types with relatively fast recovery rates. Additionally, the overall footprint (area effected annually) of the scallop fishery is very small (149 square nautical miles) equating to about 0.1% of the total available benthic EFH area. The effects of this fishery are concentrated in a very small portion of EFH; thus these effects are considered minimal and temporary in nature, and the scallop fisheries were not analyzed in detail in Appendix B of the EFH EIS (NMFS 2005).

The remainder of Appendix B of the EFH EIS evaluates whether the groundfish fisheries, as they are currently conducted off of Alaska, affect habitat that is essential to the welfare of managed species, including scallops, in a way that is more than minimal and not temporary. The previous statement describes the standard set in the EFH regulations which, if met, requires Councils to act to minimize such effects. The analysis in Appendix B of the EFH EIS identified changes to habitat features that are not expected to be temporary. The habitat features were selected as those which a) can be affected by fishing and b) may be important to fish in spawning, breeding, feeding, and growth to maturity. This section evaluates the extent that these changes relate to the EFH of scallop species and whether they constitute an effect to EFH that is more than minimal.

Two conclusions are necessary for this evaluation: (1) the definition of EFH draws a distinction between the amount of habitat necessary for a species to “support a sustainable fishery and the managed species’ contribution to a healthy ecosystem” (50 CFR 600.10) and all habitat features used by any individuals of a species; (2) this distinction applies to both the designation of EFH and the evaluation of fishing effects on EFH. The “more than minimal” standard relates to impacts that potentially affect the ability of the species to fulfill its fishery and ecosystem roles, not just impacts on a local scale. The analysis indicated substantial effects to some habitat features in some locations, many of which are within the spatial boundaries of the EFH for scallops. These habitat changes may or may not affect the welfare of scallops (a term used to represent “the ability of a species to support a sustainable fishery and its role in a healthy ecosystem”). The evaluation method is detailed in Section B.3.1 of Appendix B of the EFH EIS (NMFS 2005).

The evaluation of fishing effects on EFH for BSAI groundfish species was reconsidered as part of the Council’s EFH 5-year Review for 2010, and is documented in the Final Summary Report for that review

(NPFMC and NMFS 2010). The review evaluated new information since the development of the EFH EIS, for individual species and their habitat needs, as well as the distribution of fishing intensity, spatial habitat classifications, classification of habitat features, habitat- and feature-specific recovery rates, and gear- and habitat-specific sensitivity of habitat features. Based on the review, the Council concluded that recent research results are consistent with the habitat sensitivity and recovery parameters and distributions of habitat types used in the analysis of fishing effects documented in the EFH EIS. The review noted that fishing intensity has decreased overall, gear regulations have been designated to reduce habitat damage, and area closures have limited the expansion of effort into areas of concern.

4.1 Habitat Connections

Weathervane scallops are found from shallow intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40 to 130 m on beds of mud, clay, sand, and gravel (Hennick 1973, Turk 2000). Scallop beds tend to be elongated along the direction of current flow. A combination of large-scale processes (overall spawning population size and oceanographic conditions) and small-scale processes (site suitability for settlement) influence the recruitment of scallops to beds.

Spawning/Breeding—Successful scallop recruitment depends upon high egg-fertilization rate, transport of spat to nursery areas, environmental conditions, and survival to the adult stage. Scallop gametes are broadcast into the water and rely on currents to mix sperm and eggs. If males and females are not close together, the dilution of sperm can limit fertilization. Thus, spatial distribution is thought to be a critical component of the spawning/breeding success of scallops (Stokesbury 2000, ADF&G 2000). Indicators of potential effects on spatial distribution are changes in population biomass and fishing mortality.

Feeding—Scallops are filter feeders. Successful feeding depends on the concentration and quality of suspended food particles, particularly phytoplankton. Prey availability depends on localized plankton blooms. Fishing activity can impact feeding of scallops through introduction of particles low in nutrient quality or organic content, thus diluting the naturally occurring nutritional particles (MacDonald 2000). More fishing activity by trawl or dredge gear could potentially introduce additional inorganic particulate matter that could negatively affect scallop feeding success, or conversely, introduce organic matter that could be beneficial to scallops.

Growth to Maturity—Growth to maturity is measured in terms of survival to maturity (which occurs at sizes smaller than those commercially harvested). The consequences of fishing activities on scallop survival depend upon habitat alteration and gear-induced damage and mortality (Grant 2000). The effects of habitat alternation may depend primarily on sediment resuspension and the potential for siltation, which would increase mortality.

4.2 Evaluation of Effects

Issue	Evaluation
Spawning/breeding	MT (Minimal or temporary effect)
Feeding	U (Unknown effect)
Growth to maturity	MT (Minimal or temporary effect)

Summary of Effects—Because scallops have limited mobility, scallop settlement generally occurs on substrates and in locations where adults are already found (Turk 2000). Thus, the nursery areas are the same areas occupied by adults. These are also the areas where the directed scallop fisheries occur. However, there is no evidence that scallop recruitment has decreased with the current level of scallop fishing effort.

The overall footprint (area effected annually) of the scallop fishery was small (149 square nm), equating to about 0.1% of the total available amount of those habitat types (sand, mud, and gravel) (Witherell 2002). Although the effects of scallop dredge gear on the bottom are thought to be higher than other gear types, the fishery occurs in areas and habitat types that have relatively fast recovery rates. Thus, the effects of the fishery are concentrated in a relatively small proportion of benthic habitats. The effects on spawning and breeding of scallops are considered minimal and temporary in nature.

Sediment resuspension by dredges can have positive or negative effects on scallop feeding. The current fishing effort intensity of the Alaska scallop fishery does not appear to affect scallop growth, so one may surmise that feeding is not disturbed. However, there is not enough information to evaluate this issue.

The weathervane scallop resource is considered to be at sustainable biomass levels and has maintained relatively high recruitment in most areas over the past 10 years (Barnhart, J., ADF&G, personal communication). This species does not depend upon any habitat feature vulnerable to fishing activities. Based on the overlap of fisheries with juvenile and adult scallop stock distribution, there appear to be minimal effects on the weathervane scallop habitat.

5.0 Non-fishing Activities that may Adversely Affect Essential Fish Habitat

The waters and substrates that comprise essential fish habitat (EFH) are susceptible to a wide array of human activities unrelated to fishing. Broad categories of such activities include, but are not limited to, mining, dredging, fill, impoundment, discharges, water diversions, thermal additions, actions that contribute to nonpoint source pollution and sedimentation, introduction of potentially hazardous materials, introduction of exotic species, and the conversion of aquatic habitat that may eliminate, diminish, or disrupt the functions of EFH. Non-fishing activities discussed in this document are subject to a variety of regulations and restrictions designed to limit environmental impacts under federal, state, and local laws. Listing all applicable environmental laws and management practices is beyond the scope of the document. Moreover, the coordination and consultation required by section 305(b) of the Magnuson-Stevens Conservation and Management Act (MSA) does not supersede the regulations, rights, interests, or jurisdictions of other federal or state agencies. NMFS may use the information in this document as a source when developing conservation recommendations for specific actions under section 305(b)(4)(A) of the MSA. NMFS will not recommend that state or federal agencies take actions beyond their statutory authority, and NMFS' EFH conservation recommendations are not binding.

Ideally, actions that are not water-dependent should not be located in EFH if such actions may have adverse impacts on EFH. Activities that may result in significant adverse effects on EFH should be avoided where less environmentally harmful alternatives are available. If there are no alternatives, the impacts of these actions should be minimized. Environmentally sound engineering and management practices should be employed for all actions that may adversely affect EFH. If avoidance or minimization is not practicable, or will not adequately protect EFH, compensatory mitigation as defined for section 404 of the Clean Water Act (CWA) should be considered to conserve and enhance EFH.

The potential for effects from larger, less readily managed processes associated with human activity also exists, such as climate change and ocean acidification. Climate change may lead to habitat changes that prompt shifts in the distribution of managed species. Likewise, should ocean conditions warm to allow for new shipping routes, new vectors may emerge for introducing invasive species in cargo and ballast waters. Ocean acidification could also alter species distributions and complicated food web dynamics. These larger ecosystem-level effects are discussed in this document where applicable, within each activity type.

This section of the fishery management plan (FMP) synthesizes a comprehensive review of the "Impacts to Essential Fish Habitat from Non-fishing Activities in Alaska" (NMFS 2011), which is incorporated in the FMP by reference. The general purpose of that document is to identify non-fishing activities that may adversely impact EFH and provide conservation recommendations that can be implemented for specific types of activities to avoid or minimize adverse impacts to EFH. This information must be included in FMPs under section 303(a)(7) of the MSA. It is also useful to NMFS biologists reviewing proposed actions that may adversely affect EFH, and the comprehensive document (NMFS 2011) will be utilized by federal action agencies undertaking EFH consultations with NMFS, especially in preparing EFH assessments.

The conservation recommendations for each activity category are suggestions the action agency or others can undertake to avoid, offset, or mitigate impacts to EFH. NMFS develops EFH conservation recommendations for specific activities case-by-case based on the circumstances; therefore, the recommendations in this document may or may not apply to any particular project. Because many non-fishing activities have similar adverse effects on living marine resources, some redundancy in the descriptions of impacts and the accompanying conservation recommendations between sections in this report is unavoidable.

The comprehensive non-fishing activities document (NMFS 2011) updates and builds upon a collaborative evaluation of non-fishing effects to EFH completed in 2004 by the NMFS Alaska Region, Northwest Region, and Southwest Region and the respective Fisheries Science Centers. In April 2005, NMFS completed the Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS; NMFS 2005) and the North Pacific Fishery Management Council amended its FMPs to address the EFH requirements of the MSA. The EFH EIS contained an Appendix (Appendix G) that addressed non-fishing impacts to EFH. A 5-year review of the Council's EFH provisions, including those addressing non-fishing impacts to EFH, was completed by the Council in April 2010 (NPFMC and NMFS 2010), on the basis of which this section has been updated.

The remainder of this section addresses non-fishing activities that may adversely affect EFH. These activities are grouped into the four different systems in which they usually occur: upland, river or riverine, estuary or estuarine, and coastal or marine.

5.1 Upland Activities

Upland activities can impact EFH through both point source and nonpoint source pollution. Nonpoint source impacts are discussed here. Technically, the term "nonpoint source" means anything that does not meet the legal definition of point source in section 502(14) of the CWA, which refers to discernible, confined, and discrete conveyance from which pollutants are or may be discharged. Land runoff, precipitation, atmospheric deposition, seepage, and hydrologic modification, generally driven by anthropogenic development, are the major contributors to nonpoint source pollution.

Nonpoint source pollution is usually lower in intensity than an acute point source event, but may be more damaging to fish habitat in the long term. It may affect sensitive life stages and processes, is often difficult to detect, and its impacts may go unnoticed for a long time. When population impacts are detected, they may not be tied to any one event or source, and may be difficult to correct, clean up, or mitigate.

The impacts of nonpoint source pollution on EFH may not necessarily represent a serious, widespread threat to all species and life history stages. The severity of the threat of any specific pollutant to aquatic organisms depends upon the type and concentration of the pollutant and the length of exposure for a particular species and its life history stage. For example, species that spawn in areas that are relatively deep with strong currents and well-mixed water may not be as susceptible to pollution as species that inhabit shallow, inshore areas near or within enclosed bays and estuaries. Similarly, species whose egg, larval, and juvenile life history stages utilize shallow, inshore waters and rivers may be more prone to coastal pollution than are species whose early life history stages develop in offshore, pelagic waters.

5.1.1 Silviculture/Timber Harvest

Recent revisions to federal and state timber harvest regulations in Alaska and best management practices (BMPs) have resulted in increased protection of EFH on federal, state, and private timber lands (USDA 2008; http://www.fs.fed.us/r10/tongass/projects/tlmp/).

These revised regulations include forest management practices, which when fully implemented and effective, could avoid or minimize adverse effects to EFH. However, if these management practices are ineffective or not fully implemented, timber harvest could have both short and long term impacts on EFH throughout many coastal watersheds and estuaries. Historically, timber harvest in Alaska was not conducted under the current protective standards, and these past practices may have degraded EFH in some watersheds.

Potential Adverse Impacts

In both small and large watersheds there are many complex and important interactions between fish and forests (Northcote and Hartman 2004). Five major categories of silvicultural activities can adversely affect EFH if appropriate forestry practices are not followed: (1) construction of logging roads, (2) creation of fish migration barriers, (3) removal of streamside vegetation, (4) hydrologic changes and sedimentation, and (5) disturbance associated with log transfer facilities (LTFs). Possible effects to EFH include the following (Northcote and Hartman 2004):

- Removal of the dominant vegetation and conversion of mature and old-growth upland and riparian forests to tree stands or forests of early seral stage;
- Reduction of soil permeability and increase in the area of impervious surfaces;
- Increase in erosion and sedimentation due to surface runoff and mass wasting processes, also potentially affecting riparian areas;
- Impaired fish passage because of inadequate design, construction, and/or maintenance of stream crossings;
- Altered hydrologic regimes resulting in inadequate or excessive surface and stream flows, increased streambank and streambed erosion, loss of complex instream habitats;
- Changes in benthic macroinvertebrate populations,
- Loss of instream and riparian cover;
- Increased surface runoff with associated contaminants (e.g., herbicides, fertilizers, and fine sediments) and higher temperatures;
- Alterations in the supply of large woody debris (LWD) and sediment, which can have negative effects on the formation and persistence of instream habitat features; and
- Excess debris in the form of small pieces of wood and silt, which can cover benthic habitat and reduce dissolved oxygen levels.

Recommended Conservation Measures

The following recommended conservation measures for silviculture/timber harvest should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH. Additionally, management standards, guidelines, and BMPs are available from the Forest Service Region 10, the State of Alaska Division of Forestry, and forest plans for the Tongass and Chugach National Forests.

- Stream Buffers: For timber operations in watersheds with EFH, adhere to modern forest management practices and BMPs, including the maintenance of vegetated buffers along all streams to the extent practicable in order to reduce sedimentation and supply large wood.
- Estuary and Beach Fringe: For timber operations adjacent to estuaries or beaches, maintain vegetated buffers as needed to protect EFH.
- Watershed Analysis: A watershed analysis should be incorporated into timber and silviculture projects whenever practicable.
- Forest Roads: Forest roads can be a major cause of sediment into streams and road culverts can block or inhibit upstream fish passage. Roads need to be designed to minimize sediment transport problems and to avoid fish passage problems.

5.1.2 Pesticides

Pesticides are substances intended to prevent, destroy, control, repel, kill, or regulate the growth of undesirable biological organisms. Pesticides include the following: insecticides, herbicides, fungicides, rodenticides, repellents, bactericides, sanitizers, disinfectants, and growth regulators. More than 900 different active pesticide ingredients are currently registered for use in the United States and are formulated with a variety of other inert ingredients that may also be toxic to aquatic life. Legal mandates covering pesticides are the CWA and the Federal Insecticide, Fungicide, and Rodenticide Act. Water quality criteria for the protection of aquatic life have only been developed for a few of the currently used ingredients (EPA, Office of Pesticide Programs). While agricultural run-off is a major source of pesticide pollution in the lower 48 states, in Alaska, other human activities, such as fire suppression on forested lands, forest site preparation, noxious weed control, right-of-way maintenance (e.g., roads, railroads, power lines), algae control in lakes and irrigation canals, riparian habitat restoration, and urban and residential pest control, are the most common sources of these substances.

Pesticides are frequently detected in freshwater and estuarine systems that provide EFH. Pesticides can enter the aquatic environment as single chemicals or as complex mixtures. Direct applications, surface runoff, spray drift, agricultural return flows, and groundwater intrusions are all examples of transport processes that deliver pesticides to aquatic ecosystems. Habitat alteration from pesticides is different from more conventional water quality parameters because, unlike temperature or dissolved oxygen, the presence of pesticides can be difficult to detect due to limitations in proven methodologies. This monitoring may also be expensive. As analytical methodologies have improved in recent years, the number of pesticides documented in fish and their habitats has increased. In addition, pesticides may bioaccumulate in the ecosystem by retention in sediments and detritus, which are then ingested by macroinvertebrates, and which, in turn, are eaten by larger invertebrates and fish (Atlantic States Marine Fisheries Commission 1992).

Potential Adverse Impacts

There are three basic ways that pesticides can adversely affect EFH. These are (1) a direct, lethal or sublethal, toxicological impact on the health or performance of exposed fish; (2) an indirect impairment of aquatic ecosystem structure and function; and (3) a loss of aquatic macroinvertebrates that are prey for fish and aquatic vegetation that provides physical shelter for fish.

Recommended Conservation Measures

The following recommended conservation measures regarding pesticides (including insecticides, herbicides, fungicides, rodenticides, repellents, bactericides, sanitizers, disinfectants, and growth regulators) should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Incorporate integrated pest management and BMPs as part of the authorization or permitting process (Scott et al. 1999). If pesticides must be applied, consider area, terrain, weather, droplet size, pesticide characteristics, and other conditions to avoid or reduce effects to EFH.
- Carefully review labels and ensure that application is consistent with the product's directions.
- Avoid the use of pesticides within 500 linear feet and/or 1,000 aerial feet of anadromous fish bearing streams.
- For forestry vegetation management projects, establish a 35-foot pesticide-free buffer area from any surface or marine water body and require that pesticides not be applied within 200 feet of a public water source (Alaska Department of Environmental Conservation guidelines).
- Consider current and recent meteorological conditions. Rain events may increase pesticide runoff into adjacent water bodies. Saturated soils may inhibit pesticide penetration.
- Do not apply pesticides when wind speeds exceed 10 mph.
- Begin application of pesticide products nearest to the aquatic habitat boundary and proceed away from the aquatic habitat; do not apply towards a water body.

5.1.3 Urban and Suburban Development

Urban and suburban development is most likely the greatest non-fishing threat to EFH (NMFS 1998 a, 1998b). Urban and suburban development and the corresponding infrastructure result in four broad categories of impacts to aquatic ecosystems: hydrological, physical, water quality, and biological (CWP 2003).

Potential Adverse Impacts

Potential impacts to EFH most directly related to general urban and suburban development discussed below are the watershed effects of land development, including stormwater runoff. Other development-related impacts are discussed in later sections of this document, including dredging, wetland fill, and shoreline construction.

Development activities within watersheds and in coastal marine areas can impact EFH on both long and short timeframes. The Center for Watershed Protection (CWP) made a comprehensive review of the impacts associated with impervious cover and urban development and found a negative relationship between watershed development and 26 stream quality indicators (CWP 2003). The primary impacts include (1) the loss of hyporheic zones (the region beneath and next to streams where surface and groundwater mix), and riparian and shoreline habitat and vegetation; and (2) runoff. Removal of riparian and upland vegetation has been shown to increase stream water temperatures, reduce supplies of LWD, and reduce sources of prey and nutrients to the water system. An increase in impervious surfaces in a watershed, such as the addition of new roads, buildings, bridges, and parking facilities, results in a decreased infiltration to groundwater and increased runoff volumes. This also has the potential to adversely affect water quality and the shape of the hydrograph in downstream water bodies (i.e., estuaries and coastal waters).

Recommended Conservation Measures

The following recommended conservation measures should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH where threats of impacts from urban and suburban development exist.

- Implement BMPs for sediment control during construction and maintenance operations (USEPA 1993).
- Avoid using hard engineering structures for shoreline stabilization and channelization when possible.
- Encourage comprehensive planning for watershed protection, and avoid or minimize filling and building in coastal and riparian areas affecting EFH.
- Where feasible, remove obsolete impervious surfaces from riparian and shoreline areas, and reestablish water regime, wetlands, and native vegetation.
- Protect and restore vegetated buffer zones of appropriate width along streams, lakes, and wetlands that include or influence EFH.
- Manage stormwater to replicate the natural hydrologic cycle, maintaining natural infiltration and runoff rates to the maximum extent practicable.
- Where instream flows are insufficient to maintain water quality and quantity needed for EFH, establish conservation guidelines for water use permits, and encourage the purchase or lease of water rights and the use of water to conserve or augment instream flows.
- Use the best available technologies in upgrading wastewater systems to avoid combined sewer overflow problems and chlorinated sewage discharges into rivers, estuaries, and the ocean.
- Design and install proper wastewater treatment systems.
- Where vegetated swales are not feasible, install and maintain oil/water separators to treat runoff from impervious surfaces in areas adjacent to marine or anadromous waters.

5.1.4 Road Building and Maintenance

Roads and trails have always been part of man's impact on his environment (Luce and Crowe 2001). Federal, state, and local transportation departments devote huge budgets to construction and upgrading of roads. As in other places, roads play an important part in access and thus are vital to the economy of Alaska (Connor 2007).

Potential Adverse Impacts

Today's road design construction and management practices have improved from the past. Roads however, still have a negative effect on the biotic integrity of both terrestrial and aquatic ecosystems (Trombulak and Frissell 2000), and the effects of roads on aquatic habitat can be profound. Potential adverse impacts to aquatic habitats resulting from existence of roads in watersheds include (1) increased surface erosion, including mass wasting events, and deposition of fine sediments; (2) changes in water temperature; (3) elimination or introduction of migration barriers such as culverts; (4) changes in streamflow; (5) introduction of invasive species; and (6) changes in channel configuration, and (7) the concentration and introduction of polycyclic aromatic hydrocarbons, heavy metals and other pollutants.

Recommended Conservation Measures

The following conservation measures should be viewed as options to avoid and minimize adverse impacts from road building and maintenance and promote the conservation, enhancement, and proper functioning of EFH.

- Roads should be sited to avoid sensitive areas such as streams, wetlands, and steep slopes to the extent practicable.
- Build bridges rather than culverts for stream crossings when possible. If culverts are to be used, they should be sized, constructed, and maintained to match the gradient and width of the stream, so as to accommodate design flood flows; they should be large enough to provide for migratory passage of adult and juvenile fishes.
- Design bridge abutments to minimize disturbances to stream banks, and place abutments outside of the floodplain whenever possible.
- Specify erosion control measures in road construction plans.
- Avoid side casting of road materials on native surfaces and into streams.
- Use only native vegetation in stabilization plantings.
- Use seasonal restrictions to avoid impacts to habitat during species critical life history stages (e.g., spawning and egg development periods).
- Properly maintain roadway and associated stormwater collection systems.
- Limit roadway sanding and the use of deicing chemicals during the winter to minimize sedimentation and introduction of contaminants into nearby aquatic habitats.

5.2 Riverine Activities

5.2.1 Mining

Mining within riverine habitats may result in direct and indirect chemical, biological, and physical impacts to habitats within the mining site and surrounding areas during all stages of operations. On site mining activities include exploration, site preparation, mining and milling, waste management, decommissioning or reclamation, and abandonment (NMFS 2004, American Fisheries Society 2000). Mining and its associated activities have the potential to cause adverse effects to EFH from exploration through post-closure. The operation of metal, coal, rock quarries, and gravel pit mines in upland and riverine areas has caused varying degrees of environmental damage in urban, suburban, and rural areas. Some of the most severe damage, however, occurs in remote areas, where some of the most productive fish habitat is often located (Sengupta 1993). In Alaska, existing regulations, promulgated and enforced by other federal and state agencies, are designed to control and manage these changes to the landscape to avoid and minimize impacts. However, while environmental regulations may avoid, limit, control, or offset many potential impacts, mining will, to some degree, always alter landscapes and environmental resources (National Research Council 1999). (Additional information on mining impacts in the marine environment is covered later in this synthesis.)

5.2.1.1 Mineral Mining

Mining and mineral extraction activities take many forms, such as commercial and recreational suction dredging, placer, open pit and surface mining, and contour operations. The process for mineral extraction involves exploration, mine development, mining (extraction), processing and reclamation.

Potential Adverse Impacts

The potential adverse effects of mineral mining on fish populations and EFH are well documented (Farag et al. 2003, Hansen et al. 2002, Brix et al. 2001, Goldstein et al. 1999) and depend on the type, extent, and location of the activities. Impacts associated with the extraction of material from within or near a stream or river bed may include (1) alteration in channel morphology, hydraulics, lateral migration and natural channel meander; (2) increases in channel incision and bed degradation; (3) disruption in pre-existing balance of suspended sediment transport and turbidity; (4) direct impacts to fish spawning and nesting habitats (redds), juveniles, and prey items; (5) simplification of in-channel fluvial processes and LWD deposition; (6) altered surface and ground water regimes and hydro-geomorphic and hyporheic processes; and (7) destruction of the riparian zone during extraction operations. Additional impacts may include mining-related pollution, acid mine drainage, habitat fragmentation and conversion, altered temperature regimes, reduction in oxygen concentration, the release of toxic materials (NMFS 2008), and additional impacts to wetland and riverine habitats. Many of these types of impacts have been previously introduced in the document. The additional discussion that follows is intended to round out the discussion of impacts that have not been previously introduced.

Recommended Conservation Measures

The following measures are adapted from recommendations in Spence et al. (1996), NMFS (2004), and Washington Department of Fish and Wildlife (2009). These conservation recommendations for mineral mining should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- To the extent practicable, avoid mineral mining in waters, water sources and watersheds, riparian areas, hyporheic zones, and floodplains providing habitat for federally managed species.
- Schedule necessary in-water activities when the fewest species/least vulnerable life stages of federally managed species will be present.
- Minimize spillage of dirt, fuel, oil, toxic materials, and other contaminants into EFH. Prepare a spill prevention plan if appropriate.
- Treat and test wastewater (acid neutralization, sulfide precipitation, reverse osmosis, electrochemical, or biological treatments) and recycle on site to minimize discharge to streams.
- Minimize the effects of sedimentation on fish habitat, using methods such as contouring, mulching, construction of settling ponds, and sediment curtains. Monitor turbidity during operations, and cease operations if turbidity exceeds predetermined threshold levels.
- If possible, reclaim, rather than bury, mine waste that contains heavy metals, acid materials, or other toxic compounds to limit the possibility of leachate entering groundwater.
- Restore natural contours and use native vegetation to stabilize and restore habitat function to the extent practicable. Monitor the site to evaluate performance.
- Minimize the aerial extent of ground disturbance and stabilize disturbed lands to reduce erosion.
- For large scale mining operations, stochastic models should be employed to make predictions of ground and surface hydrologic impacts and acid generating potential in mine pits and tailing impoundments.

5.2.1.2 Sand and Gravel Mining

In Alaska, riverine sand and gravel mining is extensive and can involve several methods: wet-pit mining (i.e., removal of material from below the water table); dry-pit mining on beaches, exposed bars, and ephemeral streambeds; and subtidal mining.

Potential Adverse Impacts

Primary impacts associated with riverine sand and gravel mining activities include (1) turbidity plumes and re-suspension of sediment and nutrients, (2) removal of spawning habitat, and (3) alteration of channel morphology. These often lead to secondary impacts including alteration of migration patterns, physical and thermal barriers to upstream and downstream migration, increased fluctuation in water temperature, decrease in dissolved oxygen, high mortality of early life stages, increased susceptibility to predation, loss of suitable habitat (Packer et al. 2005), decreased nutrients (from loss of floodplain connection and riparian vegetation), and decreased food production (loss of invertebrates) (Spence et al. 1996).

Recommended Conservation Measures

The following recommended conservation measures for sand and gravel mining are adapted from NMFS (2004) and OWRRI (1995). They should be viewed as options to avoid and minimize adverse impacts to EFH due to sand and gravel mining and promote the conservation, enhancement, and proper functioning of EFH.

- To the extent practicable, avoid sand/gravel mining in waters, water sources and watersheds, riparian areas, hyporheic zones and floodplains providing habitat for federally managed species.
- Identify upland or off-channel (where the channel will not be captured) gravel extraction sites as alternatives to gravel mining in or adjacent to EFH, if possible.
- If operations in EFH cannot be avoided, design, manage, and monitor sand and gravel mining operations to minimize potential direct and indirect impacts to living marine resources and habitat. For example, minimize the areal extent and depth of extraction.
- Include restoration, mitigation, and monitoring plans, as appropriate, in sand/gravel extraction plans.
- Implement seasonal restrictions to avoid impacts to habitat during species critical life history stages.

5.2.2 Organic and Inorganic Debris

Organic and inorganic debris, and its impacts to EFH, extend beyond riverine systems into estuarine coastal and marine systems. To reduce duplication, impacts to other systems are also addressed here.

Natural occurring flotsam, such as LWD and macrophyte wrack (i.e., kelp), plays an important role in aquatic ecosystems, including EFH. LWD and wrack promote habitat complexity and provide structure to various aquatic and shoreline habitats.

The natural deposition of LWD creates habitat complexity by altering local hydrologic conditions, nutrient availability, sediment deposition, turbidity, and other structural habitat conditions. In riverine systems, the physical structure of LWD provides cover for managed species, creates habitats and microhabitats (e.g., pools, riffles, undercut banks, and side channels), retains gravels, and helps maintain underlying channel structure (Abbe and Montgomery 1996, Montgomery et al. 1995, Ralph et al. 1994, Spence et al. 1996). LWD also plays similar role in salt marsh habitats (Maser and Sedell 1994). In benthic ocean habitats, LWD enriches local nutrient availability as deep-sea wood borers convert the wood to fecal matter, providing terrestrially-based carbon to the ocean food chain (Maser and Sedell 1994). When deposited on coastal shorelines, macrophyte wrack creates microhabitats and provides a food source for aquatic and terrestrial organisms such as isopods and amphipods, which play an important role in marine food webs.

Conversely, inorganic flotsam and jetsam debris can negatively impact EFH. Inorganic marine debris is a problem along much of the coastal United States, where it litters shorelines, fouls estuaries, entangles fish and wildlife, and creates hazards in the open ocean. Marine debris consists of a wide variety of man-made materials, including general litter, plastics, hazardous wastes, and discarded or lost fishing gear. The debris enters waterbodies indirectly through rivers and storm water outfalls, as well as directly via ocean dumping and accidental release. Although laws and regulatory programs exist to prevent or control the problem, marine debris continues to affect aquatic resources.

5.2.2.1 Organic Debris Removal

Natural occurring flotsam, such as LWD and macrophyte wrack (i.e., kelp), is sometimes intentionally removed from streams, estuaries, and coastal shores. This debris is removed for a variety of reasons, including dam operations, aesthetic concerns, and commercial and recreational purposes (e.g., active beach log harvests, garden mulch, and fertilizer). However, the presence of organic debris is important for maintaining aquatic habitat structure and function.

Potential Adverse Impacts

The removal of organic debris from natural systems can reduce habitat function, adversely impacting habitat quality. Reductions in LWD inputs to estuaries may also affect the ecological balance of estuarine systems by altering rates and patterns of nutrient transport, sediment deposition, and availability of in-water cover for larval and juvenile fish. In rivers and streams of the Pacific Northwest, the historic practice of removing LWD to improve navigability and facilitate log transport has altered channel morphology and reduced habitat complexity, thereby negatively affecting habitat quality for spawning and rearing salmonids (Koski 1992, Sedell and Luchessa 1982).

Beach grooming and wrack removal can substantially alter the macrofaunal community structure of exposed sand beaches (Dugan et al. 2000). Species richness, abundance, and biomass of macrofauna associated with beach wrack (e.g., sand crabs, isopods, amphipods, and polychaetes) are higher on ungroomed beaches than on those that are groomed (Dugan et al. 2000). The input and maintenance of wrack can strongly influence the structure of macrofauna communities, including the abundance of sand crabs (*Emerita analoga*) (Dugan et al. 2000), an important prey species for some managed species of fish.

Recommended Conservation Measures

The recommended conservation measures for organic debris removal are listed below. They should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Encourage the preservation of LWD whenever possible, removing it only when it presents a threat to life or property.
- Encourage appropriate federal, state, and local agencies to aid in the downstream movement of LWD around dams, culverts, and bridges wherever possible, rather than removing it from the system.
- Educate landowners and recreationalists about the benefits of maintaining LWD.
- Localize beach grooming practices, and minimize them whenever possible.
- Advise gardeners to only harvest dislodged, dead kelp and leave live, growing kelp (whether dislodged or not).

5.2.2.2 Inorganic Debris

Inorganic debris in the marine environment is a chronic problem along much of the U.S. coast, resulting in littered shorelines and estuaries with varying degrees of negative effects to coastal ecosystems. Nationally, land-based sources of marine debris account for about 80 percent of the marine debris on beaches and in U.S. waters. Debris can originate from combined sewer overflows and storm drains, stormwater runoff, landfills, solid waste disposal, poorly maintained garbage bins, floating structures, and general littering of beaches, rivers, and open waters. It generally enters waterways indirectly through rivers and storm drains or by direct ocean dumping. Ocean-based sources of debris also create problems for managed species. These include discarded or lost fishing gear (NMFS 2008), and galley waste and trash from commercial merchant, fishing, military, and other vessels.

Potential Adverse Impacts

Land and ocean sourced inorganic marine debris is a very diverse problem, and adverse effects to EFH are likewise varied. Floating or suspended trash can directly affect managed species that consume or are entangled in it. Toxic substances in plastics can kill or impair fish and invertebrates that use habitat polluted by these materials. The chemicals that leach from plastics can persist in the environment and can bioaccumulate through the food web.

Once floatable debris settles to the bottom of estuaries, coastal and open ocean areas, it can continue to cause environmental problems. Plastics and other materials with a large surface area can cover and suffocate immobile animals and plants, creating large spaces devoid of life. Currents can carry suspended debris to underwater reef habitats where the debris can become snagged, damaging these sensitive habitats. The typical floatable debris from combined sewer overflows includes street litter, sewage containing viral and bacterial pathogens, pharmaceutical by-products from human excretion, and pet wastes. Pathogens can also contaminate shellfish beds and reefs.

Recommended Conservation Measures

Pollution prevention and improved waste management can occur through regulatory controls and best management practices. The recommended conservation measures for minimizing inorganic debris listed in the section below should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Encourage proper trash disposal, particularly in coastal and ocean settings, and participate in coastal cleanup activities.
- Advocate for local, state and national legislation that rewards proper disposal of debris.
- Encourage enforcement of regulations addressing marine debris pollution and proper disposal.
- Provide resources and technical guidance for development of studies and solutions addressing the problem of marine debris.
- Educate the public on the impact of marine debris and provide guidance on how to reduce or eliminate the problem.
- Implement structural controls that collect and remove trash before it enters nearby waterways.
- Consider the use of centrifugal separation to physically separate solids and floatables from water in combined sewer outflows.
- Encourage the development of incentives and funding mechanisms to recover lost fishing gear.

- Require all existing and new commercial construction projects near the coast to develop and implement refuse disposal plans.

5.2.3 Dam Operation

Dams provide sources of hydropower, water storage, and flood control. Construction and operation of dams can affect basic hydrologic and geomorphic function including the alteration of physical, biological, and chemical processes that, in turn, can have effects on water quality, timing, quantity, and alter sediment transport.

Potential Adverse Impacts (adapted from NMFS 2008)

The effects of dam construction and operation on fish and aquatic habitat include (1) complete or partial upstream and downstream migratory impediment; (2) water quality and flow pattern alteration; (3) alteration to distribution and function of ice, sediment and nutrient budgets; (4) alterations to the floodplain, including riparian and coastal wetland systems and associated functions and values; and (5) thermal impacts. Dam construction and operations can impede or block anadromous fish passage and other aquatic species migration in streams and rivers. Unless proper fish passage structures or devices are operational, dams can either prevent access to productive upstream spawning and rearing habitat or can alter downstream juvenile migration. Turbines, spillways, bypass systems, and fish ladders also affect the quality and quantity of EFH available for salmon passage in streams and rivers (Pacific Fishery Management Council 1999). The construction of a dam can fragment habitat, resulting in alterations to both upstream and downstream biogeochemical processes.

Recommended Conservation Measures (adapted from NMFS 2008)

The following conservation recommendations regarding dams should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Avoid construction of new dam facilities, where possible.
- Construct and design facilities with efficient and functional upstream and downstream adult and juvenile fish passage which ensures safe, effective, and timely passage.
- Operate dams within the natural flow fluctuations rates and timing and, when possible, mimic the natural hydrograph, allow for sediment and wood transport, and consider and allow for natural ice function. Monitor water flow and reservoir flow fluctuation.
- Understand longer term climatic and hydrologic patterns and how they affect habitat; plan project design and operation to minimize or mitigate for these changes.
- Use seasonal restrictions for construction, maintenance, and operation of dams to avoid impacts to habitat during species' critical life history stages.
- Develop and implement monitoring protocols for fish passage.
- Retrofit existing dams with efficient and functional upstream and downstream fish passage structures.
- Construct dam facilities with the lowest hydraulic head practicable for the project purpose. Site the project at a location where dam height can be reduced.
- Downstream passage should prevent adults and juveniles from passing through the turbines and provide sufficient water downstream for safe passage.
- Coordinate maintenance and operations that require drawdown of the impoundment with state and federal resource agencies to minimize impacts to aquatic resources.
- Develop water and energy conservation guidelines for integration into dam operation

plans and into regional and watershed-based water resource plans.

- Encourage the preservation of LWD, whenever possible.
- Develop a sediment transport and geomorphic maintenance plan to allow for peak flow mimicking that will result in sediment pulses through the reservoir/dam system and allow high flow geomorphic processes.

5.2.4 Commercial and Domestic Water Use

An increasing demand for potable water, combined with inefficient use of freshwater resources and natural events (e.g., droughts) have led to serious ecological damage worldwide (Deegan and Buchsbaum 2005). Because human populations are expected to continue increasing in Alaska, it is reasonable to assume that water uses, including water impoundments and diversion, will similarly increase (Gregory and Bisson 1997). Groundwater supplies 87 percent of Alaska's 3,500 public drinking water systems. Ninety percent of the private drinking water supplies are groundwater. Each day, roughly 275 million gallons of water derived from aquifers, which directly support riverine systems, are used for domestic, commercial, industrial, and agricultural purposes in Alaska (Groundwater Protection Council 2010). Surface water sources serve a large number of people from a small number of public water systems (e.g., Anchorage and several southeastern communities).

Potential Adverse Impacts

The diversion of freshwater for domestic and commercial uses can affect EFH by (1) altering natural flows and the process associated with flow rates, (2) altering riparian habitats by removing water or by submersion of riparian areas, (3) removing the amount and altering the distribution of prey bases, (4) affecting water quality, and (5) entrapping fishes. Water diversions can involve either withdrawals (reduced flow) or discharges (increased flow).

Recommended Conservation Measures

These conservation measures for commercial and domestic water use should be viewed as options to avoid and minimize adverse impacts from commercial and domestic water use and promote the conservation, enhancement, and proper functioning of EFH.

- Design water diversion and impoundment projects to create flow conditions that provide for adequate fish passage, particularly during critical life history stages. Avoid low water levels that strand juveniles and dewater redds. Incorporate juvenile and adult fish passage facilities on all water diversion projects (e.g., fish bypass systems). Install screens at water diversions on fish-bearing streams, as needed.
- Maintain water quality necessary to support fish populations by monitoring and adjusting water temperature, sediment loads, and pollution levels.
- Maintain appropriate flow velocity and water levels to support continued stream functions. Maintain and restore channel, floodplain, riparian, and estuarine conditions.
- Where practicable, ensure that mitigation is provided for unavoidable impacts to fish and their habitat.

5.3 Estuarine Activities

A large portion of Alaska's population resides near the state's 33,904-mile coastline (NOAA 2010). The dredging and filling of coastal wetlands for commercial and residential development, port, and harbor development directly removes important wetland habitat and alters the habitat surrounding the developed area. Physical changes from shoreline construction can result in secondary impacts such as increased suspended sediment loading, shading from piers and wharves, as well as introduction of chemical contamination from land-based human activities (Robinson and Pederson 2005). Even development projects that appear to have minimal individual impacts can have significant cumulative effects on the aquatic ecosystem (NMFS 2008).

5.3.1 Dredging

The construction of ports, marinas, and harbors typically involves dredging sediments from intertidal and subtidal habitats to create navigational channels, turning basins, anchorages, and berthing docks. Additionally, periodic dredging is used to maintain the required depths after sediment is deposited into these facilities. Dredging is also used to create deepwater navigable channels or to maintain existing channels that periodically fill with sediments. (Impacts from dredging from marine mining are also addressed later.)

Potential Adverse Impacts

Dredging activities can adversely affect benthic and water-column habitat. The environmental effects of dredging on managed species and their habitat can include (1) direct removal/burial of organisms; (2) turbidity and siltation, including light attenuation from turbidity; (3) contaminant release and uptake, including nutrients, metals, and organics; (4) release of oxygen consuming substances (e.g., chemicals and bacteria); (5) entrainment; (6) noise disturbances; and (7) alteration to hydrodynamic regimes and physical habitat.

Recommended Conservation Measures

The recommended conservation measures for dredging are listed in the following section. They should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Avoid new dredging in sensitive habitat areas to the maximum extent practicable.
- Reduce the area and volume of material to be dredged to the maximum extent practicable.
- Avoid dredging and placement of equipment used in conjunction with dredging operations in special aquatic sites and other high value habitat areas.
- Implement seasonal restrictions to avoid impacts to habitat during species critical life history stages (e.g., spawning season, egg, and larval development period).
- Utilize BMPs to limit and control the amount and extent of turbidity and sedimentation.
- For new dredging projects, undertake multi-season, pre-, and post-dredging biological surveys to assess the cumulative impacts to EFH and allow for implementation of adaptive management techniques.
- Prior to dredging, test sediments for contaminants as per U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE) requirements.

- Provide appropriate compensation for significant impacts (short-term, long-term, and cumulative) to benthic environments resulting from dredging.
- Identify excess sedimentation in the watershed that prompts excessive maintenance dredging activities, and implement appropriate management actions, if possible.

5.3.2 Material Disposal and Filling Activities

Material disposal and filling activities can directly remove important habitat and alter the habitat surrounding the developed area. The discharge of dredged materials or the use of fill material in aquatic habitats can result in covering or smothering existing submerged substrates, loss of habitat function, and adverse effects on benthic communities.

5.3.2.1 Disposal of Dredged Material

Potential Adverse Impacts (adapted from NMFS 2008)

The disposal of dredged material can reduce the suitability of water bodies for managed species and their prey by (1) reducing floodwater retention in wetlands; (2) reducing nutrients uptake and release; (3) decreasing the amount of detrital input, an important food source for aquatic invertebrates (Mitsch and Gosselink 1993); (4) habitat conversion through alteration of water depth or substrate type; (5) removing aquatic vegetation and preventing natural revegetation; (6) impeding physiological processes to aquatic organisms (e.g., photosynthesis, respiration) caused by increased turbidity and sedimentation (Arruda et al. 1983, Cloern 1987, Dennison 1987, Barr 1993, Benfield and Minello 1996, Nightingale and Simenstad 2001a); (7) directly eliminating sessile or semi-mobile aquatic organisms via entrainment or smothering (Larson and Moehl 1990, McGraw and Armstrong 1990, Barr 1993, Newell et al. 1998); (8) altering water quality parameters (i.e., temperature, oxygen concentration, and turbidity); and (9) releasing contaminants such as petroleum products, metals, and nutrients (USEPA 2000a).

Recommended Conservation Measures

The following recommended conservation measures for dredged material disposal should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Avoid disposing dredged material in wetlands, submerged aquatic vegetation (SAV) and other special aquatic sites whenever possible.
- Test sediment compatibility for open-water disposal per EPA and USACE requirements.
- Ensure that disposal sites are properly managed and monitored to minimize impacts associated with dredge material.
- Where long-term maintenance dredging is anticipated, acquire and maintain disposal sites for the entire project life.
- Encourage beneficial uses of dredged materials.

5.3.2.2 Fill Material

Like the discharge of dredged material, the discharge of fill material to create upland areas can remove productive habitat and eliminate important habitat functions.

Potential Adverse Impacts

Adverse impacts to EFH from the introduction of fill material include (1) loss of habitat function and (2) changes in hydrologic patterns.

Recommended Conservation Measures

The following recommended conservation measures for the discharge of fill material should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Federal, state, and local resource management and permitting agencies should address the cumulative impacts of fill operations on EFH.
- Minimize the areal extent of any fill in EFH, or avoid it entirely.
- Consider alternatives to the placement of fill into areas that support managed species.
- Fill should be sloped to maintain shallow water, photic zone productivity; allow for unrestricted fish migration; and provide refugia for juvenile fish.
- In marine areas of kelp and other aquatic vegetation, fill (including artificial structure fill reefs) should be designed to maximize kelp colonization and provide areas for juvenile fish to find shelter from higher currents and exposure to predators.
- Fill materials should be tested and be within the neutral range of 7.5 to 8.4 pH.

5.3.3 Vessel Operations, Transportation, and Navigation

In Alaska, the growth in coastal communities is putting demands on port districts to increase infrastructure to accommodate additional vessel operations for cargo handling and marine transportation. Port expansion has become an almost continuous process due to economic growth, competition between ports, and significant increases in vessel size. In addition, increasing boat sales have put more pressure on improving and building new harbors, an important factor in Alaska because of the limited number of roads.

Potential Adverse Impacts

Activities associated with the expansion of port facilities, vessel/ferry operations, and recreational marinas can directly and indirectly impact EFH. Impacts include (1) loss and conversion of habitat; (2) altered light regimes and loss of submerged aquatic vegetation; (3) altered temperature regimes; (4) siltation, sedimentation, and turbidity; (5) contaminant releases; and; and (6) altered tidal, current, and hydrologic regimes.

Recommended Conservation Measures

The following recommended conservation measures for vessel operations, transportation infrastructure, and navigation, should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Locate marinas in areas of low biological abundance and diversity.
- Leave riparian buffers in place to help maintain water quality and nutrient input.
- Include low-wake vessel technology, appropriate routes, and BMPs for wave attenuation structures as part of the design and permit process.
- Incorporate BMPs to prevent or minimize contamination from ship bilge waters, antifouling paints, shipboard accidents, shipyard work, maintenance dredging and disposal, and nonpoint source contaminants from upland facilities related to vessel operations and navigation.

- Locate mooring buoys in water deep enough to avoid grounding and to minimize the effects of prop wash.
- Use catchment basins for collecting and storing surface runoff to remove contaminants prior to delivery to any receiving waters.
- Locate facilities in areas with enough water velocity to maintain water quality levels within acceptable ranges.
- Locate marinas where they do not interfere with natural processes so as to affect adjacent habitats.
- To facilitate movement of fish around breakwaters, breach gaps and construct shallow shelves to serve as "fish benches," as appropriate.
- Harbor facilities should be designed to include practical measures for reducing, containing, and cleaning up petroleum spills.

5.3.4 Invasive Species

Introductions of invasive species into estuarine, riverine, and marine habitats have been well documented (Rosecchi et al. 1993, Kohler and Courtenay 1986, Spence et al. 1996) and can be intentional (e.g., for the purpose of stock or pest control) or unintentional (e.g., fouling organisms). Exotic fish, shellfish, pathogens, and plants can be spread via shipping, recreational boating, aquaculture, biotechnology, and aquariums. The introduction of nonindigenous organisms to new environments can have many severe impacts on habitat (Omori et al. 1994).

Invasive aquatic species that are considered high priority threats to Alaska's marine waters include Atlantic salmon (*Salmo salar*), green crab (*Carcinus maenas*), Chinese mitten crab (*Eriocheir sinensis*), signal crayfish (*Pacifastacus leniuaculus*), zebra mussels (*Dreissena polymorpha*), New Zealand mudsnail (*Potamopyrgus antipodarum*), saltmarsh cordgrass (*Spartina alterniflora*), purple loosestrife (*Lythrum salicaria*), and tunicates (*Botrylloides violaceus* and *Didemnum vexillum*).[2]

Potential Adverse Impacts

Invasive species can create five types of negative effects on EFH: (1) habitat alteration, (2) trophic alteration, (3) gene pool alteration, (4) spatial alteration, and (5) introduction of diseases.

Recommended Conservation Measures

The following recommended conservation measures for invasive species should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Uphold fish and game regulations of the Alaska Board of Fisheries (AS 16.05.251) and Board of Game (AS 16.05.255), which prohibit and regulate the live capture, possession, transport, or release of native or exotic fish or their eggs.
- Adhere to regulations and use best management practices outlined in the State of Alaska Aquatic Nuisance Species Management Plan (Fay 2002).

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[2] http://www.adfg.state.ak.us/special/invasive/invasive.ph

- Encourage vessels to perform a ballast water exchange in marine waters to minimize the possibility of introducing invasive estuarine species into similar habitats.
- Discourage vessels that have not performed a ballast water exchange from discharging their ballast water into estuarine receiving waters.
- Require vessels brought from other areas over land via trailer to clean any surfaces that may harbor non-native plant or animal species (e.g., propellers, hulls, anchors, fenders).
- Treat effluent from public aquaria displays and laboratories and educational institutes using non-native species before discharge.
- Encourage proper disposal of seaweeds and other plant materials used for packing purposes when shipping fish or other animals.
- Undertake a thorough scientific review and risk assessment before any non-native species are introduced.

5.3.5 Pile Installation and Removal (From NMFS 2005)

Pilings are an integral component of many overwater and in-water structures. They provide support for the decking of piers and docks, function as fenders and dolphins to protect structures, support navigation markers, and help in the construction of breakwaters and bulkheads. Materials used in pilings include steel, concrete, wood (both treated and untreated), plastic, or a combination thereof. Piles are usually driven into the substrate by using either impact or vibratory hammers.

5.3.5.1 Pile Driving

Potential Adverse Impacts

Pile driving can generate intense underwater sound pressure waves that may adversely affect EFH. These pressure waves have been shown to injure and kill fish (CalTrans 2001, Longmuir and Lively 2001, Stotz and Colby 2001, Stadler, pers. obs. 2002). Fish injuries associated directly with pile driving are poorly studied, but include rupture of the swim bladder and internal hemorrhaging (CalTrans 2001, Abbott and Bing-Sawyer 2002, Stadler pers. obs. 2002). Sound pressure levels (SPLs) 100 decibels (dB) above the threshold for hearing are thought to be sufficient to damage the auditory system in many fishes (Hastings 2002).

The type and intensity of the sounds produced during pile driving depend on a variety of factors, including the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile-driving hammer. Driving large hollow steel piles with impact hammers produces intense, sharp spikes of sound that can easily reach levels injurious to fish. Vibratory hammers, on the other hand, produce sounds of lower intensity, with a rapid repetition rate. A key difference between the sounds produced by impact hammers and those produced by vibratory hammers is the responses they evoke in fish. The differential responses to these sounds are due to the differences in the duration and frequency of the sounds.

Systems using air bubbles have been successfully designed to reduce the adverse effects of underwater SPLs on fish. Confined (i.e., metal or fabric sleeve) and unconfined air bubble systems have been shown to attenuate underwater sound pressures (Longmuir and Lively 2001, Christopherson and Wilson 2002, Reyff and Donovan 2003).

5.3.5.2 Recommended Conservation Measures

The following recommended conservation measures for pile driving should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Install hollow steel piles with an impact hammer at a time of year when larval and juvenile stages of fish species with designated EFH are not present.

If the first measure is not possible, then the following measures regarding pile driving should be incorporated when practicable to minimize adverse effects:

- Drive piles during low tide when they are located in intertidal and shallow subtidal areas.
- Use a vibratory hammer when driving hollow steel piles.
- Implement measures to attenuate the sound should SPLs exceed the 180 dB (re: 1 μPa) threshold.
- Surround the pile with an air bubble curtain system or air-filled coffer dam.
- Use a smaller hammer to reduce sound pressures.
- Use a hydraulic hammer if impact driving cannot be avoided.
- Drive piles when the current is reduced in areas of strong current, to minimize the number of fish exposed to adverse levels of underwater sound.

5.3.5.3 Pile Removal

Potential Adverse Impacts

The primary adverse effect of removing piles is the suspension of sediments, which may result in harmful levels of turbidity and release of contaminants contained in those sediments (see earlier). Vibratory pile removal tends to cause the sediments to slough off at the mudline, resulting in relatively low levels of suspended sediments and contaminants. Breaking or cutting the pile below the mudline may suspend only small amounts of sediment, providing that the stub is left in place, and little digging is required to access the pile. Direct pull or use of a clamshell to remove broken piles may, however, suspend large amounts of sediment and contaminants. When the piling is pulled from the substrate using these two methods, sediments clinging to the piling will slough off as it is raised through the water column, producing a potentially harmful plume of turbidity and/or contaminants. The use of a clamshell may suspend additional sediment if it penetrates the substrate while grabbing the piling.

While there is a potential to adversely affect EFH during the removal of piles, many of the piles removed in Alaska are old creosote-treated timber piles. In some cases, the long-term benefits to EFH obtained by removing a chronic source of contamination may outweigh the temporary adverse effects of turbidity.

Recommended Conservation Measures

The following recommended conservation measures for pile removal should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Remove piles completely rather than cutting or breaking them off, if they are structurally sound.

- Minimize the suspension of sediments and disturbance of the substrate when removing piles. Measures to help accomplish this include, but are not limited to, the following:
    - When practicable, remove piles with a vibratory hammer.
    - Remove the pile slowly to allow sediment to slough off at, or near, the mudline.
    - The operator should first hit or vibrate the pile to break the bond between the sediment and the pile.
    - Encircle the pile, or piles, with a silt curtain that extends from the surface of the water to the substrate.
- Complete each pass of the clamshell to minimize suspension of sediment if pile stubs are removed with a clamshell.
- Place piles on a barge equipped with a basin to contain attached sediment and runoff water after removal.
- Using a pile driver, drive broken/cut stubs far enough below the mudline to prevent release of contaminants into the water column as an alternative to their removal.

5.3.6 Overwater Structures (from NMFS 2005)

Overwater structures include commercial and residential piers and docks, floating breakwaters, barges, rafts, booms, and mooring buoys. These structures typically are located in intertidal areas out to about 49 feet (15 meters) below the area exposed by the mean lower low tide (i.e., the shallow subtidal zone).

Potential Adverse Impacts

Overwater structures and associated developments may adversely affect EFH in a variety of ways, primarily by (1) changes in ambient light conditions, (2) alteration of the wave and current energy regime, (3) introduction of contaminants into the marine environment, and (4) activities associated with the use and operation of the facilities (Nightingale and Simenstad 2001b).

Recommended Conservation Measures

The following recommended conservation measures for overwater structures should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Use upland boat storage whenever possible to minimize need for overwater structures.
- Locate overwater structures in deep enough waters to avoid intertidal and shade impacts, minimize or preclude dredging, minimize groundings, and avoid displacement of submerged aquatic vegetation, as determined by a preconstruction survey.
- Design piers, docks, and floats to be multiuse facilities to reduce the overall number of such structures and to limit impacted nearshore habitat.
- Incorporate measures that increase the ambient light transmission under piers and docks.
    - Maximize the height and minimize the width to decrease the shade footprint.
    - Use reflective materials on the underside of the dock to reflect ambient light.
    - Use the fewest number of pilings necessary to support the structures.

    - Align piers, docks, and floats in a north-south orientation to allow the arc of the sun to cross perpendicular to the structure and to reduce the duration of light limitation.

- Use floating rather than fixed breakwaters whenever possible, and remove them during periods of low dock use. Encourage seasonal use of docks and off-season haul-out.
- Locate floats in deep water to avoid light limitation and grounding impacts to the intertidal or shallow subtidal zone.
- Maintain at least 1 foot (0.30 meter) of water between the substrate and the bottom of the float at extreme low tide.
- Conduct in-water work when managed species and prey species are least likely to be impacted.
- To the extent practicable, avoid the use of treated wood timbers or pilings.
- Mitigate for unavoidable impacts to benthic habitats.

5.3.7 Flood Control/Shoreline Protection (from NMFS 2005)

Structures designed to protect humans from flooding events can result in varying degrees of change in the physical, chemical, and biological characteristics of shoreline and riparian habitat. These structures also can have long-term adverse effects on tidal marsh and estuarine habitats. Tidal marshes are highly variable, but typically have freshwater vegetation at the landward side, saltwater vegetation at the seaward side, and gradients of species in between that are in equilibrium with the prevailing climatic, hydrographic, geological, and biological features of the coast. These systems normally drain through tidal creeks that empty into the bay or estuary. Freshwater entering along the upper edges of the marsh drains across the surface and enters the tidal creeks. Structures placed for coastal shoreline protection may include concrete or wood seawalls, rip-rap revetments (sloping piles of rock placed against the toe of the dune or bluff in danger of erosion from wave action), dynamic cobble revetments (natural cobble placed on an eroding beach to dissipate wave energy and prevent sand loss), vegetative plantings, and sandbags.

Potential Adverse Impacts

Dikes, levees, ditches, or other water controls at the upper end of a tidal marsh can cut off all tributaries feeding the marsh, preventing the flow of freshwater, annual renewal of sediments and nutrients, and the formation of new marshes. Water controls within the marsh can intercept and carry away freshwater drainage, thus blocking freshwater from flowing across seaward portions of the marsh, or conversely increase the speed of runoff of freshwater to the bay or estuary. This can result in lowering the water table, which may permit saltwater intrusion into the marsh, and create migration barriers for aquatic species. In deeper channels where anoxic conditions prevail, large quantities of hydrogen sulfide may be produced that are toxic to marsh grasses and other aquatic life (NMFS 2008). Acid conditions of these channels can also result in release of heavy metals from the sediments.

Long-term effects of shoreline protection structures on tidal marshes include land subsidence (sometimes even submergence), soil compaction, conversion to terrestrial vegetation, greatly reduced invertebrate populations, and general loss of productive wetland characteristics (NMFS 2005). Alteration of the hydrology of coastal salt marshes can reduce estuarine productivity, restrict suitable habitat for aquatic species, and result in salinity extremes during droughts and floods (NMFS 2008). Armoring shorelines to prevent erosion and to maintain or create shoreline real estate can reduce the amount of intertidal habitat, and affects nearshore processes and the ecology of numerous species (Williams and Thom 2001). Hydraulic effects on the shoreline include increased energy seaward of the armoring, reflected wave energy, dry beach narrowing, substrate coarsening, beach steepening, changes in sediment storage capacity, loss of organic debris, and downdrift sediment starvation (Williams and Thom 2001). Installation of breakwaters and jetties can result in community changes from burial or removal of resident biota, changes in cover and preferred prey species, and predator attraction (Williams and Thom 2001). As with armoring, breakwaters and jetties modify hydrology and nearshore sediment transport, as well as movement of larval forms of many species (Williams and Thom 2001).

Recommended Conservation Measures

The following recommended conservation measures for flood and shoreline protection should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Avoid or minimize the loss of coastal wetlands as much as possible.
- Do not dike or drain tidal marshlands or estuaries.
- Wherever possible, use soft in lieu of “hard” shoreline stabilization and modifications.
- Ensure that the hydrodynamics and sedimentation patterns are properly modeled and that the design avoids erosion to adjacent properties when “hard” shoreline stabilization is deemed necessary.
- Include efforts to preserve and enhance fishery habitat to offset impacts.
- Avoid installing new water control structures in tidal marshes and freshwater streams.
- Ensure water control structures are monitored for potential alteration of water temperature, dissolved oxygen concentration, and other parameters.
- Use seasonal restrictions to avoid impacts to habitat during critical life history stages.
- Address the cumulative impacts of development activities in the review process for flood control and shoreline protection projects.
- Use an adaptive management plan with ecological indicators to oversee monitoring and to ensure that mitigation objectives are met. Take corrective action as needed.

5.3.8 Log Transfer Facilities/In-Water Log Storage (from NMFS 2005)

Rivers, estuaries, and bays were historically the primary ways to transport and store logs in the Pacific Northwest, and log storage continues in some tidal areas today. Using estuaries and bays and nearby uplands for storage of logs is common in Alaska, with most log transfer facilities (LTFs) found in Southeast Alaska and a few located in Prince William Sound. LTFs are facilities that are constructed wholly or in part in waterways and used to transfer commercially harvested logs to or from a vessel or log raft, or for consolidating logs for incorporation into log rafts (USEPA 2000b). LTFs may use a crane, A-frame structure, conveyor, slide, or ramp to move logs from land into the water. Logs can also be placed in the water at the site by helicopters.

Potential Adverse Impacts

Log handling and storage in the estuaries and intertidal zones can result in modification of benthic habitat and water quality degradation within the area of bark deposition (Levings and Northcote 2004). EFH may be physically impacted by activities associated with LTFs. LTFs may cause shading and other indirect effects similar in many ways to those of floating docks and other over-water structures (see earlier).

Recommended Conservation Measures

The following recommended conservation measures for log transfer and storage facilities should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

The physical, chemical, and biological impacts of LTF operations can be substantially reduced by adherence to appropriate siting and operational constraints. Adherence to the Alaska Timber Task Force (ATTF) operational and siting guidelines and BMPs in the National Pollutant Discharge Elimination System (NPDES) General Permit will reduce (1) the amount of bark and wood debris that enters the marine and coastal environment, (2) the potential for displacement or harm to aquatic species, and (3) the accumulation of bark and wood debris on the ocean floor. The following conservation measures reflect those guidelines.[3]

- Restrict or eliminate storage and handling of logs from waters where state and federal water quality standards cannot be met at all times outside of the authorized zone of deposition.
- Minimize potential impacts of log storage by employing effective bark and wood debris control, collection, and disposal methods at log dumps, raft building areas, and mill-side handling zones; avoiding free-fall dumping of logs; using easy let-down devices for placing logs in the water; and bundling logs before water storage (bundles should not be broken except on land and at millside).
- Do not store logs in the water if they will ground at any time or shade sensitive aquatic vegetation such as eelgrass.
- Avoid siting log-storage areas and LTFs in sensitive habitat and areas important for specified species, as required by the ATTF guidelines.
- Site log storage areas and LTFs in areas with good currents and tidal exchanges.
- Use land-based storage sites where possible.

5.3.9 Utility Line, Cables, and Pipeline Installation

With the continued development of coastal regions comes greater demand for the installation of cables, utility lines for power and other services, and pipelines for water, sewage, and other utilities. The installation of pipelines, utility lines, and cables can have direct and indirect impacts on the offshore, nearshore, estuarine, wetland, beach, and rocky shore coastal zone habitats. Many of the direct impacts occur during construction, such as ground disturbance in the clearing of the right-of-way, access roads, and equipment staging areas. Indirect impacts can include increased turbidity, saltwater intrusion, accelerated erosion, and introduction of urban and industrial pollutants due to ground clearing and construction.

Potential Adverse Impacts

Adverse effects on EFH from the installation of pipelines, utility lines, and cables can occur through (1) destruction of organisms and habitat, (2) turbidity impacts, (3) resuspension and release of contaminants, (4) changes in hydrology, and (5) destruction of vertically complex hard bottom habitat (e.g., hard corals and vegetated rocky reef).

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[3] See also http://www.fs.fed.us/r10/TLMP/F_PLAN/APPEND_G.PDF.

Recommended Conservation Measures

The following recommended conservation measures for cable and utility line installation should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Align crossings along the least environmentally damaging route.
- Use horizontal directional drilling where cables or pipelines would cross anadromous fish streams, salt marsh, vegetated inter-tidal zones, or steep erodible bluff areas adjacent to the intertidal zone.
- Store and contain excavated material on uplands.
- Backfill excavated wetlands with either the same or comparable material capable of supporting similar wetland vegetation, and at original marsh elevations.
- Use existing rights-of-way whenever possible.
- Bury pipelines and submerged cables where possible.
- Remove inactive pipelines and submerged cables unless they are located in sensitive areas (e.g., marsh, reefs, sea grass).
- Use silt curtains or other barriers to reduce turbidity and sedimentation whenever possible.
- Limit access for equipment to the immediate project area. Tracked vehicles are preferred over wheeled vehicles.
- Limit construction equipment to the minimum size necessary to complete the work.
- Conduct construction during the time of year when it will have the least impact on sensitive habitats and species.
- Suspend transmission lines beneath existing bridges or conduct directional boring under streams to reduce the environmental impact.
- For activities on the Continental Shelf, implement the following to the extent practicable:
  - Shunt drill cuttings through a conduit and either discharge the cuttings near the sea floor, or transport them ashore.
  - Locate drilling and production structures, including pipelines, at least 1 mile (1.6 kilometers) from the base of a hard-bottom habitat.
  - Bury pipelines at least 3 feet (0.9 meter) beneath the sea floor whenever possible.
  - Locate alignments along routes that will minimize damage to marine and estuarine habitat.

5.3.10 Mariculture

Productive embayments are often used for commercial culturing and harvesting operations. These locations provide protected waters for geoduck, oyster, and mussel culturing. In 1988, Alaska passed the Alaska Aquatic Farming Act (AAF Act) which is designed to encourage establishment and growth of an aquatic farming industry in the state. The AAF Act establishes four criteria for issuance of an aquatic farm permit, including the requirement that the farm may not significantly affect fisheries, wildlife, or other habitats in an adverse manner. Aquatic farm permits are issued by the Alaska Department of Natural Resources (ADNR).

Potential Adverse Impacts

Shellfish aquaculture tends to have less impact on EFH than finfish aquaculture because the shellfish generally are not fed or treated with chemicals (OSPAR Commission 2009). Adverse impacts to EFH by mariculture operations include (1) risk of introducing undesirable species and disease; (2) physical disturbance of intertidal and subtidal areas; and (3) impacts on estuarine food webs, including disruption of eelgrass habitat (e.g., dumping of shell on eelgrass beds, repeated mechanical raking or trampling, and impacts from predator exclusion netting, though few studies have documented impacts). Hydraulic dredges used to harvest oysters in coastal bays can cause long-term adverse impacts to eelgrass beds by reducing or eliminating the beds (Phillips 1984).

Recommended Conservation Measures

The following recommended conservation measures for mariculture facilities should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Site mariculture operations away from kelp or eelgrass beds.
- Do not enclose or impound tidally influenced wetlands for mariculture.
- Undertake a thorough scientific review and risk assessment before any non-native species are introduced.
- Encourage development of harvesting methods to minimize impacts on plant communities and the loss of food and/or habitat to fish populations during harvesting operations.
- Provide appropriate mitigation for the unavoidable, extensive, or permanent loss of plant communities.
- Ensure that mariculture facilities, spat, and related items transported from other areas are free of nonindigenous species.

5.4 Coastal/Marine Activities

5.4.1 Point-Source Discharges

Point source pollutants are generally introduced via some type of pipe, culvert, or similar outfall structure. These discharge facilities typically are associated with domestic or industrial activities, or in conjunction with collected runoff from roadways and other developed portions of the coastal landscape. Waste streams from sewage treatment facilities and watershed runoff may be combined in a single discharge. Point source discharges introduce inorganic and organic contaminants into aquatic habitats, where they may become bioavailable to living marine resources.

Potential Adverse Impacts (adopted from NMFS 2008)

The Clean Water Act (CWA) includes important provisions to address acute or chronic water pollution emanating from point source discharges. Under the NPDES program, most point-source discharges are regulated by the state or EPA. While the NPDES program has led to ecological improvements in U.S.

waters, point sources continue to introduce pollutants into the aquatic environment, albeit at reduced levels.

Determining the fate and effect of natural and synthetic contaminants in the environment requires an interdisciplinary approach to identify and evaluate all processes sensitive to pollutants. This is critical as adverse effects may be manifested at the biochemical level in organisms (Luoma 1996) in a manner particular to the species or life stage exposed. Exposure to pollutants can inhibit (1) basic detoxification mechanisms, e.g., production of metallothioneins or antioxidant enzymes; (2) disease resistance; (3) the ability of individuals or populations to counteract pollutant-induced metabolic stress; (4) reproductive processes including gamete development and embryonic viability; (5) growth and successful development through early life stages; (6) normal processes including feeding rate, respiration, osmoregulation; and (7) overall Darwinian fitness (Capuzzo and Sassner 1977; Widdows et al. 1990; Nelson et al. 1991; Stiles et al. 1991; Luoma 1996; Thurberg and Gould 2005).

Recommended Conservation Measures

The following recommended conservation measures for point source discharges should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Locate discharge points in coastal waters well away from shellfish beds, sea grass beds, corals, and other similar fragile and productive habitats.
- Reduce potentially high velocities by diffusing effluent to acceptable velocities.
- Determine baseline benthic productivity by sampling before any construction activity.
- Provide for mitigation when degradation or loss of habitat occurs.
- Institute source-control programs that effectively reduce noxious materials.
- Ensure compliance with pollutant discharge permits, which set effluent limitations and/or specify operation procedures, performance standards, or BMPs.
- Treat discharges to the maximum extent practicable.
- Use land-treatment and upland disposal/storage techniques where possible.
- Avoid siting pipelines and treatment facilities in wetlands and streams.

5.4.2 Seafood Processing Waste—Shoreside and Vessel Operation

Seafood processing is conducted throughout much of coastal Alaska. Processing facilities may be vessel-based or located onshore (ADEC 2010a). Seafood processing facilities generally consist of mechanisms to offload the harvest from fishing boats; tanks to hold the seafood until the processing lines are ready to accept them; processing lines, process water, and waste collection systems; treatment and discharge facilities; processed seafood storage areas; and necessary support facilities such as electrical generators, boilers, retorts, water desalinators, offices, and living quarters. In addition, recreational fish cleaning at marinas and small harbors can produce a large quantity of fish waste.

Pollutants of concern from seafood processing wastewater are primarily components of the biological wastes generated by processing raw seafood into a marketable form, chemicals used to maintain sanitary conditions for processing equipment and fish containment structures, and refrigerants (ammonia and freon) that may leak from refrigeration systems used to preserve seafood (ADEC 2010b). Biological wastes include fish parts (e.g., heads, fins, bones, and entrails) and chemicals, which are primarily disinfectants that must be used in accordance with EPA specifications.

Potential Adverse Impacts

Seafood processing operations have the potential to adversely affect EFH through the discharge of nutrients, chemicals, fish byproducts, and "stickwater" (water and entrained organics originating from the draining or pressing of steam-cooked fish products). Seafood processing discharges influence nutrient loading, eutrophication, and anoxic and hypoxic conditions significantly influencing marine species diversity and water quality (Theriault et al. 2006, Roy Consultants 2003, Lotze et al. 2003). Although fish waste is biodegradable, fish parts that are ground to fine particles may remain suspended for some time, thereby overburdening habitats from particle suspension (NMFS 2005). Scum and foam from seafood waste deposits can also occur on the water surface and/or increase turbidity. Turbidity decreases light penetration into the water column, reducing primary production. In addition, stickwater takes the form of a fine gel or slime that can concentrate on surface waters and move onshore to cover intertidal areas.

Recommended Conservation Measures

The following recommended conservation measures for fish processing waste should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- To the maximum extent practicable, base effluent limitations on site-specific water quality concerns.
- Encourage the use of secondary or wastewater treatment systems where possible.
- Do not allow designation of new zones of deposit for fish processing waste and instead seek disposal options that avoid an accumulation of waste.
- Promote sound recreational fish waste management through a combination of fish-cleaning restrictions, public education, and proper disposal of fish waste.
- Encourage alternative uses of fish processing wastes.
- Explore options for additional research.
- Monitor biological and chemical changes to the site of processing waste discharges.

5.4.3 Water Intake Structures/Discharge Plumes

Withdrawals of riverine, estuarine, and marine waters are common for a variety of uses such as to cool power-generating stations and create temporary ice roads and ice ponds. In the case of power plants, the subsequent discharge of heated and/or chemically treated discharge water can also occur.

Potential Adverse Impacts

Water intake structures and effluent discharges can interfere with or disrupt EFH functions in the source or receiving waters by (1) entrainment, (2) impingement, (3) degrading water quality, (4) operation and maintenance, and (5) construction-related impacts.

Recommended Conservation Measures

The following recommended conservation measures for water intakes and discharges should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Locate facilities that rely on surface waters for cooling in areas other than estuaries, inlets, heads of submarine canyons, rock reefs, or small coastal embayments where managed species or their prey concentrate.
- Design intake structures to minimize entrainment or impingement.
- Design power plant cooling structures to meet the best technology available requirements as developed pursuant to section 316(b) of the CWA.
- Regulate discharge temperatures so they do not appreciably alter the ambient temperature to an extent that could cause a change in species assemblages and ecosystem function in the receiving waters.
- Avoid the use of biocides (e.g., chlorine) to prevent fouling where possible.
- Treat all discharge water from outfall structures to meet state water quality standards at the terminus of the pipe.

5.4.4 Oil and Gas Exploration, Development, and Production

Two agencies, the Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement are responsible for regulating oil and gas operations on the Outer Continental Shelf (OCS). The ADNR Division of Oil and Gas exercises similar authority over State waters (ADNR1999). Offshore petroleum exploration, development, and production activities have been conducted in Alaska waters or on the Alaska OCS in since the 1960s (Kenai Peninsula Borough 2004). As demand for energy resources grows, the debate over trying to balance the development of oil and gas resources and the protection of the environment will also continue.

Potential Adverse Impacts

Offshore oil and gas operations can be classified into exploration, development, and production activities (which includes transportation). These activities occur at different depths in a variety of habitats, and can cause an assortment of physical, chemical, and biological disturbances (NMFS 2005, Helvey 2002). (Some of these disturbances are listed below; however, not all of the potential disturbances in this list apply to every type of activity.)

Noise from seismic surveys, vessel traffic, and construction of drilling platforms or islands

Physical alterations to habitat from the construction, presence, and eventual decommissioning and removal of facilities such as islands or platforms, storage and production facilities, and pipelines to onshore common carrier pipelines, storage facilities, or refineries

Waste discharges, including well drilling fluids, produced waters, surface runoff and deck drainage, domestic waste waters generated from the offshore facility, solid waste from wells (drilling muds and cuttings), and other trash and debris from human activities associated with the facility

Oil spills

Platform storage and pipeline decommissioning

The potential disturbances and associated adverse impacts on the marine environment have been reduced through operating procedures required by regulatory agencies and, in many cases, self-imposed by facilities operators. Most of the activities associated with oil and gas operations are conducted under permits and regulations that require companies to minimize impacts or avoid construction in sensitive marine habitats. New technological advances in operating procedures also reduce the potential for impacts.

Recommended Conservation Measures

The following recommended conservation measures for oil and gas exploration and development should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH:

- Avoid the discharge of produced waters into marine waters and estuaries.
- Avoid discharge of muds and cuttings into the marine and estuarine environment.
- To the extent practicable, avoid the placement of fill to support construction of causeways or structures in the nearshore marine environment.
- As required by federal and state regulatory agencies, encourage the use of geographic response strategies that identify EFH and environmentally sensitive areas.
- Evaluate potential impacts to EFH that may result from activities carried out during the decommissioning phase of oil and gas facilities.
- Vessel operations and shipping activities should be familiar with Alaska Geographic Response Strategies which detail environmentally sensitive areas of Alaska's coastline.

5.4.5 Habitat Restoration and Enhancement

Habitat loss and degradation are major, long-term threats to the sustainability of fishery resources (NMFS 2002). Viable coastal and estuarine habitats are important to maintaining healthy fish stocks. Good water quality and quantity, appropriate substrate, ample food sources, and adequate shelter from predators are needed to sustain fisheries. Restoration and/or enhancement of coastal and riverine habitat that supports managed fisheries and their prey will assist in sustaining and rebuilding fish stocks by increasing or improving ecological structure and functions. Habitat restoration and enhancement may include, but is not limited to, improvement of coastal wetland tidal exchange or reestablishment of natural hydrology; dam or berm removal; fish passage barrier removal or modification; road-related sediment source reduction; natural or artificial reef, substrate, or habitat creation; establishment or repair of riparian buffer zones; improvement of freshwater habitats that support anadromous fishes; planting of native coastal wetland and submerged aquatic vegetation; and improvements to feeding, shade or refuge, spawning, and rearing areas that are essential to fisheries.

Potential Adverse Impacts

The implementation of restoration and enhancement activities may have localized and temporary adverse impacts on EFH. Possible impacts can include (1) localized nonpoint source pollution such as influx of sediment or nutrients, (2) interference with spawning and migration periods, (3) temporary removal feeding opportunities, (4) indirect effects from construction phase of the activity, (5) direct disturbance or removal of native species, and (6) temporary or permanent habitat disturbance.

Recommended Conservation Measures

The following recommended conservation measures for habitat restoration and enhancement should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- Use BMPs to minimize and avoid potential impacts to EFH during restoration activities.

    - Use turbidity curtains, hay bales, and erosion mats.
    - Plan staging areas in advance, and keep them to a minimum size.
    - Establish buffer areas around sensitive resources.
    - Remove invasive plant and animal species from the proposed action area before starting work. Plant only native plant species.
    - Establish temporary access pathways before restoration activities.
- Avoid restoration work during critical life stages for fish such as spawning, nursery, and migration.
- Provide adequate training and education for volunteers and project contractors to ensure minimal impact to the restoration site.
- Conduct monitoring before, during, and after project implementation.
- To the extent practicable, mitigate any unavoidable damage to EFH.
- Remove and, if necessary, restore any temporary access pathways and staging areas used.
- Determine benthic productivity by sampling before any construction activity in the case of subtidal enhancement (e.g., artificial reefs). Avoid areas of high productivity to the maximum extent possible.

5.4.6 Marine Mining

Mining activities, which are also described in Sections 3.1.1 and 3.1.2 of the EFH EIS (NMFS 2005), can lead to the direct loss or degradation of EFH for certain species. Offshore mining, such as the extraction of gravel and gold in the Bering Sea, can increase turbidity, and resuspension of organic materials could impact eggs and recently hatched larvae in the area. Mining large quantities of beach gravel can also impact turbidity, and may significantly affect the transport and deposition of sand and gravel along the shore, both at the mining site and down-current (NMFS 2005).

Potential Adverse Impacts

Impacts from mining on EFH include both physical impacts (i.e., intertidal dredging) and chemical impacts (i.e., additives such as flocculates) (NMFS 2005). Physical impacts may include the removal of substrates that serve as habitat for fish and invertebrates; habitat creation or conversion in less productive or uninhabitable sites, such as anoxic holes or silt bottom; burial of productive habitats, such as in near-shore disposal sites (as in beach nourishment); release of harmful or toxic materials either in association with actual mining, or in connection with machinery and materials used for mining; creation of harmful turbidity levels; and adverse modification of hydrologic conditions so as to cause erosion of desirable habitats. Submarine disposal of mine tailings can also alter the behavior of marine organisms.

Recommended Conservation Measures

The following recommended conservation measures for marine mining should be viewed as options to avoid and minimize adverse impacts and promote the conservation, enhancement, and proper functioning of EFH.

- To the extent practicable, avoid mining in waters containing sensitive marine benthic habitat, including EFH (e.g., spawning, migrating, and feeding sites).
- Minimize the areal extent and depth of extraction to reduce recolonization times.

- Monitor turbidity during operations, and cease operations if turbidity exceeds predetermined threshold levels.
- Monitor individual mining operations to avoid and minimize cumulative impacts.
- Use seasonal restrictions as appropriate; to avoid and minimize impacts to EFH during critical life history stages of managed species (e.g., migration and spawning).
- Deposit tailings within as small an area as possible.

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6.0 CUMULATIVE EFFECTS OF FISHING AND NON-FISHING ACTIVITIES ON EFH

This section discusses the cumulative effects of fishing and non-fishing activities on EFH. As identified in Section 4.0, historical fishing practices may have had effects on EFH that have led to declining trends in some of the criteria examined. As described in earlier sections, the effects of current fishing activities on EFH are classified as minimal and temporary or unknown. Additional information and analysis is provided in Appendix B of the EFH EIS (NMFS 2005).

A review of the effects of non-fishing activities on EFH is found in Section 5.0. Additional information and analysis is provided in Appendix G of the EFH EIS. Section 5.0 identifies 29 non-fishing activities for which potential effects. However, the magnitude of these effects cannot currently be quantified with available information. Of the 29 activities, most are described as likely having less than substantial potential effects on EFH. Some of these activities such as urban/suburban development, road building and maintenance (including the placement of fill material), vessel operations/transportation/navigation, silviculture (including LTFs), and point source discharge may have potential cumulative impacts due to the additive and chronic nature of these activities. NMFS does not have regulatory authority over non-fishing activities, but frequently provides recommendations to other agencies to avoid, minimize, or otherwise mitigate the effects of these activities.

Fishing and each activity identified in the analysis of non-fishing activities may not significantly affect the function of EFH. However, the synergistic effect of the combination of all of these activities may be a cause for concern. Unfortunately, available information is not sufficient to assess how the cumulative effects of fishing and non-fishing activities influence the function of EFH on an ecosystem or watershed scale. The magnitude of the combined effect of all of these activities cannot be quantified, so the level of concern is not known at this point.

7.0 RESEARCH APPROACH FOR EFH

The EFH EIS (NMFS 2005) identified a research approach for EFH regarding minimizing fishing impacts. The research approach was revised in 2010 following the Council's EFH 5-year Review for 2010, documented in a Final Summary Report (NPFMC and NMFS 2010).

7.1 Objectives

Reduce impacts. (1) Limit bottom trawling in the AI to areas historically fished and prevent expansion into new areas. (2) Limit bottom contact gear in specified coral garden habitat areas. (3) Restrict higher impact trawl fisheries from a portion of the GOA slope. (4) Increase monitoring for enforcement. (5) Establish a scientific research program.

Benthic habitat recovery. Allow recovery of habitat in a large area with relatively low historic effort.

7.2 Research Questions

Reduce impacts. Does the closure effectively restrict higher-impact trawl fisheries from a portion of the GOA slope? Is there increased use of alternative gears in the GOA closed areas? Does total bottom trawl effort in adjacent open areas increase as a result of effort displaced from closed areas? Do bottom trawls affect these benthic habitats more than the alternative gear types? What are the research priorities? Are fragile habitats in the AI affected by any fisheries that are not covered by the new EFH closures? Are sponge and coral essential components of the habitat supporting FMP species?

Benthic habitat recovery. Did the habitat within closed areas recover or remain unfished because of these closures? Do recovered habitats support more abundant and healthier FMP species? If FMP species are more abundant in the EFH protection areas, is there any benefit in yield for areas that are still fished without EFH protection?

7.3 Research Activities

- Fishing effort data from observers and remote sensing would be used to study changes in bottom trawl and other fishing gear activity in the closed (and open) areas. Effects of displaced fishing effort would have to be considered. The basis of comparison would be changes in the structure and function of benthic communities and populations, as well as important physical features of the seabed, after comparable harvests of target species are taken with each gear type.
- Monitor the structure and function of benthic communities and populations in the newly closed areas, as well as important physical features of the seabed, for changes that may indicate recovery of benthic

habitat. Whether these changes constitute recovery from fishing or just natural variability/shifts requires comparison with an area that is undisturbed by fishing and otherwise comparable.

- Validate the LEI model and improve estimates of recovery rates, particularly for the more sensitive habitats, including coral and sponge habitats in the Aleutian Islands region, possibly addressed through comparisons of benthic communities in trawled and untrawled areas.
- Obtain high resolution mapping of benthic habitats, particularly in the on-shelf regions of the Aleutian Islands.
- Time series of maturity at age should be collected to facilitate the assessment of whether habitat conditions are suitable for growth to maturity.
- In the case of red king crab spawning habitat in southern Bristol Bay, research the current impacts of trawling on habitat in spawning areas and the relationship of female crab distribution with respect to bottom temperature.

7.4 Research Timeframe

Changes in fishing effort and gear types should be readily detectable. Biological recovery monitoring may require an extended period if undisturbed habitats of this type typically include large or long-lived organisms and/or high species diversity. Recovery of smaller, shorter-lived components should be apparent much sooner.

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Appendix E: Research Needs

This following research section reviews the results of a workshop on scallop biology and the effects of scallop dredging on benthic communities (ADF&G 2000). The workshop was held in Kodiak, Alaska during 10-12 June 1999. A review of the history of the Alaskan weathervane scallop fishery was presented. Other speakers presented papers on scallop biology and fisheries in other cold water areas. Topics of the papers included physical and biological variables influencing distribution, impacts of suspended particles on energetics, modeling approaches to identify dredging impacts, effects of long-term dredging, benthic communities associated with scallops, and the importance of protecting areas from fishing. Following the first day of public presentations, a two-day workshop was convened to develop a viable study program for examining the effects of dredging on the scallop's life history, population dynamics, and associated benthic community. The workshop results were intended to be applied to the Alaskan fishery for weathervane scallops, but they are applicable to many scallop fisheries. The working groups identified ten research topics for which information needs to be gathered. Topics include the importance of spatial distribution on fertilization success, the reproductive output of individuals, the importance of nursery areas, scallop behavior and how it may be altered by dredging, factors that affect growth, fishery induced injury and mortality, causes and rates of natural mortality, long-term factors affecting recruitment, effects of scallop dredging on the benthos, and developing harvest strategies for scallops. Also, the working groups recommended that a monitoring program be established that included short- and long-term data gathering, and they identified methods and tools that might be used for this task.

Question 1. How does spatial distribution (distance of its nearest neighbor) affect fertilization success?

Rationale

A key factor in successful scallop recruitment is having a high egg-fertilization rate. Scallop gametes are broadcast into the water and rely on currents to mix sperm and eggs. Because of the dilution of the sperm, males and females need to be close to one another for successful fertilization. Therefore spatial distribution is critical.

Suggested Research Studies

- Laboratory fertilization trials to determine the effects of distance, dilution, and time to fertilization
- Measure fertilization success in the field
- Measure synchronization of spawning in the field
- Model fertilization probabilities and the effects of fisheries on them

Question 2. What is the reproductive output of individuals relative to weight, size and age?

Rationale

The reproductive output of large females is considerably highly than that of recently matured females. Females curtail reproduction when they get to be very old. Thus, size and age structure of the population is important for determining reproductive success. The currant harvest strategy removes the most fecund females by selecting for larger individuals. The consequence of harvesting these large females is not understood.

Suggested Research Studies

- Conduct laboratory studies that measure reproductive output relative to weight, size, and age
- Conduct field studies of reproductive cycle with size, age, and location components
- Construct models linking reproductive output with fertilization success in different areas
- Construct models linking reproductive output with fishing activity

Question 3. Where and when do spat settle, and what constitutes nursery areas?

Rationale

Protecting juveniles is critical to the survival of any harvested species. The spatial relationship between adult and juvenile distributions is unknown. Identifying and protecting nursery areas are commonly used management tools to preserve a resource.

Suggested Research Studies

- Collect information from population surveys and fishery observer programs including benthic and epibenthic species present, and geologic and biogenic structures where juveniles occur
- Identify habitat preferences through laboratory experiments (e.g., temperature, salinity, and food).
- Examine stomachs of potential scallop predators to identify mortality sources and relate to the timing of settlement
- Identify food type and size for larval survival
- Estimate larval duration and growth to determine when spat settle
- Identify oceanographic features that may retain larvae (e.g., fronts, gyres, eddies, currents)
- Develop a larval drift model

Question 4. After settling, what movement behaviors are critical for survival of juvenile and adult scallops, an are these behaviors altered by dredging?

Rationale

The distribution of scallops is critical to reproductive success. Dredge fishing alters the distribution of juvenile and adult scallops. The consequences of this redistribution are unknown, but in adults it may reduce fertilization success. Anecdotal evidence indicates large movements of scallop aggregations sometimes occur.

Suggested Research Studies

- Investigate the scallop’s capacity for movement
- Measure the distance a scallop can swim per unit times as a function of size and season
- Is the scallop’s capacity for movement altered by the effects of dredging?
- What are the effects of handling, aerial exposure, being discarded (e.g., righting response)?
- If juvenile and adult distributions differ, how and when do juveniles migrate into the adult areas?
- Observe movements relative to sediment type, predators, currents (velocities, direction, eddies, gyres), and fishing gear

- Determine if scallops move to re-aggregate after disruption

Question 5. What factors determine growth rates of scallops?

Rationale

Growth rates determine age of recruitment and potential yield to the fishery. There are geographical differences in growth rates that may be related to physical conditions, primary production levels, scallop densities, or genetic characteristics.

Suggested Research Studies

- Determine physical factors that affect growth: temperature/salinity, turbidity, seasonality, storm activity
- Determine biological factors that affect growth: metabolism, food, maturation, genetic (stock) effects on physiology, injury, age, and population density
- Develop a bioenergetic model for growth rates of weathervane scallops

Question 6. What are the effects of fishery-induced injuries and handling on mortality?

Rationale

Dredging can damage scallops, some of which are not brought to the surface. Management strategies need to incorporate this mortality but currently do not for lack of data.

Suggested Research Studies

- Fishery discards
- Injured or disturbed but uncaptured scallops (e.g., lethal versus sublethal, acute versus chronic)

Question 7. What is the natural mortality rate of scallops from recruitment into the fishery onward?

Rationale

Management plans predict natural mortality so sustainable harvest quotas can be set. For scallops natural mortality rates are poorly understood. Mortality rates probably differ with locality, age structure, local physical conditions, and benthic community structure.

Suggested Research Studies

- Specific locations at several fishery and closed areas
- Annual variability at several fishery and closed areas
- What are the factors influencing natural mortality?

Question 8. What factors affect recruitment of scallops?

Rationale

Viable fisheries depend on populations with abundance levels that allow harvest. Population abundance trends are dictated by recruitment. Interannual variability and recruitment depend on environmental processes, which are modified by fishing. In scallops, recruitment is periodic.

Suggested Research Studies

- Compare differences in recruitment between fished and unfished beds
- Identify sources and sinks, at the bed level, of recruiting scallops
- Consider indirect effects of fishing through enhanced settlement, predation, disease, and other factors
- Examine the member-vagrant theory and the ocean factors influencing it
- Develop age-structured models of the populations to estimate recruitment
- Develop methods to estimate juvenile scallop abundance using bottom-sampling devices, surveys of predator stomachs, submersibles
- How does the timing of dredging affect recruitment success (pre- and – post –settlement)?
- Contrast recruitment indices from different areas using age data

Question 9. What is the effect of scallop dredging on the benthos?

Rationale

Dredges alter the structure of the sediment and topography, kill some species, and displace others. Many species affected are commercially important or important prey of other commercially important species (e.g., shrimp, crabs, groundfishes). Dredging may lead to both short- and long-term detrimental consequences for scallops and associated species.

Suggested Research Studies

Geochemical studies need to be performed to:

- Determine how dredging affects geochemical (including organic content) and physical attributes (e.g. topography) of the bottom
- Determine how dredging affects water-column or interface turbidity
- Compare the effects of dredging to natural disturbance (e.g., tidal currents, storm events, runoff from land)

Ecological studies need to be performed to determine:

- Dominant infaunal and epifaunal benthic species and their relationships by bottom type
- How dredging affects benthic mobile epifauna and groundfish (e.g., crabs, flatfishes)
- How dredging affects sessile epifauna (e.g., hydroids, bryozoans, and long-lived species)
- How dredging affects the infuana community structure and successional events
- How dredging affects faunal patchiness within these communities
- What are the consequences of the frequency of dredging on benthic communities?
- What are the consequences of the amount of area dredged on benthic communities?
- Which species settle first into a disturbed area?
- Which predators benefit from dredging?

Question 10. What are the considerations for developing harvest strategies of scallops?

Rationale

In several scallop fisheries around the world overfishing and significant alterations of the benthic community have been demonstrated. The following suggestions may serve to avoid the mistakes in other fisheries and capitalize on successful harvest strategies. It is important to learn from the worldwide experiences associated with various scallop species and the fisheries for these species.

Suggested Research Studies

Beyond the ecological considerations mentioned I this document the following should be addressed and understood in the development of harvest strategies for scallops:

- Stock size relative to the unfished population
- The scallop distribution and proportion of their habitats fished
- How many year classes support the fishery?
- What is the applicability of traditional harvest models for scallops?
- What harvest level or rate is sustainable?
- Is MSY (maximum sustainable yield) appropriate?
- Determine if there are several scallop beds with different abundances in a management area
- What is the appropriate unit for a management area? Is it at the level of a bed or larger?
- Need to consider the effect of scallop removals on spatial distribution relative to critical density
- Size versus age limit: What is optimum age or size of harvest given meat yield and reproduction?
- What are the effects of area closures and rotation on scallop recruitment?
- What is the unit stock, and where do the recruits come from?
- Should areas with persistent recruitment be set aside as nurseries?
- Can we set aside areas of broodstock for fishery enhancement?
- Do different year classes come from different parental sources?
- What is the heritability of growth, and does the fishery affect growth?
- What is the best season for fishing?
- Consider

Reference:

Alaska Department of Fish and Game and University of Alaska Fairbanks. 2000. A workshop examining potential fishing effects on population dynamics and benthic community structure of scallops with emphasis on the weathervane scallop *Patinopecten caurinus* in Alaskan Waters. Alaska Department of Fish and Game, Division of Commercial Fisheries, Special Publication 14, Juneau.

Appendix F: Community Profiles

The following community profiles were excerpted from:

> Jennifer Sepez, Heather Lazrus, Christina Package, Bryan Tilt, and Ismael Vaccaro, 2004. Fishing Communities of the North Pacific, Volume I: Alaska (Draft). Economics and Social Sciences Research Program, Alaska Fisheries Science Center, Seattle, WA.

With the exception of the Seattle profile which was excerpted from:

> Down, M. 2004. Community Profiles for the BSAI crab fisheries. EDAW Inc. San Diego, CA.

This profile was done in connection with the EIS for the BSAI crab rationalization initiative and is thus heavily focused upon the BSAI crab fishery.

Additional demographic information on these communities may be found in those documents. Communities included in this section are those which have had landings of scallops from 1990-2003. Information contained in the profiles is intended to give an overview of the community, demographics and involvement in North Pacific Fisheries with particular emphasis placed upon harvest and processing of scallops (listed under *other* shellfish). Additional information on fishing communities in Alaska may be found in Sepez et al (2004).

Cordova

Cordova is located on the western edge of the Copper River Delta in the Chugach National Forest in the Gulf of Alaska and at the southeastern most end of Prince William Sound. The community was built on Orca Inlet, at the base of Eyak Mountain. The area encompasses 61.4 square miles of land and 14.3 square miles of water.

Demographic Profile

According to the U. S. Census, the population of Cordova was 2,434 in 2000. Total population numbers were reasonably stable between the early 1900s and late 1970s. Since the 1980s there has been a steady increase in the population corresponding with the growth of the commercial fishing industry.

Current Economy

The economic base of Cordova has been the fishing industry since the 1940s and roughly half of all households have at least one member directly involved in commercial harvesting or processing. There are several fish processing plants in Cordova which serve a large fleet relative for Prince William Sound. Salmon is major component of the harvest and the current reduction in salmon prices has adversely affected the economy of Cordova. The largest employers are North Pacific Processors, Cordova School District, Cordova Hospital, the City, and the Department of Transportation. Additionally, the U.S. Forest Service and the U.S. Coast Guard maintain personnel in Cordova.

A total of 621 commercial fishing permits were held by 343 permit holders in 2000 according to the Commercial Fisheries Entry Commission.

At the time of the 2000 U.S. Census, 62.2% of the potential labor force was employed and there was a 4.6% unemployment rate and 3.6% of the population were in the armed forces. A total of 29.1% of the population over 16 years of age was not in the labor force and 7.5% of the population was below the poverty level. The median household income in the same year was $50, 114 and the per capita income was $25,256.

Involvement in North Pacific Fisheries

Commercial Fishing

Like many towns in the region, the fishing industry is the major component of Cordova's economy. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 621 permits were held by 343 permit holders and 425 permits were actually fished in Cordova in 2000. There were 42 vessel owners in the federal fisheries, 328 vessel owners in the salmon fishery and overall 411 crew members claiming residence in Cordova in 2000. The commercial vessel fleet delivering landings to Cordova was involved in groundfish (74 vessels), sablefish (32 vessels) halibut (81 vessels) and salmon (660 vessels) fisheries. In the year 2000, there were 4,269.11 tons of federally managed fish, including 530.02 tons of sablefish, 3250.51 tons of other groundfish, 508.58 tons of halibut, and 21,975.02 tons of salmon landed at the docks in Cordova.

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Cordova for the year 2000 related to crab, halibut, herring roe, other finfish, other shellfish, sablefish, and salmon.

Crab: One permit was issued for a Dungeness crab pot gear vessel over 60 feet restricted to Yakutat (not fished).

Halibut: There were a total of 64 permits issued for halibut in 2000, 51 of which were actually fished in 2000.

Herring: A total of 124 permits were issued for herring roe in Cordova in 2000 (only 14 permits were actually fished).

Other finfish: One experimental/special permit was issued for freshwater finfish with unspecified gear in statewide waters (not fished).

Other Groundfish: There were 54 permits issued for groundfish excluding sablefish in Cordova in 2000, 19 of which were actually fished.

Other Shellfish: One permit was issued for an octopi/squid longline vessel under 60 feet in statewide waters (not fished) and one for a shrimp pot gear vessel under 60 feet limited to Prince William Sound (not fished).

Sablefish: There were 11 permits issued for sablefish in Cordova in 2000, 10 of which were actually fished.

Salmon: There were 364 permits issued in Cordova for Salmon in 2000, 331 of which were actually fished.

In 2000 there were eight fish processing plants operating in Cordova with the capacities to process Halibut, Sablefish, other groundfish and salmon. Some of the larger companies operating processing facilities, such as North Pacific Processors and Ocean beauty Seafoods, also contributed to the port facilities available at the docks.

Sport Fishing

Most of the fresh waters of Prince William Sound, particularly those in the Cordova area, are open the entire year to salmon fishing. Chinook salmon, silver salmon, red salmon, halibut, rockfish and lingcod are other popular sportfishing species found in the marine waters of Orca Inlet, Simpson Bay, Sheep Bay and as close as Spike Island, located just outside the harbor. Prince William Sound is closed to all crab fishing, but is open to shrimping by permit between April 15 through September 15 and other marine invertebrate collecting. In total there were 15 businesses involved in saltwater sportfishing in Cordova in 2002 and 15 engaged in freshwater sportfishing. There was a total of 3215 sport fishing licenses sold in Cordova in 2000, 1251 of which were sold to Alaska residents.

Subsistence Fishing

Data from 1997 compiled on behalf of the Division for Subsistence of the Alaska Dept of Fish and Game provides useful information about subsistence practices in Cordova. About 97.6% of households participated in the use of subsistence resources, including harvesting, sharing and consuming resources, illustrating the importance of subsistence to life in the community. Approximately 88.5% of the total population used salmon and 84.6% used non-salmon fish (herring, herring roe, smelt, bass, cod, flounder, greenling, halibut, rockfish, sablefish, sculpin, shark, wolfish, sole, char, grayling, trout), many fewer households, only11%, used marine mammals and about half the households in the community, 51.7%, used marine invertebrates.

The average per capita harvest for the year 1997 was 179.43 pounds. The composition of the total subsistence harvest can be shown by the percentages of the resources which demonstrate the amount of each resource category used by the community relative to other resources categories. The total subsistence harvest was composed of 34.87% Salmon, non-salmon fish made up 42.61%, land mammals 54.49%, marine mammals 3.64%, birds and eggs accounted for 2.23% of the total subsistence harvest, marine invertebrates for 5.52% and vegetation made up 8.36%. The wild food harvest in Cordova made up 83% of the recommended dietary allowance of protein in 1993 (corresponding to 49g of protein per day or 0.424 lbs. of wild food per day) (Wolfe, Division of Subsistence, ADF&G).

Only one permit was held by a household in Cordova for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. The permit was used solely for sockeye salmon. Residents of Cordova and members of the Native Village of Eyak, an Alaska Native Tribe, who hold a valid Subsistence Halibut Registration Certificate (SHARC) issued by NMFS, are eligible to harvest subsistence halibut. These allocations are based on recognized customary and traditional uses of halibut. Regulations to implement subsistence halibut fishing were published in the Federal Register in April 2003 and became effective May 2003.

Homer

Location

Homer is a first-class city located on the southwestern edge of the Kenai Peninsula, in the Kenai Peninsula Borough. It encompasses 10.6 square miles of land and 11.9 square miles of water.

Demographic Profile

As a result of the recent boom in the commercial and sport fishing industries, the population of Homer has tripled since 1960. In 2000, the community had 3,946 residents in 1,599 households.

Current Economy

The economy of Homer is dominated by the commercial and sport fishing industries. Fish processing is also a significant factor in the local economy, as are the marine-related trades, including welding, canvas work and electronics. Tourism is a growing industry in Homer; in recent years, the city has developed a small but growing artist community. The South Peninsula Hospital, located in Homer, is a major source of employment. Because of the city's dependence on fishing, the population swells during the summer months as seasonal laborers come to take advantage of jobs in fishing, fish processing, and related activities.

The median annual per capita income in 2000 was $21,823, and the median household income was $42,821. Approximately 5.8% of the total potential labor force was unemployed, and 32.7% of residents aged 16 and older were not in the labor force (ie. not employed and not seeking work). Approximately 9.3% of residents live below the poverty level.

Involvement in North Pacific Fisheries

Commercial Fishing

Commercial fishing, particularly in the halibut, salmon, and groundfish fisheries, is a major part of the economy of Homer. In 2000 there were 132 vessel owners with operations in federal fisheries and 262 vessel owners with operations in state fisheries who resided in Homer. There were 759 registered crew members. In 2000, 539 Homer residents held a total of 1,150 commercial fishing permits. The following section describes the permits in detail by fishery group, gear, and vessel type.

Crab: Fifty-nine residents held a total of 75 commercial permits in the crab fishery, and 27 of these permits were actually fished.

Other Shellfish: Twenty-three residents held a total of 26 permits for other shellfish, and 10 permits were actually fished. A detailed breakdown of the permits is as follows: one octopus/squid longline permit for vessels under 60 feet in statewide waters (none was actually fished); three octopus/squid pot gear permits for vessels over 60 feet in statewide waters (one was actually fished); two shrimp pot gear permits for vessels under 60 feet in Prince William Sound (none was actually fished); two shrimp pot gear permits for vessels over 60 feet in the westward region (none was actually fished); three sea cucumber diving gear permits for statewide waters excluding the southeast region (two were actually fished); 13 clam shovel permits for statewide waters (six were actually fished); one sea urchin diving gear permit for statewide waters, excluding the southeast region (none was actually fished); and one scallop dredge permit for statewide waters (one was actually fished).

Halibut: One hundred ninety-seven residents held a total of 210 commercial halibut permits, and 167 permits were actually fished.

Herring: Eighty-one residents held a total of 133 commercial permits in the herring fishery, and 42 permits were actually fished.

Sablefish: Seventy-one residents held a total of 81 commercial permits for the sablefish fishery, and 58 permits were actually fished.

Other Groundfish: One hundred eighty-four residents held a total of 274 commercial permits in the groundfish fishery, and 113 permits were actually fished.

Salmon: Three hundred thirty-four residents held a total of 350 commercial permits in the salmon fishery, and 291 permits were actually fished

Other Finfish: There was also one freshwater miscellaneous finfish set gillnet permit issued in Homer, but the permit was not fished.

Homer is also an important hub for commercial fish processing, with six registered processors and a total of 2,660 tons of processed fish from federally managed fisheries in 2000. For that year, vessels made deliveries to processors in Homer for the following fisheries: sablefish (41 vessels); halibut (142 vessels); other groundfish (109 vessels); and salmon (4 vessels).

Sport Fishing

The importance of sportfishing to the economy of Homer cannot be overstated. Fishermen from Alaska, the lower 48 U.S. states, Canada and elsewhere come to Homer to fish in the Cook Inlet, Kachemak Bay, and nearby rivers. The sportfishing industry primarily revolves around halibut, but Coho, Sockeye and Pink salmon are also important. Nearby rivers offer fishing for steelhead and Dolly Varden, as well.

In 2000, sportfishing license sales in Homer totaled 20,550, including 14,664 sold to non-Alaska residents. There were 84 registered saltwater sportfishing guides and 21 freshwater sportfishing guides in Homer in 2002.

Subsistence

Many residents in Homer depend to some degree upon subsistence resources for their livelihoods. In recent years, however, the Kenai Peninsula has been classified as "non-rural" under subsistence designation, so residents have not been permitted to harvest subsistence resources from federally managed lands and waters. Significant harvesting of subsistence resource still occurs on state-managed lands and waters.

In terms of historical reliance on subsistence, the Alaska Department of Fish and Game, Division of Subsistence, reports that, in 1982, 86.7% of households in Homer used salmon (all five Pacific species) for subsistence, and 92.5% used non-salmon fish (including halibut, trout, herring, and other species). A significant portion of households (87.9%) also used marine invertebrates (including clams, crabs, mussels and shrimp) for subsistence.

The average annual per capita harvest of subsistence foods for Homer residents in 1982 was 93.8 pounds, and was comprised of the following resources: salmon (21.2%), non-salmon fish (31.9%), land mammals (25.4%), marine invertebrates (17.9%), birds and eggs (2.1%), and vegetation (1.9%). The most important variety of non-salmon fish for Homer residents is halibut, primarily from the Cook Inlet. Salmon is landed from the Cook Inlet, Kachemak Bay, and nearby rivers.

Kodiak

Location

The city of Kodiak is located close to the eastern tip of Kodiak Island. Kodiak Island is located in the Gulf of Alaska and is the largest island in Alaska, also referred to as 'the emerald isle'. The community is 252 air miles south of Anchorage and is located in the Kodiak Recording District. It is made up of 3.5 sq. miles of land and 1.4 sq. miles of water.

Demographic Profile

In the year 2000 there were 6,334 inhabitants of Kodiak as recorded by the Census and of those 53.3% were male and 46.7% were female. A population was first recorded by the Census for Kodiak in the year 1890 and at that time was reported as having 495 inhabitants. Until 1930 the population remained relatively stable, although in 1940 it doubled to 864 inhabitants and has continued to grow substantially, but in the year 2000 it decreased slightly from the 6,365 people reported in 1990 to the 6,334 reported in 2000. There is a large seasonal population in the community which was most likely not recorded by the Censuses.

Current Economy

Kodiak's economy is based on fishing, seafood processing, retail, and government employment. A total of 1,569 commercial fishing permits were issued to residents of Kodiak in the year 2000 and many fish processors operate in Kodiak including but not limited to: Cook Inlet Processors, North Pacific, Ocean Beauty, Trident, and International Seafoods. A total of 1,263 residents of Kodiak were licensed crew members in the year 2000. In addition to fishing and processing, the City and the hospital are also top employers of those in the community. A $38 million low-Earth orbit launch facility, the Kodiak Launch Complex is located near Chiniak and the largest U.S. Coast Guard station is located south of the city. Subsistence is also important to residents of the community.

Of the population age 16 and over in Kodiak in the year 2000; 68.0% were employed, 3.6% were unemployed, 2.4% were in the armed forces, and 26.1% were not in the labor force. The median household income in the year 2000 was $60,484 with the per capita income having been $21,522. About 7.4% of those in Kodiak were below the poverty level in the year 2000.

Involvement in North Pacific Fisheries

Commercial Fishing[*]

Kodiak is the state's largest fishing port where about every possible fishery is harvested and delivered being done by almost every possible gear group. There were 1,569 commercial fishing permits issued to residents of Kodiak in the year 2000 and 1,263 licensed crew members which were residents of the community. There were 256 vessel owners which were residents of the city of Kodiak who participated in the federal commercial fisheries and 187 participated in the commercial salmon fishery. Of the total 1,569 permits issued, 948 were fished in the year 2000. There were 119 crab permits issued to residents of Kodiak for crab, 285 for halibut, 152 for herring, 540 for other groundfish, 67 for other shellfish, 58 for sablefish, and 348 were issued for salmon.

Crab: Of the 119 crab permits issued to residents of Kodiak, 82 were actually fished.

Halibut: In regards to the 285 halibut permits, 236 were actually fished.

Herring: Of the 152 herring permits issued in 2000, only 37 were fished

Groundfish: Out of the 540 other groundfish permits issued to residents of Kodiak in the year 2000, 280 were actually fished.

Other Shellfish: Of the 67 other shellfish permits, 26 were actually fished. No permits were issued for geoduck clams using diving gear in the southeast, but one permit was fished by a resident of the community. For octopi or squid three permits were issued using longline on a vessel under 60' statewide (zero were fished), 21 using pot gear on a vessel under 60' statewide (10 were fished), and 10 using pot gear on a vessel over 60' statewide (three were fished). For shrimp; one permit was issued using an otter trawl westward (zero were fished), nine using pot gear on a vessel under 60' westward (zero were fished), one using pot gear in the southeast (zero were fished), and four using pot gear on a vessel over 60' westward (zero were fished). Two permits were issued for sea cucumbers using diving gear in the southeast (one was fished) and 10 were issued for sea cucumbers using diving gear statewide excluding the southeast (seven were fished). One permit was issued for clams using a shovel to a resident of Kodiak, but was not fished. In regards to sea urchins, no permits were issued using diving gear in the southeast but one was fished and four were issued using diving gear statewide excluding the southeast (two were fished). One permit was issued for scallops dredging statewide and it was fished.

Sablefish: Of the 58 total sablefish permits, 40 were fished.

Salmon: Out of the 348 salmon permits issued to residents of Kodiak, 247 were actually fished.

In regards to landings, 455 vessels participated in the other groundfish fishery and delivered landings to Kodiak for a total of 102,318.27 metric tons in groundfish landings in the year 2000. There were 108 vessels which delivered sablefish for a total of 1,542.49 metric tons. A total of 298 vessels delivered 4,352.30 metric tons of halibut, 32 vessels delivered 1,041.98 metric tons of Bering Sea Aleutian Islands (BSAI) crab, 331 vessels delivered 23,759.03 metric tons of salmon, and 26 vessels delivered 951.34 metric tons of herring. The landings information for scallops delivered to Kodiak has been suppressed for reasons of confidentiality according to Federal Statue 3AAC48.045 because there were only 2 vessels which delivered scallops to the community. The total amount landed in federal species in Kodiak in 2000 was 109,255.03 metric tons.

Kodiak is a major processing center where all species including BSAI crab, groundfish, halibut, herring, sablefish, salmon, and scallops are processed. There are quite a few processors in the community

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[*] Commercial fishing permit data from the CFEC is given for the communities of Chiniak and Kodiak

including 11 which processed federal species in the year 2000. Some of the processors in Kodiak include Alaska Fresh Processors Inc., Global Seafoods Kodiak LLC, Island Seafoods Inc, Kodiak Salmon Packers Inc, Tt Acquisition Inc, and Western Alaska Fisheries Inc, with the largest processors in Kodiak being Cook Inlet Processors, International Seafoods, Ocean Beauty, North Pacific, and Trident. Production runs year round at many of the facilities and the workforce population most likely runs in the thousands with a large amount of the work force being residents of the communities of the island. There is a large subculture of Filipino employees in Kodiak because of their work in the canneries.

Sport Fishing

Kodiak is known for its famous sport fishing. The community had a large amount of sport fishing businesses listed for the year 2002 with a wide variety of services including saltwater guide businesses, freshwater guide businesses, aircraft fly-in services, drop-off services, and full service guiding services. There were 5,030 sport fishing licenses sold to Alaskan residents in the city of Kodiak in the year 2000 and a total of 11,331 licenses sold in Kodiak to residents of Alaska, the United States, and from all over the world. There is a variety of sport fishing activities held in the community such as the Kodiak Kid's Pink Salmon Jamboree and the Silver Salmon Derby.

Subsistence Fishing

According to the Alaska Department of Fish and Game (ADF&G), Division of Subsistence in the city of Kodiak for the most representative subsistence year which was in 1993; 99.0% of all households in Kodiak used all subsistence resources, 93.3% used salmon, 95.2% used non-salmon fish (herring, herring roe, smelt, cod, flounder, greenling, halibut, perch, rockfish, sablefish, sculpin, shark, skates, sole, wolffish, char, grayling, pike, trout, and whitefish), 1.9% used marine mammals, and 79.0% of all households used marine invertebrates. The per capita harvest of all subsistence resources was 151.05 lbs in the community in 1993. Of that per capita harvest 31.61% was salmon, 39.70% was non-salmon fish, 0% was marine mammals, 6.29% was marine invertebrates, 0.44% was birds and eggs, 15.36% was land mammals, and 6.59% was vegetation. Also according to ADF&G there were 1,138 household permits for subsistence salmon issued to residents of Kodiak in the year 1999 for an estimated harvest of 24,956 total salmon. Residents of Kodiak do have the right to apply for halibut subsistence certificates.

Ketchikan

Location

Ketchikan is located on the southwestern coast of Revillagigedo Island, near the southern boundary of Alaska. It is 235 miles south of Juneau. The area encompasses 3.4 square miles of land and 0.8 square miles of water.

Demographic Profile

In 2000 there were 7,922 residents in 3,197 households

Current Economy

The largest economic driving force in Ketchikan is the commercial fishing industry. Many residents hold commercial fishing permits, or work in commercial fish processing plants and supporting industries. In addition, several small timber companies operate in Ketchikan. The tourism industry is growing in importance. The city has become a major port of call for Alaska-bound cruise ships, and an estimated 500,000 cruise passengers visit Ketchikan each year.

In 2000 the median per capita income in Ketchikan was $22,484 and the median household income was $45,802. The unemployment rate was 5.7%, and 29.1% of residents aged 16 years and older were not in the labor force (i.e., not seeking work). Approximately 7.6% of local residents were living below the poverty level.

Involvement in North Pacific Fisheries

Commercial[*]

Ketchikan is a major commercial fishing hub for the southeast region, and fishing makes up the lion's share of economic activity within the city. In 2000 there were 59 vessel owners with operations in federal fisheries and 140 vessel owners with operations in state fisheries residing in the community. There were 485 registered crew members in the community. That same year, 396 local residents held a total of 787 commercial fishing permits. The following section contains a detailed description of these permits.

Crab: Twenty-six residents held a total of 30 commercial permits in the crab fishery.

Other Shellfish: One hundred twenty-six local residents held a total of 195 commercial permits for other shellfish. These permits included the following: 26 geoduck clam diving gear permits for the southeast region (18 were actually fished); 54 shrimp pot gear permits for the southeast region (27 were actually fished); 70 sea cucumber diving gear permits for the southeast region (61 were actually fished); one clam shovel permit for statewide waters (one was actually fished); 41 sea urchin diving gear permits for the southeast region (22 were actually fished); and one octopus/squid pot gear permits for vessels under 60 feet in statewide waters (none was actually fished).

Halibut: Ninety-five local residents held a total of 97 permits for the halibut fishery.

Herring: Sixty-four local residents held a total of 105 commercial permits in the herring fishery.

Sablefish: Twenty-four local residents held a total of 29 permits in the sablefish fishery.

Other Groundfish: Forty-six local residents held a total of 74 commercial permits for other groundfish.

Other Finfish: Five residents held a total of five freshwater fish beach seine permits for statewide waters (none was actually fished).

Salmon: Two hundred thirty-nine residents held a total of 252 commercial permits in the salmon fishery.

In addition to its role as a hub for commercial fishermen, Ketchikan is also a center of fish processing and storage. In 2000 there were 4 commercial fish processors. Landings for federally managed species (including halibut, sablefish, and groundfish) totaled 413 tons. Salmon landings totaled 26,093 tons. A total of 631 vessels made deliveries of state-managed species to processors in Ketchikan, and a total of 281 vessels made deliveries of federally managed species.

Sport Fishing

Ketchikan is the largest sport fishing hub in southeast Alaska. Fishermen come from all over Alaska, as well as Canada, the lower 48 states, and around the world, to fish the productive waters in the area.

In 2000 there were 117 registered saltwater sport fishing guides and 70 freshwater sport fishing guides. Sport fishing license sales in Ketchikan for 2000 totaled 34,509; the majority of these (27,829) were to non-Alaska residents. This constituted the highest number of licenses sold in any Alaskan community except Anchorage. Major sport species include all five species of Pacific salmon, halibut, trout, steelhead, and char.

Subsistence

Many residents in Ketchikan supplement their incomes with subsistence resources. However, the Alaska Department of Fish and Game does not have detailed information on subsistence harvests and amounts

[*] Commercial fishing permit data from the CFEC is given for the communities of Ketchikan, Ketchikan East, and Ward Cove

for Ketchikan. In 1999, a total of 329 households held permits to harvest subsistence salmon. A total of 9,267 salmon—primarily sockeye—were harvested. Ward Cove holds a Subsistence Halibut Registration Certificate (SHARC), which allows residents to harvest halibut for subsistence purposes.

Pelican

Location

Pelican is lies on the northwest coast of Chichagof Island in Lisianski Inlet. Most of the community is in fact built on pilings over the tidelands. The island is part of the world's largest coastal temperate rainforest; the Tongass National Forest. The area encompasses 0.6 square miles of land and 0.1 square miles of water. According to the U. S. Census, the population of Pelican was 163 in 2000.

Current Economy

Commercial fishing, including crabbing, and seafood processing are the mainstays of Pelican's economy. Fishing vessels deliver fish to be sold at Pelican Seafoods, the local fish proscessing and cold storage plant. Most employment occurs at Pelican Seafoods, which also owns the electric utility, a fuel company and store. The plant processes black cod, halibut, ling cod, rockfish, and salmon. The City and school provide some employment. A total of 100 commercial fishing permits were held by 41 permit holders in 2000 according to the Commercial Fisheries Entry Commission.

At the time of the 2000 U.S. Census, 70.9% of the potential labor force was employed and there was an 5.5% unemployment rate. A seemingly high 29.1% of the population over 16 years of age was not in the labor force, though this may be explained by the intensely seasonal nature of the fishing and tourism industries, and 4.7% of the population was below the poverty level. The median household income in the same year was $57,083 and the per capita income was $29,347.

Involvement in North Pacific Fisheries

Commercial Fishing

Commercial fishing is important to the economy of Pelican. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 100 permits were held by 41 permit holders but only 59 permits were actually fished in Pelican in 2000. There were 16 vessel owners in the federal fisheries, 21 vessel owners in the salmon fishery and overall 25 crew members claiming residence in Pelican in 2000. The commercial vessel fleet delivering landings to Pelican was involved in halibut (29 vessels), sablefish (19 vessels), other ground fish (26 vessels), and salmon (95 vessels) fisheries in 2000 (figures for landings by species are suppressed for reasons of confidentiality according to Federal Statute 3AAC48.045).

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Pelican for the year 2000 related to halibut, herring, sablefish, other groundfish, crab, other shellfish and salmon.

Halibut: There were a total of 20 permits issued for halibut in Pelican in 2000, 15 of which were actually fished.

Herring: There was one permit issued for the herring fishery in Pelican in 2000, which was not fished.

Sablefish: A total of 12 sablefish permits were issued in 2000 in Pelican, all of which were actually fished.

Other groundfish: A total of 24 permits were issued in 2000 for other groundfish in Pelican, only seven of which were actually fished.

Crab: One permit was issued in Pelican for crab in 2000, which was fished and pertained to tanner crab pot gear in southeast waters.

Other shellfish: Five permits were issued for other shellfish in Pelican in 2000, only one of which was actually fished. Permits pertained three octopi/squid pot gear vessels over 60 feet in statewide waters (no permits fished), one shrimp pot gear in southeast waters (not fished) and to one sea cucumber diving gear in southeast waters.

Salmon: A total of 37 permits were issued in Pelican in 2000 for the salmon fishery, 22 of which were actually fished.

Two seafood processing plants were in operation in Pelican in 2000 and additionally filed 'Intents to Operate' for 2003. Pelican Seafoods has the capability to process groundfish, halibut, high-seas salmon, salmon and sablefish. The plant also has harbor facilities used by the community.

Sport Fishing

There were nine saltwater sport fishing businesses registered in Pelican in 2002 and seven businesses licensed to provide freshwater recreational fishing according to the Alaska Department of Fish and Game. There was a total of 249 sport fishing licenses sold in Pelican in 2000, 53 of which were sold to Alaska residents.

Subsistence Fishing

Data from 1987 compiled on behalf of the Division for Subsistence of the Alaska Dept of Fish and Game provides useful information about subsistence practices in Elfin Cove. Records describe the subsistence patterns for all 100% of households which participated in the use of subsistence resources, including harvesting, sharing and consuming resources, illustrating the importance of subsistence to life in the community. Of the total population, 94.8% used salmon and 100% used non-salmon fish (herring, herring roe, smelt, cod, flounder, halibut, rockfish and char), 27.1% used marine mammals and a high percentage, 92.3%, used marine invertebrates.

The average per capita harvest for the year 1987 was 355.13 pounds. The composition of the total subsistence harvest can be shown by the percentages of the resources which demonstrate the amount of each resource category used by the community relative to other resources categories. The total subsistence harvest was composed of 16.99% salmon, non-salmon fish made up 33.51%, land mammals 31.24%, marine mammals 2.11%, birds and eggs accounted for only 0.4%, marine invertebrates for 13.12% and vegetation made up 2.64%. The wild food harvest in Pelican made up 229% of the recommended dietary allowance of protein in 1987 (corresponding to a daily allowance of to 49g of protein per day or 0.424 lbs. of wild food per day) (Wolfe, Division of Subsistence, ADF&G).

A total of 13 permits were held by households in Pelican for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. Sockeye was the main component of the salmon harvest. Residents of Pelican who hold a valid Subsistence Halibut Registration Certificate (SHARC) issued by NMFS, are eligible to harvest subsistence halibut. These allocations are based on recognized customary and traditional uses of halibut. Regulations to implement subsistence halibut fishing were published in the Federal Register in April 2003 and became effective May 2

Petersburg

Location

Petersburg lies along the northwest end of Mitkof Island, where the Wrangell Narrows meet Frederick Sound. It is located about midway between Juneau and Ketchikan. The area encompasses 43.9 square miles of land and 2.2 square miles of water.

Demographic Profile

According to the U. S. Census, the population of Petersburg was 3,224 in 2000. Population numbers have risen steadily since the early decades of the 1900 and are now at a maximum.

Current Economy

The economy of Petersburg is based on commercial fishing and timber harvests and is therefore highly seasonal. A total of 1226 commercial fishing permits were held by 648 permit holders in 2000 according to the Commercial Fisheries Entry Commission. . Several processors operate cold storage, canneries and custom packing services. The state runs the Crystal Lake Hatchery which contributes to the local salmon resource. Petersburg is the supply and service center for many area logging camps. Independent sportsmen and tourists utilize the local charter boats and lodges, but there is no deep water dock suitable for cruise ships.

At the time of the 2000 U.S. Census, 63.6% of the potential labor force was employed and there was a 7.3% unemployment rate. A seemingly high 29.2% of the population over 16 years of age was not in the labor force, though this may be explained by the intensely seasonal nature of the fishing and tourism industries, and 5% of the population was below the poverty level. The median household income in the same year was $40,028 and the per capita income was $25,827.

Involvement in North Pacific Fisheries

Commercial Fishing

Commercial fishing is important to the economy of Petersburg. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 1,226 permits were held by 468 permit holders but only 831 permits were actually fished in Petersburg in 2000. There were 160 vessel owners in the federal fisheries, another 217 vessel owners in the salmon fishery and overall 530 crew members claiming residence in Petersburg in 2000. The commercial vessel fleet delivering landings to Petersburg was involved in herring (44 vessels), halibut (180 vessels), sablefish (64 vessels), other groundfish (158 vessels), and salmon (414 vessels) fisheries in 2000. Landings in Petersburg for the year 2000 included 930.97 tons of federal fish, including 766.47 tons of halibut, 164.50 tons of other groundfish (other figures for landings by species are suppressed for reasons of confidentiality according to Federal Statute 3AAC48.045) and 21,660.18 tons of salmon.

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Petersburg for the year 2000 related to halibut, herring, other finfish, sablefish, other groundfish, crab, other shellfish and salmon.

Halibut: There were a total of 221 permits issued for halibut in Petersburg in 2000, 203 of which were actually fished.

Herring: There were a total of 115 permits issued for the herring fishery in Petersburg in 2000 making it one of the major fisheries for the community, 58 permits were actually fished that year.

Other Finfish: Two permits were issued in Petersburg n 2000 for freshwater fish beach seines in statewide waters, neither of which were fished.

Sablefish: A total of 80 sablefish permits were issued in 2000 in Petersburg, 75 of which were actually fished.

Other groundfish: A total of 158 permits were issued in 2000 for other groundfish in Sitka, only 54 of which were actually fished.

Crab: A total of 203 permits were issued in Petersburg for crab in 2000, 171 of which were actually fished.

Other shellfish: A total of 73 permits were issued in Petersburg in 2000 for other shellfish, 34 of which were actually fished. Permits pertained to eight sets of geoduck clam diving gear in southeast waters (three permits were actually fished), one octopi/squid longline vessel under 60 feet in statewide waters (not fished), four shrimp pot gear vessels under 60 feet in southeast waters (one permits actually fished), eight shrimp beam trawls in southeast waters (four permits fished), 29 shrimp pot gear in southeast waters (13 permit fished), 17 sets of sea cucumber diving gear in southeast waters (13 permits fished), and six sets of sea urchin diving gear in southeast waters (none fished).

Salmon: A total of 374 permits were issued in Sitka in 2000 for the salmon fishery, 236 of which were actually fished.

Sport Fishing

There were 35 saltwater sport fishing businesses registered in Elfin Cove in 2002 and 20 businesses licensed to provide freshwater recreational fishing according to the Alaska Department of Fish and Game. There was a total of 3,985 sport fishing licenses sold in Petersburg in 2000, 1432 of which were sold to Alaska residents.

Subsistence Fishing

Numerous social, economic and technological changes have influenced life in Alaskan fishing communities and subsistence harvests and practices continue to provide fishing communities with important nutritional, economic, social and cultural requirements. Data from 1987 compiled on behalf of the Division for Subsistence of the Alaska Dept of Fish and Game provides useful information about subsistence practices in Petersburg. Records describe the subsistence patterns for 96.9% of households in the community which participated in the use of subsistence resources, including harvesting, sharing and consuming resources, illustrating the importance of subsistence to life in the community. Of the total population, 96.9% used salmon and 87.6% used non-salmon fish (herring, herring roe, smelt, cod, flounder, halibut, rockfish, char), no households used marine mammals although a fairly high percentage, 80.3%, used marine invertebrates.

The average per capita subsistence harvest for the year 1987 was 197.67 pounds. The composition of the total subsistence harvest can be shown by the percentages of the resources which demonstrate the amount of each resource category used by the community relative to other resources categories. The total subsistence harvest was composed of 22.92% salmon, non-salmon fish made up 22.49%, land mammals 28.95%, marine mammals did not factor as a significant percentage of the composition of subsistence foods, birds and eggs accounted for only 1.80% of the total subsistence harvest, marine invertebrates for 19.49% and vegetation made up 4.36%. The wild food harvest in Petersburg made up 128% of the recommended dietary allowance of protein in 1987 (corresponding to a daily allowance of 49g of protein per day or 0.424 lbs. of wild food per day) (Wolfe, Division of Subsistence, ADF&G).

A total of 77 permits were held by households in Petersburg for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. Sockeye made up the largest proportions of the salmon harvest. Residents of Petersburg and members of Petersburg Indian Association who hold a valid Subsistence Halibut Registration Certificate (SHARC) issued by NMFS, are eligible to harvest subsistence halibut. These allocations are based on recognized customary and traditional uses of halibut. Regulations to implement subsistence halibut fishing were published in the Federal Register in April 2003 and became effective May 2003.

Sand Point

Location

Sand Point is located on Humboldt Harbor on the northwestern edge of Popof Island, on the Popof Strait. It is part of the Shumagin Islands, off the Alaska Peninsula. Sand Point is administratively located in the

Aleutians East Borough. It is five miles south of the Alaska Peninsula and about 570 miles southwest Anchorage. The area encompasses 7.8 square miles of land and 21.1 square miles of water.

Demographic Profile

In the year 2000, according to the US Census, Sand Point had 952 residents. The population of Sand Point has been constantly growing since the 1900s. This steady rate of increase was secured in the 1930s with the establishment of the fishing industry, which replaced gold mining.

Current Economy

Sand Point harbors the largest fishing fleet of the Aleutian chain. In the year 2000 117 residents held commercial fishing permits. Trident Seafoods operated a major year-round bottomfish, pollock, salmon and fish meal processing plant, and provided fuel and other services. It employed from 50 to 400 employees, depending on the season. Peter Pan Seafoods owned a storage and transfer station in the community to support its fleet.

Involvement in North Pacific Fisheries

Commercial Fishing

Sand Point is home to one of the largest commercial fleets of Southwest Alaska. According to official records, in the year 2000 Sand Point had 116 commercial permit holders and a total of 327 all-fisheries combined permits. In Sand Point 225 individuals were registered as crewmen and there were 61 federal fisheries vessel owners plus 98 owners of salmon vessels residing in the community. Sand Point's fleet was involved, in one way or another, in most of the Alaskan fisheries, including crab, sablefish, halibut, herring, other groundfish, other shellfish and salmon. The following is a breakdown of permits issued to Sand Point residents in 2000.

Halibut: There were 52 issued permits for halibut fisheries, 38 of which were actually fished.

Groundfish: Groundfish was the fishery that accumulated the highest number of permits, with 150 permits and 84 permit holders. Only 70 permits were actually fished.

Salmon: The salmon fleet accounted for 100 permits, 85 of which were fished.

Crab: There were three king crab permits (one for a vessel under 60 feet with pot gear and two for vessels over 60' fishing with pot gear in Bristol Bay). There are also two permits for vessels over 60 feet for Tanner crab with pot gear in the Bering Sea.

Other: Other fisheries in Sand Point included herring and other shellfish. Herring permits included eight herring roe purse seine permits, three in Bristol Bay, one in Cook Inlet, one in Chignik, and three along the Alaska Peninsula. None of these permits was actually fished. In addition, there were two herring roe gillnet permits (none was fished), and none herring food/bait purse seine permits on the Alaska Peninsula (none was fished). Other shellfish, including octopus and squid had one permit for vessels over 60 feet with pot gear (none was actually fished), and one sablefish mechanical jig permit (none was actually fished).

In terms of fish processing, Trident Seafoods operated a major year-round bottomfish, pollock, salmon and fish meal processing plant, and provided fuel and other services. It employed from 50 to 400 employees depending on the season. Peter Pan Seafoods owned a storage and transfer station that supported its fleet. Because the community had less than three processors, the data on landings was confidential. The fleet delivering landings to Sand Point was larger than the number of ships homeported or anchored in that particular harbor.

Sport Fishing

In the year 2000 this community issued 42 sport fishing permits, 25 of which were bought by Alaskan residents. This small number of permits does not preclude the possibility that the area could be visited by outsiders who their permits elsewhere. In 2000, Sand Point also had five sport fishing guide businesses: four focused on freshwater activities while one worked in saltwater fisheries.

Subsistence Fishing

A survey conducted by ADF&G in 1992 in Sand Point demonstrated the significance of subsistence practices to most Alaskan communities. All Sand Point households participated in the use of subsistence resources. In relation to the main marine resources, 99% of the households used subsistence salmon, 97.1% used other types of fish (herring, smelt, cod, eel, flounder, greenling, halibut, perch, rockfish, sablefish, sculpin, skates, sole, tuna, burbot, char, pike, sheefish, trout, whitefish), 25% of households used marine mammals and 90.4% used marine invertebrates. The total per capita harvest of subsistence resources was 255.7 pounds.

The breakdown of the subsistence harvest was as follows: salmon (53.8%), other fish (21.1%), land mammals (11.31%), marine mammals (1.84%), birds and eggs (2.3%), marine invertebrates (7%) and vegetation (2.7%).

In 1999, Sand Point had 54 Alaska salmon household subsistence permits. The catch was mainly sockeye and Chum. In addition, residents of Sand Point (rural residents or members of an Alaska Native tribe) are eligible to harvest subsistence halibut by holding Subsistence Halibut Registration Certificates (SHARC). This program is still in the initial phase of implementation and no definitive certificate numbers have been released.

Seattle

According to the U.S. Census, the population of Seattle was 3,554,760 in 2000. This represents an increase of nearly 1 million people since the previous census in 1990.

Locational issues are discussed with respect to the Seattle area and the BSAI crab fishery. Here, the discussion is divided into three components: the institution of the Port of Seattle, the "traditional" community of Ballard, and the planning area construct of the Ballard Interbay Northend Manufacturing Industrial Center (BINMIC). Each component provides a different and useful perspective on the Seattle social/socioeconomic ties to the fishery.

The Port of Seattle

Martin Associates (2000) provides an overall assessment of the economic impact of fishing activity based at Port of Seattle facilities. They conclude that such activity generates $400 million in wages (direct, indirect, and induced), $315 million in business revenues, $42 million in local purchases, and $48 million in state and local taxes. There is no way to desegregate the Alaskan distant water fleet from this overall impact, so the utility of the information for the present purposes is limited. They do provide estimates for the annual expenditures in Seattle of the various fishing vessels homeported there, and as might be expected, those for the larger vessels, such as participate in the Alaskan groundfish fisheries, are the highest in terms of expenditures per vessel – $250,000 for catcher trawlers, $900,000 for factory trawlers, and $1.7 million for motherships. Crabbers are in the $180,000 range. Most of the vessels in these classes homeported in Seattle probably participate in the Alaskan groundfish fisheries but also participate in other fisheries. There are also many vessels in the Seattle distant water fleet that do not participate in the Alaskan groundfish fisheries. The Port itself does not have information on moorage fees received, either in total or for segments of the fleet.

The Port of Seattle is separate from the Municipality of Seattle and is an economically self-supporting entity. Besides its direct revenues, it receives 1% of the property tax collected in King County, but with a cap on funding not to exceed $33 million a year. In turn, all port revenues are charged a 12.4% tax, which is split between the City of Seattle and the State of Washington (in lieu of property tax). The Port's charge is the development of infrastructure that will support local and regional economic activities, especially in cases where the rate of return on investment in that infrastructure may be too low (although still positive) for the private investor. Such development contributes to the overall economy of the region through synergistic and multiplier effects.

Ballard

When looked at on a neighborhood basis, one of more obvious foci of the distant water fishery in the greater Seattle area is the community of Ballard. Today the term "Ballard" represents a loosely defined geographical neighborhood of northwest Seattle. There is no geographically standard area for which various types of comparable information exists. Nonetheless, the area does have a geographical identity in peoples' minds and, together with Magnolia and Queen Anne, has its own yellow pages telephone directory (published by the Ballard and Magnolia Chambers of Commerce). The following brief section is based predominately on information from the Ballard Chamber of Commerce (1998), Reinartz (1988a, 1988b, 1988c, 1988d), Hennig and Tripp (1988), and McRae (1988).

Fishermen's Terminal on Salmon Bay is recognized as the home of the Pacific fishing fleet and has been characterized as the West Coast's "premier home port." Fishermen's Terminal (Salmon Bay Terminal) in turn has often been identified with Ballard, which was formerly a separate city (incorporated 1890) before annexation by Seattle in 1907. Until the construction of the Chittenden Locks and the Lake Washington Ship Canal, opened in 1917, Salmon Bay Terminal was confined to relatively small vessels but was the focus of a developing fishing fleet. Once the area was platted and incorporated, it quickly attracted settlers and industries desiring or dependent upon access to Puget Sound. The timber industry was the first to develop, due to the need to clear land as well as the value of the timber that was available. By the end of the 1890s, Ballard was a well-established community with the world's largest shingle manufacturing industry, as well as boat building and fishing industries. By 1900 Ballard was the largest area of concentrated employment north of San Francisco.

Ballard effectively blocked the expansion of Seattle to the north, and court decisions had given Seattle control over Ballard's freshwater supply, with the result that Ballard became part of Seattle in 1907. At that time the community had 17 shingle mills, 3 banks, 3 saw mills, 3 iron foundries, 3 shipyards, and approximately 300 wholesale and retail establishments. The Scandinavian identity of Ballard developed at or somewhat before this time. In 1910, first- and second-generation Scandinavian-Americans accounted for 34% of Ballard's population, and almost half of Ballard's population was foreign-born. Currently, less than 12% of the population is of Scandinavian descent, but the cultural association remains pervasive.

Ballard's economy continued to develop and diversify, but it remained fundamentally dependent on natural resources, and especially timber and fishing. In 1930 the *Seattle Weekly News* reported that 200 of the 300 schooners of the North Pacific halibut fleet were homeported in Ballard, demonstrating not only the centrality of Ballard but the long-term importance of distant water fisheries to Seattle fishermen. In 1936 the Port of Seattle built a new wharf at the Salmon Bay terminal, and in 1937 a large net and gear warehouse was scheduled for construction there. Over the years, Seattle-based vessels were central to the evolution of a number of North Pacific fisheries.

Thus in some ways Ballard is considered a "fishing community within" Seattle. While this has historically been the case, when examined specifically with respect to the BSAI crab fishery, the area cannot cleanly be considered a "village within a city." While there is a concentration of multigenerational fishing families within the area, the "industrialization" of the Alaska fisheries has tended to disperse the ties and relationships. While support service businesses remain localized to a degree (as discussed in another section below), there does not appear to be a continuity of residential location that is applicable to the Alaska crab fishery. This is due to the many changes within the cluster of individual species fisheries that make up the overall Alaska crab fishery, and others in which these fishermen may participate. In summary, this "community within the community" issue is not straightforward due to the complex nature of historical ties, continuity of fishing support sector location through time, changes in the technology and methods of fishing, and industrialization of the fishery. Clearly, Seattle represents a different pattern of colocation of residence and industry with respect to the BSAI crab fishery than that seen in the relevant Alaska communities.

The Ballard Interbay Northend Manufacturing Industrial Center

One of the fundamental purposes for the establishment of the BINMIC Planning Committee was the recognition that this area provided a configuration of goods and services that supported the historical, industrial, and maritime character of the region. At the same time, developmental regional dynamics are promoting changes within the BINMIC area that may threaten the continued vitality of its maritime orientation. Among other objectives, the BINMIC final plan states:

> The fishing and maritime industry depends upon the BINMIC as its primary Seattle home port. To maintain and preserve this vital sector of our economy, scarce waterfront industrial land shall be preserved for water-dependent industrial uses and adequate uplands parcels shall be provided to sufficiently accommodate marine-related services and industries (BINMIC Planning Committee 1998:6).

Previous documents produced for the NPFMC (e.g., NPFMC 2002; IAI 1998) have discussed the BINMIC area, and some of this information is abstracted below. It is now becoming dated, however, as the BINMIC planning document has remained in the form in which it was "finalized" and the City of Seattle does not collect time series measures for the BINMIC area comparable to those, for example, collected for the Port of Seattle.

As previously noted, Ballard, in northwest Seattle, is commonly identified as the center of Seattle's fishing community. This may be true in a historical residential sense, but commercial fishing-related suppliers and offices are spread along both sides of Salmon Bay-Lake Washington Ship Canal, around Lake Union, along 15th Avenue West through Queen Anne, and then along the shores of Elliot Bay on both sides of Pier 91. Not surprisingly, this is also the rough outline of the formal boundaries of BINMIC, which is bordered by the Ballard, Fremont, Queen Anne, Magnolia, and Interbay neighborhoods. It is defined so as to exclude most residential areas, but to include manufacturing, wholesale trade, and transportation-related businesses. It includes rail transportation, ocean and freshwater freight facilities, fishing and tug terminals, moorage for commercial and recreational boats, warehouses, manufacturing and retail uses, and various port facilities (Terminal 86, Piers 90 and 91).

The BINMIC "Economic Analysis" document (Economic Consulting Services 1997) uses much of the same information as was reviewed above, in combination with an economic characterization of the BINMIC area, to establish that certain economic activities are especially important for that area. One of these activities is commercial fishing, although again the specific extent of connections to the BSAI crab fishery in particular are difficult to establish.

The BINMIC area is relatively small, but contributes disproportionately to the city and regional economy. Again, those characteristics are part of what determined its borders. The BINMIC resident population is only 1,120 (1990 census), but there are 1,048 businesses in the area and 16,093 employees. The great majority of business firms are small, 85% have fewer than 26 employees, but accounted for only 30% of total BINMIC employment. Self-employed individuals (i.e., fishermen) are probably not included in these numbers.

An important indicator of the importance of commercial fishing and other maritime activities is the availability of commercial moorage. As of 1994, more than 50% of all commercial moorage available in Puget Sound was located in Seattle, and of that, more than 50% was in the BINMIC area (representing 30% of all commercial moorage in the Puget Sound area). Thus, the BINMIC area is clearly important in terms of being an area where vessels (especially larger commercial vessels) are concentrated. The Port of Seattle has concluded that only the ports of Olympia and Tacoma at present provide a significant source of moorage in Puget Sound outside of Seattle. Port Angeles may build additional capacity at some point in the future. Olympia's facility was rebuilt in 1988. Some older moorage constructed of timber piling prior to 1950 is nearing the end of its useful life and will need to be replaced. On the other hand, it is expected that much of the private old timber moorage will not be replaced, so that overall moorage capacity will decline. In the Seattle area, there has also been a dynamic whereby commercial moorage had been converted to recreational moorage. Within the BINMIC area, recreational moorage within the UI Shoreline is prohibited altogether, because of the importance of commercial activity and the danger of interference from recreational moorage. The Port has concluded that it is unlikely that any new private commercial moorage will be developed (because of cost and regulatory regime) and is examining their options (Port of Seattle 1994). As previously mentioned, the Port is pursuing a program of repairing its facilities where economically feasible (when it can be fairly well assured of a steady tenant).

The BINMIC area is fairly well "built out." The BINMIC area contains 971 acres, divided into 806 parcels with an average size of 1.043 acres, but a median size of 0.207 acres. Thus there are many small parcels. Public entities of one sort or another own 574.8 acres (59%). The Port of Seattle is the largest landowner with 166 acres, while the city has 109 acres. Private land holders own 396 acres, of which only 19.45 acres were classified as vacant – 19.27 acres in 81 parcels as vacant industrial land and 0.18 acres in 2 parcels as vacant commercial land. An additional 200.76 acres were classified as "underutilized," meaning that it had few buildings or other improvements on it. This classification does not mean that the land may not be in use in a fruitful way (for instance, storage of gear or other use that is not capital intensive).

Economic Consulting Services (1997, Appendix C) lists 85 companies that have a processing presence in Washington State. Of these, over half (47) are located in Seattle, with many in the surrounding communities (Bellevue, Kirkland, Redmond). Of these 47, at least 18 are located within the BINMIC area, and the rest are located very near the boundaries of the BINMIC. Some examples of fairly large fishing entities that are located within the BINMIC (as well as elsewhere) are Trident Seafoods, Icicle Seafoods, Ocean Beauty Seafoods, Peter Pan, Alaska Fresh Seafood, and NorQuest Seafoods. All demonstrate some degree of integration of various fishing industry enterprises.

The BINMIC area of Seattle displays the following characteristics, which indicate its important economic roles:

- significant component of, and plays a vital role in, the greater Seattle economy;
- integrated into local, regional, national, and multinational markets;
- key port for trade with Alaskan and the West Coast, Pacific, and Alaska fishing industries - and the Alaskan fishery is especially significant;
- Salmon Bay, Ship Canal, and Ballard function as a small port of its own but also support fishing and a wide range of other maritime activities - including recreation and tourist vessels and activities; and
- an area of concentration of businesses, corporations, organizations, institutions, and agencies that participate in, regulate, supply, service, administer, and finance the fishing industry.

Chase and Pascall (1996) focus on the importance of Alaska as a market for Seattle region (Puget Sound) produced goods and services. They do so by identifying particular industrial sectors that generate the bulk of these economic impacts, but they do not locate these industrial sectors in terms of particular geographic locations within the region. In their discussion of the fisheries sector, Chase and Pascall indicate that only a fraction of the regional economy is based on fishing and seafood processing industries, but that these industry sectors are concentrated in several communities and rely heavily on North Pacific (Alaskan) resources. The communities that they single out are Bellingham, Anacortes, and the Ballard neighborhood of Seattle. They say that Seattle is the major base for vessels for various fisheries – groundfish (catcher vessels, catcher processors, motherships), halibut, crab, salmon, and others. There are numerous secondary processing plants in the region, and about 60% of the seafood harvested and shipped south for processing moves through the Port of Tacoma (Chase and Pascall 1996:23).

The relative value of Alaskan shellfish (crab, shrimp, etc.) for the Seattle fleet varies from year to year, but in 1994 was about 25% of the ex-vessel value of the Alaska/North Pacific commercial fishing harvest (Chase and Pascall 1996:26), which represented about 75% by harvest value, and 92% by weight, of all fish harvested by the Puget Sound fishing fleet (Chase and Pascall 1996:23 - citing ADF&G, NPFMC, NMFS). Since that time, crab harvests have declined considerably, however, so this percentage would now be smaller.

Other relatively recent work (Martin O'Connell Associates 1994) indicates the wide range of activities that the Port of Seattle supports and the web of support services that commercial fishing helps support, but it provides no measure of the contribution of the BSAI crab fishery to this support. Fishing activities are included in this study only to the extent that they are reflected in activities at Fishermen's Terminal. This would generally reflect Bering Sea and Gulf of Alaska catcher vessel activity but would also include a great number of other smaller vessels moored at Fishermen's Terminal. On the other hand, it would also include some Alaskan groundfish activity of similarly sized and somewhat larger vessels, and some factory trawlers. It would not include the activities of larger Alaskan groundfish vessels such as catcher-processor, mothership, and secondary processing activities. By their estimation, fishing activity at Fishermen's Terminal in 1993 generated 4,007 direct jobs (the majority of them crew positions), earning an average of $48,690 per direct job (total $195 million). Also, an additional 2,765 induced and indirect jobs were created. Fishing businesses also expended $145 million on local purchases of goods and services (Martin O'Connell Associates 1994:45-49). Again, this does not indicate the contribution of the BSAI crab fishery so much as it establishes that the local fishing/processing economy is densely developed.

Seldovia

Location

Seldovia is situated on the southern tip of the Kenai Peninsula facing the Cook Inlet and across the water from Homer on the south shore of Kachemak Bay. The area encompasses 0.4 square miles of land and 0.2 square miles of water.

Demographic Profile

According to the U. S. Census, the population of Seldovia was 286 in 2000. Total population numbers increased steadily over the century between 1890, when the population totaled 99, to 1980 when there were 479 residents. Over the last two decades, however, the population has declined to nearly half of its maximum number.

Current Economy

The economy of Seldovia is intimately linked to the local and national fishing industries. Seldovia is both a commercial fishing and processing center and a popular sport fishing destination. The timber industry is small but significant to the community and tourism is increasing in importance. A total of 104 commercial fishing permits were held by 57 permit holders in 2000 according to the Commercial Fisheries Entry Commission.

Involvement in North Pacific Fisheries

Commercial Fishing[*]

[*] Commercial fishing permit data from the CFEC is given for the communities of Red Mountain and Seldovia

Commercial fishing is a main contributor to the economy of Seldovia, along with other natural resource uses. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 104 permits were held by 57 permit holders but only 60 permits were actually fished in Seldovia in 2000. There were 10 vessel owners in the federal fisheries, 9 vessel owners in the salmon fishery and overall 45 crew members claiming residence in Seldovia. One vessel in the salmon fishery actually delivered its landings to Seldovia (figures for landings by species are suppressed for reasons of confidentiality according to Federal Statute 3AAC48.045).

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Seldovia for the year 2000 related to halibut, herring, sablefish, other groundfish, crab and salmon.

Halibut: There were a total of 18 permits issued for halibut in Seldovia in 2000, 16 of which were actually fished.

Herring: There were a total of 11 permits issued for the herring fishery in Seldovia in 2000, none of which were actually fished that year.

Sablefish: A total of five sablefish permits were issued in 2000 in Seldovia, all of which were actually fished.

Other groundfish: A total of 23 permits were issued in 2000 for other groundfish in Seldovia, only seven of which were actually fished.

Crab: Eight permits were issued in Seldovia for crab in 2000, two of which were actually fished.

Salmon: A total of 39 permits were issued in Seldovia in 2000 for the salmon fishery, 30 of which were actually fished.

Although fish processing, especially of shellfish, is considered to have been an important endeavor in Seldovia, only one processing plant was operating in the town in 2000. Port Graham Seafoods Inc. had the capacity to process salmon in that year.

Sport Fishing

In 2002 there were seven sport fishing saltwater guides in operation. In 2000 there was a total of 597 sport fishing licenses sold in Seldovia, 242 of which were sold to Alaska residents. Several species are targeted for sport fishing in Seldovia, including halibut, king salmon, silver salmon, red salmon, pink salmon, jacks, coho, sockeye, chum, tyee, dolly varden, steelhead, Pollock, rainbow trout, arctic char, manta ray, black bass. The City of Seldovia's website proclaims: 'Life doesn't get any better then fishing on one of Seldovia's charter boats.'

Subsistence Fishing

Data from 1993 compiled on behalf of the Division for Subsistence of the Alaska Dept of Fish and Game provides useful information about subsistence practices in Seldovia. Records describe the subsistence patterns for all 95.4% of households which participated in the use of subsistence resources, including harvesting, sharing and consuming resources, illustrating the importance of subsistence to life in the community. Of the total population, 89.2% used salmon and 86.2% used non-salmon fish (herring, herring roe, smelt, cod, greenling, halibut, rockfish, sablefish, trout), many fewer households, only13.8%, used marine mammals and a high percentage, 90.8%, used marine invertebrates.

The average per capita harvest for the year 1993 was 183.55 pounds. The composition of the total subsistence harvest can be shown by the percentages of the resources which demonstrate the amount of each resource category used by the community relative to other resources categories. The total subsistence harvest was composed of 35.01% salmon, non-salmon fish made up 23.76%, land mammals 12.85%, marine mammals only 0.67%, birds and eggs accounted for 0.70% of the total subsistence harvest, marine invertebrates for 18.5% and vegetation made up 8.51%. The wild food harvest in Seldovia made up 119% of the recommended dietary allowance of protein in 1993 (corresponding to 49g of protein per day or 0.424 lbs. of wild food per day) (Wolfe, Division of Subsistence, ADF&G).

A total of 15 permits were held by households in Seldovia for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. Sockeye and Chinook made up the largest proportions of the salmon harvest, followed by chum. Residents of Seldovia and members of the Seldovia Village Tribe, an Alaska Native Tribe, who hold a valid Subsistence Halibut Registration Certificate (SHARC) issued by NMFS, are eligible to harvest subsistence halibut. These allocations are based on recognized customary and traditional uses of halibut. Regulations to implement subsistence halibut fishing were published in the Federal Register in April 2003 and became effective May 2003.

Seward

Location

Seward is located on Resurrection Bay on the southeast coast of the Kenai Peninsula. It lies at the foot of a mountain range, ending in the South with Mount Marathon. Seward is the gateway to the Kenai Fjords National Park. The area encompasses 14.4 square miles of land and 7.1 square miles of water.

Demographic Profile

According to the U. S. Census, the population of Seward was 2,830 in 2000. Total population numbers have increased steadily from 1910 when there were 534 residents of the community.

Current Economy

There are several fish processing plants in Seward with the collective capacity to process halibut, sablefish, other groundfish and salmon. Salmon is major component of the harvest and the current reduction in salmon prices has adversely affected the economy of Seward.

Involvement in North Pacific Fisheries

Commercial Fishing

Commercial fishing is important to the economy of Seward. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 164 permits were held by 80 permit holders but only 86 permits were actually fished in Seward in 2000. There were 25 vessel owners in the federal fisheries, 24 vessel owners in the salmon fishery and overall 198 crew members claiming residence in Seward. The commercial vessel fleet delivering landings to Seward was involved in halibut (169 vessels), sablefish (129 vessels), other ground fish (203 vessels), and salmon (211 vessels) fisheries in 2000. Landings in Seward for the year 2000 included 2,678.79 tons of federal fish (figures for landings by species are suppressed for reasons of confidentiality according to Federal Statute 3AAC48.045) and 11,530.35 tons of salmon.

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Seward for the year 2000 related to halibut, herring, other finfish, sablefish, other groundfish, crab, other shellfish and salmon.

Halibut: There were a total of 29 permits issued for halibut in Seward in 2000, 27 of which were actually fished.

Herring: There were a total of 14 permits issued for the herring fishery in Seward in 2000, only two of which were actually fished that year.

Other finfish: Three permits were issued for other finfish in Seward in 2000, none of which were actually fished.

Sablefish: A total of 18 sablefish permits were issued in 2000 in Seward, 12 of which were actually fished.

Other groundfish: A total of 44 permits were issued in 2000 for other groundfish in Seward, only 13 of which were actually fished.

Crab: Five permits were issued in Seward for crab in 2000, three of which were actually fished.

Other shellfish: Of five permits, only one permit that had been issued in Seward in 2000 was actually fished. Permits issued in Seward pertained to one shrimp pot gear vessel under 60 feet in westward waters (not fished), one shrimp pot gear in southeast waters (not fished), one shrimp pot gear vessel over 60 feet in westward waters (not fished), one sea cucumber diving gear permit for statewide waters but excluding southeast waters, one sea urchin diving gear permit for statewide waters but excluding southeast waters (not fished).

Salmon: A total of 46 permits were issued in Seward in 2000 for the salmon fishery, 28 of which were actually fished.

Between the five processors registered in Seward in 2000, there were facilities for processing halibut, salmon, sablefish and groundfish. These processors are significant seasonal employers and providers of harbor and portside facilities. Resurrection Bay Seafoods, a processing plant in Seward owned by Wards Cove Packing Company, was purchased by Seattle-based Smoki Foods in the spring of 2003, just before the opening of the halibut season. In recent years, the Seward plant has primarily been a halibut and black cod processing facility. It was put on the market in December after Wards Cove announced it was closing the doors of its Alaska salmon processing facilities.

Sport Fishing

The considerable diversity of fish species available for recreational fishing in the waters around Seward, as well as the town's easy accessibility, make it popular destination for sport fishers. Chinook salmon, silver salmon, red salmon, halibut, rockfish and lingcod are common sportfishing species found in the nearby marine waters. There were 37 sportfishing businesses registered in Seward in 2002 and four freshwater businesses. There was a total of 13,923 sport fishing licenses sold in Seward in 2000, 4,099 of which were sold to Alaska residents. The high numbers are due to Seward's famous river fishing which attract people from all over the world and necessitate arranging accommodation and fishing guides well in advance during summer months.

Subsistence Fishing

According to 2003-2004 Federal subsistence fishery regulations, Seward is designated as a Federal nonrural area. Correspondingly, residents of Seward are not eligible for subsistence fishing permits and are not permitted to harvest fish or shellfish under Federal subsistence regulations.

A total of five permits were held by households in Seward for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. Salmon is not a federally managed fish, and is therefore not subject to the same restriction as other fisheries. Pink salmon made up the largest proportions of the salmon harvest, followed by sockeye and chum.

Sitka

Location

Sitka is located on the west coast of Baranof Island fronting the Pacific Ocean, on Sitka Sound in southeast Alaska. An extinct volcano, Mount Edgecumbe, rises 3,200 feet above the community. The area encompasses 2,874.0 square miles of land and 1,937.5 square miles of water.

Demographic Profile

According to the U. S. Census, the population of Sitka was 8,835 in 2000. Population numbers have risen steadily since the late 1800s with drastic population increases occurring in 1880s, 1950s and 1960s.

Current Economy

The economy of Sitka is relatively diverse, including fishing, fish processing, tourism, government, transportation, retail, and health care services. Cruise ships bring over 200,000 visitors annually and numerous businesses cater to tourism, including fishing charters, sightseeing tours and visitor accommodations. Sitka Sound Seafood and the Seafood Producers Co-op are major employers. Regional health care services, the U.S. Forest Service and the U.S. Coast Guard also employ a number of residents. A total of 1,369 commercial fishing permits were held by 586 permit holders in 2000 according to the Commercial Fisheries Entry Commission.

Involvement in North Pacific Fisheries

Commercial Fishing[*]

Commercial fishing is important to the economy of Sitka. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 1369 permits were held by 586 permit holders but only 888 permits were actually fished in Sitka in 2000. There were 233 vessel owners in the federal fisheries, 288 vessel owners in the salmon fishery and fishery and overall 658 crew members claiming residence in Sitka in 2000. The commercial vessel fleet delivering landings to Sitka was involved in herring (17 vessels), halibut (277 vessels), sablefish (159 vessels), other groundfish (331 vessels), and salmon (629 vessels) fisheries in 2000. Landings in Sitka for the year 2000 included 4,269.11 tons of federal fish, including 1081.89 tons of halibut, 569.99 tons of other groundfish (other figures for landings by species are suppressed for reasons of confidentiality according to Federal Statute 3AAC48.045) and 8087.729 tons of salmon.

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Sitka for the year 2000 related to halibut, herring, sablefish, other groundfish, crab, other shellfish and salmon.

Halibut: There were a total of 258 permits issued for halibut in Sitka in 2000, 210 of which were actually fished.

Herring: There were a total of 32 permits issued for the herring fishery in Sitka in 2000, 25 of which were actually fished that year.

Sablefish: A total of 133 sablefish permits were issued in 2000 in Sitka, 130 of which were actually fished.

Other groundfish: A total of 338 permits were issued in 2000 for other groundfish in Sitka, only 109 of which were actually fished.

Crab: A total of 43 permits were issued in Sitka for crab in 2000, 35 of which were actually fished.

Other shellfish: A total of 154 permits were issued in Sitka in 2000, 84 of which were actually fished.

[*] Commercial fishing permit data from the CFEC is given for the communities of Katlian, Mount Edgecumbe, and Sitka

Salmon: A total of 411 permits were issued in Sitka in 2000 for the salmon fishery, 295 of which were actually fished.

Sport Fishing

There were 148 saltwater sport fishing businesses registered in Sitka in 2002 and 63 businesses licensed to provide freshwater recreational fishing according to the Alaska Department of Fish and Game. There was a total of 18,400 sport fishing licenses sold in Sitka in 2000, 3,261 of which were sold to Alaska residents.

Subsistence Fishing

Numerous social, economic and technological changes have influenced life in Alaskan fishing communities and subsistence harvests and practices continue to provide fishing communities with important nutritional, economic, social and cultural requirements. Data from 1996 compiled on behalf of the Division for Subsistence of the Alaska Dept of Fish and Game provides useful information about subsistence practices in Sitka. Records describe the subsistence patterns for 97.4% of households in the community which participated in the use of subsistence resources, including harvesting, sharing and consuming resources, illustrating the importance of subsistence to life in the community. Of the total population, 89.4% used salmon and 91.7% used non-salmon fish (herring, herring roe, smelt, bass, cod, flounder, greenling, halibut, perch, rockfish, sablefish, char, grayling, trout), many fewer households, 17.5%, used marine mammals and a high percentage, 72.4%, used marine invertebrates.

The average per capita subsistence harvest for the year 1996 was 205.01 pounds. The composition of the total subsistence harvest can be shown by the percentages of the resources which demonstrate the amount of each resource category used by the community relative to other resources categories. The total subsistence harvest was composed of 54.48% salmon, non-salmon fish made up 26.27%, land mammals 24.86%, marine mammals 3.56%, birds and eggs accounted for only 0.29% of the total subsistence harvest, marine invertebrates for 13.4% and vegetation made up 3.41%. The wild food harvest in Sitka made up 133% of the recommended dietary allowance of protein in 1996 (corresponding to a daily allowance of 49g of protein per day or 0.424 lbs. of wild food per day) (Wolfe, Division of Subsistence, ADF&G).

A total of 530 permits were held by households in Sitka for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. Sockeye made up the vast majority of the salmon harvest. Residents of Sitka and members of Sitka Tribe of Alaska who hold a valid Subsistence Halibut Registration Certificate (SHARC) issued by NMFS, are eligible to harvest subsistence halibut. These allocations are based on recognized customary and traditional uses of halibut. Regulations to implement subsistence halibut fishing were published in the Federal Register in April 2003 and became effective May 2003.

Unalaska / Dutch Harbor

Location

Unalaska is a town located on Unalaska Island in the western Aleutian Islands. The Dutch Harbor portion of the community is located on Amaknak Island and is mainly an industrial port area, connected by a bridge to Unalaska Island, where most of the population is concentrated. Unalaksa and Dutch Harbor are treated as a single community here, in accordance with their inseparability in certain data sets and an underlying socioeconomic interconnectivity.

Demographic Profile

Unalaska is a town of 4,283 people in 988 housing units (Census 2000). During peak fishing seasons the population of the city can swell to over ten thousand.

Current Economy

The Unalaska/Dutch Harbor economy is based almost entirely on commercial fishing. It is the major source of employment, accounting for over 90% of jobs. Employment occurs in the harvest and processing sectors, and in fishing-related services such as fuel, vessel maintenance, trade and transportation (Alaska Department of Community and Economic Development). A nascent tourism industry is present in the community, with cruise ship stopovers, sportfishing, kayaking, and birdwatching attracting visitors. The subsistence economy is also still important in the community.

The median per capita income in 2000 was $24,676, and the median household income was 69,539. Approximately 12.5% of the population was below the poverty level. In 2000, 11.1% of residents were unemployed and seeking work, and 16.8% were unemployed and not seeking work (not in the total potential labor force).

Involvement in North Pacific Fisheries

Commercial Fishing

Unalaska/Dutch Harbor are located at the center of the most productive groundfish fishery in the world. Pollock generates the most revenue of the commercially fished species in Dutch Harbor/Unalaska. Other species processed in Dutch Harbor/Unalaska include pacific cod, black cod, halibut, flatfish, salmon, herring, opilio, tanner, and king crab. In 2000 there were 50 residents who held a total of 103 commercial fishing permits. There were 17 resident vessel owners operating in federal fisheries and six vessel owners operating in non-federal fisheries. There were 200 registered crew members residing in Unalaska/Dutch Harbor in 2000. This section contains detailed information about commercial permits in 2000 for Unalaska and Dutch Harbor as a single entity.

Crab: Permits in the crab fishery totaled 16, and 13 of them were actually fished.

Other Shellfish: A total of four permits for other shellfish were issued, but none was actually fished.

Halibut: *Permits* in the halibut fishery totaled 25, and 13 of them were actually fished.

Herring: There was only one permit issued in the herring fishery, and none was actually fished. This permit was for a vessel with purse seine gear in Bristol Bay.

Other Groundfish: Permits in the groundfish fishery totaled 40, and 18 of them were actually fished.

Sablefish: Permits in the sablefish fishery totaled seven, and five of these were actually fished.

Salmon: Permits in the salmon fishery totaled eight, and five were actually fished.

Dutch Harbor/Unalaska is the busiest fishing port in the nation in terms of landings; nine processors reported a total of 316,312.6 tons in landings for 2000. Of this, the vast majority of landings (305,394.8 tons, or 96.5%) were in the groundfish fishery. Vessels delivered landings to Dutch Harbor/Unalaska for the following species: groundfish (192 vessels); Sablefish (56 vessels); halibut (197 vessels); BSAI crab (136 vessels); salmon (50 vessels); herring (46 vessels); and scallops (1 vessel).

The largest onshore processors in Dutch Harbor/Unalaska are Unisea, Westward Seafoods, and Alyeska Seafoods. Osterman Fish, Prime Alaska, and Royal Aleutian also operate in Dutch Harbor. The off-shore processors in the area are the Bering Star, which is a floating processor that spends most of its time in Dutch Harbor/Unalaska, and the Fishing Company of Alaska (FCA), which is an at-sea processing company.

Sport Fishing

There are at least eight charter boat companies that operate out of Unalaska/Dutch Harbor, taking customers on sport fishing cruises to catch sockeye salmon, silver salmon, pink salmon, halibut, and dolly varden. There are three registered fishing guides for fresh water and six for salt water. Sport fishing permit sales for Unalaska totaled 833 in 2000, including 485 to Alaska residents.

Each season sport fishermen are lured to Unalaska for the Halibut Derby which offers prizes for the largest halibut caught each season and a prize of $100,000 for breaking the IGFA Pacific Halibut World Record, which is currently a fish of 459 pounds, caught in Unalaska. Some participants in the halibut charter fleet report a recent increase in competition on the local fishing grounds from commercial fishing boats which have responded to a decrease in the ex-vessel value of salmon by moving into halibut fisheries.

Subsistence

Many residents of Unalaska use subsistence resources to supplement their incomes. The Alaska Department of Fish and Game, Division of Subsistence, reports that, in 1994, 96.8% of Unalaska households used subsistence resources. Approximately 91.9% of households used salmon, particularly coho and cockeye. Approximately 94.6% of households used non-salmon fish species, including cod, halibut, herring, rockfish, sablefish, and char. In addition, 13.8% used marine mammals for subsistence, and 86.5% used marine invertebrates.

The annual per capita harvest of subsistence foods for Unalaska in 1994 was 194.5 pounds, and was comprised of the following resources: salmon (27.7%), non-salmon fish (41.6%), land mammals (4.9%), marine mammals (4.9%), birds and bird eggs (0.8%), marine invertebrates (14.1%), and vegetation (6.0%). In 1999, 206 households in Unalaska and Dutch Harbor held subsistence salmon harvesting permits. The local Qawalingin Tribe of Unalaska holds a Subsistence Halibut Registration Certificate (SHARC), which allows them to harvest halibut for subsistence.

Yakutat

Location

Yakutat lies among the lowlands along an extremely isolated stretch of coastline in the Gulf of Alaska. The community is located at the mouth of Yakutat Bay, one of the few refuges for vessels along this stretch of coast. The massive Hubbard and Malaspina Glaciers are nearby. The area encompasses 7,650.5 square miles of land and 1,808.8 square miles of water. Yakutat city is the sole residential grouping in Yakutat borough, making figures for each reflective of the other and therefore somewhat interchangeable.

Demographic Profile

According to the U. S. Census, the population of Yakutat City and Borough was 808 in 2000. Population numbers are currently at a maximum having increased drastically since the 1970s when the population was in the hundreds

Current Economy

Yakutat's monetary economy is almost exclusively dependent on fishing, fish processing and government. North Pacific Processors is the major private employer. Recreational fishing opportunities, both saltwater and freshwater fishing in the Situk River, are world-class and attract visitors to the region from across the globe. Most residents depend heavily on subsistence hunting and fishing. Salmon, trout, shellfish, deer, moose, bear and goats are harvested. A total of 253 commercial fishing permits were held by 162 permit holders in 2000 according to the Commercial Fisheries Entry Commission.

At the time of the 2000 U.S. Census, 71.8% of the potential labor force was employed and there was a 6.0% unemployment rate. Of the population over 16 years of age, 22.2% were not in the labor force, though this may be explained by the intensely seasonal nature of the fishing industry, and 13.5% of the population was below the poverty level. The median household income in the same year was $46,786 and the per capita income was $22,579.

Involvement in North Pacific Fisheries

Commercial Fishing

Commercial fishing is important to the economy of Yakutat. According to the Department of Fish and Game, and reported by the Alaska Commercial Fisheries Entry Commission 253 permits were held by 162 permit holders but only 167 permits were actually fished in Yakutat in 2000. There were 36 vessel owners in the federal fisheries, 50 vessel owners in the salmon fishery and overall 56 crew members claiming residence in Yakutat in 2000. The commercial vessel fleet delivering landings to Yakutat was involved in halibut (17 vessels), sablefish (49 vessels), other ground fish (75 vessels), and salmon (72 vessels) fisheries in 2000 (figures for landings of all species are suppressed for reasons of confidentiality according to Federal Statute 3AAC48.045).

Commercial fishing permits are issued according to specifications of species, vessel size, gear type and fishing area. Permits issued in Yakutat for the year 2000 related to halibut, herring, sablefish, other groundfish, crab, other shellfish and salmon.

Halibut: There were a total of 27 permits issued for halibut in Yakutat in 2000, 24 of which were actually fished.

Herring: One permit was issued for herring spawn on kelp in northern southeast waters, which was fished.

Sablefish: Two permits were issued for sablefish in Yakutat which pertained to two longline vessels under 60 feet in statewide waters (one permit fished).

Other groundfish: A total of 17 permits were issued in 2000 for other groundfish in Yakutat, only four of which were actually fished.

Crab: Ten permits were issued in Yakutat for crab in 2000, three of which were actually fished.

Other shellfish: A total of 18 permits were issued for other shellfish in Yakutat in 2000, six of which were actually fished. All 18 permits pertained to one shrimp pot gear vessels under 60 feet restricted to Yakutat (six permits actually fished).

Salmon: A total of 178 permits were issued in Yakutat in 2000 for the salmon fishery, 128 of which were actually fished.

Sport Fishing

There were 12 saltwater sport fishing businesses registered in Yakutat in 2002 and 19 businesses licensed to provide freshwater recreational fishing according to the Alaska Department of Fish and Game. There was a total of 3,897 sport fishing licenses sold in Yakutat in 2000, 308 of which were sold to Alaska residents.

Subsistence Fishing

Numerous social, economic and technological changes have influenced life in Alaskan fishing communities and subsistence harvests and practices continue to provide fishing communities with important nutritional, economic, social and cultural requirements. Data from 1987 compiled on behalf of the Division for Subsistence of the Alaska Dept of Fish and Game provides useful information about subsistence practices in Yakutat. Records describe the subsistence patterns for 96.4% of households in the community which participated in the use of subsistence resources, including harvesting, sharing and consuming resources, illustrating the importance of subsistence to life in the community. Of the total population, 88.3% used salmon and 96.4% used non-salmon fish (herring, herring roe, smelt, cod, flounder, greenling, halibut, rockfish, sablefish, char) 53.3% used marine mammals and a high percentage, 92.6%, used marine invertebrates.

The average per capita subsistence harvest for the year 1996 was 397.77 pounds. The composition of the total subsistence harvest can be shown by the percentages of the resources which demonstrate the amount of each resource category used by the community relative to other resources categories. The total subsistence harvest was composed of 54.20% salmon, non-salmon fish made up 19.31%, land mammals 3.7%, marine mammals 7.81%, birds and eggs accounted for only 0.63% of the total subsistence harvest, marine invertebrates for 9.98% and vegetation made up 4.38%. The wild food harvest in Yakutat made up 257% of the recommended dietary allowance of protein in 1987 (corresponding to a daily allowance of 49g of protein per day or 0.424 lbs. of wild food per day) (Wolfe, Division of Subsistence, ADF&G).

A total of 77 permits were held by households in Yakutat for subsistence fishing of salmon according to Alaska Department of Fish and Game division of Subsistence records from 1999. Sockeye made up the vast majority of the salmon harvest. Members of Yakutat Tlingit Tribe who hold a valid Subsistence Halibut Registration Certificate (SHARC) issued by NMFS, are eligible to harvest subsistence halibut. These allocations are based on recognized customary and traditional uses of halibut. Regulations to implement subsistence halibut fishing were published in the Federal Register in April 2003 and became effective May 2003.