Proposed Amendments 10, 11, and 12 to the
Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska

(1) Replace the **Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska with the following fishery management plan:**

FISHERY MANAGEMENT PLAN For The SALMON FISHERIES In The EEZ Off Alaska

North Pacific Fishery Management Council
National Marine Fisheries Service, Alaska Region
State of Alaska Department of Fish and Game

March 2012

North Pacific Fishery Management Council
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SUMMARY

This document describes the North Pacific Fishery Management Council's (Council's) plan for managing salmon fisheries in a significant portion of the U.S. Exclusive Economic Zone (EEZ or federal waters) off Alaska. The Council developed the *Fishery Management Plan for the Salmon Fisheries in the EEZ Off Alaska* (FMP) under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

The Secretary of Commerce originally approved the *Fishery Management Plan for the High Seas Salmon Fishery off the Coast of Alaska East of 175 Degrees East Longitude* and implemented it in 1979. The FMP established the Council's authority over the salmon fisheries in the EEZ, the waters from 3 to 200 miles offshore, then known as the United States Fishery Conservation Zone. The Council excluded from its coverage the Federal waters west of 175° east longitude (near Attu Island) because the salmon fisheries in that area were under the jurisdiction of the *International Convention for the High Seas Fisheries of the North Pacific Ocean*. The Council divided the United States Fishery Conservation Zone covered by the plan into a West Area and an East Area with the boundary at Cape Suckling. It authorized sport salmon fishing in both areas, prohibited commercial salmon fishing in the West Area (except in three traditional net fishing areas managed by the State of Alaska), and authorized commercial troll fishing in the East Area. Management measures for the salmon fisheries in the United States Fishery Conservation Zone were equivalent to State of Alaska regulations in the adjacent state waters.

The FMP has been amended several times and was comprehensively revised in 1990. With time, the 1979 FMP became outdated and some of Alaska's management measures changed. Thus, in 1990, the Council amended the plan to update it, correct minor errors, and remove itself from routine management of the salmon fisheries. Also, the Magnuson-Stevens Act was revised to require that fishery management plans consider fish habitat and accommodate vessel safety. Finally, the FMP needed to incorporate restrictions on Alaska salmon fisheries consistent with the 1985 *Treaty between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon*. The 1990 FMP included these changes in a reorganized and shortened document with a more appropriate title, *Fishery Management Plan for the Salmon Fisheries in the EEZ Off the Coast of Alaska*.

In the 1990 FMP, the Council reaffirmed its decision that existing and future salmon fisheries occurring in the EEZ require varying degrees of federal management and oversight. The FMP (1) retained the prohibition on salmon fishing with nets but continued to authorize commercial hand-troll and power-troll salmon fishing in the East Area, (2) retained the prohibition on commercial salmon fishing in the West Area with the exception of commercial net salmon fisheries that occur in three delineated areas of the EEZ, (3) allowed sport fishing in both areas, and (4) delegated regulation of the sport and commercial fisheries in the EEZ to the State of Alaska. Since 1990, the Council has amended the FMP eleven times to address various Magnuson-Stevens Act requirements.

In 2010, the Council began a comprehensive review of the FMP and consideration of its management strategy and scope of coverage. Since 1990, State of Alaska fisheries regulations and federal and international laws affecting Alaska salmon have changed and the reauthorized Magnuson-Stevens Act expanded the requirements for fishery management plans. The Council also recognized that the FMP was vague with respect to management authority for the three directed commercial salmon fisheries that occur

in the West Area. The Council decided to update the FMP to comply with the current Magnuson-Stevens Act requirements and to more clearly reflect the Council's policy with regard to the State of Alaska's management authority over commercial fisheries in the West Area, the commercial troll fishery in the East Area, and the sport fishery.

In 2011, the Council recommended Amendment 12 to comprehensively revise the FMP. With Amendment 12, the Council affirmed that its salmon management policy is to facilitate State of Alaska salmon management in accordance with the Magnuson-Stevens Act, the Pacific Salmon Treaty, and other applicable federal law. Under this policy, the Council identified six management objectives to guide salmon management under the FMP and achieve the management policy. To reflect this policy, the Council modified the FMP's management area to exclude the three traditional net fishing areas and the sport fishery from the West Area. The Council maintained the prohibition on commercial fishing in the West Area. In the East Area, the Council maintained the FMP and reaffirmed that management of the salmon fisheries in the East Area is delegated to the State of Alaska. The Council also recommended a number of FMP provisions to update the FMP and bring it into compliance with the Magnuson-Stevens Act and other applicable federal, State of Alaska, and international law. This revised FMP includes these changes in a reorganized and shortened document with a more concise title, *Fishery Management Plan for the Salmon Fisheries in the EEZ Off Alaska*.

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Chapter 1 INTRODUCTION

This document describes the North Pacific Fishery Management Council's (Council's) plan for managing salmon fisheries in a significant portion of the U.S. Exclusive Economic Zone (EEZ or federal waters) off Alaska. The Council developed the *Fishery Management Plan for the Salmon Fisheries in the EEZ off Alaska* (FMP) under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, 16 U.S.C. 1801 *et seq*.). The Secretary of Commerce approved the FMP and it became effective in 1979. The FMP was comprehensively revised in 1990 and in 2012.

The Magnuson-Stevens Act is the primary domestic legislation governing management of the nation's marine fisheries. The Magnuson-Stevens Act gives the Council responsibility for preparing and amending fishery management plans for any fishery in the EEZ off Alaska that requires conservation and management (16 U.S.C. 1852 (h)). The Magnuson-Stevens Act requires fishery management plans to be consistent with a number of provisions, including ten national standards, with which all fishery management plans must conform and which serve to guide fishery management. Besides the Magnuson-Stevens Act, U.S. fisheries management must be consistent with the requirements of other laws, such as the Marine Mammal Protection Act and the Endangered Species Act.

Under the Magnuson-Stevens Act, the Council is authorized to prepare and submit to the Secretary of Commerce for approval, disapproval, or partial approval, a fishery management plan and any necessary amendments for each fishery under its authority that requires conservation and management. The Council conducts public meetings to allow all interested persons an opportunity to be heard in the development of fishery management plans and amendments, and reviews and revises, as appropriate, the assessments and specifications with respect to the optimum yield from each fishery.

1.1 History of the FMP

On December 1, 1978, the Council adopted the *Fishery Management Plan for the High Seas Salmon Fishery off the Coast of Alaska East of 175 Degrees East Longitude* for managing the federal waters salmon fisheries and submitted it to the Secretary of Commerce for approval and implementation with federal regulations. The Council had determined that unless it managed the salmon fisheries in the waters under its jurisdiction, certain salmon stocks would likely be overharvested. The FMP was intended to maintain the then recent levels of fishing effort on the salmon stocks. The Secretary of Commerce approved, with one exception, the FMP on April 30, 1979, and it was implemented on May 18, 1979, with emergency regulations (44 FR 29080). NMFS published the FMP on June 8, 1979 (44 FR 33250).

The FMP established the Council's authority over the salmon fisheries in the federal waters off Alaska, from 3 to 200 miles offshore, then known as the U.S. Fishery Conservation Zone. The Council excluded from FMP coverage the federal waters west of 175° east longitude (near Attu Island) because the salmon fisheries in that area were under the jurisdiction of the *International Convention for the High Seas Fisheries of the North Pacific Ocean* and the *North Pacific Fisheries Act* (16 U.S.C. 1921 *et seq*.).

The FMP divided the federal waters off Alaska into two areas (East Area and West Area) at the longitude of Cape Suckling (143°53.6' W). It maintained the 1952 prohibition on the commercial net salmon fishing and the 1973 prohibition on commercial troll salmon fishing in the West Area (with three small exceptions for traditional coastal net fisheries) and recognized that the salmon stocks in the West Area are fully utilized by the inshore salmon fishery. The FMP established values for the maximum sustainable yield (MSY), an allowable biological catch (ABC), and optimum yield (OY), and set the total allowable level of foreign fishing equal to zero for both areas.

The FMP management measures focused primarily on the troll fishery in the East Area and the sport fishery. The FMP's primary function was to limit entry in the commercial troll fishery in federal waters by (1) placing a moratorium on commercial power troll permits, (2) establishing a separate federal permit for those power trollers who do not have Alaska limited entry permits but who have fished in the U. S. Fishery Conservation Zone and landed their catch outside of Alaska, and (3) requiring trollers to have either a State of Alaska or a federal limited-entry troll permit. The Council intended the rest of the FMP management measures for the sport fishery and the commercial troll fishery in the East Area to be complementary with the State of Alaska regulations for the salmon fisheries in adjacent state waters. The FMP adopted the State of Alaska's harvest restrictions and management measures.

The Council allowed the sport fishery to be open all year, but restricted sport gear and harvest by adopting the then current State of Alaska regulations.

The Council intended to prohibit hand trolling in the federal waters (to be consistent with the existing state ban on hand trolling in waters seaward of the surfline), but the Secretary of Commerce disapproved that provision. The Secretary of Commerce determined that the prohibition on hand trolling was inconsistent with National Standard 4 because prohibiting fishing by certain hand trollers who had historically fished in this area would have treated hand trollers different from power trollers without serving a conservation or management purpose (44 FR 29080, May 18, 1979).

Amendment 1

On May 2, 1980, the Secretary of Commerce approved Amendment 1, with one exception (45 FR 34020, May 21, 1980). Amendment 1 made several changes to conform the FMP and implementing regulations to state regulations so that there was uniformity between state and federal waters. The Council again attempted to prohibit hand trolling, but the Secretary of Commerce disapproved that provision of Amendment 1 based on inconsistency with National Standard 4.

Amendment 2

On June 5, 1981, the Secretary of Commerce approved Amendment 2, with one exception (46 FR 57299, November 23, 1981). This amendment (1) made several changes to conform the FMP and implementing regulations to the state regulations so that there was uniformity between state and federal waters, (2) modified the objectives of the plan, and (3) reduced the ABC and OY for Chinook salmon in the East Area by 15 percent. The Council had proposed to modify its reporting requirements to require that fishermen landing their catch outside of Alaska submit an Alaska fish ticket before leaving the state. Although the Secretary of Commerce approved this provision, it was disapproved by the Office of Management and Budget, which found that this requirement imposed an unjustified burden on fishermen.

Amendment 3

In 1990, the Secretary of Commerce approved Amendment 3 (55 FR 47773, November 15, 1990). Amendment 3 completely revised the FMP. In 1986, the Council decided to amend its FMP for a third time to (a) update the FMP to contain the best available scientific information, (b) correct minor errors, (c) increase management flexibility, and (d) make the plan consistent with the 1985 *Treaty between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon* (Pacific Salmon Treaty) and the Pacific Salmon Treaty Act (16 U.S.C. 3631 *et seq.*).

In June 1988, the Council reviewed a draft FMP as it would be modified by Amendment 3 and requested its salmon plan team revise the draft to extend jurisdiction of the FMP over federal waters west of 175° east longitude, revise the definitions of MSY and OY, and delegate regulation of the salmon fisheries to the State of Alaska. In addition, the Council also (a) considered temporary adjustments because of weather or other ocean conditions affecting the safety of vessels, (b) included a section on habitat, and (c) changed the name of the U.S. Fishery Conservation Zone to the U.S. Exclusive Economic Zone (EEZ) as required by the 1986 amendments to the Magnuson-Stevens Act.

In 1990, the Council adopted Amendment 3 and reaffirmed its decision to maintain a fishery management plan for managing the EEZ salmon fisheries because existing and future salmon fisheries occurring in the EEZ require varying degrees of federal management and oversight under the Magnuson-Stevens Act.

Amendment 4

On March 1, 1991, the Secretary of Commerce approved Amendment 4 (56 FR 12365, March 25, 1991). Amendment 4 defines status determination criteria for the stocks of salmon covered by the FMP as the definitions and policies on overfishing promulgated by the Pacific Salmon Commission and the State of Alaska.

Amendment 5

On January 20, 1999, the Secretary of Commerce approved Amendment 5 (64 FR 20216, April 26, 1999). Amendment 5 describes and identifies essential fish habitat for Alaska salmon and risks to that habitat to promote the protection and conservation of habitat used by FMP species at crucial stages of their life cycles.

Amendment 6

On January 2, 2002, the Secretary of Commerce approved Amendment 6 (67 FR 1163, January 9, 2002). Amendment 6 implements status determination criteria for the salmon stocks harvested in the Southeast Alaska troll fishery to prevent overfishing and ensure that conservation and management measures continue to be based on the best scientific information available. Amendment 6 modified Amendment 4 by amending the FMP to include new status determination criteria for the East Area.

Amendments 7 and 8

On May 3, 2006, the Secretary of Commerce approved Amendments 7 and 8 (71 FR 36694, June 28, 2006). These amendments revise the FMP by identifying and describing essential fish habitat, designating habitat areas of particular concern, and including measures to minimize to the extent practicable adverse effects on essential fish habitat. These amendments protect important salmon habitat features to sustain managed salmon. These amendments replaced Amendment 5.

Amendment 9

On February 4, 2008, the Secretary of Commerce approved Amendment 9 (73 FR 9035, February 19, 2008). Amendment 9 revises the boundaries of the Aleutian Islands Habitat Conservation Area described in the FMP to ensure the boundaries accurately reflect the Council's intent to prohibit nonpelagic trawling in those areas with minimal or no fishing and sensitive habitat, and to allow nonpelagic trawling in areas historically fished by this gear type.

Amendment 10

On [insert date], the Secretary of Commerce approved Amendment 10 [insert FR citation]. Amendment 10 amends the FMP to provide authority for NMFS to recover the administrative costs of processing applications for any future permits that may required under this FMP, except for exempted fishing permits and prohibited species donation permits.

Amendment 11

On [insert date], the Secretary of Commerce approved Amendment 11 [insert FR citation]. In April 2011, the Council recommended Amendment 11 as part of its 5-year review for essential fish habitat. Amendment 11 changes the Council's time period to solicit HAPC proposals from every 3 years to every 5 years, to coincide with the EFH 5-year review. Additionally, Amendment 11 retains the flexibility for the Council to solicit HAPC proposals at any time. Amendment 11 also revises Appendix A to update the description of the non-fishing impacts to salmon EFH and the recommendations for entities conducting non-fishing activities in areas that are considered salmon EFH.

Amendment 12

On [insert date], the Secretary of Commerce approved Amendment 12 [insert FR citation]. Amendment 12 comprehensively revises the FMP to facilitate State of Alaska salmon management in accordance with the Magnuson-Stevens Act, the Pacific Salmon Treaty, and other applicable federal law. Under this policy, the Council identified six management objectives to guide salmon management under the FMP and achieve the management policy. To reflect this policy, the Council modified the FMP's management area to exclude the three traditional net fishing areas and the sport fishery from the West Area. The Council maintained the prohibition on commercial fishing in the West Area. In the East Area, the Council maintained the FMP and reaffirmed that management of the salmon fisheries in the East Area is delegated to the State of Alaska. The Council also recommended a number of FMP provisions to update the FMP and bring it into compliance with the Magnuson-Stevens Act and other applicable federal, state, and international law.

Table 1 Amendments to the Salmon FMP.

Amendment	Date	Pertinent Function(s)	Federal Register document
FMP for the High Seas Salmon Fisheries off the Coast of Alaska East of 175 Degrees East Longitude	1979	• Establishes Council and NMFS authority over the salmon fisheries in federal waters from 3 to 200 miles seaward. • Excludes waters west of 175°E. long. from the FMP.	44 FR 29080 44 FR 33250
Amendment 1	1980	• Makes several changes to conform the FMP and implementing regulations to state regulations	45 FR 34020
Amendment 2	1981	• Makes several changes to conform the FMP and implementing regulations to the state regulations. • Modifies the objectives of the plan. • Reduces the ABC and OY for Chinook salmon in the East Area by 15 percent.	46 FR 57299
Amendment 3 *FMP for the Salmon Fisheries in the EEZ off the Coast of Alaska*	1990	• Extends FMP jurisdiction to EEZ west of 175°E. long. • Delegates regulation of sport and commercial fisheries to state but maintains federal participation and oversight.	55 FR 47773
Amendment 4 *(modified by Amend 6)*	1991	• Establishes status determination criteria.	56 FR 12385
Amendment 5 *(superseded by Amend 7)*	1999	• Implements Essential Fish Habitat (EFH) provisions contained in the Magnuson-Stevens Act.	64 FR 20216
Amendment 6 *Revise Definitions of Overfishing, MSY, and OY*	2002	• Establishes new status determination criteria for the Southeast Alaska troll fishery in compliance with the Magnuson-Stevens Act, and consistent with state and federal cooperative management and based on the State of Alaska salmon management and the Pacific Salmon Treaty.	67 FR 1163
Amendments 7 and 8 *Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC)*	2006	• Describes and identifies salmon EFH and HAPCs. • Makes conservation and enhancement recommendations for EFH and HAPCs.	71 FR 36694
Amendment 9 *Aleutian Islands Habitat Conservation Area*	2008	• Revises the boundaries of the Aleutian Islands Habitat Conservation Area described in the FMP	73 FR 9035
Amendment 10 *Permit Fees*	2012	• Establishes a system to collect fees for permits	[insert]
Amendment 11 *Essential Fish Habitat*	2012	• Updates description of EFH impacts from non-fishing activities, and EFH conservation recommendations for non-fishing activities. • Revises the timeline associated with the HAPC process to a 5-year timeline. • Updates EFH research priority objectives.	[insert]
Amendment 12 *FMP for the Salmon Fisheries in the EEZ Off Alaska*	2012	• Clarifies the Council's salmon management policy and objectives. • Redefines the management area to remove the 3 historical net fishing areas and the sport fishery from the West Area. • Delegates management of the salmon fisheries in the East Area to the State of Alaska. • Updates the FMP to comply with the Magnuson-Stevens Act, and applicable federal, state, and international law.	[insert]

Chapter 2 DESCRIPTION OF THE FISHERY MANAGEMENT UNIT

The Fishery Management Unit (FMU) for the FMP, described in detail in this chapter, represents the Council's choice of biological, geographic, economic, technical, social, and ecological management perspectives that best achieve the FMP's management policy and objectives. Section 2.1 describes the geographic scope of the FMU; section 2.2 describes the species included in the FMU; and section 2.3 describes the fisheries within the FMU. Section 2.4 provides a description of the nature and extent of Indian treaty fishing rights within the FMU.

2.1 Salmon Management Area

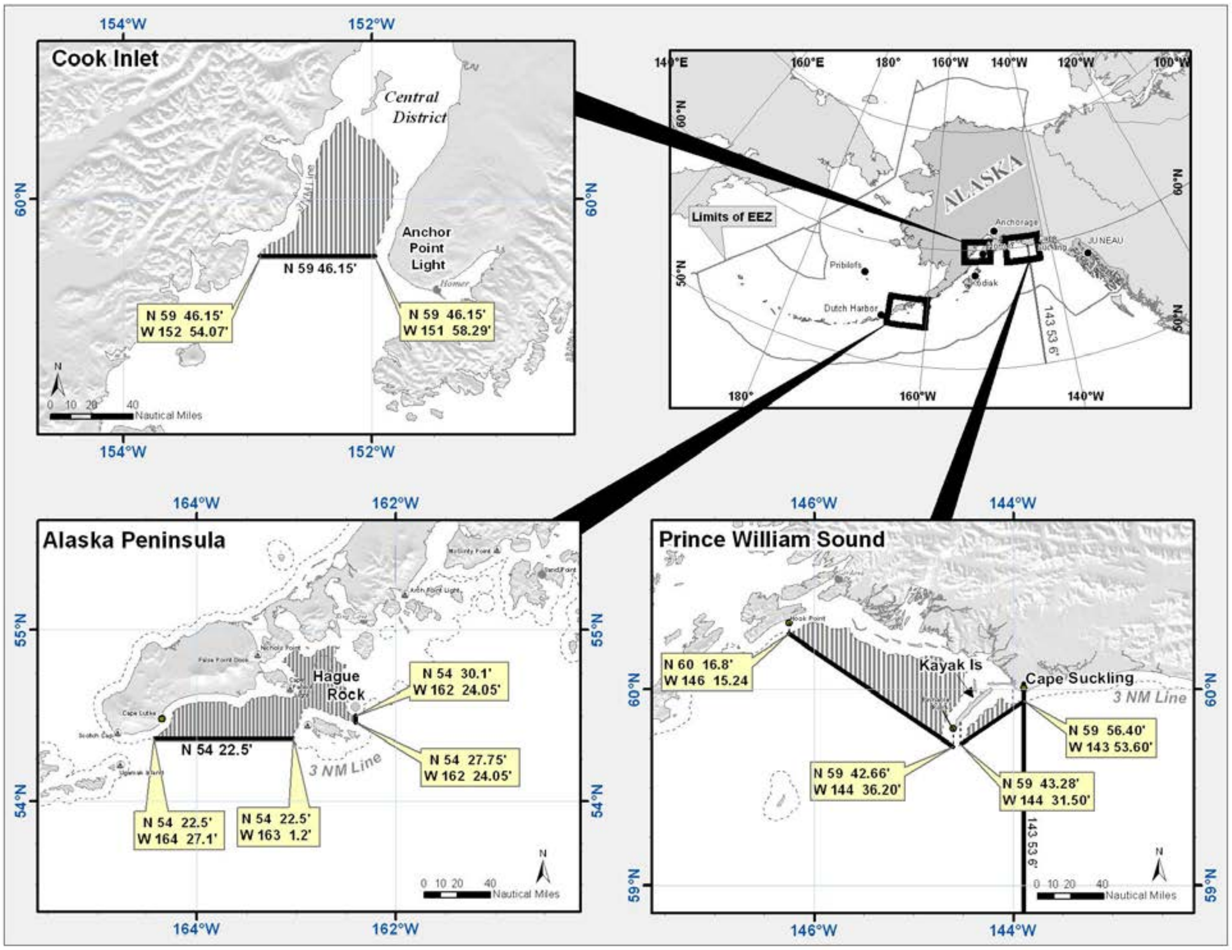
The salmon management area consists of all of the EEZ off Alaska, and the salmon fisheries that occur there, except for three defined areas that are excluded from the management area. The EEZ extends from 3 miles to 200 miles offshore. The salmon management area is divided into the East Area and the West Area (Figure 1). The border between the two areas is at the longitude of Cape Suckling (143°53.6' west longitude).

The East Area is the area of the EEZ in the Gulf of Alaska east of the longitude of Cape Suckling.

The West Area is the area of the EEZ off Alaska west of the longitude of Cape Suckling, including the Gulf of Alaska, Bering Sea, Chukchi Sea, and Beaufort Sea. The West Area does not include the three areas excluded from the management area.

Areas Excluded from the Management Area are the three traditional net fishing areas in the EEZ off Alaska that have commercial fisheries managed by the State of Alaska: the Cook Inlet Area, Prince William Sound Area, and the Alaska Peninsula Area (Figure 1). These areas technically extend into the EEZ, but the salmon fisheries that occur there are managed by the State of Alaska. This FMP does not manage these areas or the salmon fisheries that occur there.

Figure 1 The FMP's salmon management area, showing the East Area and the West Area and the three areas excluded from the salmon management area (shaded).



2.2 Salmon

The FMP includes all five species of Pacific salmon:

Chinook, *Oncorhynchus tshawytscha*

Coho, *Oncorhynchus kisutch*

Pink, *Oncorhynchus gorbuscha*

Sockeye, *Oncorhynchus nerka*

Chum, *Oncorhynchus keta*

For more information on the salmon, freshwater and marine distributions, life histories, and habitat, refer to Appendix A.

In the East Area, Chinook salmon originate from natural spawning grounds and hatcheries in Southeast Alaska, British Columbia, Washington, Oregon, and Idaho. Most coho, pink, chum, and sockeye in the East Area originate from Southeast Alaska natural spawning grounds and hatcheries, but some also originate in British Columbia.

In the West Area, Chinook salmon originate in North American fresh waters from coastal Oregon and the Columbia River to the streams of the Chukchi Sea and the uppermost reaches of the Yukon River. Harvestable coho originate primarily in Alaskan streams, ranging from those in southern Southeast to those in the northern parts of Western Alaska. Some coho in the West Area come from the Canadian portion of the Yukon River, and some probably come from Asia. The chum and pink salmon come from Asia and North America, whereas the sockeye come mostly from North America.

2.3 Fisheries

This FMP governs commercial fishing for salmon in the West Area, and governs commercial and sport (or recreational) fishing for the salmon in the East Area. The Magnuson-Stevens Act defines commercial fishing for salmon as fishing in which the salmon harvested, either in whole or in part, are intended to enter commerce or enter commerce through sale, barter or trade. The Magnuson-Stevens Act defines recreational fishing as fishing for sport of pleasure. Management measures applicable to these fisheries are described in chapter 6.

2.3.1 Sport (or Recreational) Salmon Fishery in the East Area

The FMP governs sport fishing for salmon in the East Area. The sport fishery for salmon takes place almost entirely within state waters (there is little reason for sport fishermen to fish for salmon seaward of state waters). In the East Area, the sport harvest of salmon from the EEZ is estimated to be a few thousand salmon, less than one percent of the combined state and federal marine waters sport harvest. Chinook and coho salmon are taken primarily in the charter boat fishery. A description of the sport fishery is provided in the Fishery Impact Statement in chapter 8.

2.3.2 Commercial Salmon Fishery in the East Area

The FMP governs commercial fishing for salmon in the East Area. Net fishing is prohibited in the East Area. Within the East Area, the troll fishery (hand-troll and power-troll) is the only commercial salmon fishery allowed. Management of the commercial troll fishery in the EEZ is delegated to the State of Alaska and the fishery is managed as a single unit throughout federal and state waters. From Alaska statehood in 1959 until 1979, this fishery was conducted and managed with little recognition of the boundary separating federal from state waters, although at one time the State of Alaska banned hand trolling seaward of the surf line. Upon implementation of the FMP in 1979, the portion of the fishery in the EEZ came under federal management. A description of the commercial troll fishery is provided in the Fishery Impact Statement in chapter 8.

2.3.3 Commercial Salmon Fishery in the West Area

The FMP governs commercial fishing for salmon in the West Area. Although the FMP governs commercial fishing for salmon in the West Area, no commercial fishing for salmon in the West Area has been permitted for a number of years. Commercial salmon fishing with nets has been prohibited in the majority of the West Area since 1952 with the *International Convention for the High Seas Fisheries of the North Pacific Ocean*. The North Pacific Fisheries Act of 1954 implemented the *International Convention for the High Seas Fisheries of the North Pacific Ocean*. The North Pacific Fisheries Act included an exception to the prohibition on commercial fishing for the three traditional net fishing areas managed by the State of Alaska. In 1970, under the authority of the North Pacific Fisheries Act of 1954, NMFS issued regulations that defined the North Pacific area and prohibited harvesting salmon in the North Pacific area (35 FR 7070, May 5, 1970). The regulations excluded from the North Pacific area the exclusive waters adjacent to Alaska where salmon net fishing was permitted under State of Alaska regulations.

The 1979 *Fishery Management Plan for the High Seas Salmon Fishery Off the Coast of Alaska East of 175 Degrees East Longitude* continued the prohibition on commercial fishing in the West Area, with the exception of the three traditional net fishing areas. The area east of 175° east longitude was not under the FMP because a Japanese high-seas mothership fishery operated there under the jurisdiction of the *International Convention for the High Seas Fisheries of the North Pacific Ocean*.

In 1990, in revising the FMP, the Council extended the West Area, and the prohibition on commercial salmon fishing, to include the EEZ waters west of 175° east longitude.

With Amendment 12, the Council excluded the three historic net fishing areas, and the commercial salmon fisheries that occur there, from the West Area: the Cook Inlet Area, Prince William Sound Area, and the Alaska Peninsula Area (Figure 1).

2.4 Indian Treaty Fishing Rights

The Magnuson-Stevens Act requires that fishery management plans contain a description of the nature and extent of Indian treaty fishing rights (16 U.S.C. 1853(a)(2)). The only Indian treaty fishing rights related to the fisheries covered by this plan are those resulting from treaties negotiated between the United States and a number of Pacific Northwest Indian tribes in the late 1800s. No treaties were negotiated with Alaska Native Tribes. However, a proclamation by President Warren G. Harding on April 28, 1916, created the Annette Island Fishery Reserve and established an exclusive fishing zone (3,000 feet wide) around the Annette Islands. Within this zone, the fisheries by Metlakatla Indians are regulated by the

U.S. Department of the Interior and are managed by the U.S. Fish and Wildlife Service and the Metlakatla Community in cooperation with the Alaska Department of Fish and Game.

Some Chinook salmon caught in and adjacent to Alaska originate in Oregon, Idaho, and Washington and harvest of these salmon is subject to the treaties with Pacific Northwest Tribes. These treaties apply to all stocks of salmon under U.S. control or jurisdiction (including jurisdiction exercised by the States) that – absent prior interception – would pass through or be available at any of the treaty tribes' usual and accustomed fishing grounds.

The Pacific Salmon Treaty resolved issues regarding harvests off Alaska by requiring agreement on allowable Chinook salmon harvests in and adjacent to Southeast Alaska and British Columbia through the Pacific Salmon Commission process. Pacific Northwest Tribes participate directly in the Pacific Salmon Commission process through membership on the Commission and numerous technical and policy committees that support activities of the Commission.

Chapter 3 MANAGEMENT POLICY AND OBJECTIVES

The Council and NMFS, in cooperation with the State of Alaska, are committed to the long-term management of the salmon fishery off Alaska. The goal is to promote stable management and maintain the health of the salmon resource and environment.

The Magnuson-Stevens Act is the primary domestic legislation governing management of the nation's marine fisheries. The Magnuson-Stevens Act requires fishery management plans to be consistent with a number of provisions, including ten national standards, with which all fishery management plans must conform and which guide fishery management. In summary, these national standards state a fishery management plan shall: (1) prevent overfishing while achieving, on a continuing basis, the optimum yield from each U.S. fishery; (2) base conservation and management measures on the best scientific information available; (3) manage the harvest of a fish stock (or interrelated stocks) throughout its range as a unit or in close coordination; (4) not discriminate between residents of different states and allocate fishing privileges in a manner that is fair and equitable, reasonably calculated to promote conservation, and prevents an individual, corporation or other entity from acquiring an excessive share of such privileges; (5) consider efficiency in the use of fishery resources, except that economic allocation cannot be the sole purpose; (6) take into account and allow for variations in catches; (7) minimize costs and avoid unnecessary duplication; (8) take into account the importance of fishery resources to fishing communities by providing for their sustained participation, and minimizing adverse economic impacts to the extent practicable; (9) minimize bycatch and bycatch mortality to the extent practicable; and (10) promote the safety of human life at sea to the extent practicable (16 U.S.C. 1851(a)(1)—(10)).

The Pacific Salmon Treaty requires each party to manage its fisheries in accordance with the principles and goals of the Treaty and the decisions of the Pacific Salmon Commission, for the international conservation and harvest sharing of Pacific salmon. Article III, Principles of the Treaty, requires each party to: (1) conduct its fisheries and salmon enhancement programs to prevent overfishing, provide for optimum production, and allow each party to receive benefits equivalent to the production of salmon originating in its waters; (2) cooperate with the other party in management, research, and enhancement; and (3) take into account the desirability of reducing interceptions, of avoiding undue disruption of existing fisheries, and annual variations in abundance of the stocks. The Treaty's abundance-based salmon management program for Chinook salmon establishes annual harvest regimes that are responsive to changes in production, account for fishery-induced mortalities, and are designed to meet MSY or other biologically-based escapement objectives.

Within the scope of the requirements of the Magnuson-Stevens Act and the Pacific Salmon Treaty, the Council has developed a management policy and objectives to guide its development of management recommendations to the Secretary of Commerce and to guide State of Alaska management of the salmon fishery in the East Area.

The Council recognizes that these objectives cannot be accomplished by any fishery management plan for the EEZ alone. To that end, the Council considers this plan to represent its contribution to a comprehensive management regime for the salmon fishery that will be achieved in concert with actions taken by the Pacific Salmon Commission and the State of Alaska.

3.1 Management Policy

The Council's salmon management policy is to facilitate State of Alaska salmon management in accordance with the Magnuson-Stevens Act, Pacific Salmon Treaty, and applicable federal law. This FMP represents the Council's contribution to a comprehensive management regime for the salmon fishery that will be achieved in concert with actions taken by the Pacific Salmon Commission and the State of Alaska. This policy ensures the application of judicious and responsible fisheries management practices, based on sound scientific research and analysis, proactively rather than reactively, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future, as well as current generations.

Under this policy, all management measures will be based on the best scientific information available. This management policy recognizes the need to balance many competing uses of marine resources and different social and economic objectives for sustainable fishery management, including protection of the long-term health of the resource and the optimization of yield. This policy uses and improves upon the Council's and State's existing open and transparent process of public involvement in decision-making.

3.2 Management Objectives

The Council has identified the following six management objectives to carry out the management policy for this FMP. The Council, NMFS, and the State of Alaska will consider the following objectives in developing amendments to this FMP and associated management measures. Because adaptive management requires regular review, the management objectives identified in this section will be reviewed periodically by the Council. The Council, NMFS, and the State of Alaska will also review, modify, eliminate, or consider new management measures, as appropriate, to best carry out the management objectives for this FMP.

3.2.1 Objective 1 – Prevent overfishing and achieve optimum yield

Manage the commercial and sport salmon fisheries in the East Areas in concert with the Pacific Salmon Commission, and in accordance with the conservation and harvest sharing goals of the Pacific Salmon Treaty, to prevent overfishing and obtain the number and distribution of spawning fish capable of producing the optimum yield on a sustained basis (wild and hatchery). Prevent overfishing and achieve optimum yield in the West Area by prohibiting the commercial harvest of salmon. Prohibiting commercial harvest enables the State of Alaska to manage salmon fisheries to achieve escapement goals and maximize economic and social benefits from the fishery.

3.2.2 Objective 2 – Manage salmon as a unit throughout their range

Manage salmon fisheries in the EEZ in a manner that enables the State of Alaska to manage salmon stocks seamlessly throughout their range. In the East Area, this objective is achieved by delegating management of the sport and commercial troll fishery to the State of Alaska, to manage consistent with state and federal laws, including the Pacific Salmon Treaty. In the West Area, this objective is achieved by prohibiting commercial fishing for salmon in the West Area so that the State of Alaska can manage Alaska salmon stocks as a unit.

3.2.3 Objective 3 – Minimize Bycatch and Bycatch Mortality

To the extent practicable, manage salmon fisheries to minimize bycatch and minimize the mortality of unavoidable bycatch. Decrease where possible the incidental mortalities of salmon hooked and released, consistent with allocation decisions and the objective of providing the greatest overall benefit to the people of the United States.

3.2.4 Objective 4 – 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 benefits such as the economic stability of coastal communities, recreational value, non-consumptive use value, and non-use value. 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:

- Control of fishing effort and salmon catches.
- Fair and equitable allocation of harvestable surplus of salmon.
- Economic impacts on coastal communities and other identifiable dependent groups (e.g., subsistence users).

This examination will be accomplished by considering, to the extent that data allow, the impact of management measures 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. Other benefits are tied to economic stability and impacts of commercial fishing, as well as, unguided and charter recreational fishing associated with coastal communities, subsistence fishing supporting traditional social and cultural ‘communities,’ and passive-use ‘communities’.

3.2.5 Objective 5 – Protect wild stocks and fully utilize hatchery production

Manage salmon fisheries to ensure sustainability of naturally spawning stocks while providing access to hatchery production.

3.2.6 Objective 6 – Promote Safety

Promote the safety of human life at sea in the development of fisheries management measures. Upon request, and from time to time as appropriate, the Council, NMFS, or the State of Alaska may provide for temporary adjustments, after consultation with the U.S. Coast Guard and fishery participants, for vessels that are otherwise excluded because of weather or ocean conditions causing safety concerns while ensuring no adverse effect on conservation in other fisheries or discrimination among fishery participants.

Chapter 4 ROLES OF AGENCIES IN IMPLEMENTING THIS PLAN

The salmon and salmon fisheries off Alaska are international in scope and are subject to the Pacific Salmon Treaty as well as the Magnuson-Stevens Act and the laws of the State of Alaska. Thus, the Council must coordinate its management of the salmon fisheries in the management area with a number of regional, national, and international agencies. Chief among these are the U.S. Department of Commerce (including the National Oceanographic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS)), the State of Alaska, the Pacific Salmon Commission, and the North Pacific Anadromous Fish Commission.

4.1 Role of the North Pacific Fishery Management Council

The Council accepts the harvest levels set by the Pacific Salmon Commission and the State of Alaska, as long as those levels are consistent with the Council's policy and the objectives of this plan. Further, it accepts the allocations of harvests among the various groups of fishermen set by the Alaska Board of Fisheries, as long as those allocations are consistent with the Council's policy and objectives and the national standards of the Magnuson-Stevens Act.

This FMP delegates regulation of the commercial troll and sport salmon fisheries in the East Area to the State of Alaska. Under this delegation, the State of Alaska may regulate the commercial troll and sport salmon fisheries and fishing vessels in the East Area as long as the state law and regulations are consistent with this FMP, the Magnuson-Stevens Act, and other applicable federal law. Chapter 9 describes the ways in which the Council and NMFS will monitor management measures for consistency and the process that will be followed if NMFS determines that a state management measure is inconsistent with the FMP, the Magnuson-Stevens Act, or other applicable federal law.

The Council will amend the FMP when necessary and reserves the right to withdraw its delegation of authority to the State of Alaska. Further, the Council reserves the right to specify management measures applicable to the East Area that differ from those of the State if, in accordance with the procedure specified in chapter 9, it determines that a state management measure is inconsistent with this FMP or the Magnuson-Stevens Act.

4.2 Role of the U.S. Department of Commerce, NOAA, and NMFS

The Magnuson-Stevens Act assigns to the Secretary of Commerce (Secretary) the authority to approve fishery management plans and implement them with federal regulations and to provide the regional fishery management councils with a number of services. The Secretary has delegated fishery management authority and responsibility to NOAA, an agency with the Department of Commerce, and NOAA, in turn has delegated some of its authority and responsibility to NMFS, an agency within NOAA. In its regular activities, the Council works with the Secretary, the Department of Commerce, and NOAA through the NMFS Alaska Region.

Staff of the NMFS Alaska Region assists the Council staff in performing analyses and drafting documents, and may consult with the State of Alaska on regulations and inseason adjustments of regulations for the salmon fisheries in the East Area.

NMFS may assess and collect fees to recover the administrative costs incurred by the federal government in processing applications for federal permits required to participate in the fisheries managed under this FMP, as authorized by the Magnuson-Stevens Act (16 U.S.C 1853(b)).

Enforcement of federal fishing regulations for fisheries in the management area is primarily the responsibility of the NOAA Office of Law Enforcement and the U.S. Coast Guard. The NOAA Office of Law Enforcement, Alaska Region, enforces the regulations that implement this FMP, in cooperation with the U. S. Coast Guard and the Alaska Department of Public Safety. Enforcement of State of Alaska fishing regulations is primarily the responsibility of the Fish and Wildlife Protection Division of the Alaska Department of Public Safety. Many agents are deputized that can enforce both sets of regulations.

The NOAA Office of General Counsel, Alaska Region, provides legal advice and prosecutes violators of federal regulations.

4.3 Role of the State of Alaska

Four agencies/entities of State of Alaska are involved in managing the salmon fisheries under its jurisdiction. The Alaska Board of Fisheries (Board) sets policy and promulgates the regulations for allocation of salmon resources, the Alaska Department of Fish and Game (ADF&G) manages the fisheries according to the policies and regulations of the Board and state law, the Alaska Commercial Fisheries Entry Commission (CFEC) limits the number of permit holders eligible to participate in the fisheries, and the Alaska Department of Public Safety enforces the regulations.

With regulation of the commercial troll and sport salmon fisheries in the East Area delegated to the State of Alaska, the State will manage those salmon fisheries and participating vessels regardless of whether the vessels in the East Area are registered under the laws of the State of Alaska (16 U.S.C 1856(a)(3)).

4.3.1 Alaska Board of Fisheries

The Council relies on the Board to establish fishing regulations and allocate harvests among groups of fishermen through a public forum that provides for public and agency input. The Council considers that the public review and comment process of the Board will satisfy most, if not all, of the Council's needs for public review, thereby making maximum use of limited state and federal resources and preventing duplication of effort.

Each year, the Board solicits proposed changes to the regulations governing Alaska's fisheries. Usually, chief among those submitting proposals is ADF&G. The Board distributes these proposals to the public for review and comment and then conducts open public meetings to evaluate and take action on the proposals. The fishing community has come to rely on this regularly scheduled participatory process as the basis for changing Alaska's fishing regulations.

Among those things considered by the Board are fishing periods and areas for the salmon fisheries, and the allocation of harvests among the various groups of fishermen.

The Board system provides for extensive public input, is flexible enough to accommodate changes in salmon abundance and fishing patterns, and is familiar to salmon fishermen, fish processors, and other members of the public.

4.3.2 Alaska Department of Fish and Game

Under this FMP, the Council delegates the regulation of the commercial troll and sport salmon fisheries in the East Area to the State of Alaska. Under this delegation, state regulations apply to all fishing vessels participating in these fisheries regardless of whether the vessel is registered under the laws of the State of Alaska.

ADF&G manages the fisheries during the fishing season (e.g. inseason) and issues emergency regulations to achieve conservation objectives and to implement allocation policies established by the Board. ADF&G also monitors the fisheries and collects data on the stocks and the performance of the fisheries.

ADF&G has managed salmon fisheries in federal waters since statehood in 1959 and has made substantial investments over the years in facilities, communications, information systems, vessels, equipment, experienced personnel capable of carrying out extensive management, research, and enforcement programs. With the implementation of the FMP in 1979, the State of Alaska has played the major role in managing the salmon fisheries in the EEZ, and the Council, for the most part, has coordinated its management with the state.

Under the Magnuson-Stevens Act (16 U.S.C. 1852(g)(1)(E) and (h)(6)), this FMP establishes the State of Alaska's salmon management process as the peer review process to provide scientific information to advise the Council on conservation and management, and to establish fishing level recommendations, for the commercial troll and sport salmon fisheries in the East Area. As part of their normal duties, ADF&G regional staff prepare annual reports on the status of the stocks and the fisheries for each of the management regions. ADF&G provides these reports to the Council for the commercial and sport fisheries in the East Area. These reports provide the scientific information used to advise the Council about the conservation and management of the salmon fisheries occurring in the East Area.

4.3.3 Alaska Commercial Fisheries Entry Commission

The CFEC is an independent, quasi-judicial state agency responsible for helping promote the conservation and sustained yield management of Alaska's fishery resources and the economic health and stability of commercial fishing by regulating entry into the fisheries. Its primary duties are limiting the number of persons eligible to hold permits; issuing permits and vessel licenses to qualified individuals in both limited and unlimited fisheries; providing due process hearings and appeals; performing critical research; and providing data to governmental agencies, private organizations and the general public. In 1974, the CFEC undertook the process of limiting the number of power trollers that may participate in the commercial salmon fisheries in Southeast Alaska. The first limited permits were issued in 1975. In 1982, the process of limiting hand trollers was undertaken with the first limited permits issued in 1983.

4.3.4 Alaska Department of Public Safety

The Fish and Wildlife Protection Division of the Alaska Department of Public Safety enforces state regulations in cooperation with the NOAA Office of Law Enforcement and the U.S. Coast Guard. Many agents are deputized that can enforce both state and federal regulations.

4.4 Role of the Pacific Salmon Treaty and the Pacific Salmon Commission

In 1985, the United States and Canada (collectively “the Parties”) entered into the *Treaty between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon* (Pacific Salmon Treaty), for the cooperative management, research, and enhancement of Pacific salmon. The Pacific Salmon Treaty is important to the way many Pacific coast salmon fisheries are managed, encompasses many salmon stocks covered by this FMP, and addresses the conservation and allocation of many Pacific salmon stocks that originate in the waters of one country and are subject to interception by the other.

Pursuant to Article III, the Parties are required conduct their fisheries and salmon enhancement programs to prevent overfishing, provide for optimum production, and afford each Party equitable benefit from the salmon originating in its waters. To meet these objectives, the Pacific Salmon Treaty sets out an intricate system to coordinate management of transboundary Pacific salmon stocks. The Pacific Salmon Treaty establishes the Pacific Salmon Commission. The Pacific Salmon Commission has established Panels as specified in Annex I to the Pacific Salmon Treaty, and these Panels make recommendations to the Pacific Salmon Commission and perform functions as directed by the Pacific Salmon Commission or Pacific Salmon Treaty. The Parties report technical information to the Pacific Salmon Commission on conduct of domestic fisheries, the status of stocks subject to the Pacific Salmon Treaty, and any enhancement activities undertaken. The Panels and Technical Committees analyze this information and report fishery recommendations to the Pacific Salmon Commission. Based on the reports, the Pacific Salmon Commission recommends fishing regimes to the Parties. If the Parties adopt the Pacific Salmon Commission’s recommendations, the fishery regimes are included in Annex IV. Article IV of the Pacific Salmon Treaty requires the Parties to establish and enforce regulations to implement the fishing regimes adopted by the Parties.

The original bilateral fishing arrangements under Annex IV of the Pacific Salmon Treaty expired in 1992, and from 1992 to 1998, Canada and the United States were not able to reach agreement on comprehensive, coast-wide fisheries arrangements. The Pacific Salmon Treaty was ultimately reauthorized in 1999, establishing 10-year fishery regimes. In May 2008, the Pacific Salmon Commission recommended new bilateral fishing agreements, which were approved by the United States and Canadian governments in December 2008. As with the 1999 Agreement, this agreement established fishing regimes that will be in force for a 10-year period (2009 through 2018). These new fishing regimes are contained in chapters 1, 2, 3, 5, and 6 of Annex IV.

Further, the Parties have established two bilateral Restoration and Enhancement Funds to support improvements in information for resource management, to rehabilitate and restore marine and freshwater habitat, and to enhance wild stock production through low technology techniques. The Funds are endowments with initial contributions from both Parties under a trust agreement, subject to continuation through the Pacific Salmon Treaty.

The Pacific Salmon Treaty Act, (16 U.S. C. 3631-3645) requires the Secretary of Commerce to promulgate regulations in consultation with the Secretary of the Interior, the Secretary of the Department in which the U. S. Coast Guard is operating and the appropriate Regional Fishery Management Council, necessary to carry out U.S. obligations under the Treaty. The Pacific Salmon Treaty Act further authorizes the Secretary of Commerce, in cooperation with the Regional Fishery Management Council, State of Alaska, and Indian tribes, to promulgate regulations in addition to, and not in conflict with, fisheries regimes and Fraser River Panel regulations adopted under the Treaty.

The chapters of Annex IV of primary relevance to the Council for this FMP are those for: Transboundary Rivers (Chapter 1), Southeastern Alaska (Chapter 2), Chinook Salmon (Chapter 3), Coho Salmon (Chapter 5); and the General Obligations of the Parties to the Treaty (Chapter 7). The General Obligations of both the United States and Canada: "With respect to intercepting fisheries not dealt with elsewhere in this Annex [IV], unless otherwise agreed, neither Party shall initiate new intercepting fisheries, nor conduct or redirect fisheries in a manner that intentionally increases interceptions." The Pacific Salmon Treaty expressly states that it does not affect or modify rights established in existing Indian treaties and other existing federal laws (Article XI).

4.5 Role of the North Pacific Anadromous Fish Commission and the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean

The North Pacific Anadromous Fish Commission (NPAFC) was established in 1993 under the *Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean* (Convention). The Convention dissolved the prior International North Pacific Fisheries Commission, established through the 1952 *International Convention for the High Seas Fisheries of the North Pacific Ocean* between Canada, Japan, and the United States.

The member Parties include the United States, Canada, Japan, the Republic of Korea, and the Russian Federation (collectively "the Parties"), which are the major countries of origin and migration for Pacific anadromous fish stocks. The area to which the Convention applies is the "waters of the North Pacific Ocean and its adjacent seas, north of 33 degrees North Latitude beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured" (Article I). The Convention's principle objective is to "promote the conservation" of anadromous fish species in the Convention Area, including chum, coho, pink, sockeye, and Chinook salmon (Article VIII).

To promote conservation, the Convention prohibits direct fishing for anadromous fish in the Convention Area. The Convention also prohibits retention of anadromous fish taken as incidental catch during fishing for non-anadromous fish and requires minimization, to the maximum extent practicable, of any incidental taking of anadromous fish (Article III). The Parties are also encouraged to take appropriate measures to prevent trafficking in anadromous fish. The NPAFC Science Plan, however, allows fishing of anadromous fish for scientific research purposes. The Science Plan is a long-term, cooperative scientific research plan that endeavors to predict the annual variations in Pacific salmon production, in order to forecast returning salmon abundances for accurate salmon population conservation and management (Article VII).

Finally, pursuant the Convention, each member Party has the authority to board, inspect, and detain fishing vessels of other Parties found operating in violation of the Convention, though only the authorities of the Party to which the violating person or vessel belongs may try the offense and impose penalties (Article V). The Parties are to cooperate in exchange of information on any violation of the provisions of the Convention and on any enforcement action undertaken (Article VI).

4.6 Costs Likely to be Incurred in Managing the Salmon Fishery

The costs of managing the salmon fisheries in the management area can reasonably be discussed only in relative terms. For the past several years, the annual cost of managing the salmon fishery probably amounts to the equivalent of one employee-year. That total includes the effort of the Council and Council staff, NMFS Alaska Region staff (including NMFS enforcement staff), NOAA Regional Counsel staff, NMFS Headquarters staff, NOAA and other Department of Commerce staff, and the cost of publishing regulations in the *Federal Register*.

Costs to the Federal Government (Council, Department of Commerce, Office of the Federal Register) are low because of the limited role in managing and regulating the salmon fishery. Costs include (1) enforcing the prohibition of commercial salmon fishing in the West Area, (2) participating in the Pacific Salmon Commission and NPAFC, (3) considering information from the State of Alaska on the delegated fisheries in the East Area and review of state regulations applicable in the East area for consistency under chapter 9, and (4) ensuring compliance with the FMP, Magnuson-Stevens Act, Endangered Species Act, and other applicable law.

The State of Alaska has substantial investment in infrastructure and personnel to manage and monitor the Southeast Alaska troll fleet and sport fishery in a manner consistent with state salmon management policy specified in state statutes and regulations. The fishery is managed as a unit, and costs incurred by the State of Alaska in managing the federal waters in the East Area are insignificant relative the costs of managing the fishery overall.

Chapter 5 REGULATION OF THE SALMON FISHERIES

The FMP authorizes commercial fishing for salmon with hand troll or power troll gear in the East Area. The FMP prohibits commercial fishing for salmon with any gear type other than hand troll or power troll gear in the East Area. The FMP also authorizes sport fishing for salmon in the East Area.

Under this FMP, the Council delegates the regulation of the commercial troll and sport salmon fisheries in the East Area to the State of Alaska, pursuant to the Magnuson-Stevens Act (16 USC 1856(a)(3)(B)). Under the Magnuson-Stevens Act, the delegation of fishery management to the State means the State of Alaska may regulate a salmon fishing vessel in the East Area.

All of the measures currently used by the State of Alaska to manage the commercial troll and sport salmon fisheries in the East Area are designed to attain one or more of the FMP's management objectives. In general, the fisheries are controlled by prescribing limits on harvests, fishing periods and areas, types and amounts of fishing gear, commercial fishing effort, minimum length for Chinook salmon, and reporting requirements. For details refer to Alaska Statutes, Title 16 - Fish and Game, and the Alaska Administrative Code, Title 5 (5 AAC).

The FMP requires that sport and commercial salmon fishermen in the East Area report their fishing activities as required by the State of Alaska to ensure that harvest ceilings or quotas are not exceeded and that salmon stocks are not overfished. ADF&G has an efficient system for monitoring and reporting salmon harvests during the fishing periods, and this system serves as the basis for inseason management of the salmon fisheries. Salmon harvested from the EEZ off Alaska or in state waters and landed outside Alaska must also be reported as required by the State of Alaska.

Under this arrangement, the Council finds no reason for NMFS to collect any data on the commercial troll and sport salmon fisheries. The Council relies on annual reports from ADF&G to keep it apprised of the status of the salmon fisheries in the East Area.

The FMP prohibits commercial salmon fishing in the West Area. In prohibiting commercial salmon fishing, the Council recognizes that the State of Alaska manages salmon outside of the West Area largely as near-shore fisheries to achieve escapement goals and fully allocate the harvest of salmon among defined user-groups. Closing the EEZ waters to commercial salmon fishing enables the State to manage Alaska salmon stocks on an individual or indicator stock basis according to the best available information and using inseason run strength indicators. This prevents overfishing of weak-stocks, ensures biological escapement, and allows for the allocation of harvestable surplus to defined user-groups.

Chapter 6 STATUS DETERMINATION CRITERIA

To achieve National Standard 1 – prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery – the Magnuson-Stevens Act requires each fishery management plan to (1) specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished and contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery and (2) establish mechanisms for specifying annual catch limits (ACLs) to prevent overfishing and include accountability measures to prevent ACLs from being exceeded and to correct overages of the ACL if they do occur.

6.1 East Area

Salmon stocks caught in the East Area are separated into three tiers for the purposes of status determination criteria. An MSY control rule, a maximum fishery mortality threshold (MFMT), and a minimum stock size threshold (MSST) are established for each tier.

Tier 1 stocks are Chinook salmon stocks covered by the Pacific Salmon Treaty. The overfishing definition is based on a harvest relationship between a pre-season relative abundance index generated by the Pacific Salmon Commission's Chinook Technical Committee and a harvest control rule specified in the Pacific Salmon Treaty. The Pacific Salmon Treaty also provides for an inseason adjustment to the harvest level based on an assessment of inseason data. In addition, decreases in the allowable catch are triggered by conservation concerns regarding specific stock groups. This abundance-based system reduces the risk of overharvest at low stock abundance while allowing increases in harvest with increases in abundance, as with the management of the other salmon species in the southeast Alaska salmon fishery.

This FMP does not establish a mechanism for specifying ACLs for Chinook salmon in the East Area because of the Magnuson-Stevens Act exception from the ACL requirement for stocks managed under an international fisheries agreement in which the United States participates (16 U.S.C. 1853 note).

Tier 2 and tier 3 are salmon stocks managed by the Board and ADF&G. Tier 2 stocks are coho salmon stocks. Tier 3 stocks are coho, pink, chum, and sockeye salmon stocks managed as mixed-species complexes, with coho salmon stocks as indicator stocks. Management of coho is based on aggregate abundance. Lack of a general coho stock identification technique prevents assessment of run strength of individual stock groups contributing to these early-season mixed stock fisheries. Information available on individual coho indicator stocks is considered in management actions. The southeast Alaska wild coho indicator stocks are Auke Creek coho, Berners River coho, Ford Arm Lake coho, and Hugh Smith Lake coho. The overfishing definitions, OY, and ACLs for tier 2 and 3 are based on the State of Alaska's MSY escapement goal policies. The present policies and status determination criteria would prevent overfishing and provide for rebuilding of overfished stocks in the manner and timeframe required by the Magnuson-Stevens Act.

If a stock or stock complex is declared overfished or if overfishing is occurring, the Council will request that the State of Alaska conduct a formal assessment of the primary factors leading to the decline in abundance and report to the Council the management measures the State will implement to prevent overfishing and rebuild the fishery. The Council and NMFS will assess these rebuilding measures for compliance with the Magnuson-Stevens Act, including the national standard guidelines. If the Council and NMFS deem the State of Alaska's proposed rebuilding measures sufficient to comply with Magnuson-Stevens Act requirements, the State rebuilding program may be adopted without an FMP amendment to assure timely implementation, the State rebuilding program may be adopted without an FMP amendment to assure timely implementation.

6.1.1 Tier 1: Chinook stocks

(1) Under the Pacific Salmon Treaty, the MSY control rule consists of a segmented linear relationship between catch and relative abundance (Table 1 from Pacific Salmon Treaty, Annex 4). Each segment of the relationship is of the form:

$$Y_t = \alpha_{X_t} X_t + \beta_{X_t}$$

where t represents time (measured in years), Y_t represents the all-gear catch (measured in number of fish) in year t, X_t represents relative abundance in year t (as established by the Pacific Salmon Commission's Chinook Technical Committee), and α and β represent coefficients whose values depend on X_t. The relationships between X_t, α, and β are as follow:

If X_t is greater than or equal to	and X_t is less than	then α is	and β is
0	0.05	0	0
0.05	1.00	130,000	20,000
1.00	1.25	285,000	-135,000
1.25	1.55	178,495	20,000
1.55	2.25	193,370	20,000

According to the Pacific Salmon Treaty, this control rule is "designed to contribute to the achievement of MSY or other agreed biologically-based escapement objectives." The portion of the all-gear catch that is allocated to troll gear can be computed by subtracting 20,000 from Yt (to exclude the amount allocated to net gear) and multiplying the result by 0.8 (to exclude the 20 percent allocated to the sport fishery).

The Pacific Salmon Treaty identifies one or more "indicator" stocks for each of the eight stock groups that comprise the Southeast Alaska Chinook salmon fishery. The Pacific Salmon Treaty also requires the Chinook Technical Committee to establish biologically-based "escapement goal ranges" for each group's indicator stocks, either individually or in aggregate. If more than one group's indicator stocks exhibit escapements below the lower bound of the escapement goal range for two consecutive years, the Pacific Salmon Treaty provides for a specific reduction in the α parameter used in the MSY control rule, subject to various qualifications. The required reduction in α varies with the number of stock groups exhibiting back-to-back escapement failures, as shown in the following table:

Number of stock groups requiring response	Percentage reduction in α
2 stock groups	10%
3 stock groups	20%
4+ stock groups	30%

(2) The *fishing mortality rate (F)* for these stocks is expressed as cumulative catch per generation time:

$$F_t = \sum_{i=t-Tchin+1}^{t} C_i$$

where C_t represents the all-gear catch taken in year t and T_{chin} represents the average Chinook salmon lifespan that would be expected over the long term in the absence of exploitation. The default value of T_{chin} is 5 years, but the Scientific and Statistical Committee may set T_{chin} at another value, without a plan amendment, on the basis of the best scientific information available. It may be noted that the above definition of fishing mortality rate is somewhat different from that commonly used for many other species, for example those managed under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area and the Fishery Management Plan for Groundfish of the Gulf of Alaska. The reason for the difference is as twofold. First, for groundfish species, the fishery in any given year has access to the entire stock, whereas for salmon species, the fishery in any given year has access only to the portion of the stock returning in that year. Second, the above definition conforms more closely to the Pacific Salmon Treaty.

(3) The maximum fishing mortality threshold is computed as follows:

$$\mathrm{MFMT}_t = 1.075 \times \sum_{i=t-Tchin+1}^{t} Y_i$$

(Y_t represents the all-gear catch associated with the MSY control rule in year t; it may or may not equal C_t, the catch that was *actually taken* in year t). The 7.5 percent overage allowance is a current feature of the FMP and is prescribed by the Pacific Salmon Treaty (Annex IV, Chapter 3, paragraph 7).

(4) Should the fishing mortality rate exceed the MFMT in any year, it will be determined that the stocks are being subjected to overfishing.

(5) The productive capacity of a stock group is measured as the sum of the indicator stocks' escapements from the most recent T_{chin} years.

(6) The MSST for a stock group is equal to one-half the sum of the indicator stocks' MSY escapement goals from the most recent T_{chin} years, where each MSY escapement goal is set at the midpoint of the respective escapement goal range established by the Chinook Technical Committee.

(7) Should a stock group's productive capacity fall below the MSST in any year, it will be determined that the stock group is overfished.

6.1.2 Tier 2: Coho stocks managed as individual units

(1) The MSY control rule is of the "constant escapement" form. Specifically, the catch corresponding to the control rule in any given year is equal to the amount that would result in a post-harvest run size equal to the MSY escapement goal, unless the pre-harvest run size fails to exceed the MSY escapement goal, in which case the catch corresponding to the control rule is zero:

$$Y_t = \max(0, R_t - G_t)$$

where R_t is pre-harvest run size in year t and G_t is the MSY escapement goal in year t. The MSY escapement goal is normally constant across years, but may vary due to changes in environmental conditions. It is specified so that the long-term average catch expected under this strategy is maximized. In cases where the State of Alaska's "biological escapement goal" consists of a range, the MSY escapement goal corresponds to the lower endpoint of that range. In cases where the State's "biological escapement goal" consists of a single point, the MSY escapement goal corresponds to that point.

(2) The fishing mortality rate for these stocks is expressed as an exploitation rate, and is computed as a weighted average of recent run-specific exploitation rates observed in the stock:

$$F_t = \frac{\sum_{i=t-Tcoho+1}^{t} C_i}{\sum_{i=t-Tcho+1}^{t} R_i}$$

where T_{coho} represents the average coho lifespan that would be expected over the long term in the absence of exploitation. The default value of T_{coho} is 4 years, but the Scientific and Statistical Committee may set T_{coho} at another value, without a plan amendment, on the basis of the best scientific information available.

(3) The maximum fishing mortality threshold for these stocks is computed as a weighted average of recent run-specific exploitation rates corresponding to the MSY control rule:

$$\mathrm{MFMT}_t = \frac{\sum_{i=t-Tcoho+1}^{t} Y_i}{\sum_{i=t-Tcoho+1}^{t} R_i}$$

(4) Should the fishing mortality rate exceed the MFMT in any year, it will be determined that the stock is being subjected to overfishing.

(5) The productive capacity of a stock is measured as the sum of the stock's escapements from the most recent T_{coho} years.

(6) The MSST for a stock is equal to one-half the sum of the stock's MSY escapement goals from the most recent T_{coho} years.

(7) Should a stock's productive capacity fall below the MSST in any year, it will be determined that the stock is overfished.

6.1.3 Tier 3: Coho, sockeye, pink, and chum salmon stocks managed as complexes

(1) The MSY control rule is of the "constant escapement" form. The difference with respect to Tier 2 is not the *form* of the control rule, but rather the level of aggregation at which it is applied.

(2) Whenever estimates of *F* or MFMT, as defined under Tier 2, are unavailable for each stock in a stock complex managed under this FMP, a list of "indicator" coho stocks will be established by ADF&G.

(3) Using the same definitions and criteria described under Tier 2, a determination that one or more indicator coho stocks is being subjected to overfishing will constitute a determination that the respective stock complex is being subjected to overfishing, except as provided in the paragraph below.

(4) Overfishing of one or more stocks in a stock complex may be permitted, and will not result in a determination that the entire stock complex is being subjected to overfishing, under the following conditions (50 CFR §600.310(m)):

a) it is demonstrated by analysis that such action will result in long-term net benefits to the Nation;

b) it is demonstrated by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/configuration, or other technical characteristic in a manner such that no overfishing would occur; and

c) the resulting rate or level of fishing mortality will not cause any stock or stock complex to fall below its MSST more than 50 percent of the time in the long term.

In the absence of significant evidence to the contrary, satisfaction of the above conditions will be considered equivalent to the State's establishment of an "optimal escapement goal" lower than the "biological escapement goal" for the same stock.

(5) The productive capacity of a stock complex is measured as the sum of the indicator coho stocks' escapements from the most recent T_{coho} years.

(6) The MSST for a stock complex is equal to one-half the sum of the indicator coho stocks' MSY escapement goals from the most recent T_{coho} years.

(7) Should a stock complex's productive capacity fall below the MSST in any year, it will be determined that the stock complex is overfished.

6.1.4 Annual Catch Limits for Tier 2 and 3 salmon stocks

The mechanisms for specifying ACLs for Tier 2 and 3 salmon stocks are the State of Alaska's scientifically-based management measures used to determine stock status and control catch to achieve the biomass level necessary to produce MSY. The State's salmon management program is based on scientifically defensible escapement goals and inseason management measures to prevent overfishing. Accountability measures include the State's inseason management measures and the escapement goal setting process that incorporates the best available information on stock abundance.

Escapement is defined as the annual estimated size of the spawning salmon stock. Quality of the escapement may be determined not only by numbers of spawners, but also by factors such as sex ratio, age composition, temporal entry into the system, and spatial distribution within salmon spawning habitat.

Alaska's salmon fisheries are managed to maintain escapement within levels that provide for MSY, escapements are assessed on an annual basis, all appropriate reference points are couched in terms of escapement level, and status determinations are made based on the stock's level of escapement. Escapement goal ranges together with real-time escapement enumeration (i.e. visual counts from towers, weir counts, aerial survey counts, sonar counts) and intensive fishery monitoring programs, have been established for most of Alaska's major salmon stocks. In cases where the salmon runs have been below forecast levels, the State of Alaska closes the fishery to achieve its escapement goals, thus preventing overfishing.

For salmon, MSY is achieved by controlling fishing to maintain the spawning escapement at levels that provide potential to maximize surplus production. Escapement goals are based on direct assessments of MSY escapement levels from stock recruit analysis or a reasonably proxy. Escapement goals are specified as a range, lower bound, or a threshold. In general escapement goal ranges are specified to produce 90 percent to 100 percent of MSY. Escapement goal ranges give managers the flexibility to moderate fishing to protect stocks of weak runs that are commonly exploited in mixed stock fisheries. Scientifically-based biological reference points for salmon populations are estimated based on long-term, stock specific assessment of recruits from parent escapement or long-term assessment of escapement. The salmon stock assessment programs employed by ADF&G are designed to monitor stock and age-specific catch and escapements. Comprehensive implementation of the ADF&G salmon stock assessment programs, over time, provides stock-recruitment data necessary for developing MSY-based escapement goals. Since the catch and escapement monitoring program are conducted in real-time, they provide in-season assessments of run strength necessary for managers to implement ADF&G's escapement based harvest policies.

For these salmon stocks, the State of Alaska's escapement based management system is a more effective management system for preventing overfishing than a system that places rigid numeric limits on the number of fish that may be caught. The fundamental goal of fishery managers who employ catch limits to prevent overfishing is to ensure that the number of fish that survive to breed is sufficient to produce maximum yields over the long term. Given salmon's particular life history attributes, the preferred method to annually ensure that surviving spawners will maximize present and future yields is a system that establishes escapement goals intended to maximize surplus productivity of future runs, estimates run strength in advance and also monitors actual run strength and escapement during the fishery, and utilizes in-season management measures, including fishery closures, to ensure that minimum escapement goals are achieved. Such an approach provides a more effective mechanism to prevent overfishing than a system that prescribes rigid catch limits before the season based on predictions of run strength. Such a catch-based system would rely on pre-season predictions of run strength and of the resulting catch that would allow the stock to meet prescribed escapement goals; however, because it would employ rigid catch limits, such a system would lack the added features of in-season monitoring to confirm actual run strength and the ability to adjust fishing pressure to ensure that escapement goals are met if pre-season predictions of run strength prove inaccurate.

Moreover, an additional advantage of the State of Alaska's escapement based system is that it does not rely on fishermen's or managers' ability to accurately identify the particular stock to which each harvested fish belongs. There are numerous stocks of each species of Pacific salmon managed under this FMP, and fish of the same species from different breeding stocks cannot be distinguished visually.

6.1.5 Optimum Yield

Magnuson-Stevens Act requires that a fishery management plan assess and specify the optimum yield (OY) from the fishery, and include a summary of the information utilized in making such specification (16 U.S.C. 1853(a)(3)). The Magnuson-Stevens Act defines OY as 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 as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, 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.

For the troll fishery in the East Area, several economic, social, and ecological factors are involved in the definition of OY. Of particular importance are the annual variations in the abundance, distribution, migration patterns, and timing of the salmon stocks; provisions of the Pacific Salmon Treaty; decisions of the Pacific Salmon Commission; allocations by the Board; traditional times, methods, and areas of salmon fishing; and inseason indices of stock strength. Further, because the commercial troll fishery and the sport fishery take place in the EEZ and state waters without formal recognition of the boundary between these two areas, the OY should not and cannot be subdivided into separate parts for the EEZ and state waters.

MSY is established for each tier based on the MSY control rules in section 5.1. For Chinook salmon stocks in tier 1, an all-gear MSY is prescribed in terms of catch by the Pacific Salmon Treaty and takes into account the biological productivity of Chinook salmon and ecological factors in setting this limit. The portion of the all-gear catch limit allocated to troll gear represents the OY for that fishery and takes into account the economic and social factors considered by the Board in making allocation decisions.

For stocks in tiers 2 and 3, MSY is defined in terms of escapement. MSY escapement goals account for biological productivity and ecological factors, including the consumption of salmon by a variety of marine predators. The OY for the troll fishery is that fishery's annual catch which, when combined with the catch from all other salmon fisheries, results in a post-harvest run size equal to the MSY escapement goal for each indicator stock. The portion of the annual catch harvested by the troll fishery reflects the biological, economic, and social factors considered by the Board and ADF&G in determining when to open and close the coho salmon harvest by the troll fishery.

The Magnuson-Stevens Act requires Regional Councils to "review on a continuing basis, and revise as appropriate, the assessments and specifications made ... with respect to the optimum yield." In particular, OY may need to be respecified in the future if major changes occur in the estimate of MSY. Likewise, OY may need to be respecified if major changes occur in the ecological, social, or economic factors governing the relationship between OY and MSY.

6.2 West Area

This FMP prohibits commercial fishing in the West Area so that the State can manage the salmon fisheries in waters adjacent to the West Area. Salmon that spend part of their lifecycle in the West Area are subject to commercial salmon fisheries after they reach maturity and travel back to their natal rivers and streams. These directed commercial fisheries are managed by the State of Alaska and are not subject to this FMP. National Standard 1 is achieved by the State's scientifically-based approach for controlling catch to achieve the biomass level necessary to produce MSY by ensuring that overfishing does not occur in the fishery. To ensure overfishing does not occur as a result of incidental catch of salmon by other fisheries not regulated under this FMP, this FMP relies on management measures adopted under federal fishery management plans, together with the State's management program in waters adjacent to the West Area.

Commercial fishing is prohibited in the West Area, therefore the directed harvest OY is zero. The West Area has been closed to commercial net fishing since 1952 and commercial troll fishing since 1973 and there has not any yield from this area. This OY recognizes that salmon are fully utilized by state managed fisheries and that the State of Alaska manages fisheries based on the best available information using the State's escapement goal management system. Additionally, management measures adopted under other federal FMPs, together with the State's scientifically-based management program in waters adjacent to the West Area, ensure that overfishing of salmon does not occur as a result of incidental catch of salmon by other EEZ fisheries not regulated under this FMP. This OY also recognizes that non-Alaska salmon are fully utilized and managed by their respective management authority when they return to their natal regions.

6.3 Domestic Annual Harvesting and Processing Capacity

Domestic annual harvesting capacity is the expected amount of the allowable harvest of salmon that the domestic fisheries (subsistence, sport, and commercial) are capable of harvesting in one year. The Council has determined that domestic harvesters are able to, and expect to, harvest the entire OY of salmon each year.

Domestic annual processing capacity is the estimated portion of the domestic annual harvesting capacity that U.S. processors expect to process. For salmon, domestic annual processing capacity means the amount of salmon harvested (and processed) by sport and subsistence fishermen, as well as that harvested by domestic commercial fishermen, less any of the commercial harvest delivered to any permitted foreign processors. In the past, domestic processors have been able to process the entire commercial troll harvest of salmon; there is no reason to expect that situation to change.

6.4 Foreign Fishing and Processing

Title II of the Magnuson-Stevens Act establishes the criteria for the regulation of foreign fishing and processing within the U.S. EEZ. Regulations implementing Title II of the Magnuson-Stevens Act are published in 50 CFR part 600. The regulations provide for the setting of a total allowable level of foreign fishing for species based on the portion of the optimum yield that will not be caught by U.S. vessels. Pursuant to Title II of the Magnuson-Stevens Act, this FMP does not allow foreign harvesting of salmon in the EEZ. At the highest conceivable level of abundance, the allowable amount of salmon in the EEZ can be harvested completely by U.S. fisheries.

Foreign processing refers to fish harvested by U.S. fishermen and processed by foreign processors. In the past, some foreign processing of salmon has taken place in Alaskan waters, particularly in Norton Sound and Bristol Bay, and some domestic harvesters have delivered unprocessed or whole fresh salmon caught within Alaskan waters to British Columbian ports. The Governor of Alaska has the authority to authorize foreign processing within state internal waters. Pursuant to Title II of the Magnuson-Stevens Act, for processing in the EEZ, the foreign partner must be authorized under an international fisheries agreement and possess a valid and applicable permit.

Chapter 7 ESSENTIAL FISH HABITAT AND HABITAT AREAS OF PARTICULAR CONCERN

The Magnuson-Stevens Act requires fishery management plans 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 (16 U.S.C. 1853(a)(7)).

7.1 Description of Essential Fish Habitat

This FMP describes salmon EFH in text, maps EFH distributions, and includes information on habitat and biological requirements for each life history stage of the species. Appendix A contains this required information for salmon, as well as identifying an EFH research approach.

7.2 Description of Habitat Areas of Particular Concern

The EFH regulations at 50 CFR 600.815(a)(8) provide guidance on identifying 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. Fishery management plans 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 fishery management plans 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:

- Alaska Seamount Habitat Protection Areas
- Bowers Ridge Habitat Conservation Zone
- Gulf of Alaska Coral

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

7.3 Conservation and Enhancement Recommendations for EFH and HAPC

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

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

- Aleutian Islands Habitat Conservation Area
- Aleutian Islands Coral Habitat Protection Areas
- Gulf of Alaska Slope Habitat Conservation Areas

7.4 Fishing restrictions

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

Maps of these areas, as well as their coordinates, are contained in Appendix A.

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 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.

Alaska Seamount Habitat Protection Area

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 A. The use of bottom contact gear and anchoring, as described in 50 CFR part 679, is prohibited in these areas.

7.5 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, to coincide with the EFH 5-year review, or may be initiated at any time by the Council.

Chapter 8 FISHERY IMPACT STATEMENT

A fishery impact statement is required by the Magnuson-Stevens Act (16 U.S.C. 1853(a)(9)). The fishery impact statement must assess, specify, and analyze any likely effects (including cumulative conservation, economic, and social impacts) of the conservation and management measures on the following:

(A) participants in the fisheries and fishing communities affected by the plan or amendment;

(B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants; and

(C) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery.

Additionally, the fishery impact statement must consider possible measures for mitigating any adverse impacts. This fishery impact statement also addressed the Magnuson-Stevens Act's related requirements for fishery information: (1) a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, actual and potential revenues from the fishery, and any recreational interest in the fishery; (2) a specification of the present and probable future condition of the fishery, and include a summary of the information utilized in making such specification; and (3) a description of the commercial, recreational, and charter fishing sectors which participate in the fishery, including its economic impact, and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors (16 U.S.C. 1853(a)).

8.1 Present Condition of the Fisheries

ADF&G is responsible for the protection, management, conservation, and restoration of Alaska's fish and game resources. The Board is responsible for considering and adopting regulations to allocate resources between user groups; establishing fish reserves and conservation areas, fishing seasons, quotas, bag limits and size restrictions; habitat protection; stock enhancement; and developing commercial, subsistence, sport and personal use fisheries. CFEC helps to conserve and maintain the economic health of Alaska's commercial fisheries.

The Board has adopted regulations that control the time, area of operation, and efficiency of salmon fisheries to address the unique challenges of managing mixed-stock resources. Fishing effort on mixed Chinook and coho salmon stocks is managed to avoid overharvest of individual salmon stocks. Chinook salmon harvested in Southeast Alaska fisheries are managed under provisions of the Pacific Salmon Treaty, an international agreement with Canada which provides for an abundance-based management regime that takes into account the highly mixed stock nature of the harvest. The majority of coho salmon harvested in Southeast Alaska are produced from streams in the region and ADF&G maintains several stock assessment projects to track the abundance and escapement of the species on an inseason basis.

8.1.1 East Area Commercial Troll Fishery

The commercial troll fishery is the only commercial fishery allowed in the East Area. From Alaska statehood in 1959 until 1979, this fishery was conducted and managed with little recognition of the boundary separating federal and state waters, although at one time the State of Alaska banned hand trolling seaward of the surf line. Upon implementation of the FMP in 1979, accounting of salmon harvests became delineated between the EEZ and state waters; however, the commercial troll fishery continues to be managed and prosecuted as a single unit.

The commercial troll fishery in Southeast Alaska and Yakutat (Region 1) occurs in State of Alaska waters and in the EEZ east of the longitude of Cape Suckling and north of Dixon entrance. All other waters of Alaska and the EEZ are closed to commercial trolling. The commercial troll fishery harvests primarily Chinook and coho salmon; though chum sockeye, and pink salmon are also harvested. The troll fleet also incidentally harvests Pacific halibut under Individual Fishing Quota (IFQ) regulations, and lingcod and rockfish under state regulations (refer to section below for a discussion on incidental harvest and bycatch management in the directed salmon fisheries).

Troll gear works by dragging baited hooks through the water. The commercial troll fleet is composed of hand and power troll gear types. State regulations limit vessels using hand troll gear to two lines on two hand-operated gurdies or four fishing rods. Specific exceptions to these gear limits may be found in state regulations at 5 AAC 29.120. While the majority of the troll fleet sells their fresh catch directly to processing plants onshore or to tender vessels affiliated with those facilities, the fleet does include catcher-processor vessels that harvest and freeze their catch at sea.

Chinook Salmon Troll Fishery

The commercial troll salmon fishery is divided into two seasons: a winter season and a general summer season, which is divided into a spring fishery, and a summer fishery. The harvest of Treaty Chinook salmon (those other than Chinook salmon produced at Alaska hatcheries) by commercial salmon trollers is limited to a specific number of fish, which varies annually according to an abundance estimate established under the Pacific Salmon Treaty. Accounting of Treaty Chinook salmon harvested by the commercial troll fleet begins with the start of the winter season and ends with the close of the general summer season.

The winter troll season is defined as October 11 through April 30, and is managed not to exceed a guideline harvest level of 45,000 Chinook salmon (with a guideline range of 43,000 to 47,000 fish). Treaty Chinook salmon caught in the winter troll fishery count towards the annual Southeast Alaska troll fishery allocation (under provisions established by the Board) and the Southeast Alaska all-gear Treaty quota (under provisions of the Pacific Salmon Treaty). Any Treaty Chinook salmon not harvested during the winter fishery will be available for harvest during the spring and summer fisheries. By regulation, the open area during the winter fishery is restricted to those areas lying east of the "surf line" south of Cape Spencer, and the waters of Yakutat Bay. All outer coastal areas, including the EEZ, are closed during the winter troll fishery. More information on the winter troll fishery can be found in ADF&G fishery management plans. Because the winter troll fishery does not occur in the EEZ, the fishery is outside the scope of this FMP.

The spring troll fishery begins after the winter fishery closes, and may start prior to May 1 if the winter fishery closes early when the harvest cap of 45,000 Chinook salmon is reached. The spring troll and terminal area troll fisheries are designed to target Alaska hatchery-produced Chinook salmon (though Chinook salmon from across the Treaty area are also harvested) and occur primarily in inside waters near hatchery release sites or along the migration routes of early returning hatchery fish. Because the spring troll fishery does not occur in the EEZ, the fishery is outside the scope of the FMP.

The summer troll fishery opens July 1 and targets the remainder, which is the majority of the annual Treaty Chinook salmon quota in two open periods during the July 1 through September 30 timeframe. During the general summer season, most waters of the Southeast Alaska/Yakutat area are open to commercial trolling, including outer coastal waters in the EEZ, except for those waters described in 5 AAC 29.150. Those closed waters in effect during the summer fishery are exempted during the defined spring fishery; however, waters within 3,000 feet of Annette Island (Annette Island Reserve) are closed.

The primary objectives for management of the summer Chinook salmon fishery are as follows:

- Management of Chinook salmon harvest under the conservation and harvest sharing provisions of the Pacific Salmon Treaty.
- Maximize the harvest of Alaska hatchery-produced Chinook salmon.
- Achieve harvest allocations among user groups as mandated by the Board.
- Minimize the incidental mortality of Chinook salmon to the extent practicable.

A harvest control limit is set for management of Chinook salmon during the summer fishery. ADF&G manages the summer fishery by targeting harvest of 70 percent of the annual summer Chinook salmon quota in an initial opening beginning July 1. The remainder of the Chinook salmon quota is harvested in August. Due to the time lag between when fish are harvested and when the harvest information is received through receipt of fish landing tickets, ADF&G conducts a fisheries performance data program to estimate the catch per unit effort (catch per boat day [CPBD]) inseason during the summer fishery. Confidential interviews are conducted with trollers to obtain detailed CPBD data. Aerial vessel surveys are conducted to obtain an immediate estimate of fishing effort. Total harvest to date is estimated by multiplying vessel counts observed during weekly overflights with the CPBD data obtained from the interviews. Daily tallies from processors are also an important tool in tracking harvest.

Following the first Chinook opening, the waters of high Chinook salmon abundance will be closed, unless ADF&G determines that less than 30 percent of the Chinook salmon harvest goal for the initial opening was taken in that opening. In addition, during the second Chinook salmon opening, if ADF&G determines after 10 days that the annual troll Chinook salmon harvest ceiling might not be reached by September 20 with those waters closed, ADF&G shall reopen the waters of high Chinook salmon abundance by emergency order. Following the closure of the initial summer Chinook salmon period, all Chinook salmon must be offloaded prior to trolling for other species. Further information on the spring and summer troll fisheries can be found in ADF&G fishery management plans.

Chinook salmon caught in the troll fishery must be equal to or greater than 28 inches in total length and the heads of all adipose-fin clipped salmon must remain attached until the fish is sold in order to facilitate recoveries of coded wire tags. If the ADF&G Commissioner determines that Chinook salmon in a terminal harvest area are predominately Alaska hatchery produced, the Commissioner may, by emergency order, allow the retention of Chinook salmon greater than 26 inches in total length. A proportion of Chinook salmon produced in hatcheries (approximately 5 percent to 20 percent depending upon release size) have adipose fins that are clipped as a way to externally identify them as having an internal coded wire tag. Coded wire tag provide information on migration routes, run-timing, exploitation rates, and the contribution to commercial and recreational fisheries of Chinook salmon from specific river systems. Chum, sockeye, and pink salmon of any size may be retained at any time during open fishing periods.

Coho Salmon Troll Fishery

Coho salmon management is based on aggregate abundance. Coho salmon fisheries in southern Southeast Alaska are also managed in cooperation with Canada under guidelines of the Pacific Salmon Treaty. There are no harvest ceilings for Southeast Alaska coho salmon fisheries under the Treaty; however, areas near the United States/Canada border will close to trolling if the harvest by Alaska trollers fishing in the border area falls below specified thresholds. The primary objectives for management of the coho salmon fishery are as follows:

- Provide adequate escapement of coho salmon, by area, to ensure sustainable populations.
- Provide maximum opportunities for harvest consistent with conservation objectives.
- Manage the coho salmon fisheries to achieve allocations consistent with Board regulations.
- Manage coho salmon on the United States/Canada border to comply with provisions of the Pacific Salmon Treaty.

The regulatory period for coho salmon retention in the troll fishery is June 15 through September 20, with a potential extension (by emergency order) through September 30 in years of high coho salmon abundance. Troll harvests of coho salmon generally peak between mid-July and early September. The troll fishery may also be closed, by emergency order, for conservation of coho salmon stocks as follows:

- For up to seven days beginning on or after July 25 if the total projected commercial harvest of wild coho salmon is less than 1.1 million fish; or
- For up to ten days, if ADF&G makes an assessment and determines that:
    - the number of coho salmon reaching inside waters might be inadequate to provide for spawning requirements under normal or restricted inside fisheries for coho salmon and other species; the primary abundance indicators for the assessment consist of relative harvest levels by all fisheries and, in particular, catch per unit effort in inside drift gillnet and sport fisheries as compared to average 1971 through 1980 levels and escapement projections for streams where escapement goals have been established; or
    - the proportional share of coho salmon harvest by the troll fishery is larger than that of inside gillnet and sport fishing fisheries when compared to average (1971 through 1980) levels; the primary inside fisheries indicators for the assessment are overall coho salmon harvests and catch per unit effort in the District 1, 6, 11, and 15 drift gillnet fisheries and by anglers sport fishing from boats in the salt water sport fishery that return to any port connected to the Juneau road system.

Following any closure, waters for coho salmon trolling may be reopened by emergency order; however, if ADF&G determines that the strength of the coho salmon run in the inshore and terminal salmon fishing waters is less than required to provide a spawning escapement that will maintain the runs on a sustained-yield basis, ADF&G may take additional actions on coho salmon fishing seasons, periods, and areas.

Similar to Chinook salmon, ADF&G's primary tool for inseason assessment of coho salmon catch rates is a program of dockside interviews with vessel skippers. Catches by the net fisheries are obtained from fish tickets, and an assessment of run strength using troll catch per unit effort data occurs in mid to late July.

Chum Salmon Troll Fishery

Historically, chum salmon were harvested incidentally in the general summer troll fishery. Effort directed at targeting chum salmon from Alaska hatcheries has increased in recent years. Target effort is primarily found in terminal or near terminal waters close to hatchery facilities. Chum salmon troll fisheries in terminal areas may be conducted during periods of closures for Chinook or coho salmon. In such fisheries, a person may not have Chinook salmon or coho salmon (respectively) on board a salmon troll vessel while fishing for chum salmon.

8.1.2 Effort in the Troll Fishery

Limited entry for the power troll fishery was adopted in 1974 by the CFEC and the first permits were issued in 1975. The number of permits fished has fluctuated, with a peak of 919 in 1979 and a low of 637 in 2003. After the power troll fleet came under limited entry, the hand troll fleet, which was not yet limited, increased dramatically. The number of hand troll permits fished doubled from 1,100 permits in 1975 to a peak of 2,644 permits in 1978. Limited entry for the hand troll fishery was initiated in 1980 and the first permits were issued in 1982. Of the 2,161 permits issued that year (many of which had been issued as not-transferable), 1,107 were vacated due to non-renewal through 2009. The number of hand troll permits fished declined steadily from 1979 through 2002 when hand troll participation reached a low of 254 permits. From 2003 to 2008, the number of hand troll permits fished increased to 376, but has since declined to 332. During the 2010 spring and summer troll fisheries, both hand and power troll effort decreased when compared to 2009; this was not the case during the 2010 winter troll fishery, when both hand and power troll effort increased significantly compared to 2009. Fluctuations in effort in both the power and hand troll fisheries relates strongly to salmon prices and abundance.

8.1.3 Chinook Salmon Allocation

The Pacific Salmon Treaty provides a framework for the management of salmon fisheries in part by establishing fishing regimes that set upper limits on intercepting fisheries. Such regimes are expected to be amended periodically upon recommendation from the Pacific Salmon Commission as new information becomes available to better accomplish the Treaty's conservation, production, and allocation objectives.

The original regimes established in 1985 expired by the end of 1992. Between 1993 and 1998, salmon fisheries subject to the Pacific Salmon Treaty were managed pursuant to short term agreements that governed only some of the fisheries. Where short term agreements were not able to be reached, the fisheries were managed independently by the respective domestic management agencies in approximate conformity with the most recently applicable bilateral agreement.

In 1999, new fishery agreements under the Pacific Salmon Treaty were adopted by the United States and Canada, including an agreement for Chinook salmon. The new abundance-based Chinook salmon agreement replaced the previous fixed ceiling-based regime. A major component of this Agreement is the management regime set forth for Chinook salmon, which established a basic aggregate abundance-based management approach for three major ocean Chinook salmon fisheries in southeast Alaska and Canada coupled with an individual stock-based management approach for all other Treaty-area fisheries in Canada and the Pacific Northwest. The all-gear Chinook salmon fishery is managed to achieve a harvest target; the Treaty agreement specifies a harvest based on a relationship between a preseason Abundance Index generated by the Pacific Salmon Commission's Chinook Technical Committee and a target harvest rate specified in the agreement. The harvest ceiling is abundance-based, with increased quotas when abundance is high and decreased quotas when abundance is low. In addition to the catch ceiling of Treaty fish, provisions of the Treaty provide for an additional harvest of Chinook salmon that have been produced in Alaskan hatcheries (add-on). The all-gear add-on is equal to the total number of Alaskan hatchery Chinook caught, minus the pre-Treaty production of Chinook salmon of around 5,000 fish, and a risk adjustment factor of around 1,000 fish. The hatchery add-on is calculated in season through port sampling programs.

The fishing regimes established under the 1999 agreement applied for ten years, expiring at the end of 2008. In May 2008, the Pacific Salmon Commission recommended a new bilateral agreement which was approved by the U.S and Canadian governments in December 2008. As with the 1999 Agreement, the new agreement established fishing regimes that will be in force for a ten year period (2009 through 2018). These new fishing regimes are contained in chapters 1, 2, 3, 5, and 6 of Annex IV to the Pacific Salmon Treaty.

ADF&G manages the sport and commercial fisheries for Chinook salmon in accordance with the annual harvest ceiling established by the Pacific Salmon Commission under the Pacific Salmon Treaty and allocation guidelines established by the Board. The allocation of the annual Chinook salmon harvest ceiling for each fishery is as follows:

- Troll fishery: 80 percent, after the net fishery allocations are subtracted from the annual harvest ceiling
- Sport fishery: 20 percent, after the net fishery allocations are subtracted from the annual harvest ceiling
- Purse seine fishery: 4.3 percent of the annual harvest ceiling
- Drift gillnet fishery: 2.9 percent of the annual harvest ceiling
- Set gillnet fishery: 1,000 Chinook salmon

For the purposes of calculating the Chinook salmon harvest, the annual harvest period begins with the opening of the winter troll season. For the purpose of calculating the annual harvest performance for the Chinook salmon fisheries, the harvest in the sport and commercial net and troll fisheries is applied to the cumulative harvest, which includes the Alaska hatchery contribution.

8.1.4 Chinook Salmon Harvest

In 2010, all-gear Chinook salmon harvests totaled 265,186 fish out of a total salmon (all species, all gear) harvest of 37 million fish harvested in federal and state waters east of the longitude of Cape Suckling (Table 2). During the 2010 winter troll fishery, 42,536 Chinook salmon were harvested, which represents 22 percent of the total troll Chinook salmon harvest for 2010. The winter harvest increased by 41 percent when compared to the 2009 season. During the 2010 spring fishery, 28,614 Chinook salmon were harvested, which was 3,967 fish fewer than the 2009 spring harvest. The 2010 spring harvest was the lowest since 2000, but was the 11th highest on record.

In 2010, the preseason abundance index of 1.35 for Southeast Alaska was established through the technical committee process of the Pacific Salmon Commission, which translated to an all-gear quota of 221,823 Treaty Chinook salmon. Under the Board's commercial fisheries allocation plan, the purse seine fleet was allocated 9,538 (4.3 percent) Chinook salmon; the drift gillnet fleet was allocated 6,433 (2.9 percent) Chinook salmon; and the set gillnet fleet was allocated 1,000 Chinook salmon. The remainder of the 204,852 fish was then divided between the troll and sport fisheries in an 80/20 split, which translated to 163,882 Chinook salmon to the troll fishery and 40,970 Chinook salmon to the sport fishery.

8.1.5 Coho Salmon Allocation

Coho salmon are managed to ensure escapement goals and to achieve Board allocation guidelines. Coho salmon in fisheries near Dixon Entrance are managed in cooperation with Canada according to provisions of the Treaty agreement. The traditional harvest allocation of coho salmon in the Southeastern Alaska and Yakutat commercial salmon fisheries is 61 percent troll, 19 percent purse seine, 13 percent drift gillnet, and 7 percent set gillnet. While these percentages may vary from season to season, given fluctuations in salmon abundance and the distribution and limitations of fisheries management, ADF&G manages the fishery to maintain these allocation guidelines over the long-term. To do so, ADF&G may not disrupt any of the traditional commercial fisheries upon which this traditional allocation is founded; however, ADF&G may make inseason adjustments to attempt to achieve these traditional harvest allocation guidelines.

A region-wide troll closure for up to 10 days may be required during the coho salmon season to address allocations between outer coastal fisheries and inside water fisheries if ADF&G determines that the proportional share of coho salmon harvest by the troll fishery is larger than that of inside gillnet and sport fisheries compared to 1971 through 1980 levels. Primary inside fishery indicators for this assessment are overall coho salmon harvests, escapement projections for streams where escapement goals have been established, catch per unit effort in the Tree Point, Prince of Wales, Taku/Snettisham, and Lynn Canal drift gillnet fisheries, and harvest in the Juneau marine sport fishery. Additional inseason management actions may be required for conservation.

8.1.6 Coho Salmon Harvest

All-gear harvests of coho salmon averaged 2 million fish during the 1940s. A decline in average harvest occurred during the next three decades, with a low decade average of 1 million fish in the 1970s. The average all-gear commercial coho salmon harvest increased to 1.9 million fish in the 1980s and to 3.2 million fish in the 1990s with a record of 5.5 million fish harvested in 1994. In 2010, the all-gear coho salmon harvest totaled approximately 2.577 million fish (Table 2).

Coho salmon retention in the troll fishery opens by regulation on June 15, during the spring troll fisheries. The majority of the troll coho salmon harvest occurred after July 1 during the general summer season. In 2010, the initial late-July coho salmon run strength assessment appeared to be average to below average based on power troll catch/boat/day. The second run strength assessment in early August indicated that the coho salmon run strength was average and did not have any conservation concerns at that time. A 4-day closure of the troll fishery was implemented in mid-August in order to provide for adequate escapement and transition to inside waters. On September 13, ADF&G issued a news release announcing that 2010 was not considered to be a high coho salmon abundance year and that the fishery would close by regulation on September 20. An extension of the troll season was not warranted due to the below-average region-wide, power troll catch rates seen after the August closure and the below-average cumulative troll coho salmon harvest. The final 2010 troll coho salmon harvest of 1,342,212 fish was the 19^{th} highest in the 50 years since statehood.

8.1.7 Chinook and Coho Salmon Troll Fishery EEZ Harvests

In 2010, approximately 11 percent of the Chinook salmon (28,831 fish) and 4 percent of the coho salmon (98,946 fish) harvested by commercial salmon fisheries in Southeast Alaska was reported taken outside of state waters in the EEZ (Table 2). In addition, 102 sockeye, 1,081 pink, and 466 chum salmon were reported taken in the EEZ. When all salmon species are combined, less than one percent of the troll harvest was reported to be taken outside state waters.

The reported number of Chinook salmon harvested from the troll fishery in the East Area has decreased considerably since the FMP first went into effect in 1979. From 1977 through 1985, the troll fishery in the EEZ accounted for about 18 percent of the troll harvest of Chinook salmon, 10 percent of the coho, 7 percent of the sockeye, 6 percent of the pink, and 8 percent of the chum in numbers of fish. The peak Chinook salmon harvest from the EEZ occurred in 1980, with 134,666 taken or about 45 percent of the total troll Chinook harvest. Since the Pacific Salmon Treaty went into effect in 1985, the average (1985 through 1989) percentages of the total troll harvest made in the EEZ dropped: 10.6 percent of the Chinook, 5 percent of the coho, 2.6 percent of the sockeye, 1.4 percent of the pinks, and 3.8 percent of the chum. The reasons for the decrease have been the shorter summer troll fishing period for Chinook salmon with a resulting increased percentage of the harvest from the coastal and inside waters as those areas are open longer.

Table 2 Southeast Alaska salmon harvest associated with commercial fisheries, EEZ waters only and total, 1991 through 2010 (numbers of fish).

	Chinook salmon			Sockeye salmon			Coho salmon			Pink salmon			Chum salmon			Salmon total		
Year	**EEZ**	**Total**	**EEZ as % of Total**	**EEZ**	**Total**	**EEZ as % of Total**	**EEZ**	**Total**	**EEZ as % of Total**	**EEZ**	**Total**	**EEZ as % of Total**	**EEZ**	**Total**	**EEZ as % of Total**	**EEZ**	**Total**	**EEZ as % of Total**
1991	16,615	339,127	4.9%	287	2,063,585	0.0%	56,004	3,194,517	1.8%	3,602	61,926,339	0.0%	609	3,336,042	0.0%	77,117	70,859,610	0.1%
1992	3,266	226,990	1.4%	3,868	2,666,382	0.1%	402,550	3,694,214	10.9%	31,794	34,963,251	0.1%	8,979	4,936,434	0.2%	450,457	46,487,271	1.0%
1993	13,589	297,032	4.6%	692	3,190,945	0.0%	212,439	3,663,518	5.8%	4,921	57,299,350	0.0%	5,347	7,879,758	0.1%	236,988	72,330,603	0.3%
1994	10,286	221,125	4.7%	1,586	2,392,365	0.1%	254,993	5,715,550	4.5%	2,691	57,269,259	0.0%	1,376	10,402,759	0.0%	270,932	76,001,058	0.4%
1995	10,484	214,835	4.9%	1,252	1,795,330	0.1%	295,621	3,343,075	8.8%	6,244	47,965,505	0.0%	5,869	11,225,674	0.1%	319,470	64,544,419	0.5%
1996	11,986	220,437	5.4%	319	2,799,841	0.0%	134,452	3,153,471	4.3%	1,370	64,629,713	0.0%	2,041	16,043,236	0.0%	150,168	86,846,698	0.2%
1997	18,172	298,712	6.1%	3,368	2,456,751	0.1%	101,901	1,966,193	5.2%	1,335	28,679,834	0.0%	1,479	11,764,076	0.0%	126,255	45,165,566	0.3%
1998	18,262	237,495	7.7%	237	1,375,318	0.0%	161,218	2,985,384	5.4%	2,347	42,535,402	0.0%	887	15,695,279	0.0%	182,951	62,828,878	0.3%
1999	16,567	200,581	8.3%	98	1,160,729	0.0%	81,852	3,625,347	2.3%	396	77,848,284	0.0%	203	14,930,931	0.0%	99,116	97,765,872	0.1%
2000	14,264	226,913	6.3%	143	1,229,390	0.0%	60,226	1,954,546	3.1%	972	20,313,426	0.0%	1,480	15,910,909	0.0%	77,085	39,635,184	0.2%
2001	11,061	251,049	4.4%	170	2,035,230	0.0%	53,639	3,297,633	1.6%	1,024	67,055,991	0.0%	497	8,754,392	0.0%	66,391	81,394,295	0.1%
2002	52,024	388,658	13.4%	114	806,447	0.0%	56,412	3,237,674	1.7%	1,286	45,331,007	0.0%	654	7,455,007	0.0%	110,490	57,218,793	0.2%
2003	58,588	411,028	14.3%	192	1,525,356	0.0%	38,870	2,495,053	1.6%	1,340	52,515,632	0.0%	602	11,115,085	0.0%	99,592	68,062,154	0.1%
2004	49,372	482,251	10.2%	287	2,037,745	0.0%	144,193	3,080,644	4.7%	822	45,333,012	0.0%	1,585	11,371,625	0.0%	196,259	62,305,277	0.3%
2005	13,499	447,536	3.0%	504	1,607,835	0.0%	85,413	2,998,830	2.8%	333	59,182,242	0.0%	47	6,427,530	0.0%	99,796	70,663,973	0.1%
2006	35,792	364,109	9.8%	606	1,333,496	0.0%	78,566	2,087,807	3.8%	721	11,695,411	0.0%	221	13,555,280	0.0%	115,906	29,036,103	0.4%
2007	32,014	355,369	9.0%	312	1,904,802	0.0%	82,952	2,058,431	4.0%	681	44,884,739	0.0%	1,243	9,417,807	0.0%	117,202	58,621,148	0.2%
2008	20,176	246,149	8.2%	32	436,279	0.0%	69,355	2,380,628	2.9%	358	15,974,343	0.0%	301	9,053,046	0.0%	90,222	28,090,445	0.3%
2009	23,615	271,451	8.7%	135	925,749	0.0%	69,912	2,635,471	2.7%	784	38,101,430	0.0%	748	9,660,364	0.0%	95,194	51,594,465	0.2%
2010	28,831	265,186	10.9%	102	717,563	0.0%	98,946	2,577,683	3.8%	1,081	24,208,300	0.0%	466	9,474,546	0.0%	129,426	37,243,278	0.3%
Total	**458,463**	**5,966,033**	**7.7%**	**14,304**	**34,461,138**	**0.0%**	**2,539,514**	**60,145,669**	**4.2%**	**64,102**	**897,712,470**	**0.0%**	**34,634**	**208,409,780**	**0.0%**	**3,111,017**	**1,206,695,090**	**0.3%**

Note: Total Southeast harvest is associated with the following CFEC permit types: Southeast salmon purse seine (S01A), Southeast salmon drift gillnet (S03A), Yakutat set gillnet (S04D), Statewide salmon hand troll (S05B), statewide salmon power troll (S15B), Southeast salmon special harvest area (S77A) a hatchery permit, and Southeast Metlakatla reservation permit (S99A), an experimental or special permit. All salmon associated with commercial activity is included, regardless of disposition, including test fishing and hatchery cost recovery.

EEZ harvest in Southeast Alaska reflects harvest from statistical areas 15000, 15200, 15400, 15600, 15700, 18900, 18930, 18940, and 18950. EEZ harvest is by vessels fishing with statewide salmon hand troll (S05B) and statewide salmon power troll (S15B) permits. There are no harvests in these statistical areas attributed to other permit types.

8.1.8 Bycatch Management

Bycatch in the directed commercial salmon fisheries primarily consists of groundfish species and the incidental catch of immature salmon. State and federal management measures minimize bycatch to the extent practicable and minimize the mortality of bycatch.

A combination of factors work together to keep both the number of fish taken as bycatch and the associated mortality of those fish at a negligible amount. First, ADF&G fish tickets serve as a standardized reporting method documenting all retained harvest from both state and EEZ waters. ADF&G regulations require that fish tickets record the type of gear used as well as the number, pounds, delivery condition, and disposition of fish species harvested and retained for both commercial and personal use (5 AAC 39.130(c)). Maximum retainable allowances (MRAs) of certain non-salmon allow for bycatch to be treated as incidental catch so that those species are able to be utilized. In addition, non-retention requirements when MRAs are achieved create incentives to avoid those species taken as bycatch. Specified closure areas during those times of the year when bycatch is generally highest serves to significantly reduce the amount of bycatch taken. Finally, the nature of the gear utilized in the troll fishery allows for discarded species to be released with limited mortality. Additional management measures are not necessary to document bycatch interactions within salmon fisheries.

Groundfish Incidental Catch Management Measures

The State of Alaska reports the amount and type of groundfish harvested incidentally in the Southeast Alaska troll fishery in the Southeast region groundfish report prepared for the Board on a 3-year cycle.

The Southeast Alaska troll fishery incidentally harvests state managed groundfish species; including lingcod, black rockfish, dark rockfish, blue rockfish, and demersal shelf rockfish (DSR). The seven species of rockfish in the DSR assemblage are yelloweye, quillback, canary, rosethorn, copper, china, and tiger rockfish. Bycatch allowances for federal waters are the same as in state waters only for the state managed groundfish species. For federally managed groundfish species, trollers are restricted to a federal retainable percentage found at http://www.alaskafisheries.noaa.gov/rr/tables/tabl10.pdf. To this end, vessels trolling for salmon in EEZ waters of the Gulf of Alaska that retain groundfish as bycatch must have a Federal Fisheries Permit endorsed for troll gear. This requirement identifies the number of troll vessels that can fish in the EEZ and retain groundfish.

In the East Area, all groundfish incidentally taken by hand and power troll gear being operated to take salmon (consistent with applicable laws and regulations) can be legally taken and possessed with the following restrictions:

- The bycatch allowance for DSR is limited to 10 percent of the round weight of all salmon on board the vessel. All DSR in excess of 10 percent must be weighed and reported as bycatch overage on an ADF&G fish ticket. DSR bycatch overages may be kept for a person’s own use but fish retained for that purpose must be reported on fish tickets.
- Lingcod may be taken as bycatch in the commercial salmon troll fishery only from May 16 through November 30.
- Lingcod must measure at least 27 inches from the tip of the snout to the tip of the tail, or 20.5 inches from the front of the dorsal fin to the tip of the tail.

Lingcod harvest allocations for the troll fishery are set by Lingcod Management Area, and area closures will occur as allocations are taken. Inseason closures will be announced by news release and marine radio broadcast.

Halibut incidentally taken during an open commercial halibut season by power and hand troll gear being operated for salmon consistent with applicable state laws and regulations are legally taken and possessed. Commercial halibut may be legally retained only by IFQ permit holders during the open season for halibut. Trollers making an IFQ halibut landing of 500 pounds or less of IFQ weight are exempted from the 3 hour Prior Notice of Landing if landed concurrently with a legal landing of salmon. Halibut taken incidentally during the troll fishery must be reported on an ADF&G fish ticket using the CFEC salmon permit.

Trollers are allowed to longline for groundfish and troll for salmon on the same trip as long as fish are not onboard the vessel in an area closed to commercial fishing or closed to retention of that species and the fisher has both a commercial salmon permit and the appropriate commercial longline permit.

A vessel may not participate in a directed fishery for groundfish with dinglebar troll or mechanical jig gear if they have commercial salmon on board. A vessel fishing for groundfish with dinglebar troll gear must display the letter “D” and a vessel fishing for groundfish with mechanical jigging machines must display the letter “M” at all times when fishing with or transporting fish taken with dinglebar troll gear or mechanical jigging machines. A vessel displaying one of these letters may not be used to fish for salmon.

All harvest information on bycatch in the commercial troll fishery comes from catch reported on fish tickets. Table 3 shows that lingcod and black rockfish, both state managed species, make up the primary bycatch in the commercial troll fishery. Reported harvest of groundfish from EEZ waters is small when compared to harvest totals from all of Southeast Alaska and occurs during the months of July, August, and September when the summer troll season is open. Unreported harvest and discard-at-sea mortality is not estimated, but is thought to be low given the nature of troll gear and the times and locations fished.

A significant management measure taken by the State of Alaska, which affects both the bycatch of groundfish and the incidental catch of non-target salmon species, is the closure of Chinook salmon high abundance waters after the first summer period, which ends June 30 (Figure 2). The purpose of this regulation (5 AAC 29.025) is to slow the Chinook salmon harvest rate during the Chinook salmon retention fishery and to reduce the number of Chinook salmon incidentally hooked and released during a non-retention fishery. While a portion of the closed waters is in state waters, a large portion (the Fairweather Grounds) is within waters of the EEZ. In addition, lingcod and other groundfish may not be taken in the waters off Cape Edgecumbe (Edgecumbe Pinnacles Marine Reserve) enclosed by a box defined as 56° 55.50’ N. lat., 56° 57.00’ N. lat., 135° 54.00’ W. long., and 135° 57.00’ W. long. [5AAC 28.150(c)]. These waters are entirely in the EEZ.

Table 3 **All groundfish species (round pounds) reported on salmon troll fish tickets for EEZ waters only, 2005 through 2010.**

	YEAR					
SPECIES	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Black rockfish	2,049	2,690	1,144	2,217	550	167
Bocaccio rockfish			26			48
Canary rockfish	8		13	11		
Dusky rockfish	5	581	59	10	696	684
General shark	29					
Lingcod greenling	2,701	8,322	10,569	6,241	8,047	7,308
Quillback rockfish		6	3	89	7	42
Redstripe rockfish			11			
Rougheye rockfish			6			
Salmon shark				111		
Silvergray rockfish	108	63	36	50	84	20
Widow rockfish				39		
Yelloweye rockfish	54	208	413	64	282	191
Yellowtail rockfish	40	22	65	38	5	
Total	**4,994**	**11,892**	**12,345**	**8,869**	**9,670**	**8,460**

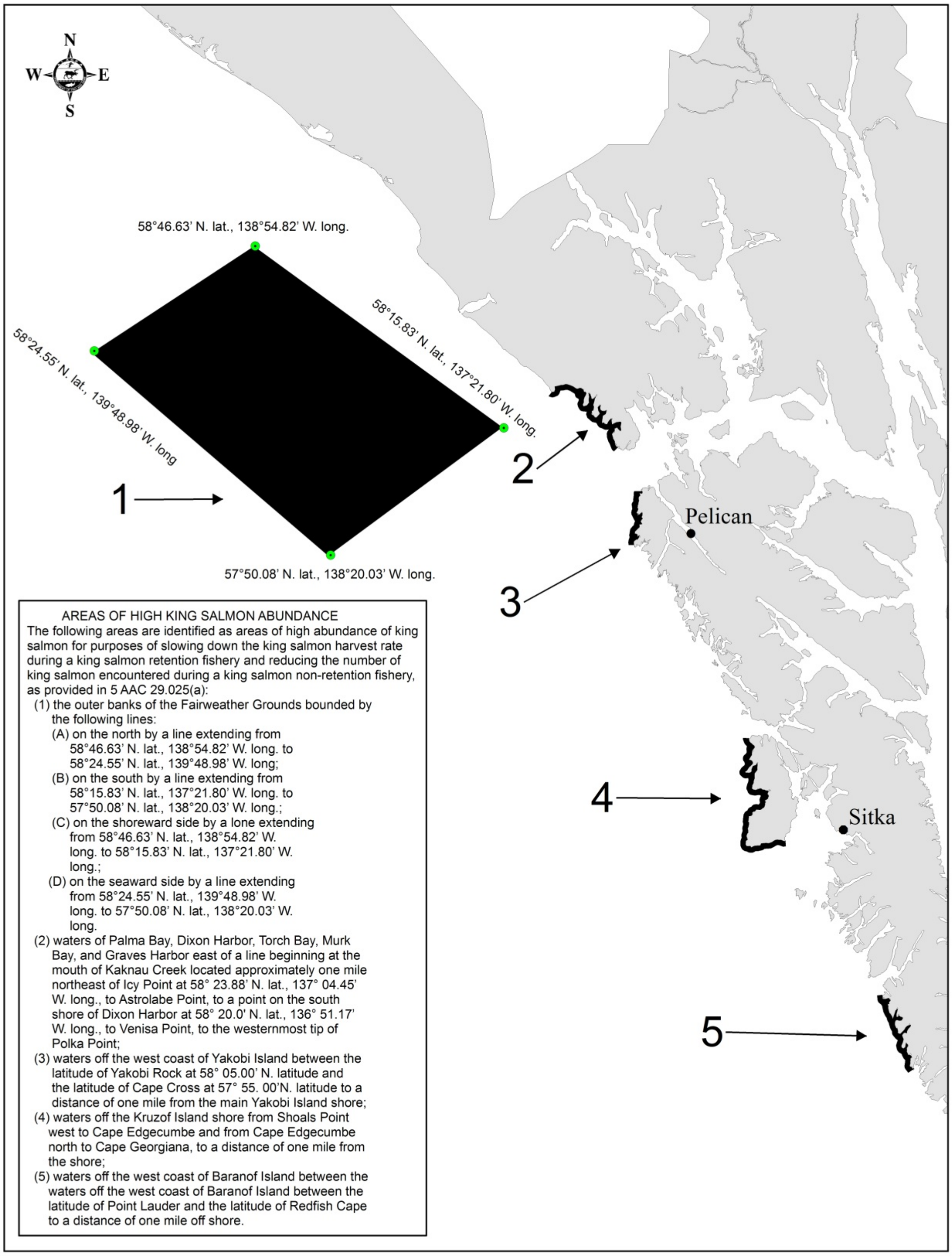


Figure 2 ADF&G's map of areas of high Chinook salmon abundance

Salmon Incidental Catch Management Measures

In the State of Alaska's Policy for the Management of Mixed Stock Salmon Fisheries (5AAC 39.220), conservation of wild salmon stocks consistent with sustained yield is given the highest priority. In the absence of a regulatory management plan that allocates or restricts harvest, and when it is necessary to restrict fisheries on stocks where there are known conservation problems, the burden of conservation shall be shared among all fisheries in close proportion to their respective harvest on the stock of concern. Assigning conservation burdens in mixed stock fisheries is through the application of specific fishery management plans set out in regulation. To this end, management plans are adopted by the State of Alaska that work to both minimize and maximize allocations of specific salmon stocks, depending upon the conservation need identified. As such, management plans incorporate conservation burden and allocation of harvest opportunity that affects all users of the resource. Management plan provisions such as net mesh size restrictions, weekly fishing periods, and size limits work to reduce the incidental catch of non-target salmon species in the salmon fishery so that stocks are able to achieve their established escapement goals.

A Southeast Alaska troll vessel observer program was conducted during the general summer troll fishery from 1985 to 1988. A Southeast Alaska troll vessel observer and logbook program was reinstituted during the general summer troll fishery from 1998 to 2006. The primary purpose of these programs was to estimate the sex and maturity composition of the Chinook and coho salmon catches, and the number of legal sized and sublegal sized Chinook salmon that were released. The coho salmon sex ratios and maturity data were used to evaluate methods for estimating run timing. In addition, during the second program, the observers collected coded-wire-tag and genetic samples from Chinook for a pilot program to determine stock origin. Estimates of total Chinook releases for 1985 through 1988 and 1998 through 2006 were made by directly expanding the observer and logbook data to the entire Southeast Alaska troll fishery. Although the Southeast Alaska troll vessel observer and logbook program has been discontinued, the Southeast Alaska troll Fishery Performance Data program continues to provide sample data on fishing location and effort that are expanded to estimate the total effort in the fishery. Estimates of Chinook releases for the periods 1989 through 1997 and 2007 through the present are based on the observed relationships between total effort in the Southeast Alaska troll fishery and the total number of Chinook salmon releases during the years when observer and logbook programs were in operation.

8.1.9 Sport Fisheries

The ADF&G Division of Sport Fish manages the sport fisheries. Alaska statute defines sport fishing as the "taking of or attempting to take for personal use, and not for sale or barter, any fresh water, marine, or anadromous fish by hook and line held in the hand, or by hook and line with the line attached to a pole or rod which is held in the hand or closely attended, or by other means defined by the Board of Fisheries" (AS 16.05.940(30)).

Under criteria adopted by the Board, the ADF&G Commissioner may increase or decrease sport fish bag limits or modify methods of harvest for sport fish by means of emergency orders. An emergency order has the force and effect of law after field announcement by the commissioner or an authorized designee. These changes may not reduce the allocation of harvest among other user groups. An emergency order may not supersede bag and possession limits or methods and means established in regulatory management plans established by the Board.

The ADF&G Commissioner or an authorized designee may decrease sport fish bag and possession limits and restrict methods and means of harvest by emergency order when (A) the total escapement of a species of anadromous fish is projected to be less than the escapement goal or the lower limit of the escapement range for that species listed in management plans that have been adopted by the Board or established by ADF&G; or (B) the recreational harvest must be curtailed in any fishery for conservation reasons. ADF&G may issue a "catch-and-release only" emergency order when the estimated hooking mortality is not projected to reduce the population of fish below the number required for spawning escapement or, in the case of resident species, below the level required for maintenance of the desired age and size distribution of the population.

The ADF&G Commissioner or an authorized designee may increase sport fish bag and possession limits and liberalize methods and means of harvest by emergency order when (A) the total escapement of a species of anadromous fish is projected to exceed the optimum escapement goal by 25 percent or the upper limit of the escapement range for that species listed in management plans that have been adopted by the Board or established by ADF&G, if the total harvest under the increased bag and possession limit will not reduce the escapement below the optimum escapement goal or the upper limit of the escapement range; or (B) hatchery-produced fish escape through existing fisheries to designated harvest areas in numbers that exceed brood stock needs, any natural spawning requirements, or cost recovery goals of private nonprofit hatcheries. The intent of this subparagraph is to allow harvest when there are no other competing user groups.

The Division of Sport Fish has conducted a mail survey (Statewide Harvest Survey) to estimate sport fishing annual effort (angler-days), harvest (fish kept) since 1977, and total catch (fish kept plus fish released) since 1990. Harvest and catch estimates are available for species commonly targeted by sport anglers. Effort, harvest, and catch estimates are available by region and area, but are not specifically available for the EEZ. In Southeast Alaska, the Division of Sport Fish has conducted a creel survey and port sampling program to estimate effort (angler days), harvest, and catch.

Given the available data for sport fishing activity in the EEZ, harvest estimates can only be provided for 2010. Estimating the sport harvest of salmon for the East Area was not possible prior to 2010, and is recently only possible due to modifications made to maps used with the Saltwater Charter Vessel Logbook program. Modifications were made prior to the 2010 fishing season, whereby existing logbook maps were edited using GIS to include the NOAA-NMFS groundfish statistical areas adjacent to the ADF&G salmon statistical areas along the outer coast of Southeast Alaska.

Sport Salmon Harvest in the East Area

The sport harvest of Chinook, coho, and sockeye salmon in the EEZ waters of the East Area during 2010 was minimal (Table 4). Effort for the harvest of these salmon species in the EEZ, which is measured as the number of vessels and trips conducted, was also minimal (Table 4).

Most of the Chinook salmon harvest took place off of the west coast of Prince of Wales Island. Likewise, the vast majority of the EEZ harvest for coho salmon took place off of Prince of Wales Island, with an additional estimated 26 fish off Sitka and four fish out of Cross Sound that were landed in Gustavus. All of the saltwater sport harvest of sockeye salmon in the East Area during 2010 occurred off of Sitka.

Ports observed to land the majority of salmon coming from EEZ waters in the East Area were predominately off of Prince of Wales Island (Waterfall Resort and Craig/Klawock) and Sitka. A small number of trips (less than five) originated from Elfin Cove and Gustavus, which likely fished outside of Cross Sound.

Table 4 Comparison of 2010 state waters and EEZ saltwater sport fishery harvests of Chinook, coho, and sockeye salmon (numbers of fish) and effort (numbers of vessels and trips).

	State	Federal
Chinook	53,919	82
Coho	153,819	163
Sockeye	3,938	4
Vessels	609	12
Trips	18,919	25

Sport Fishing Guide Operations

Per Alaska statute (5 AAC 75.075(c)), the Division of Sport Fish is also responsible for overseeing the annual licensing of sport fish businesses and guides. A 'sport fishing guide' means a person who is licensed to provide sport fishing guide services to persons who are engaged in sport fishing (AS 16.40.299). 'Sport fishing guide services' means assistance, for compensation or with the intent to receive compensation, to a sport fisherman to take or to attempt to take fish by accompanying or physically directing the sport fisherman in sport fishing activities during any part of a sport fishing trip. Salmon is one of the primary species targeted in the states' sport fisheries. All saltwater and freshwater sport fishing charter vessels must be registered through ADF&G.

In addition, all freshwater and saltwater sport fishing guide operators are required to maintain an ADF&G-issued logbook of their clients' catch. The Division of Sport Fish conducts a program to issue saltwater and freshwater charter logbooks, which provides comprehensive effort, harvest, and catch estimates for guided anglers in saltwater. Logbook data are available specifically for state and federal waters in Southeast Alaska since 2010.

Sport Fishing and Chartering from a Registered Troll Vessel

State regulations pertaining to sport fishing for salmon in the marine waters of Alaska apply in the East Area. A person may sport fish from a registered commercial salmon hand or power troll vessel. A troll gurdy may be used as a downrigger in conjunction with a sport fishing rod to sport fish for salmon. A person who sport fishes from a vessel licensed for commercial fishing (other than a charter vessel) in waters closed to commercial salmon fishing shall, immediately upon bringing a salmon aboard, mark the salmon by removing its dorsal fin. This regulation also applies when a person is sport fishing for a species closed to commercial trolling. Sport fishing from a commercially licensed vessel while commercially caught salmon are in possession is illegal in waters closed to commercial fishing.

A registered troll vessel may also be registered as a charter vessel. A vessel registered both as a commercial troller and as a charter vessel may not be used to troll commercially and charter in the same day.

8.2 Safety

According to the National Institute for Occupational Safety and Health (NIOSH), of the major commercial fisheries in Alaska, salmon fisheries have the lowest annual commercial fishing fatality rate, which accounts for the number of workers and exposure time on the water. From 2000 through 2009, commercial salmon fisheries experienced a rate of 115 fatalities per 100,000 full-time equivalent workers. From 2000 through 2010, 40 fishermen died while fishing for salmon; these deaths included 17 falls overboard, 14 lives lost after a vessel disaster (i.e., vessel sinking, skiff swamping), 5 on board injuries, and 4 fatalities that occurred on shore. These fatalities occurred on vessels using the following gear type: drift gillnet (18 fatalities), set gillnet (10 fatalities), troll gear (5 fatalities), purse seine (2 fatalities), and no fishing gear (4 fatalities). By location, Southwest Alaska had the highest number of fatalities with 18 deaths from 2000 through 2010; Southcentral and Southeast Alaska had an equal number of fatalities with 11 each.

From the information gathered and reported by NIOSH, it is impossible to delineate whether the fatalities discussed above occurred within state waters or outside the state waters boundary into the EEZ. However, it is important to note that the only salmon gear groups operating in the EEZ are the drift gillnet and purse seine (Alaska Peninsula only) salmon fisheries in the West Area and the troll fisheries in the East Area. As such, the fatality numbers recorded above likely inflate the actual number of deaths that have occurred in the EEZ.

Through its public process, the Board addresses specific fishery safety issues as they arise and works to modify its regulations, as necessary, in order to increase safety and minimize risk of injury or death for all fishery participants. ADF&G promotes safety whenever possible in its salmon fisheries through management practices, support in the regulation formation process, and through assistance to enforcement agencies. Examples of safety supported through management practices include: daytime openings, when possible, of salmon fisheries by emergency order allowing fishermen to harvest and deliver fish during daylight hours; and delays in opening weekly fishing periods when severe weather is forecast and extending fishing time after severe weather thereby encouraging fishermen to seek shelter and still be able to fish when the weather moderates. An example of safety supported through regulation includes limits on salmon net length and size, which moderate harvest levels to manageable quantities that are safer for fishermen to handle. Additionally, ADF&G promotes safety through direct assistance to enforcement agencies. ADF&G provides information on harvest patterns, fishing effort, and lists of registered vessels to the Alaska Wildlife Troopers, NMFS, and the U. S. Coast Guard. This allows these enforcement agencies to focus efforts in areas where the fishing fleets are concentrated, thus providing on-scene presence of enforcement personnel, vessels, and aircraft which provides expedited reaction times when accidents occur.

8.3 Economic and Community Impacts of EEZ Harvests

For analytical purposes, it is convenient to divide the EEZ salmon fishery contributions to regional employment and income into direct, indirect, and induced effects. The direct effects are those reflected in jobs and income directly attributable to participation in the fisheries. In this case, these include the direct employment of the crew of the salmon trollers, gillnetters, and seiners and direct income to various participants in the fishing firms (crew shares, vessel shares, or shares for Alaska limited entry permit holders).

The indirect effects are those generated in other businesses, by the purchases or sales of the salmon fishing firms. Indirect effects would accrue to businesses supplying fuel and supplies, fishing gear and fishing gear repairs, ship construction and repairs, insurance, banking, legal, and accounting services, lobbying, and consulting. The goods and services above are “backward” linkages. Jobs and income may also be associated with "forward" linkages, in processing firms, and in firms providing transportation, warehousing, cold storage, brokering, and other distribution services.

Induced effects are those generated when directly or indirectly employed persons spend their income. Employment and income are created when people receiving income from fisheries spend their money on such things as groceries, gas, cars, car repairs, rent, home repairs, home construction, and insurance.

It is customary to think of these regional economic contributions in terms of multipliers showing the total indirect and induced employment and income associated with direct employment and income. Multiplier estimates depend in part on the size of the community under consideration because the smaller the community, the greater the "leakage," as more labor, goods, and services are purchased outside of the community.

Multipliers for fishing activity within Alaska tend to be relatively low compared to those for other Alaskan industries. Significant proportions of the management and labor in fisheries and fish processing, tend to originate outside of the state. Significant proportions of productive inputs tend to be purchased outside of the state. Because of this, direct, indirect, and induced effects tend to be divided between Alaska, and the places of origin for these inputs.

Revenue

Table 5 highlights earnings from salmon commercially harvested in the EEZ of Southeast Alaska. In 2010, the estimated gross earnings from salmon (all species) harvested in the EEZ was $2.6 million, which represents approximately 9 percent of the total earnings grossed by the troll fishery (hand and power combined) in all of Southeast Alaska and approximately 2.5 percent of the earnings grossed by all salmon fisheries (troll and net) in all of Southeast Alaska. Between 1991 and 2010, earnings from salmon commercially harvested in the EEZ represented at the maximum (1992) 16 percent of the total troll fishery earnings and 4.5 percent of the total all-gear earnings throughout Southeast Alaska. On average, from 1991 to 2010, earning from salmon commercially harvested in the EEZ represent 8.4 percent of the total troll fishery earnings and 2.4 percent of the total all-gear earnings throughout Southeast Alaska.

From 2006 to 2010, the majority of commercially retained salmon harvested in the EEZ portion of Southeast Alaska was delivered directly or by tender to Sitka. The average amount of salmon (all species combined) delivered to Sitka over this time period was 370,440 pounds with an average ex-vessel value of $1,193,270. The other primary ports taking deliveries of troll caught salmon in Southeast Alaska include Yakutat, Craig, Pelican, and Hoonah. Sitka and Yakutat are home to multiple processing facilities. Additionally, in Southeast Alaska salmon are harvested and processed by freezer vessels. From 2006 to 2008, an average of 149,182 pounds were attributed to these vessels with an average ex-vessel value of $512,593 (no deliveries from these vessels were made in Southeast Alaska in 2009 or 2010). Some deliveries of salmon harvested in the EEZ portion of Southeast Alaska are delivered to the Washington communities of Seattle, La Connor, and Bellingham, but these represent an extremely small proportion of the landings when compared to the processing activity that takes place in the communities of Southeast Alaska.

In addition to being the primary port where deliveries of commercially retained salmon are made, Sitka is also the primary community of residence for troll (hand and power combined) permit holders operating in the EEZ. From 2006 to 2010, an average of 33 Sitka troll permit holders were active in the EEZ and had combined annual average estimated gross earnings of $618,886 from EEZ harvests. Other main Alaska communities of residence for troll permit holders operating in the EEZ include Yakutat, Craig, Wrangell, Juneau, and Petersburg. Communities of residence associated with this activity outside of Alaska include Port Angeles, Washington.

Marine sport fishing is particularly important in Southeast Alaska, where over 80 percent of all angler days are in saltwater. A 2008 report titled "Economic Impacts and Contributions of Sportfishing in Alaska, 2007", coauthored by the ADF&G and Southwick Associates, Inc., estimated more than 85 percent of all trip and package spending in Southeast Alaska was geared towards saltwater fishing trips in 2007. Trip and package spending for saltwater fishing in the Southeast region contributed an estimated $54 million of income, supported 1,897 jobs, and contributed $26 million of tax revenues in 2007. The portion of these benefits attributable specifically to salmon and specifically to EEZ waters of Southeast Alaska is not known. The amount and limited activity by both guided and unguided anglers that can be quantified operating within the EEZ of Southeast Alaska is negligible when compared to the activities conducted in state waters. Although there is some documented effort within federal waters, the precision with which we could estimate the economic impacts to the communities of Sitka, Craig or Klawock where landings likely occur, is marginal relative to what is realized from state waters effort.

Employment

The direct employment contribution of EEZ fishing activity is the employment of persons on the fishing vessels. The Alaska Department of Labor (ADOL) surveys permit holders in Alaska's fisheries and uses the responses to estimate crew factors in Alaska's commercial fisheries. The crew factor for a fishery is equal to the estimated average size of vessel crews in the fishery, excluding the skipper. Using the ADOL crew factor estimates from its 2010 survey, and adjusting them to account for skippers, it is possible to estimate the number of separate job positions available in fisheries in a year. This is done by assuming that each permit fished corresponds to a separate fishing operation, incrementing the ADOL crew factor for the fishery by one, to account for the skipper, and multiplying the number of permits fished by the adjusted crew factor. The number of separate persons active is likely to be larger, due to turnover in positions. The survey does not collect information about the place of residence of crewmembers.

In the East Area, the estimated average vessel crew size (the ADOL crew factor increased by one) for power trollers was 2.4 persons in 2010. Treating the number of permits fished from 1991 to 2010 as a guide to the distribution of permits normally fished, and multiplying the number of permits fished by the estimated average vessel crew size, the median number of positions active in the EEZ is 362.

Residency

The share of fishing activity conducted by Alaskan residents differs by fishery. The fisheries that are affected by this action require limited entry permits issued by the State of Alaska. Alaska tracks permit issuance, permits fished, and permit production and revenue by state of residence of the permit holder. The percentage of permits fished by Alaska residents varies by permit fishery. This discussion of the residency of permit holders is based on an examination of Basic Information Tables prepared by CFEC. In Alaska, there should be one limited entry permit holder present with each fishing operation. The number of crew present on an operation will normally be larger than this. For the percentages reported here to be indicative of the place of origin for the crew as a whole, it is necessary to assume that permit holders hire crew from their own state of residence.

In the East Area, about 85 percent of the power troll permits fished in 2010 were held by Alaskan residents and these permit holders accounted for about 85 percent of the fishery gross revenues. In the hand troll fishery, about 91 percent of the permits fished were held by Alaskan residents, and these accounted for about 93 percent of revenues.

Alaska residents are found in smaller proportions in the seafood processing sector than in the fishing sector. In Sitka in 2001, with 758 seafood processing workers, about 30 percent are Alaska residents. Alaska workers in these places do tend to receive a disproportionate share of the wages, either because they work more during the year, or because they occupy higher wage jobs. In Sitka, they receive about 53 percent of the wages. Note that these numbers relate to all seafood processing, and not just salmon processing.

Fisheries Taxes

Alaska's fisheries taxes, some of which are shared with communities or enhancement operations local to fisheries, are another source of indirect salmon fishery effect. "Fish" tax receipts shared with a community may be associated with increased community spending on goods and services within the community, smaller community sales tax or property tax assessments, purchases of goods and services outside the community, or some combination of these. Costs recovered for salmon aquaculture may be a source of local employment and income as well.

The salmon fisheries that occur, in part, in the waters of the EEZ are subject to different combinations of five separate State of Alaska fisheries taxes. In addition to the taxes discussed here, municipalities may impose their own taxes, and commercial fishing operations contribute a share of the fuel tax revenues collected by Alaska.

Table 5 Comparison of Southeast Alaska salmon (all species) harvest earnings from EEZ waters and areawide, 1991 through 2010

Year	Number of Salmon Harvested in EEZ	Pounds of Salmon Harvested in the EEZ	Estimated Gross Earnings from the EEZ	Average Earnings Per Permit	CFEC Permit Count	EEZ Earnings as a Percentage of Troll Gear Earnings (all Southeast Alaska)	EEZ Earnings as a Percentage of Total Southeast Alaska Earnings (all gear)
1991	77,117	652,156	$1,124,758	$7,757	144	4.5%	1.5%
1992	450,457	3,006,900	$4,675,975	$13,554	347	15.9%	4.5%
1993	236,988	1,454,737	$1,992,755	$14,033	142	7.5%	2.1%
1994	270,932	2,142,233	$2,839,030	$16,899	167	7.3%	2.4%
1995	319,424	2,374,798	$2,256,761	$8,358	269	13.7%	2.5%
1996	150,168	1,106,474	$1,155,716	$9,631	120	7.1%	1.6%
1997	126,253	1,065,637	$1,568,293	$10,053	155	8.3%	2.2%
1998	182,344	1,490,423	$1,534,645	$9,652	160	10.3%	2.1%
1999	99,102	710,945	$1,090,426	$11,014	99	5.3%	1.2%
2000	77,045	624,846	$969,672	$8,288	117	6.6%	1.5%
2001	65,567	485,092	$645,309	$7,014	92	3.8%	0.8%
2002	110,310	1,190,119	$1,294,591	$10,611	122	9.9%	3.1%
2003	98,661	1,172,249	$1,461,097	$15,220	96	9.9%	2.9%
2004	196,041	1,706,607	$3,135,001	$18,333	169	10.8%	4.3%
2005	99,729	686,341	$1,188,166	$9,283	128	4.4%	1.6%
2006	115,759	1,008,509	$3,181,645	$20,932	153	9.2%	3.8%
2007	116,981	929,398	$2,854,124	$19,027	149	9.3%	2.9%
2008	89,877	820,820	$2,949,131	$18,905	156	8.1%	2.8%
2009	95,087	719,274	$1,725,313	$11,203	154	7.5%	1.9%
2010	129,263	1,081,694	$2,629,159	$14,212	185	8.9%	2.5%

Note: Only commercially retained harvest is included. Earnings estimates and average earnings estimates per permit are based on CFEC gross earnings data. Total Southeast harvest is associated with the following CFEC permit types: Southeast salmon purse seine (S01A), Southeast salmon drift gillnet (S03A), Yakutat set gillnet (S04D), Statewide salmon hand troll (S05B), statewide salmon power troll (S15B), Southeast salmon special harvest area (S77A) a hatchery permit, and Southeast Metlakatla reservation permit (S99A), an experimental or special permit.

8.4 Probable Future Condition and Potential Revenues

The sport and commercial troll fisheries for salmon in the East Area operate seamlessly between waters of the East Area and adjacent state waters. Revenues associated with harvest from EEZ waters in either fishery are not expected to change substantially in the near term given the State of Alaska’s limited entry program for commercial salmon fisheries, the fully developed sport fishing sector, Pacific Salmon Treaty provisions, and Board policy. Generally, revenues in either fishery would change in response to changes in the abundance of salmon in the East Area and distribution of salmon between the East Area and state waters, or changes in the market for commercial salmon or angler demand. Angler demand for salmon could be affected by changes in harvest opportunity for other species or by general economic conditions. Angler demand has been negatively impacted by the economic downturn the United States has been experiencing since 2008.

An increase or decrease in salmon harvests in the East Area and associated revenue in either fishery may or may not be correlated (positively or negatively) with changes in the same fishery within state waters. If effort shifts between the EEZ waters and state waters, any change in revenue associated with EEZ harvests might be offset by change in state waters activity. One factor likely to disproportionately affect revenues in the EEZ portions of the sport or commercial troll salmon fisheries relative to the state water portions is the cost of fuel since vessels may prefer fishing closer to ports when fuel prices are high.

Chapter 9 FEDERAL REVIEW OF STATE MANAGEMENT MEASURES APPLICABLE IN THE EAST AREA

Delegation of salmon fishery management authority to the State of Alaska requires the Council and NMFS to stay apprised of state management measures governing commercial and sport salmon fishing in the East Area and, if necessary, to review those measures for consistency with the FMP, the Magnuson-Stevens Act, and other applicable federal law. State management measures include measures adopted by the Pacific Salmon Commission and the Alaska Board of Fisheries as well as other state laws, regulations, and inseason actions. This chapter describes how the Council and NMFS fulfill this oversight role. Section 9.1 describes the ways in which the Council and NMFS monitor state management measures that regulate salmon fishing in the East Area. Section 9.2 describes the process by which NMFS will review state management measures governing salmon fisheries in the East Area for consistency with the FMP, the Magnuson-Stevens Act, and other applicable federal law. Section 9.3 describes the process by which a member of the public can petition NMFS to review state management measures in the East Area for consistency with the FMP, the Magnuson-Stevens Act, and other applicable federal law. Finally, section 9.4 describes the process NMFS will follow if NMFS determines that state management measures in the East Area are inconsistent with the FMP, the Magnuson-Stevens Act, or other applicable federal laws.

9.1 Council and NMFS Receipt of Information on State Management Measures

The Council and NMFS receive information on, and stay apprised of, state management measures that regulate commercial and sport salmon fisheries in the East Area. As explained earlier in section 4.3, the Council and NMFS will receive reports from the State of Alaska at regularly scheduled Council meetings regarding applicable state management measures that govern commercial and sport salmon fishing in the East Area. Additionally, representatives of the Council, NMFS, and NOAA’s Office of General Counsel have the opportunity to participate in the State’s regulatory process through the submission of proposals and comments to the Board of Fisheries on proposed regulations applicable to East Area salmon fisheries. These federal representatives also can advise the Board, as needed or as requested by the Board, about the extent to which proposed measures for East Area salmon fisheries are consistent with the FMP, the Magnuson-Stevens Act, and other applicable federal law. None of these federal representatives, however, will vote on any proposals submitted to the Board or the State. NMFS representatives are also members of a number of advisory panels and technical committees of the Pacific Salmon Commission.

The purpose of receiving this information is two-fold. First, it provides the Council and NMFS with opportunities to consider its salmon fishery management policies relative to the State of Alaska’s exercise of its authority. Based on the information received, the Council can determine whether the FMP is functioning as intended from a fishery management policy perspective or whether changes to the fishery management policies contained in the FMP are warranted. Second, it provides the Council and NMFS with a means to ensure that the delegation of fishery management authority to the State is being carried out in a manner consistent with the policy and objectives established within the FMP.

9.2 NMFS Review of State Management Measures for Consistency with the FMP and Federal Laws

If NMFS has concerns regarding the consistency of state management measures with the FMP, the Magnuson-Stevens Act, or other applicable federal law, NMFS may initiate a consistency review of those management measures. NMFS may initiate this consistency review independently or at the request of the Council. During this review, NMFS will provide the Council and the State of Alaska with an opportunity to submit comments to NMFS that address the consistency of the management measures in question. Because NMFS's review is limited to whether the measures are consistent with the FMP, the Magnuson-Stevens Act and other applicable federal law, NMFS will only consider comments that address consistency. NMFS may hold an informal hearing to gather additional information concerning the consistency of the measures under review if time permits and NMFS determines that such a hearing would be beneficial.

If NMFS determines after its review that the state management measures are consistent with the FMP, the Magnuson-Stevens Act, or other applicable federal law, NMFS will issue a written statement to that effect, explaining the reasons for its conclusion and identifying the information NMFS used to support its finding. If NMFS determines after its review that the state management measures are inconsistent with the FMP, the Magnuson-Stevens Act, or other applicable federal law, NMFS will follow the process set forth in section 9.4.

NMFS's review under section 9.2 is limited to consistency of state management measures in the East Area with existing provisions of the FMP, the Magnuson-Stevens Act, or other applicable law. NMFS will not initiate a consistency review under section 9.2 resulting from a divergence of fishery management policy perspectives.

9.3 Public Request for NMFS to Review State Management Measures for Consistency with the FMP and Federal Laws

Any member of the public may petition NMFS to conduct a consistency review of any state management measure that applies to salmon fishing in the East Area if that person believes the management measure is inconsistent with the provisions of the FMP, the Magnuson-Stevens Act, or other applicable federal law. Such a petition must be in writing and comply with the requirements and process described in this section. As with section 9.2, NMFS's review under section 9.3 is limited to consistency of state management measures with existing provisions of the FMP, the Magnuson-Stevens Act, or other applicable law. NMFS will not initiate a consistency review under section 9.3 from petitions that merely object to a state management measure or argue that an alternative measure would provide for better management of the salmon fishery. A person with these types of policy concerns should present them to the Board, the State, or the Council.

Although the FMP provides an administrative process by which a person may seek federal review of state management measures for consistency with the FMP, the Magnuson-Stevens Act, or other applicable federal law, the existence of the federal process does not preclude or limit that person's opportunity to seek judicial review of state management measures within the State of Alaska's judicial system as available under the provisions of the State's Administrative Procedure Act (AS 44.62). Initiation of State judicial review of a challenge to a state management measure is not required before a person may petition NMFS to conduct a consistency review.

What must a person do before submitting a petition to NMFS?

Prior to submitting a petition requesting a consistency review, a person must exhaust available administrative regulatory procedures with the State of Alaska. NMFS will conclude that a person has exhausted available state administrative regulatory procedures if the person can demonstrate that he or she: (1) submitted one or more proposals for regulatory changes to the Board of Fisheries during a Call of Proposals consistent with 5 AAC 96.610 and (2) received an adverse decision from the Board on the proposal(s). There are circumstances that may require regulatory changes outside the regular process set forth in 5 AAC 96.610, or when the process set forth in 5 AAC 96.610 is unavailable due to the timing of the action requested. Under these circumstances, NMFS also will conclude that a person has exhausted state administrative regulatory procedures if the person can demonstrate that he or she: (1) could not have followed the regular Call of Proposals requirements at 5 AAC 96.610, (2) submitted an emergency petition to the Board or ADF&G consistent with 5 AAC 96.625 or submitted an agenda change request to the Board consistent with 5 AAC 39.999 and (3) received an adverse decision from the Board or ADF&G on the emergency petition or agenda change request.

The FMP requires exhaustion of available state administrative regulatory procedures before petitioning NMFS for a consistency review for several reasons. Under this FMP, the Council and NMFS have delegated regulation of the commercial and sport salmon fisheries in the East Area to the State of Alaska in recognition of its expertise and the State is in the best position to consider challenges, and make changes, to its management measures. The Council and NMFS also recognize the importance of public participation during the development of fishery management measures, and exhaustion encourages the public to actively participate in and try to effectuate fishery management change through the State process. Finally, by requiring a person to exhaust the State's administrative regulatory procedures before petitioning NMFS, the State is presented with an opportunity to hear the challenge and take corrective action if the State finds merit in the challenge before federal resources are expended.

What must be in a petition submitted to NMFS?

A petition must: (1) identify the state management measures that the person believes are inconsistent with the FMP, the Magnuson-Stevens Act or other applicable federal law; (2) identify the provisions in the FMP, the Magnuson-Stevens Act, or other applicable federal law with which the person believes the state management measures are inconsistent; (3) explain how the state management measures are inconsistent with the identified provisions of the FMP or federal laws; and (4) demonstrate that the person exhausted available state administrative regulatory procedures before submitting the petition to NMFS. Petitions concerning the consistency of a state inseason action present some challenges for timely review given the short duration of inseason actions and the length of time it will take NMFS to review petitions. Although NMFS is unable to issue a decision on a petition challenging an inseason action before the inseason action expires, NMFS recognizes that there may be an aspect of inseason actions that is capable of repetition. Therefore, persons may submit petitions to NMFS that challenge the consistency of a recurring aspect of a state inseason action. In addition to the four requirements listed above, a petition challenging a state inseason action must identify and explain the inconsistent aspect of the inseason action that is capable of repetition. A petition with all supporting documentation must be submitted to the Regional Administrator, NMFS Alaska Region (see http://www.alaskafisheries.noaa.gov/contactinfo.htm for addresses).

A person must submit a petition to NMFS no later than 30 days from (a) the last day of the Board of Fisheries meeting at which the measure in question was adopted by the Board, (b) the day a denial was issued on an emergency petition, or (c) the day a denial was issued on an agenda change request. Although NMFS will not initiate a consistency review under this section for petitions submitted after the 30-day deadline, NMFS may initiate a consistency review under section 9.2.

What NMFS will do following receipt of a petition from the public?

Upon receipt of a petition, NMFS will immediately commence a review of the petition to determine whether it contains the information required for a consistency review. If NMFS determines that the petition fails to meet all of the requirements, NMFS will return the petition to the petitioner with an explanation that identifies the deficiencies. If NMFS determines that the petition meets all of the requirements, NMFS will initiate a consistency review and notify the petitioner that such a review has been initiated. NMFS will immediately provide a copy of the petition to the Council and to the Commissioner of the ADF&G. During its consistency review, NMFS will provide the Council and the State of Alaska with an opportunity to submit comments to NMFS that address the consistency of the measures being challenged. Because NMFS's review is limited to whether the measures in question are consistent with the FMP, the Magnuson-Stevens Act and other applicable federal law, NMFS will only consider comments that address consistency. NMFS may hold an informal hearing to gather additional information concerning the consistency of the measures under review if time permits and NMFS determines that such a hearing would be beneficial. NMFS will review a petition as quickly as possible but will take the time necessary to complete a thorough review of the consistency of the state management measure being challenged before issuing its decision.

If NMFS determines after its review that the state management measures are consistent with the FMP, the Magnuson-Stevens Act, or other applicable federal law, NMFS will issue a written statement to that effect, explaining the reasons for its conclusion and identifying the information NMFS used to support its finding. If NMFS determines after its review that the state management measures are inconsistent with the FMP, the Magnuson-Stevens Act, or other applicable federal law, NMFS will follow the process set forth in section 9.4.

9.4 NMFS Process Following a Determination that State Management Measures Are Inconsistent with the FMP or Federal Laws

If NMFS determines that a state management measure is inconsistent with the FMP, the Magnuson-Stevens Act, or other applicable federal law after conducting a consistency review under sections 9.2 or 9.3, NMFS will issue a written determination to that effect, explaining the reasons for its conclusion and identifying the information NMFS used to support its finding. NMFS will promptly notify the State of Alaska and the Council, and the petitioner if applicable, of its determination and provide the State with an opportunity to correct the inconsistencies identified in the notification. No specific amount of time is identified in this FMP in which corrective action must be taken because circumstances directly affecting what constitutes a reasonable opportunity for corrective action will likely vary. NMFS will evaluate the circumstances on a case-by-case basis to determine the amount of time that represents a reasonable opportunity for the State to take corrective action and will provide that information to the State in the notification of inconsistency.

While it is anticipated that the State of Alaska will expeditiously correct the inconsistencies identified by NMFS, it is possible that the state may disagree with NMFS's determination and choose not to correct the identified inconsistencies. If the State does not correct the inconsistencies identified by NMFS in the time provided, NMFS will need to assess whether the State's overall management scheme is unaffected by removal of the inconsistent measure or whether the inconsistent measure is an integral part of the overall management scheme and that the overall management scheme would fail if the inconsistent measure is removed. NMFS also will need to determine whether federal regulations are required in the East Area given the absence of the state management measure. Once this assessment is completed, NMFS will issue a notice announcing the extent to which the authority delegated to the State to implement fishery management measures has been withdrawn and whether NMFS intends to issue federal regulations that would govern salmon fishing in the East Area.

Any delegation of fishery management authority that is withdrawn under this section of the FMP will not be restored to the State until the Council and NMFS determine that the State has corrected the inconsistencies.

Appendix A Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC)

Contents

A.1 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 salmon FMP and corresponding amendments to the Council's other FMPs.

In 2009-2010, the Council undertook a five-year review of EFH for the Council's managed species, which was documented in the Final EFH 5-year Review Summary Report published in April 2010 (NPFMC and NMFS 2010). The review evaluated new information on EFH, including EFH descriptions and identification, and fishing and non-fishing activities that may adversely affect EFH. The review also assessed information gaps and research needs, and identified whether any revisions to EFH are needed or suggested. The Council identified various elements of the EFH descriptions meriting revision, and approved omnibus amendments 98/90/40/15/11 to the BSAI Groundfish FMP, the GOA Groundfish FMP, the BSAI King and Tanner Crab FMP, the Scallop FMP, and the Salmon FMP, respectively, in 2011. Amendment 11 to the Salmon FMP updated the description 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 coinciding with the EFH 5-year review; and updated EFH research objectives in the FMP. While EFH identification and description for salmon species was considered as part of the 2010 EFH 5-year review, the implementation of changes was delayed to a trailing amendment. The methodology that has been proposed to revise EFH descriptions for salmon species was under peer review, and the Council determined to wait until the review process was complete before amendment this portion of the FMP.

A.2 Life History Features and Habitat Requirements of FMP Species

This section describes habitat requirements and life histories of the salmon species managed by this FMP. Information contained in this appendix details life history information for federally managed salmon species. Each species or species group is described individually; however, summary tables that denote habitat associations (Table 1), reproductive traits (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 Salmon

Salmon Species	Life Stage	Nearshore				Shelf			Slope						Stratum Reference						
		Freshwater	Estuarine	Intertidal	Subtidal	Inner 1-50m	Middle 51-100m	Outer 101-200m	Upper 201-300m	Upper 301-500m	Inter-mediate 501-700m	Inter-mediate 701-1000m	Lower 1001-3000m	Basin >3000m	Shallows	Island Pass	Bay/Fjord	Bank	Flat	Edge	Gully
Chinook	M	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
	LJ														x	x	x	x			
	EJ	x	x	x											x	x	x				
	L	x																			
	E	x																			
Chum	M	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
	LJ				x	x	x	x	x	x						x	x	x			
	EJ	x	x	x	x	x	x								x	x	x	x			
	L	x		x																	
	E	x		x																	
Coho	M	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
	LJ		x	x		x	x									x	x				
	EJ	x	x	x		x									x						
	E/L	x																			
Pink	M	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
	LJ		x		x		x	x	x						x	x	x				
	EJ		x	x	x	x	x	x	x						x	x	x				
	L	x																			
	E	x																			
Sockeye	M	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
	LJ		x	x	x	x	x	x	x							x	x				
	EJ	x				x															
	L	x																			
	E	x				x															

Salmon Species	Life Stage	Location							Physical Oceanography					Substrate												
		Surface	Near surface	Semi-demersal	Demersal	Pelagic 1-200m (epi)	Pelagic 201-1000m (meso)	Pelagic >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
Chinook	M	x	x	x	x	x			x	x	x	x	x													
	LJ	x	x	x	x	x			x	x	x	x	x													
	EJ	x	x	x	x									x		x						x			x	x
	L				x												x								x	
	E				x												x								x	
Chum	M	x	x	x	x	x	x		x	x	x	x	x	x			x					x			x	
	LJ	x	x	x	x	x	x		x	x	x	x	x													
	EJ	x	x	x		x			x	x		x		x	x	x	x					x		x	x	x
	L													x		x	x					x			x	x
	E													x		x	x					x			x	
Coho	M	x	x			x						x	x	x			x					x			x	
	LJ	x	x			x																				
	EJ	x		x											x	x	x					x			x	
	E/L													x			x									
Pink	M	x	x			x			x	x	x	x		x			x					x			x	
	LJ	x	x						x	x	x	x														
	EJ	x													x	x	x					x		x	x	
	L													x			x									
	E													x			x					x			x	
Sockeye	M	x	x			x											x					x			x	
	LJ	x	x			x																				
	EJ				x																					
	L																x					x			x	
	E																x					x			x	

Salmon Species	Life Stage	Structure										Community Associations												Oceano-graphic Properties			Life Stage
		Bars	Sinks	Slumps/Rockfalls/Debri	Channels	Ledges	Pinnacles	Seamounts	Reefs	Vertical Walls	Man-made	Algal Cover	Anemones	Enchinoderms	Soft Coral	Hard Coral	Mollusca	Drift Algae/Kelp	Kelp	Polychaetes	Sea Grasses	Sea Onions	Tunicates	Temperature (Celsius)	Salinity (ppt)	Oxygen Conc (ppm)	
Chinook	M	x		x	x	x	x		x	x	x								x					<15			M
	LJ	x		x	x	x	x		x	x	x							x	x					<15			LJ
	EJ																	x	x		x			<20			EJ
	L																							0-14			L
	E																							0-14	0		E
Chum	M	x		x	x	x	x		x	x	x							x	x		x			<15		8	M
	LJ	x			x	x	x	x	x	x	x							x	x					<15		8	LJ
	EJ	x		x	x	x	x		x	x	x	x						x	x		x			<15		8	EJ
	L																							>4		>4	L
	E																							>4		>4	E
Coho	M	x		x	x	x	x		x	x	x								x					<15		8	M
	LJ																	x	x		x			<15		8	LJ
	EJ	x		x	x	x	x		x	x	x							x	x		x			<15		>4	EJ
	E/L																							>4		>4	E/L
Pink	M	x		x	x	x	x		x	x	x								x					<15		8	M
	LJ							x																<15		8	LJ
	EJ	x		x	x	x	x		x	x	x	x						x	x		x			<15		8	EJ
	L																							>4		>4	L
	E																							>4		>4	E
Sockeye	M																							<15			M
	LJ							x																<15			LJ
	EJ																							<15			EJ
	L																										L
	E																										E

Table 2 Summary of Reproductive Traits for Salmon

		Age at Maturity				Fertilization/Egg Development					Spawning Behavior						Spawning Season											
		Female		Male																								
Salmon Species	Life Stage	**50%**	**100%**	**50%**	**100%**	**External**	**Internal**	**Oviparous**	**Ovoviviparous**	**Viviparous**	**Batch Spawner**	**Broadcast Spawner**	**Egg Case Deposition**	**Nest Builder**	**Egg/Young Guarder**	**Egg/Young Bearer**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Chinook	M	4	7	4	7	x		x						x			x						x	x	x	x	x	x
	LJ																											
	EJ																											
	L																											
	E																											
Chum	M	4	7	4	7	x		x						x			x	x					x	x	x	x	x	x
	LJ																											
	EJ																											
	L																											
	E																											
Coho	M		4		4	x		x						x									x	x	x	x	x	x
	LJ																											
	EJ																											
	L																											
	E																											
Pink	M		2		2	x		x						x									x	x	x	x		
	LJ																											
	EJ																											
	L																											
	E																											
Sockeye	M	5	6	5	6	x		x						x									x	x	x	x	x	x
	LJ																											
	EJ																											
	L																											
	E																											

Table 3 Summary of Predator and Prey Associations for Salmon

Predator to

Salmon 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)	Herring	Myctophid (lantern fishes)	Cottidae (sculpins)	Arrowtooth	Salmon	Cod	Pollock	Halibut
Chinook	M							X						X						X	X	X	X	X			X	X	X	
	LJ							X						X						X	X	X	X	X			X	X	X	
	EJ				X			X		X	X		X	X				X		X										
	L																													
	E																													
Chum	M			X	X			X		X	X			X						X	X	X	X	X	X			X	X	
	LJ			X	X			X		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			X	X	
	L			X	X																									
	E																													
Coho	M							X						X						X	X	X	X							
	LJ				X			X													X						X			
	EJ				X			X		X	X									X					X		X			
	L																													
	E																													
Pink	M				X			X		X	X									X	X	X	X	X						
	LJ				X			X		X	X									X	X	X	X							
	EJ				X			X		X	X									X	X	X	X							
	L				X																									
	E																													
Sockeye	M			X	X			X		X	X		X	X						X	X	X	X	X	X			X	X	
	LJ			X	X			X		X	X																			
	EJ			X	X																									
	L																													
	E																													

Prey of

Salmon Species	Life Stage	Jellyfish	Starfish	Chaetognaths (arrowworms)	Crab	Herring	Salmon	Pollock	Pac fic 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	Eagles	Murres	Puffin	Kittiwake	Gull	Tererstrial Mammals
Chinook	M															X		X	X			X		X					X
	LJ															X			X			X							
	EJ						X	X	X																X		X	X	X
	L																												
	E																												
Chum	M															X	X	X	X			X		X				X	X
	LJ															X	X	X	X			X							
	EJ						X	X	X																X		X	X	X
	L																											X	
	E																											X	
Coho	M															X		X	X		X	X		X					X
	LJ																												
	EJ				X		X																		X	X	X	X	X
	L																												
	E																												
Pink	M															X	X	X	X	X			X	X				X	X
	LJ															X	X	X	X	X			X						
	EJ						X	X	X	X																			
	L																												
	E																												
Sockeye	M															X	X	X	X			X		X					X
	LJ						X	X	X																				
	EJ																												
	L																												
	E																												

A.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 percent is continental shelf, 13 percent is continental slope, and 43 percent is deep-water basin. Its broad continental shelf is one of the most biologically productive areas of the world. 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 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 AI (Favorite et al. 1976). There is net water transport eastward along the north side of the Aleutian Islands (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 Bering Sea (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 (Figure 1). 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 Priblof 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 percent 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.

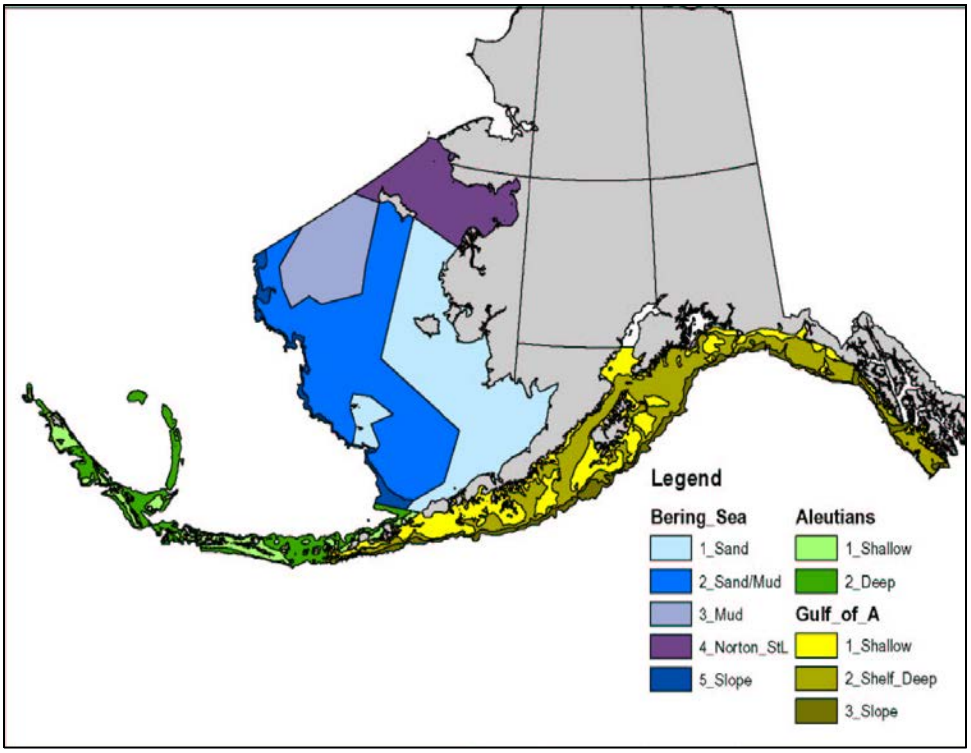
The GOA has a variety of seabed types such as gravely sand, silty mud, and muddy to sandy gravel, as well as areas of hardrock (Hampton et al. 1986) (Figure 1). Investigations of the northeast GOA shelf (less than 200 meters [m]) have been conducted between Cape Cleare (148º W) and Cape Fairweather (138º 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.

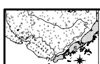
On a larger scale, evidence of biological responses to decadal-scale climate changes is also found in the coincidence of global fishery expansions or collapses of similar species complexes. For example, salmon stocks in the GOA and the California Current are out of phase. When salmon stocks do well in 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 characteristics (Appendix B, NMFS 2005) for the continental shelf.



Source: Naidu, 1988

Figure 2 Distribution of Bering Sea Sediments



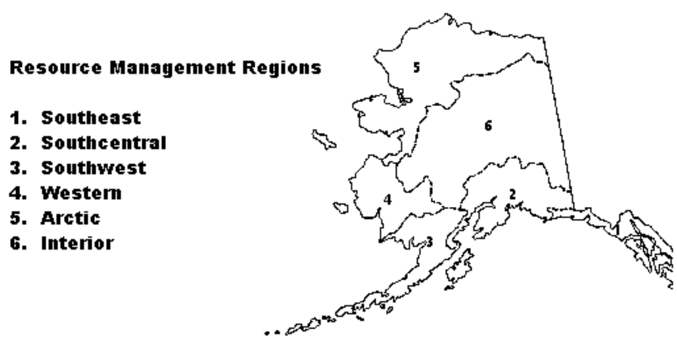
Source: Smith and McConnaughey 1999

A.2.2 Information Specific to Salmon

Freshwater habitat for the salmon fisheries in Alaska includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in the state. This represents a vast array of diverse aquatic habitats over an extremely large geographic area. Alaska contains over 3,000 rivers and has over 3 million lakes > 8 hectares. Over 14,000 water bodies containing anadromous salmonids identified in the state represent only part of the salmon EFH in Alaska because many likely habitats have not been surveyed. In addition to current and historically accessible waters used by Alaska salmon, other potential spawning and rearing habitats exist beyond the limits of upstream migration due to barrier falls or steep-gradient rapids. Salmon access to existing or potential habitats can change over time due to many factors, including glacial advance or recession, post-glacial rebound, and tectonic subsidence or uplifting of streams in earthquakes.

A significant body of information exists on the life histories and general distribution of salmon in Alaska. The location of many freshwater water bodies used by salmon are contained in documents organized and maintained by the Alaska Department of Fish and Game (ADF&G). Alaska Statute 16.05.870 requires ADF&G to specify the various streams that are important for spawning, rearing, or migration of anadromous fishes. This is accomplished through the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes* and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes*. The Catalog lists water bodies documented to be used by anadromous fish. The Atlas shows locations of these waters and the species and life stages that use them. The Catalog and Atlas are divided into six volumes for the six resource management regions established in 1982 by the Joint Boards of Fisheries and Game; see Figure 3.

Figure 3 Regional boundaries of the Resource Management Regions established by the Joint Boards of Fisheries and Game.



The Catalog and Atlas, however, have significant limitations. The location information and maps are derived from U.S. Geological Survey quadrangles which may be out of date because of changes in channel and coastline configurations. In southeast Alaska, for example, new streams are colonized by salmon in Glacier Bay as glaciers rapidly recede. Polygons are sometimes used to specify areas with a number of salmon streams that could not be depicted legibly on the maps. Waters within these polygons are often productive for juvenile salmon.

Data for the Catalog come from personal, in-field surveys by aircraft, boat, and foot for purposes of managing fish habitat and fisheries, and the upper limit of salmon is not always observed. Upper points specified in the Catalog usually reflect the extent of surveys or known fish usage rather than actual limits of anadromous fish. Upper areas used by salmon are further limited due to the remoteness and vastness of the Alaska regions. Comparably, the Alaska region has identified salmon for freshwater reaches in an area that would span between the states of Washington and Ohio and between the northern and southern borders of the United States.

In addition, only a limited number of water bodies have actually been surveyed. Virtually all coastal waters in the State provide important habitat for anadromous fish, as do many unsurveyed small- and medium-sized tributaries to known anadromous fish-bearing water bodies in remote parts of the State. Small tributaries, flood channels, intermittent streams, and beaver ponds are often used for juvenile rearing. Because of their remote location, small size, or ephemeral nature, most of these systems have not been surveyed and are not included in the Catalog or Atlas.

Marine EFH for the salmon fisheries in Alaska includes all estuarine and marine areas utilized by Pacific salmon of Alaska origin, extending from the influence of tidewater and tidally submerged habitats to the limits of the U.S. EEZ. This habitat includes waters of the Continental Shelf, which extends to about 30 to 100 km offshore from Dixon Entrance to Kodiak Island, then becomes more narrow along the Pacific Ocean side of the Alaska Peninsula and AI chain. In BS areas of southwest and western Alaska and in Chukchi and Beaufort Seas areas of northwest and northern Alaska, the Continental Shelf becomes much wider. In oceanic waters beyond the Continental Shelf, the documented range of Alaska salmon extends from lat. 42° N north to the Arctic Ocean and to long. 160° E. In the deeper waters of the Continental Slope and ocean basin, salmon occupy the upper water column, generally from the surface to a depth of about 50 m. Chinook and chum salmon, however, use deeper layers, generally to about 300 m, but on occasion to 500 m. The range of EFH for salmon is the subset of this habitat that occurs within the 320 km EEZ boundary of the United States. Foreign waters (i.e., off British Columbia in the GOA and off Russia in the BS) and international waters are not included in salmon EFH because they are outside United States jurisdiction.

A.2.3 Habitat Description for Pink Salmon *(Oncorhynchus gorbuscha)*

Life History and General Distribution

The natural freshwater range of pink salmon includes the Pacific rim of Asia and North America north of about 40°N. Within this vast area, spawning pink salmon are widely distributed in coastal streams of both continents up to the Bering Strait. North, east, and west of the Bering Strait, spawning populations become more irregular and occasional. Centers of large spawning populations occur at roughly parallel positions along the two continents from about lat. 44°N to 65°N in Asia and about 48°N to 64°N in North America. In marine environments along both the Asian and North American coastlines pink salmon occupy ocean waters south of the limits of spawning streams.

Pink salmon are distinguished from other Pacific salmon by having a fixed 2-year life span, being the smallest of the Pacific salmon as adults (averaging 1.0 to 2.5 kg), the fact that the young migrate to sea soon after emerging from the gravel, and developing a marked hump in large maturing males. This last characteristic is responsible for the vernacular name humpback salmon used in some areas. Because of the fixed 2-year life cycle, pink salmon spawning in a particular river system in old and even years are reproductively isolated from each other and have developed into genetically different lines. In some river systems, like the Fraser River in British Columbia, only the odd-year line exists; returns in even years are negligible. In Bristol Bay, Alaska, the major runs occur in even years, whereas the coastal area between these two river systems is characterized by runs in both even and odd years. In different parts of the range populations are sometimes characterized by the phenomena of dominance where one brood line is much stronger than the other brood line. Upon emergence, pink salmon fry migrate quickly to sea and grow rapidly as they make extensive feeding migrations. After 18 months in the ocean the maturing fish return to their river of origin to spawn and die.

Pink salmon are considered to be have either the simplest or most specialized life cycle within the genus, depending on whether Pacific salmon originated from marine or freshwater ancestors. One view holds that

Oncorhynchus evolved from an ancestral freshwater form of Pacific *Salmo* during the Pleistocene, probably in the vicinity of the present-day Sea of Japan. Under this scenario, pink salmon that rely least on the freshwater environment are the most specialized. Pink salmon have 52 chromosomes, fewer than other Pacific salmon, which also may suggest specialization. Another view considers Salmonidae as relatively primitive teleosts, of probable marine pelagic origin, and about five million years old. This alternative view to freshwater origin of Pacific salmon is supported, in part, by Pliocene fossils from California and Oregon. The marine origin view holds that during evolution salmonids tended towards greater dependence on fresh water and away from dependence on the sea. Under this scenario, pink salmon, with the least dependence on the freshwater environment, is considered the least advanced extant *Oncorhynchus* species.

The approximate upper size limit of juvenile fish is roughly 25 cm.

Fisheries

Pink salmon are the most abundant Pacific salmon, contributing about 40 percent by weight and 60 percent in numbers of all salmon caught commercially in the North Pacific Ocean and adjacent waters. Coastal fisheries for pink salmon presently occur in Asian (Japan and Russia) and North America (Canada and the United States) with major fisheries in both Russia and the United States. Historically some pink salmon were caught in high seas fisheries by Japan and Russia. Most pink salmon in the United States are caught in Alaska where major fisheries occur in the southeast Alaska, Prince William Sound, and Kodiak regions. Lesser fisheries for pink salmon occur in Cook Inlet, Alaska Peninsula, and Bristol Bay regions. Alaska fisheries for pink salmon occur primarily within State of Alaska territorial seas (inside 3 miles).

Pink salmon catches have been at historic records in Alaska over the past decade with catches exceeding 100 million fish in several years. Most pink salmon in Alaska are caught by purse seines with smaller commercial catches made by set and drift gill net and troll fisheries. Recreational fisheries in Alaska usually harvest between 200 and 400 thousand pink salmon annually. Historically, pink salmon in Alaska have been harvested, on average, at between 60 and 75 percent of the total annual run.

Purse seine fisheries for pink salmon have some bycatch associated with them, primarily other salmon. The most important bycatch issue is in the southeast Alaska region where younger marine-age Chinook salmon, similar in size to adult pink salmon, are caught in pink salmon purse seine fisheries. The total harvest of Chinook salmon in this region is controlled by quotas under auspices of the Pacific Salmon Treaty. The Alaska Board of Fisheries allocates a portion of the quota for Chinook salmon as an allowable bycatch in purse seine fisheries targeted on pink salmon.

Measured marine survivals of pink salmon, from entry of fry into stream mouth estuaries to returning adults, have ranged from 0.2 to over 20 percent. Scientist, in general, believe that much of the natural mortality of pink salmon in the marine environment occurs within the first few months before advanced juveniles move offshore into more pelagic ocean waters. Pink salmon populations can be very resilient, rebounding from weak to strong run strength in regional stock groups within one or two generations.

Because pink salmon are primarily caught in purse seines, there are no known gear impacts to the marine habitats where these fisheries occur.

Relevant Trophic Information

Pink salmon eggs, alevins, and fry in freshwater streams provide an important nutrient input and food source for aquatic invertebrates, other fishes, birds and small mammals. In the marine environment, pink salmon fry and juveniles are food for a host of other fishes and coastal sea birds.

Subadult and adult pink salmon are known to be eaten by 15 different marine mammals, sharks, other fishes such as Pacific halibut and humpback whales. Because pink salmon are the most abundant salmon in the North Pacific, it is likely they comprise a significant portion of the salmonids eaten by marine mammals.

Millions of pink salmon adults returning to spawn in thousands of streams throughout Alaska provide significant nutrient input into the trophic level of these coastal watersheds. Adult pink salmon in streams are major food sources for gulls, eagles, and other birds, along with bear, otter, mink, and other mammals.

Habitat and Biological Associations

Eggs and Spawning: Pink salmon choose a fairly uniform spawning bed in small and large streams in both Asia and North America. Generally, these spawning beds are situated on riffles with clean gravel, or along the borders between pools and riffles in shallow water with moderate to fast currents. In large rivers, they may spawn in discrete sections of main channels or in tributary channels. Pink salmon avoid spawning in quiet deep water, in pools, in areas with a slow current, or over heavily silted or mud-covered streambeds. Places selected for egg deposition is determined by the optimal combination of two main interconnecting variables: depth of water and velocity of current.

On both the Asian and North American sides of the Pacific Ocean, pink salmon generally spawn at depths of 30 to 100 cm. Well populated spawning grounds of pink salmon are mainly at depths of 20 to 25 cm, less often reaching depths of 100 to 150 cm. In dry years, when spawning grounds are crowded, nests can be found at shallower depths of 10 to 15 cm. Current velocities in pink salmon spawning grounds varied from 30 to 100 cm/s, sometimes reaching 140 cm/s. Directly over the redds, about 5 to 7 cm from the surface, the velocity can range from 30 to 140 cm/s but usually averages from 60 to 80 cm/s.

In general, pink salmon select sites in gravel where the gradient increases and the currents are relatively fast. In these areas, surface stream water must have permeated sufficiently to provide intragravel flow for dissolved oxygen delivery to eggs and alevins. Chum salmon, by contrast, tended to select spawning sites in areas with upwelling spring water and a relatively constant water temperature, without much regard to surface stream water. Pink salmon spawning beds consist primarily of coarse gravel with a few large cobbles, a large mixture of sand, and a small amount of silt. High quality spawning grounds of pink salmon can best be summarized as clean, coarse gravel.

Larvae/Alevins: Fertilized eggs begin their 5- to 8-month period of embryonic development and growth in intragravel interstices. To survive successfully, the eggs, alevins, and pre-emergent fry must first be protected from freezing, desiccation, stream bed scouring or shifting, mechanical injury and predators. Water surrounding them must be non-toxic and of sufficient quality and quantity to provide basic requirements of suitable temperatures, adequate supply of oxygen, and removal of waste materials. Collectively, these requirements are, on average, only partially met even under the most favorable natural conditions. Overall freshwater survival of pink salmon from egg to advanced alevin and emerged fry, even in highly productive streams, commonly reaches only 10 to 20 percent and at times is as low as about 1 percent.

Rates of egg development, survival, size of hatched alevins and percentage of deformed fry are related to temperature and oxygen levels during incubation. Temporary low stream temperatures or dissolved oxygen concentrations, however, may be relatively unimportant at some developmental stages, but lethal at others. Generally, low oxygen levels are non-lethal early, but lethal late in development. Eggs subjected to low dissolved oxygen levels hatched prematurely at a rate dependent on the degree of hypoxia. Spinal deformities occurred in eggs incubated at 3.0° and 4.5°C before gastrulation. In one study, over 50 percent of developing pink salmon eggs died at dissolved oxygen levels of 3 to 4 mg/l, and among those that hatched many alevins were deformed.

Juveniles: Newly emerged pink salmon fry show a preference for saline water over fresh water, which may, in some situations, facilitate migration from the natal stream area. Schools of pink salmon fry may move quickly from the natal stream area or remain to feed along shorelines up to several weeks. The timing and pattern of seaward dispersal is influenced by many factors, including general size and location of the spawning stream, characteristics of adjacent shoreline and marine basin topography, extent of tidal fluctuations and associated current patterns, physiological and behavioral changes with growth, and, possibly, different genetic characteristics of individual stocks.

Early marine schools of pink salmon fry, often in tens or hundreds of thousands of fish, tend to follow shorelines and, during the first weeks at sea, spend much of their time in shallow water of only a few centimeters deep. It has been suggested that this onshore period involves a distinct ecological life history stage in both pink and chum salmon. In many areas throughout their ranges, pink salmon and chum salmon fry of similar age and size co-mingle in both large and small schools during early sea life. Juvenile pink salmon in the BS off the northeastern Kamchatka coast are found in one of three hydrological zones during their first three to four months of marine life: (1) the littoral zone, up to 150 m from shore; (2) open parts of inlets and bays from 150 m to 3.2 km from shore; and (3) the open parts of the large Karaginskiy Gulf, 3.2 to 96.5 km from shore. Distribution within these regions is seasonally related to the size of pinks, with an offshore movement of larger fish in August and September.

Pink salmon juveniles routinely obtain large quantities of food sufficient to sustain rapid growth from a broad range of habitats providing pelagic and epibenthic foods. Collectively, diet studies show that pink salmon are both opportunistic and generalized feeders and on occasion they specialize in specific prey items. Diel sampling of stomachs showed fewer and more digested food items at night than during the day indicating that juvenile pinks are primarily diurnal feeders.

Adults: Ocean growth of pink salmon is a matter of considerable interest because, although this species has the shortest life span among Pacific salmon, it also is among the fastest growing. Entering the estuary as fry at around 3 cm in length, maturing adults return to the same area 14 to 16 months later ranging in length from 45 to 55 cm.

The population biology of pink salmon revolves around the 2-year life cycle. A phenomenon of cycle dominance between odd- and even-year brood lines within specific regions is common. Dominance can be weak or strong, complete, or non-existent. It can also shift between brood lines. With complete dominance, the “off-year” line is absent while non-dominance is characterized by similar population strength between odd- and even-year runs. Although many causes for dominance and its various characteristics in pink salmon populations have been proposed, none satisfactorily explains the event. Genetically, pink salmon are more similar within odd- or even-year brood lines across broad geographic regions than across brood lines within the same stream. It has been suggested for some geographic areas that present odd- and even-year pink salmon populations arose from separate glacial refuges during late Pleistocene times.

Scientists have recognized six distinct ocean migration patterns for regional stock groups of pink salmon throughout the North Pacific. Only two of these stock groups, those originating in Washington state and British Columbia and those originating in southeast, central, and southwest Alaska, occur in marine waters where they might interact in some way with the salmon fisheries off the coast of southeast Alaska. Pink salmon from these two broad stock groups co-mingle in the GOA during their second summer at sea while migrating towards natal areas.

Table 4 Habitat and biological associations of pink salmon, *Onchorynchus gorbuscha*

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceanographic Features	Other
Eggs and larvae	90 to 125 days	eggs predated by birds, fish, and mammals	late summer, fall, winter, and early spring	Intragravel; in stream beds; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	15 to 50 cm in gravel depth	medium to coarse gravel, cobble, gravel	NA	Develop at 1-10°C, eggs hatch at about 100 d, larvae emerge from gravel about 125 d post hatch
Juveniles, freshwater	1 to 15 days; short streams = 1 day, longer rivers = 15 day	fry are predated by birds, fish, and mammals	spring	rivers and streams; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	generally migrating in upper portion of water column	varied	NA	downstream migration is mostly in darkness
Juveniles, estuarine	2 to 3 months	copepods, euphausiids, decapod larva, amphipods	summer	estuarine, initially nearshore, then offshore in bays and inlets, along kelp beds	generally occupying the upper portion of water column	varied: kelp, subaquatic vegetation	NA	Preference for increasing salinities, school with other salmon and Pacific sandfish
Juveniles, marine	3 to 6 months	copepods, euphausiids, decapod larva, amphipods	summer, fall, and early, pre anulus winter	coastal; inner, middle, and outer continental shelf; moving further offshore with growth	generally migrating in upper portion of water column	varied: kelp, subaquatic vegetation	Upwelling, fronts, thermo- or pycnocline, edges	Coastal and shelf migrations move into oceanic waters in later stages
Immature and maturing adults marine	6 to 10 months	fish, squid, euphausiids, amphipods, and copepods	spring, summer, and early fall	Oceanic to nearshore in final migration	Pelagic, neustonic	NA	Upwelling, fronts, thermo- or pycnocline, edges; Regional stocks have specific oceanic migratory patterns	Rapid marine growth; onset of maturation timing varies among stocks; earlier north, later south
Adults, freshwater	2 years of age from egg to mature adult, final stage 1 to 2 months	Active feeding ceases, digestive organs atrophy	Spawning (Aug-Oct)	Water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	Varied, holding in pools, spawning on shallow riffles	medium to coarse gravel, cobble, gravel	NA	sexual dimorphism in spawning males, called humpback salmon

A.2.4 Habitat Description for Chum Salmon (*Oncorhynchus keta)*

Life History and General Distribution

Chum salmon spawn in streams emptying into the North Pacific Ocean north of about 40°N in both Asia and North America. In Asia, chum salmon spawn in streams on the east side of the Korean peninsula in both South and North Korea northward, including Japan, China (tributaries to the Amur River), Russia and westward into the Arctic Ocean as far west as the Lena River. In North America, chum salmon spawn in streams entering the North Pacific Ocean as far south as northern California and northward in streams along the coasts of Oregon, Washington, British Columbia, and Alaska on into the BS, Arctic Ocean, and Beaufort Sea as far east as the Mackenzie River in Northwest Territory. Chum salmon spawn in Yukon Territory, Canada, in tributaries of the Yukon River. Only populations small in numbers spawn north and east of the Noatak River, which enters the ocean at Kotzebue, Alaska, and south of Tillamook Bay, Oregon.

In general, chum salmon spawn in the lower reaches of coastal streams less than 100 miles upstream from the ocean. Two notable exceptions are the Yukon River in North America and the Amur River in Russia and China where chum salmon migrate upstream more than 1,500 miles to spawning areas. In Prince William Sound, and to a lesser extent southeast Alaska, chum salmon will spawn in the intertidal portions of streams in areas where ground water upwells into the streams. Chum salmon throughout their range tend to build their redds in areas of streams where ground water (about 4 to 7ºC) upwells.

In North America, chum salmon return from the ocean to spawn, for the most part, between June and January. In general, spawning starts earlier in the north and ends later in the southern part of their range. Of course, major exceptions in this pattern occur. The latest spawning in southeast Alaska occurs in the Chilkat River, near Haines, Alaska, from September through January. Most chum salmon spawning in Alaska is usually finished by early November. Most spawning in Washington/Oregon takes place from August through November; however, August spawners have been declining in recent years. Chum salmon return to the Quilcene National Fish Hatchery in December, and the Nisqually River near Olympia, Washington, has spawners during January and February and sometimes into March.

So called summer and fall races of chum salmon occur in Asia and North America. Summer and fall races both enter the Yukon River. The summer chum salmon start entering the river in May and the fall chum enter the river in June and July. The fall stocks tend to spawn farthest up river in September through November. Summer chum are more abundant than fall chum in the Yukon River; however, the fall chum are larger. In southern southeast Alaska and northern British Columbia summer chum enter mostly mainland rivers in mid-June and spawning may extend into late October and early November. Fall chum in southern southeast Alaska and northern British Columbia spawn mostly in streams on the Islands and spawning typically occurs during September and October. Unlike the Yukon River, summer chum salmon in southern Southeast Alaska and northern British Columbia are larger than the fall stocks for the same age, even though the summer stocks may spawn more than 3 months earlier.

Chum salmon return to spawn as 2- to 7-year-olds. Two-year-old chum are rare in North America and occur primarily in the southern part of their range, e.g., Oregon. Seven-year-old chum are also rare and occur mostly in the northern areas. In general, chum salmon get older from south to north. Three- and four-year-olds tend to dominate in the southern areas and 4-, 5-, and 6-year-olds tend to dominate in the more northern areas. For the most part older chum salmon are larger than younger fish but much overlap occurs between the age groups. The largest chum salmon in North America (and probably the world) occur in the Portland Canal area, which forms the border between Alaska and British Columbia.

Chum salmon fry, like pink salmon, do not overwinter in the streams but migrate (mostly at night) out of the streams directly to the sea shortly after emergence. The range of this outmigration occurs between February and June but most fry leave the streams during April and May. Chum salmon do tend to linger and forage in the intertidal areas at the head of bays. Estuaries are very important for chum salmon rearing during the spring and summer.

Juvenile chum salmon are present in the coastal waters mostly during July through October, and generally move to the north and west along the coasts of Oregon, Washington, British Columbia, and Alaska. Most juvenile chum salmon are thought to leave the coastal waters and move south into the North Pacific Ocean between Kodiak and False Pass during late fall. After chum salmon form an annulus on their scales (January to March) they are considered immature. They may remain immature for several years until they start maturing and begin their migration to their spawning streams.

Both Asian and North American chum salmon winter in the North Pacific but Asian chum salmon migrate much further east than North American chum salmon migrate to the west. North American chum salmon are seldom found west of 175°E; however, Asian salmon are found eastward to at least 140°W. However, Asian and North American stocks of chum salmon are intermingled on the high seas.

After the 1976 to 1977 Regime Shift in the North Pacific Ocean, most chum salmon stocks increased in abundance through the mid-1990s. The Regime Shift apparently created very favorable ocean conditions for all species of salmon from northern British Columbia to northern Alaska. However, as the abundance increased, age at maturity increased, and size at age decreased drastically. Chum salmon of the same age in the early 1990s weighed up to 46 percent less than they weighed in the early 1970s. During this same time, Asian chum salmon also matured older and their size at age declined. These changes in size and age at maturity as population numbers increased suggests that the North Pacific Ocean may have carrying capacity limits for chum salmon under certain conditions.

If the term juvenile chum salmon refers to the fry stage up to the time of the first annulus formation in the ocean, which occurs in January-March, the approximate upper size limit is about 30 cm. Juvenile chum salmon in the outside waters of Southeast Alaska in mid to late August range in size up to about 25 cm.

Fisheries

Chum salmon are captured primarily in purse seines and gill-nets in North America after traps were outlawed in Alaska in 1960. Some chum salmon are captured in troll fisheries, primarily in Canada.

Major fisheries occur for chum salmon from southern Washington to the Noatak River in northwestern Alaska. Significant declines of chum salmon in Oregon in the 1940s caused the state to abandon net fisheries and the stocks still have not recovered.

Most net fisheries for chum salmon occur in the coastal waters in Alaska, but some in-river gill-net fisheries occur in the larger rivers for both commercial and subsistence fisheries. Chum salmon are often captured incidently in fisheries targeting pink or sockeye salmon. Large incidental catches of chum salmon occur in southeast Alaska and Prince William Sound. When the Pacific Salmon Treaty between the United States and Canada was signed in 1984, chum salmon in the Portland Canal (on both sides of the border but particularly in Canada) were identified as a major conservation concern. The cause of this problem was blamed on incidental capture of chum salmon in fisheries targeting pink and sockeye salmon.

Chum salmon have also been captured incidentally in the trawl fisheries for pollock in the BS. Apparently, the chum are “scooped” at the surface when the trawl is being let out and brought in. In some years this can be a major problem, e.g., in 1994 when about 250,000 chum were estimated to be part of the bycatch.

Chum salmon fisheries utilize seines, gill-nets, and troll gear and there are no apparent impacts of the gear on marine or freshwater habitats.

Relevant Trophic Information

Chum salmon eggs, alevins, and juveniles in freshwater streams provide an important food source for many birds (e.g., gulls, crows, magpies, ouzels, kingfishers), small mammals, other fishes, and many invertebrates. Chum salmon carcasses provide nutrients for the freshwater watersheds and estuaries. Carcasses are also highly important for food for many birds (e.g., eagles, ravens, crows, gulls, magpies). The late chum salmon return to the Chilkat River system near Haines, Alaska, is the reason that large numbers of bald eagles congregate on the spawning grounds every year in September through December. Adult chum salmon and spawned carcasses provide a major food source for brown and black bears, wolverines, wolves, and many other small mammals. Many species of invertebrates utilize carcasses for food.

Habitat and Biological Associations

Eggs/Spawning: Chum salmon spawn in gravel in streams, side-channel sloughs, and intertidal portions of streams when the tide is below the spawning area. In all of these areas upwelling ground water is often the common denominator. Many side-channel sloughs have very little current on the surface and can be very silty; however, the upwelling ground water keeps the silt in suspension in the intragravel water. The upwelling water also keeps these spawning areas with slow moving surface water from freezing in the winter. The depth that eggs are deposited in the streams varies according to the gravel size, current, and size of the female, but the range is about 8 to 50 cm. Eggs and sperm are deposited in the redd simultaneously and each female spawns with up to six males at the same time. Several redds are constructed by each female and different males may be involved in the spawning act in subsequent redds. Stream life of both sexes varies and is longer in the early stages of the run (about 14 days) and shorter near the end of the run (as few as 6 days) in coastal streams.

Larvae/Alevins: Fertilized eggs incubate in the streambed gravel for about 5 to 8 months. Eggs, alevins, and pre-emergent fry can be killed by desiccation, freezing, mechanical injuries due to streambed shifting, e.g., during floods, and predators. The intragravel water during incubation and rearing must be of suitable temperatures and be free of toxins with adequate oxygen and flow to remove waste products. Survival from deposited eggs to emergent fry is highly variable, ranging from about 1 to 20 percent. The health of the eggs and emerging fry is also dependent on gravel composition, spawning time, spawning density, and genetic characteristics. In general, chum salmon eggs have to be fertilized in water above 4ºC and in salinity less than 2 parts per thousand. Dissolved oxygen levels during incubation need to be above 3 to 4 mg/l.

Juveniles: After emerging from the streambed (as early as February and as late as June) schooling chum salmon fry migrate downstream, mostly at night, to the estuaries where they tend to feed in the intertidal grass flats and along the shore. Chums can utilize these intertidal wetlands for several months before actively migrating out of bays and into channels on the way to the outside waters. Pink salmon on the other hand tend to move more directly to more open water areas. Chum salmon utilize a wide variety of food items, including mostly invertebrates (including insects), and gelatinous species. Offshore movement of larger juveniles occurs mostly in July to September.

Adults: Chum salmon reside in the ocean for about 1 to 6 years. Adults mature at ages 2 through 7 years; however, 2- and 7-year-old chum salmon are rare. Throughout their range 3-, 4-, and 5-year olds are common but 3- and 4-year-old salmon dominate the southern stocks and 4-, 5-, and 6-year-old chum salmon dominate the northern stocks. Slow or rapid growth in the ocean can modify age at maturity. Slower growth during the second year at sea causes some chum salmon to mature 1 or 2 years later. Chum salmon eat a variety of foods during their ocean life, e.g., amphipods, euphausiids, pteropods, copepods, fish, and squid larvae. Chum salmon also utilize gelatinous zooplankton for food more often than any of the other species of salmon. Chum salmon have a much larger stomach than the other species of salmon and this large capacity may allow them to utilize the nutrients from the gelatinous zooplankton more efficiently.

Asian and North American chum salmon are intermingled on the high seas as immature and during their last year at sea. Recently, immature and maturing chum salmon from Washington, British Columbia, and southeast Alaska have been identified in the BS in August. Chum salmon spawn mostly in November in Washington and southern British Columbia so these fish are capable of long distant migrations in their last year in the sea.

Special Habitat Concerns: Chum salmon are subject to the same habitat concerns as the other species of salmon, e.g., habitat destruction or silting due to logging and road building activities, blockages due to dams, and pollution. In addition, chum salmon have two habitat requirements that are essential in their life history that make them very vulnerable: (1) reliance on upwelling ground water for spawning and incubation, and (2) reliance on estuaries/tidal wetlands for juvenile rearing after migrating out of the streams. The hydrology of upwelling ground water into stream gravel is highly complex and poorly understood. Whatever activities change the amount and quality of groundwater that upwells would very likely affect chum salmon survival in a negative manner. Drilling activities and uplift of land masses due to earthquakes are two phenomena known to affect groundwater. Wetlands and estuaries near communities are very vulnerable to pollution and filling activities that would negatively affect essential chum salmon rearing areas.

Chum salmon will spawn in intertidal portions of streams, most notably in Prince William Sound. The intertidal portion of streams is very vulnerable to coastal pollution from oil spills et al. In Prince William Sound, chum salmon spawners are active in the intertidal zone of streams from late June through September. Eggs, alevins, and fry are in the intertidal gravel from late June through May. That leaves a very narrow "window" in June when the intertidal zone may be free of adults, eggs, alevins, or fry.

Table 5 Habitat and biological associations of chum salmon, *Onchorhynchus keta*

Stage - EFH Level	Duration or Age	Diet/ Prey	Season/ Time	Location	Water Column	Bottom Type	Oceanographic Features	Other
Eggs and larvae	90 to 125 days	eggs predated by birds, fish, and mammals	early summer, fall, winter, and early spring	intragravel in stream beds; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	7.5 to 50 cm in gravel depth	small to coarse gravel; cobble; gravel	NA	Develop at 1-10°C, eggs hatch at 52-173 d, larvae emerge from gravel 146-325 d
Juveniles (freshwater)	1 to 15 days; short streams = 1 day, longer rivers=30 days	fry are predated by birds, fish, and mammals	spring	rivers and streams; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	generally migrating in upper portion of water column	Varied	NA	downstream migration is mostly in darkness
Juveniles (estuarine)	2 to 3 months	copepods, euphausiids, decapod larva, amphipods, gelatinous zooplankton	summer	estuarine, initially nearshore, then offshore in bays and inlets, along kelp beds	generally occupying the upper portion of water column	varied: kelp, subquatic vegetation	NA	Preference for increasing salinities, school with other salmon and Pacific sandfish
Juveniles, (marine)	3 to 6 months	copepods, euphausiids, decapod larva, amphipods, gelatinous zooplankton	summer, fall, and winter, prior to annulus formation in Jan.-Mar.	Coastal; inner, middle, and outer continental shelf; moving further offshore with growth	generally migrating in upper portion of water column	varied: kelp, subquatic vegetation	Upwelling, front, thermo- or pycnocline, edges	Coastal and shelf migrations move into oceanic waters in later stages
Immature and maturing adults (marine)	6 to 10 months	fish, squid, euphausiids, amphipods, copepods, and gelatinous zooplankton	spring, summer, and early fall	Oceanic to nearshore in final migration	Pelagic, neustonic	NA	Upwelling, front, thermo- or pycnocline, edges; Regional stocks have specific oceanic migratory patterns	Rapid marine growth; onset of maturation timing varies widely among stocks; generally earlier north, later south
Adults (freshwater)	2 to 7 years of age from egg to mature adult, final stage 1-2 months	Active feeding ceases, digestive organs atrophy	spawning (June-January)	water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	Varied, holding in pools, spawning on shallow riffles, pools or side-channel sloughs	small to coarse gravel; cobble; gravel	NA	sexual dimorphism in spawners, males develop large teeth, called dog salmon

A.2.5 Habitat Description for Sockeye Salmon (*Oncorhynchus nerka)*

Life History and General Distribution

The natural freshwater range of sockeye salmon includes the Pacific rim of Asia and North America north of about 40°N. Within this area, the primary spawning grounds of sockeye salmon in North America extend from tributaries of the Columbia River to the Kuskokwim River in western Alaska, and on the Asian side, the spawning areas are found mainly on the Kamchatka Peninsula. Spawning populations become more irregular and occasional north of the Bering Strait, on the north coast of the Sea of Okhotsk, and in the Kuril Islands. Centers of the two largest spawning complexes in the North Pacific rim occur in the Bristol Bay watershed of southwestern Alaska and the Fraser River drainage of British Columbia. In marine environments along both the Asian and North American coastlines, sockeye salmon occupy ocean waters south of the limits of spawning systems.

Sockeye salmon exhibit a greater variety of life history patterns than other members of the genus *Oncorhynchus*, and characteristically make more use of lake rearing habitat in juvenile stages. Although sockeye salmon are primarily anadromous, there are distinct populations called kokanee, which mature, spawn, and die in fresh water without a period of sea life. Typically, but not universally, juvenile anadromous sockeye utilize lake rearing areas for 1 to 3 years after emergence from the gravel; however, some populations utilize stream areas for rearing and migrate to sea soon after emergence. Anadromous sockeye may spend from 1 to 4 years in the ocean before returning to fresh water to spawn and die in late summer and fall.

The adaptations of sockeye salmon to lake environments appear to require more precise homing to spawning areas, both as to time and location than is found in the other species of Pacific salmon. Although available spawning localities are more restricted because of the usual requirement of a lake rearing environment for the juveniles, the overall success of this adaptation is indicated by the fact that sockeye are much more abundant than Chinook (*O. tshawytscha*) and coho salmon (*O. kisutch*), which utilize stream rearing environments as juveniles. Juvenile sockeye salmon in fresh water do not need the territorial stream behavior displayed by juvenile Chinook and coho salmon, but do exhibit schooling tendencies more characteristic of pelagic feeding fishes.

Other distinctions of sockeye salmon include growth rate and size at maturity. Sockeye do not exhibit the rapid marine growth of coho or pink salmon (*O. gorbuscha*), which mature and return to fresh water after a single winter in the ocean, or of Chinook or chum salmon (*O. keta*), which attain a much larger average size at maturity. The flesh of sockeye is a darker red than that of the other salmon species, a color long considered to be a marketing attribute of the canned and, more recently, the fresh or fresh-frozen product.

The approximate upper size limit of juvenile fish is roughly 25 cm.

Fisheries

Sockeye salmon are an important component, and often the most lucrative fishery for Pacific salmon. Coastal fisheries for sockeye salmon presently occur in North America (Canada and the United States) and Asia (Japan and Russia) with major fisheries in all areas except Japan. From 1920 through 1945, sockeye salmon were caught on the high seas by a Japanese mother ship fishery. This fishery started again in 1953 and a land based driftnet fishery moved sufficiently offshore to begin substantial catches of sockeye in 1958. Restrictions in fishing areas resulting from renegotiation of international fishery treaties ended the high seas fisheries in the mid 1980s. In recent years, about 22 percent of the numbers and 28 percent by weight of all salmon caught commercially in the North Pacific Ocean and adjacent waters were sockeye. Catches in North America, primarily Alaska and British Columbia, have always been greater than Asian catches. North American catches averaged about 30 million through 1940, declined to 10 to 15 million in the early 1960s and surged to 40 million and more in the 1990s. The recent record high catches resulted primarily from an increase in run magnitudes of natural stocks in central and western Alaska. Historically, Asian catches of sockeye salmon have averaged fewer than 10 million fish. Most sockeye salmon in the United States are caught in Alaska where major fisheries occur in southeast, central, and westward areas. In Alaska, sockeye fisheries occur primarily within State territorial seas (inside 3 miles).

Sockeye salmon catches have been at historic records in Alaska over the past decade with catches exceeding 60 million fish in several years. Most sockeye salmon in Alaska are caught by set and drift gill net fisheries. Recreational fisheries in Alaska usually harvest between 200,000 and 400,000 sockeye salmon annually, mostly in river system of the Kenai Peninsula in central Alaska. Subsistence catches of sockeye salmon are not universally maintained, but the catches are important, particularly to native people in a number of localities. The Fraser River Indian tribes recorded annual subsistence catches for the years 1970 to 1982 of 240,000. The subsistence catch of sockeye salmon in the United States was 315,000 in 1993, and over 307,000 was caught in Alaskan waters.

Gill net fisheries for sockeye salmon have some bycatch associated with them, primarily other salmon. The most important bycatch issue is in the southeastern region where younger marine-age Chinook salmon, similar in size to sockeye, are caught in sockeye net fisheries. The total harvest of Chinook salmon in this region is controlled by quotas under auspices of the Pacific Salmon Treaty. The Alaska Board of Fisheries allocates a portion of the quota for Chinook salmon as an allowable bycatch in gill net fisheries.

Measured marine survivals of sockeye salmon, from entry of smolts into stream mouth estuaries to returning adults, have ranged from about 5 percent to over 50 percent. Scientists, in general, believe that much of the natural mortality of sockeye salmon juveniles in the marine environment occurs within the first few months, and is probably influenced by three factors of unknown relative importance: (1) size and age at seaward migration; (2) timing of entry into the marine environment; and (3) length of stay in the ocean. Variations in oceanographic conditions and in marine predator populations (fish, mammals, and birds) undoubtedly have affected the marine survival of sockeye populations in different ways around the North Pacific rim, but these effects are poorly understood.

Because sockeye salmon are primarily caught in gill nets, there are no known gear impacts to the habitats where these fisheries occur.

Relevant Trophic Information

Sockeye salmon eggs, alevins, and juveniles in freshwater streams and lake systems provide an important nutrient and food source for aquatic invertebrates, other fishes, birds, and small mammals. In the marine environment sockeye salmon juveniles are food for many other fishes and coastal sea birds. Adult sockeye salmon are known to be eaten by marine mammals and sharks.

Millions of sockeye salmon adults returning to spawn in thousands of streams throughout Alaska provide significant nutrient input into the trophic level of these coastal watersheds. Adult sockeye salmon in streams are major food sources for gulls, eagles, and other birds, along with bear, otter, mink, and other mammals.

Habitat and Biological Associations

Eggs/Spawning: Sockeye salmon generally spawn in late summer and autumn. Within this period, time of spawning for different stocks can vary greatly, apparently because of adaptations to the most favorable survival conditions for spawning, egg and alevin incubation, emergence, and subsequent juvenile feeding. Although timing of spawning varies little from year to year within a specific spawning area, there are great differences in timing among spawning areas. The timing of spawning appears to be dependent to some degree on the temperature regimen in the gravel where the eggs are incubated. This varies distinctly among spawning area types. In the Bristol Bay region of Alaska, spawning begins in late July in the smaller streams, in early to mid-August in the tributaries of some lakes, and in late August to mid-September in most lake beach areas. In Lake Kuril and its tributaries, spawning continues from the end of June until early February with the main spawning occurring from September to November.

Among the species of Pacific salmon, the sockeye salmon exhibits the greatest diversity in adaptation to a wide variety of spawning habitats. The selection of habitats and timing of spawning by a sockeye stock are linked to success of survival, not only during spawning and incubation of the eggs and alevins, but also in the chain of freshwater and marine environments to which the progeny are subsequently exposed. In most instances, but not all, the subsequent environment of the juveniles is a lake or lake chain, and the behavior of the juveniles after emergence depends on the location of the spawning area in relation to the lake rearing area to be utilized. Lake-beach spawning has been recorded in most sockeye lake systems, and is apparently important habitat. Sockeye are also known to spawn in areas that lack lake rearing habitat. These “river spawning” or “sea type” sockeye lay their eggs in river systems with no lake, and emergent fry apparently feed in the stream or low-salinity estuaries for several months before migrating to offshore ocean areas. The circumstances surrounding the initial establishment of a spawning colony and the subsequent adaptive behavior of the progeny can only be surmised. However, the continued use of a specific spawning environment by a sockeye stock depends on the precise homing ability of the species, in which straying to other potential spawning locations is minimal.

The composition of spawning substrate utilized by sockeye salmon varies widely. Some lake-beach spawning occurs to a depth of nearly 30 m in areas of strong upwelling groundwater. In some lakes, mass spawning takes place over large angular gravel too large to be moved by salmon in the normal digging process. The eggs settle in the crevices between the rocks. Generally, however, spawning along lake beaches and in streams takes place in gravel small enough to be readily dislodged by digging, and the digging process tends to remove the silt and clean the gravel where the eggs are deposited. Water depth does not seem to be a critical factor to sockeye in selecting a spawning site. In the small streams and spring ponds, it is common to observe pairs of salmon in the spawning process with their dorsal surfaces protruding from the water. In larger rivers, spawning depths are generally not great because riffle areas are preferred. Spawning on lake beaches can extend to considerable depths. It is clear that sockeye can detect upwelling groundwater areas along lake beaches and in spring ponds areas in which to spawn. Generally, the spawning beds are situated in areas with clean gravel, or along the borders between pools and riffles in shallow water with moderate to fast currents. In large rivers, they may spawn in discrete sections of main channels or in tributary channels.

Superimposition is minimized by the territorial defense of the redd by the female following egg deposition, which protects the redd for a few days. Female territory is partly a function of spawner density. Estimates of the capacity of streams to support spawning sockeye were based on density of one female/2 m^2. In spawning channels, maximum fry production was achieved at the spawner density of one female/m^2.

Larvae/Alevins: Fertilized eggs begin their 5- to 8-month period of embryonic development and growth in intragravel interstices. To survive successfully, the eggs, alevins and pre-emergent fry must first be protected from freezing, desiccation, stream bed scouring or shifting, mechanical injury and predators. Water surrounding them must be non-toxic and of sufficient quality and quantity to provide basic requirements of suitable temperatures, adequate supply of oxygen, and removal of waste materials. Collectively, these requirements are, on average, only partially met even under the most favorable natural conditions. Overall freshwater survival of sockeye salmon from egg to advanced alevin and emerged fry, even in highly productive streams, commonly reaches only 10 to 20 percent, and at times is as low as 1 percent.

Rates of egg development, survival, size of hatched alevins, and percentage of deformed fry are related to temperature and oxygen levels during incubation. Temporary low stream temperatures or dissolved oxygen concentrations, however, may be relatively unimportant at some developmental stages, but lethal at others. Generally, low oxygen levels are non-lethal early, but lethal late in development.

Juveniles: Fry emergence apparently begins in early to mid-April in most instances, peaks in early to mid-May, and ends in late May to early June. Newly emerged sockeye salmon fry show a marked negative rheotaxis and actively swim downstream to lakes. In some lake outlet spawning areas, the emerging fry swim laterally in an attempt to reach the river banks and avoid being swept downstream. The emergence behavior of fry in lakeshore spawning areas has not been reported. It has been suggested that the seasonal timing of sockeye fry emergence optimizes the timing of dispersal into their feeding habitat, particularly to take advantage of the seasonal peak abundance of zooplankton of appropriate size. It is postulated that fry emerging earlier or later than the optimum may suffer greater mortality, and thus that timing is a response to this selective pressure. The survival value in entering the lake early is to take advantage of feeding in the lake as long as possible during the summer, thus achieving larger size in preparation for spring smoltification. Annual timing of fry migration and its seasonal pattern is a function of the seasonal timing of the adult spawning period, ecological factors within the incubation habitat that affects development rate and alevin behavior, and transit time needed by the fry to reach their feeding habitat.

Upon entering nursery lakes, sockeye fry disperse quickly into their lake feeding areas. Movement of fry into the nursery areas may be direct and immediate, or sequential, the latter involving occupation of intermediate feeding areas for a period of time. The plasticity of response suggests definite racial adaptations to a variety of different environmental conditions. Intermediate feeding and growth can occur along outlet river banks before migration into the nursery lake. In-lake dispersions of fry is probably a mechanism whereby the lake zooplankton is effectively utilized as food for the juvenile fish.

Sockeye salmon juveniles typically spend one or more growing seasons in the limnetic zone of a nursery lake before smoltification. The transition in feeding behavior and diet from the time of emergence of the fry from stream or lakeshore to the time of smoltification takes many forms. In general, it is a shift from dependence on dipteran insects to pelagic zooplankton. The annual growth attained by juvenile sockeye and length of residence in fresh water varies greatly among populations in different lake systems, as well as between years within individual lakes. Factors affecting growth are highly complex and include (1) size and species composition of the food supply; (2) water temperature and thermal stratification of the lake; (3) photoperiod and length of growing season; (4) relative turbidity of the lake and available light intensity in the water column; (5) intra- and interspecific competition; (6) parasitism and disease; (7) feeding behavior of juvenile sockeye to minimize predation; and (8) migratory movements to seek favorable feeding environments. Growth influences durations of stay in fresh water before smoltification, and within many lake populations the larger members of a year class tend to migrate to sea earlier the spring or migrate a year earlier than smaller members. In the more southern systems, smoltification after 1 year is nearly universal. Size is not strictly the determinant for duration of stay in fresh water, because some populations with very poor freshwater growth in their first year migrate as yearlings, whereas other populations exhibiting good first-year growth migrate predominantly after a second year of growth. Emergent fry of “river spawning” or “sea type” sockeye, which spawn in systems lacking lake rearing habitat, feed in the stream or low-salinity estuaries for several months before migrating to offshore ocean areas.

Sockeye fry at the beginning of lake life are between 25 and 31 mm and weigh between 0.1 and 0.2 g. Yearling smolts vary greatly in size; average range 60 to 125 mm and 2.0 to 30.0 g. After a second year of growth in a lake, 2-year-old smolts often overlap the size range of yearlings, and have been reported at an average of 200 mm and 84.0 g at Hidden Lake in central Alaska. Sea type sockeye smolts are typically the same size as yearling smolts when they migrate to offshore ocean areas.

After smoltification and exodus from natal river systems in spring or early summer, juvenile sockeye enter the marine environment where they reside for 1 to 4 years, usually 2 or 3 years, before returning to spawn. Depending on the stock, they may reside in the estuarine or nearshore environment before moving into oceanic waters. They are typically distributed in offshore waters by autumn following outmigration. During the initial marine period, yearling sockeye forage actively on a variety of organisms, apparently preferring copepods and insects, but also eating amphipods, euphausiids, and fish larvae when available. Their growth rate is about 0.6 mm/d.

After entering the open sea during their first summer, juvenile sockeye salmon remain in a band relatively close to the coast. Off the outer coast of British Columbia and southeast Alaska, the juveniles are often recorded on the open sea in late June. By July, the fish are found moving northwestward into the GOA. Sampling in the North Pacific has shown that by October juvenile sockeye are still somewhat distributed primarily nearshore. Evidence indicates the northwestward movement up the eastern Pacific rim is followed by a southwestward movement along the Alaska Peninsula. An offshore movement into the GOA in late autumn or winter is conjectured for the location of age 1 sockeye in early spring.

Adults: Sockeye salmon from different regions differ in growth rate and age and size at maturity. Growth in length is greatest during the first year at sea, and increase in weight is greatest during the second year. Most sockeye spend 2 to 3 years feeding in the ocean before their final summer of return. There is substantial variation in size among populations within an age class. In Alaska, the average size of females that had spent 2 years in the ocean ranged from 45 to 54 cm, and of those that had spent 3 years the average ranged from 51 to 60 cm.

Table 6 Habitat and biological associations of sockeye salmon, *Onchorynchus nerka*

Stage	Duration or Age	Diet/ Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs and larvae (alevins)	eggs: 90 to 100 days larvae: 100 to 125 days	NA	late summer, fall and winter	water courses, rivers streams, sloughs; lakes, ponds	Intragravel	Cobble, gravel	NA	Develop at 1-10°C, eggs hatch about 100 d, alevins emerge from gravel about 125 d post hatch
Juveniles, Freshwater	1 to 3 years, fry emerge and move quickly to lakes, or, rarely, 3 to 4 months in estuaries	copepods, bosminids, Daphnia chironomids dipterans, stoneflies	for yearling and older smolt, early to late summer for sea type run	water courses, rivers streams, sloughs; lakes, ponds; estuarine	pelagic, neustonic	NA	NA	Preference pelagic feeding in lakes, usually not with other fishes, except when predators present
Juveniles, estuarine	1 to 4 months	copepods, amphipods,	spring, summer, fall	beach (intertidal); estuarine, to 30 m	pelagic, neustonic	NA	upwelling, thermo- and pycnocline	larger fish progressively farther from shore
Juveniles, marine	6 to 8 months	copepods, amphipods, small fishes, squid mysids, euphausiids	early summer to late winter	beach (intertidal); inner and middle continental shelf; island passes; nearshore bays	pelagic, neustonic	NA	upwelling, thermo- and pycnocline	movements from near-shore to offshore areas
Adult, immature and maturing, marine	1 to 4 years from smolt to mature adult	copepods, amphipods, insects, small fishes, squid	immature: year round 1 to 3 years	beach (intertidal), inner/ middle/ outer continental shelf, upper and lower slope; basin; island passes; nearshore bays	pelagic, neustonic	NA	upwelling	migration timing for different regional stock groups varies; earlier in the north, later in the south
Adults, freshwater	2 to 4 months	no active feeding in freshwater	Spawning migration (May-August)	water courses, rivers streams, sloughs; lakes, ponds	depth in streams <10 cm, depth in lakes to 20 m	cobble, gravel	NA	migration timing for different regional stock groups varies; earlier in the north, later in the south

A.2.6 Habitat Description for Chinook Salmon (*Oncorhynchus tshawytscha)*

Life History and General Distribution

Chinook salmon, also called king, spring, or tyee salmon, are the least abundant and largest of the Pacific salmon. They are distinguished from other species of Pacific salmon by their large size, the small black spots on both lobes of the caudal fin, black pigment at the base of the teeth, and a large number of pyloric caeca. The natural freshwater range of the species includes large portions of the Pacific rim of North America and Asia. In North America, Chinook salmon historically ranged from the Ventura River in California (lat. ~34°) to Kotzebue Sound in Alaska (~66° N); in addition, the species has been identified in North America in the Mackenzie River, which drains into the Arctic Ocean. In Asia, natural populations of Chinook salmon have been documented from Hokkaido Island, Japan (~42° N) to the Andyr River in Russia (~64° N). Within this range, the largest rivers tend to support the largest aggregate runs of Chinook salmon and have the largest individual spawning populations. Major rivers near the southern and northern extremes of the range support populations of Chinook salmon comparable to those near the middle of the range. For example, in North America, the Yukon River near the north edge of the range and the Sacramento-San Joaquin River system near the south edge of the range have historically supported Chinook salmon runs comparable to those of the Columbia River and the Fraser River, which are near the center of the species range along this Pacific coast.

In marine environments, Chinook salmon range widely throughout the North Pacific Ocean and the BS, from lat. 38°. The southern edge of the marine distribution expands and contracts seasonally and between years depending on ocean temperature patterns. While the marine distribution of Chinook salmon can be highly variable even within a population, there are general migration and ocean distribution patterns characteristic of populations in specific geographic areas. For example, Chinook salmon that spawn in rivers from the Rogue River in Oregon south to California disperse and rear in oceanic waters off the Oregon and California Coast, whereas those that spawn north of the Rogue River to southeast Alaska migrate north and westward along the Pacific coast. These migration patterns are of particular interest for the management of Chinook salmon in the EEZ off Alaska, as they result in the harvest of fish from Oregon, Washington, British Columbia, and Alaska within the management zone.

Pacific salmon have a generalized life history that includes the incubation and hatching of embryos and emergence and initial rearing of juveniles in freshwater; migration to oceanic habitats for extended periods of feeding and growth; and return to natal waters for completion of maturation, spawning, and death. Within this general life history strategy, Chinook salmon display diverse and complex life history patterns and tactics. Their spawning environments range from just above tidewater to over 3,200 km from the ocean, from coastal rainforest streams to arid mountain tributaries at elevations over 1,500 m. At least 16 age categories of mature Chinook salmon have been documented, involving three possible freshwater ages and total ages of 2 to 8 years, reflecting the high variability within and among populations in length of freshwater, estuarine, and oceanic residency. Chinook salmon also demonstrate variable ocean migration patterns and timing of spawning migrations.

This variation in life history strategy has been explained by separating Chinook salmon into two races: stream- and ocean-type fish. Stream-type fish have long freshwater residence as juveniles (1 to 2 years), migrate rapidly to oceanic habitats, enter freshwater as immature or “bright” fish, and spawn far upriver in late summer or early fall. Ocean-type fish have short, highly variable freshwater residency (from a few days to 1 year), extensive estuarine residency, enter fresh-water at a more advanced state of maturity, and spawn within a few weeks of freshwater entry in the lower portions of the watershed. Within these two types, there is also substantial variability due to a combination of phenotypic plasticity and genetic selection to local conditions. For example, adult run-timing is strongly influenced by in-river flow volumes and temperature levels.

Chinook salmon have distinctly different feeding habits and distribution and in ocean habitats than do other species of Pacific salmon. Chinook salmon are the most piscivorous of the Pacific salmon, and are also distributed deeper in the water column. While other species of salmon generally are surface oriented, utilizing primarily the upper 20 m, Chinook salmon tend to be at greater depths and are often associated with bottom topography. Because of their distribution in the water column, the majority of Chinook salmon harvested in commercial troll fisheries are caught at depths of 30 m or greater, and Chinook salmon is the most common salmon species taken as bycatch in mid-water and bottom trawl fisheries.

Declines in the abundance of Chinook salmon have been well documented throughout the southern portion of the range. Concern over coast-wide declines from southeast Alaska to the Pacific Northwest was a major factor leading to the signing of the Pacific Salmon Treaty between the United States and Canada in 1985. Wild Chinook salmon populations have been extirpated from large portions of their historic range in a number of watersheds in California, Oregon, Washington, Idaho, and southern British Columbia, and a number of evolutionarily significant units (ESUs) have been listed by National Marine Fisheries Service as at risk of extinction under the Endangered Species Act (ESA). Habitat degradation is the major cause for extinction of populations; most are related to dam construction. Urbanization, agricultural land use and water diversion, and logging are also factors contributing to habitat degradation and the decline of Chinook salmon. The development of large-scale hatchery programs, have, to some degree, mitigated the decline in abundance of Chinook in some areas. However, genetic and ecological interactions of hatchery and wild fish have also been identified as risk factors for wild populations, and the high harvest rates directed at hatchery fish may cause over-exploitation of co-mingled wild populations.

The approximate upper size limit of juvenile fish is 71 cm total length. This is the regulatory minimum harvest size used in the Alaska hook-and-line fisheries in order to minimize catches of immature fish. However, because Chinook salmon can mature at ages of 2 to 8 total years, the term “juvenile” is better defined by physiological progress of maturation rather than a threshold size.

Fisheries

Because of their large size and excellent taste, Chinook salmon are highly prized by commercial, sport, and subsistence fishers. In Alaska, approximately 1 million Chinook salmon are harvested annually. While this is less than 1 percent of the annual salmon catch in the state, Chinook salmon typically are the focus of a disproportionately larger amount of management and regulatory effort because of the conservation concerns and intense allocation issues for this species.

In most of the state, there is no directed harvest of Chinook salmon in the EEZ. Most fishing effort takes place in the coastal or riverine waters of the state. The FMP for salmon in the Alaska EEZ prohibits commercial harvest in the EEZ, with a few exceptions. The most notable exception is the commercial troll harvest off of southeast Alaska. While much of this fishery is also in state waters, it has been traditionally managed since Alaska statehood (1959) with little recognition of the boundary separating state and federal waters. Chinook and coho salmon are the primary target species of this hook-and-line fishery.

The commercial troll fishery for Chinook salmon in southeast Alaska developed in the early 1900s. The fishery occurred all year with no overall catch limits. Peak harvests of Chinook were in the 1930s, when annual catch averaged over 600,000. Concurrent with the development of the Columbia River hydroelectric dams, catches declined to average 250,000 to 350,000 Chinook annually. Beginning in 1978, ADF&G and the Council set harvest limits for the fishery in the first FMP for salmon in Alaska. These limits were initially a harvest range of 286,000 to 320,000 Chinook salmon for the southeast Alaska troll fishery. The FMP also banned commercial salmon fishing in the EEZ west of long. 175° E, banned fishing for salmon with nets throughout the EEZ (with a few specific exceptions), and imposed time closures on commercial trolling in the EEZ east of long. 175°.

These harvest ranges became part of a 15-year stock rebuilding program begun in 1981 for stocks that spawn in southeast Alaska and in transboundary rivers that originate in Canada and flow through southeast Alaska. In 1985, the Pacific Salmon Treaty between the United States and Canada included specific provisions for rebuilding Chinook salmon stocks coast-wide. The Chinook Annex to the treaty established specific total catch limits for Chinook in southeast Alaska and in certain fisheries in British Columbia in 1985 and 1986; subsequently, the catch limits were to be negotiated annually. The catch ceiling in southeast Alaska was originally established at 263,000 “treaty fish,” with a provision for additional harvest of fish produced by new enhancement operations in the region. The catch ceiling included an allocation for incidental catch of Chinook salmon in net fisheries directed at other salmon species, as well as the commercial and recreational troll harvests. It resulted in a reduction of approximately 100,000 Chinook in the commercial troll fishery relative to its average catches over the prior two decades.

In 1990, the Council revised the salmon FMP to reduce redundant regulation of the salmon fisheries in the EEZ with ADF&G and the Pacific Salmon Commission (PSC). While recognizing that the salmon fisheries require Federal participation and oversight stipulated in the Magnuson Act, the Council deferred setting harvest levels to ADF&G and the PSC, and regulation of the sport and commercial fishery to ADF&G providing the harvest levels and allocations are consistent with Council goals and objectives stated in the FMP and the National Standards of the Magnuson-Stevens Act. To date, the Council has not exercised its option of specifying management measures in the EEZ that differ from state regulation.

Management and catch limits in the southeast Alaska Chinook salmon fishery have continued to be a contentious issue. While Chinook salmon spawning in southeast Alaska and the transboundary rivers have been generally stable or increasing in abundance since the establishment of the PSC management regime, abundance of many wild populations of Chinook salmon in British Columbia and the Pacific Northwest have not recovered or have continued to decline. Fixed harvest levels were formulated to result in decreasing exploitation rates of Chinook salmon in mixed-stock fisheries: as wild stocks rebuilt and enhancement activities increased, general abundance of Chinook salmon in the mixed-stock fisheries, in concert with catch ceilings, would result in a lower proportion harvested by these fisheries. In the first few years after the Treaty, this concept seemed reasonable, but poor survivals due to ocean conditions in the early 1990s resulted in declining abundances in the ocean fisheries, so that fixed harvest levels result in increasing exploitation. Due to this and other allocation and conservation concerns, there has been no agreement on catch ceilings within the PSC since 1993. In 1995, ADF&G proposed a management regime based on the estimated abundance of Chinook salmon. ADF&G implemented this abundance-based management approach in 1995, but tribal groups and the state management agencies in the Pacific Northwest sued successfully for the closure of the fishery in August of 1995. In 1996, the fishery reopened with a management ceiling agreed to by the United States Commissioners (which represent both Alaska and Pacific Northwest interests) to the PSC. In 1997, the United States Commissioners agreed to apply an abundance-based management approach using a modified version of the original ADF&G proposal. The agreement calls for setting preseason catch targets based on the forecasts made by the Chinook Technical Committee (CTC) of the PSC, then refining these preseason forecasts using catch per unit effort data from the summer troll fishery. This agreement has been implemented by ADF&G in 1997, but has not been agreed to by Canada in the PSC process.

Because fish from Chinook salmon ESUs that have been listed as threatened or endangered occur in the southeast Alaska troll fishery, NMFS reviews the fishery under Section 7 of the ESA and, in association with the Biological Opinion, issues an incidental take statement that covers the ESA listed fish that are inadvertently and unknowingly taken in the fishery. The biological assessment has found that the take of listed ESUs in the fishery has been incidental to other stocks and a small percentage of the total mortality, either on a single year or cohort basis. To date, NMFS has found that this fishery is not likely to jeopardize the continued existence or recovery of ESA-listed species.

Chinook salmon fisheries in Alaska have some bycatch associated with them. Generally, the numbers of other species taken during directed Chinook fishing is small and not considered a conservation issue. The most important bycatch issue in the commercial and recreational hook-and-line fisheries is the capture of undersized Chinook salmon that must be released. While the majority of these fish survive the hooking encounter, large numbers can be hooked and substantial mortality incurred. The Pacific Salmon Treaty requires accounting for the degree of such bycatch mortality, and the CTC uses this information in modeling the status and abundance of component stocks.

Directed fisheries of Chinook salmon in Alaska include marine commercial and recreational hook-and-line fisheries; marine commercial gill-net and seine fisheries; and estuarine and riverine gill-net (both set-net and drift), recreational, personal use, and subsistence fisheries. Two types of impacts can occur: (1) direct effects of the gear to habitat and (2) bycatch or entanglement of non-target species. In the marine fisheries, direct impact of the gear to marine habitats is limited, but some localized effects can occur, such as trolling weights damaging coral or purse seines damaging kelp beds or benthic structure. Because these types of impacts also endanger the gear itself, they are typically self-limiting. Bycatch and entanglement of non-target species can occur in the marine fisheries, such as bycatch of demersal rockfish in hook-and-line fisheries, and entanglement of seabirds and marine mammals in net fisheries. In the estuarine and riverine fisheries, direct impact to riparian vegetation and channel morphology can occur from the shore-based fishing gears, such as set-nets and recreational fishing. Where use levels are high, this type of impact can be sufficient to require restoration management initiatives. An example is the Kenai River restoration work needed to repair damage from recreational fishing for Chinook salmon and other salmonids.

Relevant Trophic Information

Chinook salmon eggs, alevins, and juveniles in freshwater streams provide an important nutrient input and food source for aquatic invertebrates, other fishes, birds, and small mammals. The carcasses of Chinook adults can also be an important nutrient input in their natal watersheds, as well as providing food sources for terrestrial mammals such as bears, otters, and minks, and birds such as gulls, eagles, and ravens. Because of their relatively low abundance in coastal and oceanic waters, Chinook salmon in the marine environment are typically only an incidental food item in the diet of other fishes, marine mammals, and coastal sea birds.

Habitat and Biological Associations

Chinook salmon occur over abroad geographic range, encompassing different ecotypes and very diverse habitats. Across the geographic range that the species has colonized, populations of Chinook salmon have developed localized adaptations to site specific characteristics. These local adaptations result in different and diverse characteristics of biological importance, including timing of spawning, adult and juvenile migration timing, age and size at maturity, duration of freshwater residency, and ocean distribution. Chinook salmon have been studied and managed intensively for decades. There is a large body of literature describing their biology and ecology. For freshwater habitats, however, habitat-specific information for Chinook salmon in particular watersheds is sparse, especially in the northern portion of the range, and for estuarine and marine habitats, there is little data beyond presence/absence or density information. The range in the amount of habitat specific information by life-history stage is reflected in the information levels assigned the different life-history stages. EFH is defined for this species on the basis of watershed-specific information available about the species' distribution, and its known range of marine distribution within the EEZ.

Eggs/Spawning: Chinook salmon spawn in a broad range of habitats. They have been known to spawn in water ranging from a few centimeters deep to several meters deep, and in channel widths ranging from small tributaries 2 to 3 m wide to the main stems of large rivers such as the Columbia and Sacramento. Typically, redd (nest) size is 5 to 15 m^2, and water velocities are 40 to 60 cm/sec. The depth of the redd is inversely related to water velocity; generally the female buries her eggs in clean gravel, 20 to 36 cm deep. Because of their large size, Chinook salmon are able to spawn in higher water velocities and utilize coarser substrates than other salmon species. In general, female Chinook salmon select sections of the spawning stream with high subgravel flow. Because their eggs are the largest of the Pacific salmon, with a correspondingly small surface-volume ratio, they may be more sensitive to reduced oxygen levels and require a higher rate of irrigation. Fertilization of the eggs occurs simultaneous with deposition. Males compete for the right to breed with a spawning females. Chinook females remain on their redds 6 to 25 days after spawning, defending the area from superimposition of eggs from another female.

Larvae/Alevins: Fertilized eggs begin their 5- to 8-month period of embryonic development and growth in intragravel interstices. To survive successfully, the eggs, alevins and pre-emergent fry must first be protected from freezing, desiccation, stream bed scouring or shifting, mechanical injury, and predators. Water surrounding them must be non-toxic and of sufficient quality and quantity to provide basic requirements of suitable temperatures, adequate supply of oxygen, and removal of waste materials. Rates of egg development, survival, size of hatched alevins and percentage of deformed fry are related to temperature and oxygen levels during incubation. Generally, low oxygen levels are non-lethal early, but lethal late in development. Under natural conditions, 30 percent or less of the eggs survive to emerge from the gravel as fry.

Juveniles: Chinook salmon are typically 33 to 36 mm in length when they emerge from the incubation gravel. Residency in freshwater and size and timing of seawater migration are highly variable. Ocean-type fish can migrate seaward immediately after yolk absorption. The majority of ocean-type fish migrate at 30 to 90 days after emergence, but some fish move seaward as fingerlings in the late summer of their first year, while others overwinter and migrate as yearling fish. Stream-type fish, in contrast, generally spend at least 1 year in freshwater, migrating as 1- or 2-year-old fish. In Alaska, the stream-type life history predominates although ocean-type life histories have been documented in a few Alaska watersheds. Water and habitat quality and quantity determine the productivity of a watershed for Chinook salmon. Both stream- and ocean-type fish utilize a wide variety of habitats during their freshwater residency, and are dependent on the quality of the entire watershed, from headwater to salt water. The stream/river ecosystem must provide adequate rearing habitat, and migration corridors from spawning and rearing areas to the sea. Stream-type juveniles are more dependent on freshwater ecosystems because of their extended residence in these areas. The principal foods in freshwater are larval and adult insects. The seaward migration of smolts is timed so that the smolts arrive in the estuary when food is plentiful. Migration and rearing habitats overlap. Stream flows during the migratory period tend to be high, which facilitates seaward movement and provides some sheltering from predation.

After entering saltwater, Chinook juveniles disperse to oceanic feeding areas. Ocean-type fish have more extended estuarine residency, tend to be more coastal oriented, and do not generally migrate as far as stream-type fish. Food in estuarine areas include epibenthic organisms, insects, and zooplankton.

Adults: Chinook salmon typically remain at sea for 1 to 6 years. They have been found in oceanic waters at temperatures ranging from 1 to 15°C. They do not concentrate at the surface as do other Pacific salmon, but are most abundant at depths of 30 to 70 m. Fish make up the largest component of their diet at sea, although squid, pelagic amphipods, copepods, and euphausiids are also important at times.

Ocean distribution patterns have been shown to be influenced by both genetics and environmental factors. Migratory patterns in the ocean may have evolved as a balance between the benefits of accessing specific feeding grounds and the energy expenditure and dispersion risks necessary to reach them. Along the eastern Pacific rim, Chinook salmon originating north of Cape Blanco on the Oregon coast tend to migrate north towards and into the GOA, while those originating south of Cape Blanco migrate south and west into waters off Oregon and California. As a result, Chinook salmon that occur in the EEZ fishery in Alaska originate from the Oregon coast to southeast Alaska. Not all stocks within this large geographic area are distributed into the southeast Alaska fishery, however. For example, Puget Sound stocks do not normally migrate that far north.

Habitat Concerns

Habitat loss and alteration have reduced, and in some cases, extirpated Chinook salmon over a large portion of their range. Losses of Chinook habitat have occurred as a result of other resource development, such as hydroelectric power and logging, agriculture, and urbanization. Most habitat loss has occurred in freshwater ecosystems that support Chinook salmon development; estuarine rearing areas have also been affected in some areas by industrial development, urbanization, and dredging. The oceanic environment of Chinook salmon is considered largely unchanged by anthropogenic activities, although offshore petroleum production and local, transitory pollution events such as oil spills do pose some degree of risk.

Offshore petroleum production and large-scale transport of petroleum occurs in the Alaska EEZ, although at this time there is no offshore production of petroleum in the commercial troll area of the EEZ. Offshore oil and gas development and transport will inevitably result in some oil entering the environment at levels exceeding background amounts. The *Exxon Valdez* oil spill was shown to have direct effects on the survival and habitats of pink salmon. Chinook salmon were not directly affected, because of their different habitat utilization in the spill area. In general, the early life history stages of fish are more susceptible to oil pollution than juveniles or adults.

By far, the most serious habitat concern for Chinook salmon is the degradation of the freshwater watersheds that support those stages of their life history. Dams and impoundments for hydroelectric power and water diversion have caused large-scale extirpation of Chinook salmon in the Pacific Northwest by eliminating access to anadromous fish, and have altered the spawning, rearing, and migration corridors of Chinook salmon in many watersheds. There are presently no dams in place or in planning that would block rivers used by Chinook salmon in Alaska. However, because many Chinook salmon harvested under the FMP for Alaska originate in the Pacific Northwest, these types of habitat impacts in other regions directly affect the Alaska fishery.

Logging and associated road construction has resulted in degraded habitat by causing increased erosion and sedimentation, changes in temperature regimes, and changes in seasonal flow patterns. Timber harvest has been a major resource use in southeast Alaska, and it is increasing in southcentral Alaska. Timber harvest in the Pacific Northwest and British Columbia also impacts the Alaska fishery because of the presence of stocks from these regions in the Alaska EEZ.

Placer mining has caused serious degradation of Chinook habitats in some river systems, especially in Yukon River drainages. While these impacts are of concern, most of the stocks directly affected do not migrate into the Chinook fishery managed under the FMP.

Urbanization and coastal development can have pronounced effects on coastal ecosystems, particularly estuaries, through modification of the hydrography, biology, and chemistry in the developed area. Increased nutrient input, filling of productive wetlands, and influx of contaminants commonly occur with coastal development. These impacts can reduce or eliminate rearing potential for juvenile Chinook salmon. Increased levels of coastal development in Alaska as well as in the Pacific Northwest and British Columbia can be expected.

There is a definite south-north cline to the degree of habitat degradation and the status of Chinook populations in the eastern Pacific. Habitat degradation in Alaska is certainly a management concern, but to date has not had the degree of impacts on Chinook populations as in the Pacific Northwest. In southeast Alaska, logging is considered the largest potential threat to anadromous fish habitat. Relatively little logging has occurred, however, in watersheds supporting Chinook salmon in the region. However, because of the stock composition of the fish harvested in the EEZ of southeast Alaska, freshwater ecosystems in the

Pacific Northwest represent essential fish habitat for sustaining the diversity and abundance of Chinook salmon in the Alaska EEZ.

Table 7 Habitat and biological associations of Chinook salmon, *Oncorhynchus tshawytscha*

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic/ Riverine Features	Other
Eggs and larvae (alevins)	50 to 250 days	NA	late summer, fall, winter, early spring	streambeds	intragravel 20 to 80 cm deep	gravel	Riverbed	**DO**< 3 mg/l lethal, optimum >7 **Temp** 0-17 C, Optimum 4-12 C
Juveniles (freshwater)	days to years	insect larvae and adults, zooplankton	year-round, depending on race	streams, sloughs, rivers	surface to several meters	varied	Pools, stream and river margins, woody debris	Extremely varied freshwater life history. **DO**< 2 mg/l lethal, optimum >7 **Temp** 0-22 C, Optimum 8-12 C
Juveniles (Estuary)	Days to 6 months	copepods, euphausiids, amphipods, juvenile fish	spring, summer, fall	Beach (intertidal); nearshore bays	neustonic, pelagic	All bottom types	estuarine, littoral	Sea-type can be estuarine dependent **Temp** 2-22 C, Optimum 8-12 C **Salinity** 0-33 ppt
Juvenile (marine)	6 to 9 months: Up to first marine annulus	epipelagic fish, euphasiids, large copepods, pelagic amphipods	spring-winter	Island passés; inner/ middle/ outer continental shelf; upper slope; basin	pelagic	All bottom types	Upwelling, front, gyre, thermo- or pycnoclin e, edges	Initially surface oriented; some stocks move rapidly offshore, some remain nearshore. **Temp:** 1-15 C, Optimum 5-12 C
Immature and Maturing Adults (marine)	2 to 8 years of age	epipelagic fish (herring, sand lance, smelt, anchovy), shrimp, squid	Year Round	nearshore bays, island passés; inner/ middle/ outer continental shelf; upper slope; basin	neustonic, pelagic	All bottom types	Upwelling, front, gyre, thermo- or pycnoclin e, edges	Not surface oriented until maturing. Use salinity gradients, olfaction for terminal homing. **Temp:** 5-22 C
Adults (freshwater)	2 weeks to 4 months	little or none	Spawning: (July-Feb) Freshwater Migration: Year round, varies greatly among populations	Rivers, large streams and tributaries	0.5-10 m	Alluvial bottom types; gravel for spawning	Deep pools for resting, Riffles, pool-riffle transition for spawning	Entry timing to freshwater highly variable. **Temp:** 1-26 C, Optimum 4-15 C

A.2.7 Habitat Description for Coho Salmon (*Oncorhynchus kisutch*)

General Distribution and Life History

Coho salmon are widely distributed in cool areas of the North Pacific Ocean and most adjoining fresh and estuarine waters. Coho use more diverse habitats than other anadromous salmonids. They spawn in most accessible freshwater streams throughout their range, rear for at least 1 year in fresh or estuarine waters, and spend about 18 months at sea before reaching maturity. In North America, coho range along the Pacific coast from Monterey Bay, California, to Point Hope, Alaska, through the Aleutians (Figure 1). The species is most abundant in coastal areas from central Oregon north through southeast Alaska. In the southern part of their range, coho stocks are generally depressed from historical levels, and hatcheries are often used to supplement wild runs. The Central California Coast ESU and the Southern Oregon/ Northern California Coast ESU are listed as threatened species under the Endangered Species Act. Coho are cultured for market in several countries; attempts to establish self-sustaining coho runs in other areas of the world have had limited success.

In the NMFS Alaska Region, most coho are wild fish with a distribution north to Point Hope on the eastern Chukchi Sea, west and south to the limits of United States territorial waters, and east to the Canadian border as far north as the Yukon River drainage. Coho catch in the Alaska Region is at historically high levels, and trends in abundance of most stocks are rated as stable.

The approximate upper size limit of juvenile fish is 35 cm.

Fishery

Important commercial, sport, and subsistence fisheries for coho occur from the Soviet Far East through the BS and along the west coast of North America as far south as central California. Trolling, gill nets, and purse seines are the primary commercial gear types. Gill nets, dip nets, rod and reel, traps, fish wheels, long lines, and snagging gear are used to harvest coho for subsistence and personal use. Subsistence fisheries are often cultural or traditional and take precedence over other fisheries. Personal use fisheries require a sport fishing license or exemption. Both subsistence and personal use fisheries are restricted to designated locations and specified bag limits. Sport catches of coho are taken by hook and line and snagging.

Most coho from the Alaska Region recruit to fisheries after 1 to 2 years in fresh water and about 16 months at sea. Fisheries in the Alaska Region primarily target adult coho and take place in coastal marine migration corridors, near the mouths of rivers and streams, and in freshwater migration areas. Those fisheries coincide with migrations toward spawning areas from July through October. A few areas are stocked annually with juvenile coho to provide put-and-take sport fishing.

Bycatch depends on gear type, but is usually limited to other salmon species. Chinook salmon bycatch is limited by regulation or treaty in most coho fisheries, but other salmon species are often targeted as part of the fishery. Species such as steelhead, Dolly Varden, pollock, Pacific cod, halibut, salmon sharks, and coastal rockfish make up a small part of the catch.

Directed fisheries on coho salmon in Alaska include marine commercial and recreational hook-and-line fisheries; marine commercial gill-net and seine fisheries; and estuarine and riverine gill-net (both set-net and drift), recreational, personal use, and subsistence fisheries. Two types of impacts can occur: (1) direct effects of the fishing gear on habitat and (2) bycatch or entanglement of non-target species. In the marine fisheries, direct impact of the gear on marine habitats is limited, but some localized effects can occur, such as trolling weights damaging coral or purse seines damaging kelp beds or benthic structure. Bycatch and entanglement of non-target species can occur in the marine fisheries, such as bycatch of demersal rockfish in hook-and-line fisheries, and entanglement of seabirds and marine mammals in net fisheries. In the estuarine and riverine fisheries, direct impacts on riparian vegetation and channel morphology can occur from fishing activities, such as damage to the stream bank from boat wakes and removal of woody debris to provide access. Trampling of stream banks and the stream channel can also damage coho habitat. Where use levels are high, this type of impact may require restoration or management initiatives. An example is the Kenai River where restoration work was needed to repair damage from recreational fishing for Chinook salmon and other salmonids.

Relevant Trophic Information

Adult coho provide important food for bald eagles, terrestrial mammals (e.g., brown bear, black bear, and river otter), marine mammals (e.g., Steller sea lion, harbor seal, beluga, and orca), and salmon sharks. Adults also transfer essential nutrients from marine to freshwater environments. Juveniles are eaten by a variety of birds (e.g., gulls, terns, kingfishers, cormorants, mergansers, herons), fish (e.g., Dolly Varden, steelhead, cutthroat trout, and arctic char), and mammals (e.g., mink and water shrew). Juvenile coho are also significant predators of pink salmon fry during their seaward migration.

Habitat and Biological Associations

Juvenile and adult coho are highly migratory and depend on suitable habitat in their migration routes. Unobstructed passage and suitable water depth, water velocity, water quality, and cover are important elements in all migration habitat. Soon after emergence in spring, fry may move around considerably seeking optimal, unoccupied habitat for rearing. In fall, juveniles may migrate from summer rearing areas to areas with winter habitat. Such juvenile migrations may be extensive within the natal stream basin or between basins through salt water or connecting estuaries. Seaward migration of coho smolts occurs usually after 1-2 years in fresh water. The migration is timed primarily by photoperiod and occurs in spring, usually coincident with a spring freshet. During this transition, coho undergo major physiological changes to enable them to osmoregulate in salt water and are at that time, especially sensitive to environmental stress. At sea, juvenile Alaska coho generally migrate north and offshore into the North Pacific Ocean and BS. After 12 to 14 months at sea, they migrate to coastal areas and then along the coast to their natal streams.

Egg/Larvae: Fertilized eggs and larvae require incubation in porous substrate that allows constant circulation of cool, high-quality water that provides oxygen and removes waste. Interstitial space in the substrate must be great enough to allow growth and movement through the gravel to accommodate emergence. Sand or silt in the substrate can limit intragravel flow and trap emerging fry. As the yolk sac is absorbed, the larvae become photopositive and move through the substrate into the water column. Fry emerge between March and July, depending on when the eggs were fertilized and water temperature during development.

Juveniles (Fresh Water): In Alaska, juvenile coho usually spend 1-2 years in fresh or estuarine waters before migrating to sea, although they may spend up to 5 years where growth is slow. Coho need to attain a length of about 85 mm to become smolts. Coho smolt production is most often limited by the productivity of freshwater and estuarine habitats used for juvenile rearing. Survival from eggs to smolts is usually less than 2 percent. If spawning escapement is adequate, sufficient fry are usually produced to exceed the carrying capacity of rearing habitat. In this case, carrying capacity of summer habitat sets a density-dependent limit on the juvenile population. This summer population is then reduced by density-independent mortality over winter depending on the severity of winter conditions, fish size, and quality of winter habitat.

Coastal streams, lakes, estuaries, and tributaries to large rivers can all provide coho rearing habitat. The most productive habitats are in smaller streams less than fourth order having low-gradient alluvial channels with abundant pools often formed by large woody debris or fluvial processes. Beaver ponds can provide some of the best summer rearing areas for juvenile coho. Coho juveniles also may use brackish-water estuarine areas in summer and migrate upstream to fresh water to overwinter.

During the summer rearing stage, fish density tends to be highest in areas with abundant food (drifting aquatic invertebrates and terrestrial insects that fall into the water) and structural habitat elements (e.g., large woody debris and associated pools). Preferred habitats include a mixture of different types of pools, glides, and riffles with large woody debris, undercut banks, and overhanging vegetation, which provide advantageous positions for feeding. Coho grow best where water temperature is between 10 and 15°C, and dissolved oxygen (DO) is near saturation. Juvenile coho can tolerate temperatures between 0° and 26°C if changes are not abrupt. Their growth and stamina decline significantly when DO levels drop below 4 mg/l, and a sustained concentration less that 2 mg/l is lethal. Summer populations are usually constrained by density-dependent effects mediated through territorial behavior. In flowing water, juvenile coho usually establish individual feeding territories, whereas in lakes, large pools, and estuaries they are less likely to establish territories and may aggregate where food is abundant. Growth in summer is often density-dependent, and the size of juveniles in late summer is often inversely related to population density.

In winter, food is less important and territorial behavior fades. Juveniles aggregate in freshwater habitats that provide cover with relatively stable temperature, depth, velocity, and water quality. Winter mortality factors include hazardous conditions during winter peak stream flow, stranding of fish by ice damming, physiological stress from low temperature, and progressive starvation. In winter, juveniles prefer a narrower range of habitats than in summer, especially large mainstream pools, backwaters, and secondary channel pools with abundant large woody debris, and undercut banks and debris along riffle margins. Survival in winter, in contrast to summer, is generally not density-dependent, and varies directly with fish size and amount of cover and ponded water, and inversely with the magnitude of the peak stream flow.

The seaward migration of smolts in native stocks is typically in May and June, and is presumably timed so that the smolts arrive in the estuary when food is plentiful. Habitat requirements during seaward migration are similar to those of rearing juveniles, except that smolts tend to be more fragile and more susceptible to predation. High streamflow aids their migration by assisting them downstream and reducing their vulnerability to predators. Turbidity from melting glaciers may also provide cover from predators. Migration cover is also provided by woody debris and submerged riparian vegetation. Migrating smolts are particularly vulnerable to predation because they are concentrated and moving through areas of reduced cover where predators congregate. Mortality during seaward migration can exceed 50 percent.

Juveniles (Estuarine): Juvenile coho primarily use estuarine habitat during their first summer and also as they are leaving fresh water during their seaward migration. Intertidal sections of freshwater streams (i.e., stream-estuary ecotones) can be important rearing habitat for age 0 coho from May to October. These areas may account for one-quarter of the juvenile production in small streams. Growth in these areas is particularly rapid because of abundant invertebrate food. Habitats used include glides and pools during low tide, and coho occupy the freshwater lens during high tide. In fall, juvenile coho move upstream to fresh water to overwinter.

During seaward migration, coho smolts may be present in the estuary from May to August. Rapid growth during the early period in the estuary is critical to survival because of high size-dependent mortality from predation.

Juveniles (Marine): After leaving fresh water, coho in the Alaska Region spend up to 4 months in coastal waters before migrating offshore and dispersing throughout the North Pacific Ocean and BS. Southeast Alaska juvenile coho are ubiquitous in inside waters from June to August at depths up to 50 m, and move offshore by September. Offshore, juvenile salmon are concentrated over the continental shelf within 37 km of shore where the shelf is narrow, but may extend to at least 74 km from shore in some areas. Stock-specific aggregations have not been noted at this stage. Marine invertebrates are the primary food when coho first enter salt water, and fish prey increase in importance as the coho grow.

Immature and Maturing Adults (Marine): Most coho occupy epipelagic areas in the central GOA and BS during the 12 to 14 months after leaving coastal areas. Some coho also use coastal and inshore waters at this life stage, but those are likely to be smaller at maturity. The spatial distribution of suitable habitat conditions is affected by annual and seasonal changes in oceanographic conditions; however, coho generally use offshore areas of the North Pacific Ocean and the BS from lat. 40 to 60° N (Figure 2). The distribution of ocean harvest is generally more northerly than that for stocks from other regions (Figure 3).

Growth is the objective at this stage of the coho life cycle, and bioenergetics are controlled mainly by food quantity, food quality, and temperature. Food for salmon is most abundant above the halocline, which may range from 100 to 200 m in depth in the North Pacific. The bioenergetics of growth is best in epipelagic offshore habitat where forage is abundant and sea surface temperature is between 12 and 15°C. Coho rarely use areas where sea surface temperature exceeds 15°C.

Most coho remain at sea for about 16 months before returning to coastal areas and entering fresh water to spawn, although some precocious males will return to spawn after about 6 months at sea. Before entering fresh water to spawn, most coho slow their feeding and begin to lose weight as they develop secondary sex characteristics. Survival from smolt to adult averages about 10 percent.

Adults (Freshwater): Adult coho enter fresh water from early July through December and spawn from September through January. Fidelity to natal streams is high and straying rates are generally less than 5 percent. The fish feed little and migrate upstream using olfactory cues that were imprinted in early development.

Adult coho may travel for a short time and distance upstream to spawn in small streams or may enter large river systems and travel for weeks to reach spawning areas more than 2,000 km upstream. Upstream migrations are blocked where fall heights exceed 3.3 m or falls more than 1.2 m high have jumping pools less than 1.25 times the falls height. Blockages also occur where stream gradient exceeds 12 percent for more than 70 m, or 16 percent for more than 30 m, or 20 percent for more than 15 m, or 24 percent for more than 8 m.

Spawning sites selected for use have relatively silt-free gravels ranging from 2 mm to 10 cm in diameter, well-oxygenated intragravel flow, and nearby cover. In Alaska streams, between 2,500 and 4,000 eggs are deposited among several nests by each female coho. Several males may attend each female, but larger males usually dominate by driving off smaller males. Soon after spawning, adult coho die in or near the spawning areas.

Table 8 Habitat and biological associations of coho salmon (*Oncorhynchus kisutch*)

Stage -EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceanographic/ Riverine Features	Other
Eggs/ Larvae	150 days at optimum temperature	NA	Fall/ winter	Water courses, rivers, streams, sloughs; lakes, ponds	Intragravel	gravel	Streambed	DO < 2 mg/l lethal, optimum >8 mg/l; Temperature 0-17°C; optimum 4.4-13.3°C; substrate 2-10 cm with <15 percent fines (<3.3 mm), optimum <5 percent fines
Juveniles, Freshwater (fry to smolt)	1 to 5 years, most (>90 percent) 1 to 2 years	invertebrates and fish	Entire year	Water courses, rivers, streams, sloughs; lakes, ponds	Entire column	N/A	Pools, woody debris, currents for migration	DO lethal at <3 mg/l, optimum at saturation; Temperature 0-26°C; optimum 12-14°C.
Juveniles, Estuarine	1 to 6 months	Invertebrates and fish	Rearing - summer, Migration - spring	estuarine	Mid-water and surface, pelagic; neustonic	N/A	Pools, glides, etc.	
Juveniles, Marine	up to 4 months	fish and invertebrates	June - Sep	Beach (intertidal), inner/ middle continental shelf; nearshore bays; island passes	pelagic; neustonic	N/A	Upwelling, thermo- or pycnocline	Temperature <15°C; Depth <10 m
Immature/ Maturing Adults, Marine	12 to 14 months	Fish (e.g., herring, sand lance)		Beach (intertidal), inner/ middle continental shelf; upper and lower slope; basin; nearshore bays; island passes	pelagic; neustonic	N/A	upwelling	Temperature range 1-26°C; optimum 12-14°C
Adults, Freshwater	up to 2 months	little or none	migration - fall; spawning - fall, winter	Water courses, rivers, streams, sloughs; lakes, ponds	Deep parts of streams and lakes	Alluvial bottom types	Deep pools, Pool-riffle transition	Temperature range 1-26°C; optimum 12-14°C

A.3 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Act as “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 is determined to be the general distribution of a species described by life stage. General distribution is a subset of a species’ total population distribution, and is identified as the distribution of 95 percent 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 guidance from the EFH Final Rule (67 FR 2343), including the EFH Level of Information definitions. Analytical tools are used and recent scientific information is incorporated for each life history stage from 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’ 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, regime shifts, and the seasonality of migrating salmon stocks.

A.3.1 Description of Essential Fish Habitat

EFH descriptions are based on the best available scientific information. 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 Table 7. A “1" indicates that general distribution data are available for some or all portions of the geographic range of the species.

Table 9 EFH Information Levels for Alaska Stocks of Pacific Salmon

Salmon Species	Freshwater Eggs	Freshwater Larvae and Juveniles	Estuarine Juveniles	Marine Juveniles	Marine Immature and Maturing Adults	Freshwater Adults
Pink	1	1	1	1	1	1
Chum	1	1	1	1	1	1
Sockeye	1	1	1	1	1	1
Chinook	1	1	1	1	1	1
Coho	1	1	1	1	1	1

A.3.1.1 Pink Salmon

Freshwater Eggs

EFH for pink salmon eggs is the general distribution area for this life stage, located in gravel substrates in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a), as depicted in Figure 4 through Figure 8.

Freshwater Larvae and Juveniles

EFH for larval and juvenile pink salmon is the general distribution area for this life stage, located in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and contiguous rearing areas within the boundaries of ordinary high water during the spring, generally migrate in darkness in the upper water column. Fry leave streams in within 15 days and the duration of migration from a stream towards sea may last 2 months, as depicted in Figure 3 through Figure 8.

Estuarine Juveniles

Estuarine EFH for juvenile pink salmon is the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters and generally present from late April through June, as depicted in Figure 3 through Figure 8.

Marine Juveniles

Marine EFH for juvenile pink salmon is the general distribution area for this life stage, located in all marine waters off the coast of Alaska from the mean higher tide line to the 200-nautical mile (nm) limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean, as depicted in Figure 9.

Marine Immature and Maturing Adults

EFH for immature and maturing adult pink salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska to depths of 200 m and range from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean. Mature adult pink salmon frequently spawn in intertidal areas and are know to associate with smaller coastal streams, as depicted in Figure 9.

Freshwater Adults

EFH for pink salmon is the general distribution area for this life stage, located in freshwaters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and wherever there are spawning substrates consisting of medium to course gravel containing less than 15 percent fine sediment (less than 2-mm diameter), 15 to 50 cm in depth from June through September, as depicted in Figure 3 through Figure 8.

A.3.1.2 Chum Salmon

Freshwater Eggs

EFH for chum salmon eggs is the general distribution area for this life stage, located in gravel substrates in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a), as depicted in Figure 10 through Figure 15.

Freshwater Larvae and Juveniles

EFH for larval and juvenile chum salmon is the general distribution area for this life stage, located in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and contiguous rearing areas within the boundaries of ordinary high water and contiguous rearing areas within the boundaries of ordinary high water during the spring, generally migrate in darkness in the upper water column. Fry leave streams in within 15 days and the duration of migration from a stream towards sea may last 2 months, as depicted in Figure 10 through Figure 15.

Estuarine Juveniles

Estuarine EFH for juvenile chum salmon is the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters from late April through June, as depicted in Figure 10 through Figure 15.

Marine Juveniles

Marine EFH for juvenile chum salmon is the general distribution area for this life stage, located in all marine waters off the coast of Alaska to approximately 50 m in depth from the mean higher tide line to the 200-nm limit of the EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean, as depicted in Figure 16.

Marine Immature and Maturing Adults

EFH for immature and maturing adult chum salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska to depths of 200 m and ranging from the mean higher tide line to the 200-nm limit of the EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean, as depicted in Figure 16.

Freshwater Adults

EFH for chum salmon is the general distribution area for this life stage, located in freshwaters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and wherever there are spawning substrates consisting of medium to course gravel containing less than 15 percent fine sediment (less than 2-mm diameter) and finer substrates can be used in upwelling areas of streams and sloughs from June through January, as depicted in Figure 10 through Figure 15.

A.3.1.3 Sockeye Salmon

Freshwater Eggs

EFH for sockeye salmon eggs is the general distribution area for this life stage, located in gravel substrates in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a), as depicted in Figure 17 through Figure 22.

Freshwater Larvae and Juveniles

EFH for larval and juvenile sockeye salmon is the general distribution area for this life stage, located in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and contiguous rearing areas within the boundaries of ordinary high water. Juvenile sockeye salmon require year-round rearing habitat. Fry generally migrate downstream to a lake or, in systems lacking a freshwater lake, to estuarine and riverine rearing areas for up to 2 years. Fry out migration occurs from approximately April to November and smolts generally migrate during the spring and summer, as depicted in Figure 17 through Figure 22.

Estuarine Juveniles

Estuarine EFH for juvenile sockeye salmon is the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters. Under-yearling, yearling, and older smolts occupy estuaries from March through early August, as depicted in Figure 17 through Figure 22.

Marine Juveniles

Marine EFH for juvenile sockeye salmon is the general distribution area for this life stage, located in all marine waters off the coast of Alaska to depths of 50 m and range from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean from mid-summer until December of their first year at sea, as depicted in Figure 23.

Marine Immature and Maturing Adults

EFH for immature and maturing adult sockeye salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska to depths of 200 m and range from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean, as depicted in Figure 23.

Freshwater Adults

EFH for sockeye salmon is the general distribution area for this life stage, located in freshwaters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and wherever there are spawning substrates consisting of medium to course gravel containing less than 15 percent fine sediment (less than 2-mm diam.) and finer substrates can be used in upwelling areas of streams and sloughs from June through September. Sockeye often spawn in lake substrates, as well as in streams, as depicted in Figure 17 through Figure 22.

A.3.1.4 Chinook Salmon

Freshwater Eggs

EFH for Chinook salmon eggs is the general distribution for this life stage, located in gravel substrates in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) (see Figure 24 through Figure 29).

Freshwater Larvae and Juveniles

EFH for larval and juvenile Chinook salmon is the general distribution area for this life stage, located in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and contiguous rearing areas within the boundaries of ordinary high water. Juvenile Chinook salmon out-migrate from freshwater areas in April toward the sea and may spend up to a year in a major tributaries or rivers, such as the Kenai, Yukon, Taku, and Copper Rivers (see Figure 24 through Figure 29).

Estuarine Juveniles

Estuarine EFH for juvenile Chinook salmon is the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters. Chinook salmon smolts and post-smolt juveniles may be present in these estuarine habitats from April through September (see Figure 24 through Figure 29).

Marine Juveniles

Marine EFH for juvenile Chinook salmon is the general distribution area for this life stage, located in all marine waters off the coast of Alaska from the mean higher tide line to the 200-nm limit of the EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean. Juvenile marine Chinook salmon are at this life stage from April until annulus formation in January or February during their first winter at sea (see Figure 30).

Marine Immature and Maturing Adults

EFH for immature and maturing adult Chinook salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska and ranging from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean (see Figure 30).

Freshwater Adults

EFH for adult Chinook salmon is the general distribution area for this life stage, located in fresh waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) wherever there are spawning substrates consisting of gravels from April through September (see Figure 24 through Figure 29).

A.3.1.5 Coho Salmon

Freshwater Eggs

EFH for coho salmon eggs is the general distribution area for this life stage, located in gravel substrates in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a), as depicted in Figure 31 through Figure 36.

Freshwater Larvae and Juveniles

EFH for larval and juvenile coho salmon is the general distribution area for this life stage, located in those waters identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and contiguous rearing areas within the boundaries of ordinary high water. Fry generally migrate to a lake, slough, or estuary and rear in these areas for up to 2 years, as depicted in Figure 31 through Figure 36.

Estuarine Juveniles

Estuarine EFH for juvenile coho salmon is the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters. Juvenile coho salmon require year-round rearing habitat and also migration habitat from April to November to provide access to and from the estuary (see Figure 31 through Figure 36).

Marine Juveniles

Marine EFH for juvenile coho salmon is the general distribution area for this life stage, located in all marine waters off the coast of Alaska from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean, as depicted in Figure 37.

Marine Immature and Maturing Adults

EFH for immature and maturing adult coho salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska to 200 m in depth and range from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean, as depicted in Figure 37.

Freshwater Adults

EFH for coho salmon is the general distribution area for this life stage, located in freshwaters as identified in ADF&G's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* (ADF&G 1998a) and wherever there are spawning substrates consisting mainly of gravel containing less than 15 percent fine sediment (less than 2-mm diameter) from July to December, as depicted in Figure 31 through Figure 36.

A.3.2 Maps of Essential Fish Habitat

Figure 4 EFH Distribution for Pink Salmon – Southeastern Region

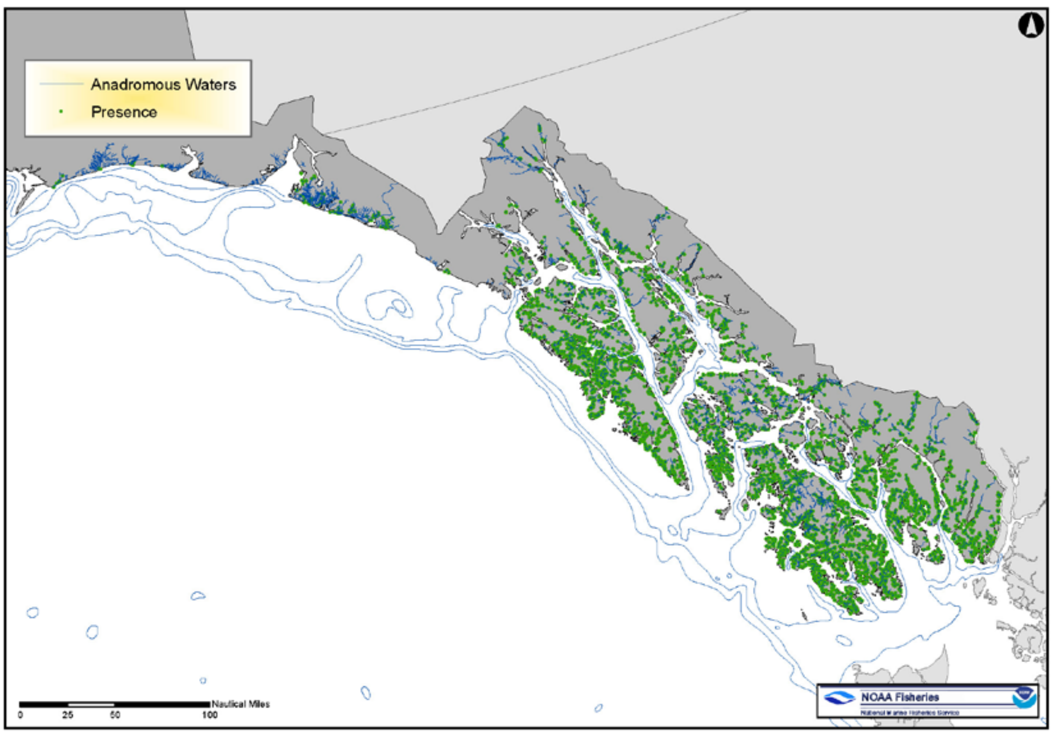


Figure 5 EFH Distribution for Pink Salmon - South-Central Region

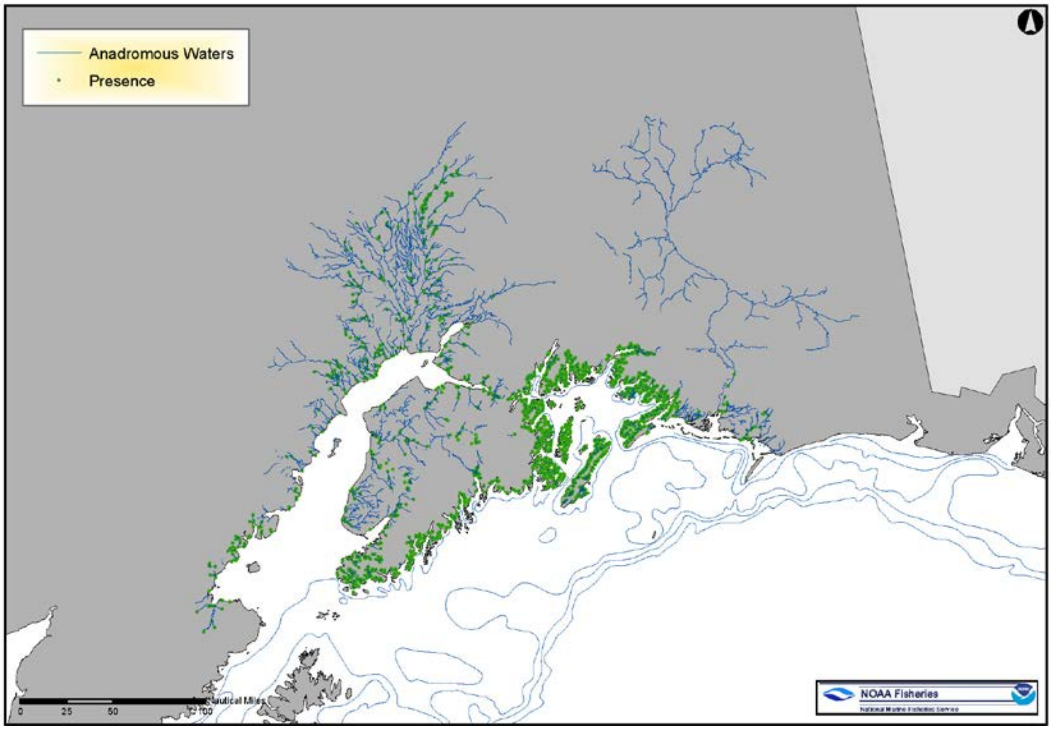


Figure 6 EFH Distribution for Pink Salmon – Southwestern Region

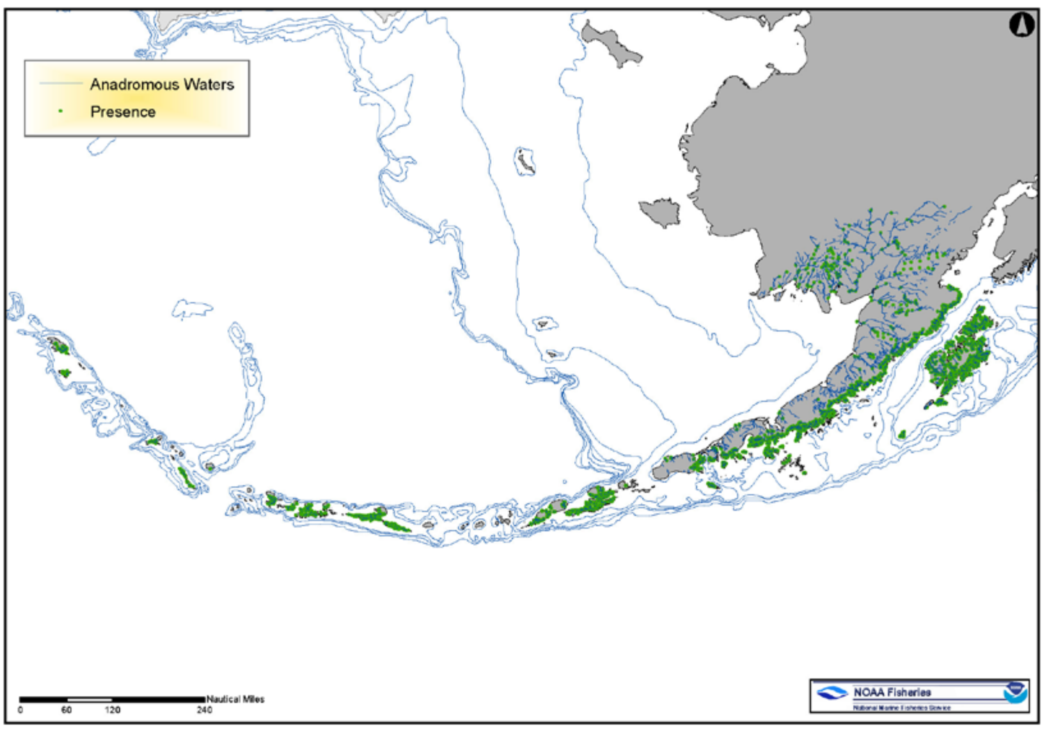


Figure 7 EFH Distribution for Pink Salmon – Western Region

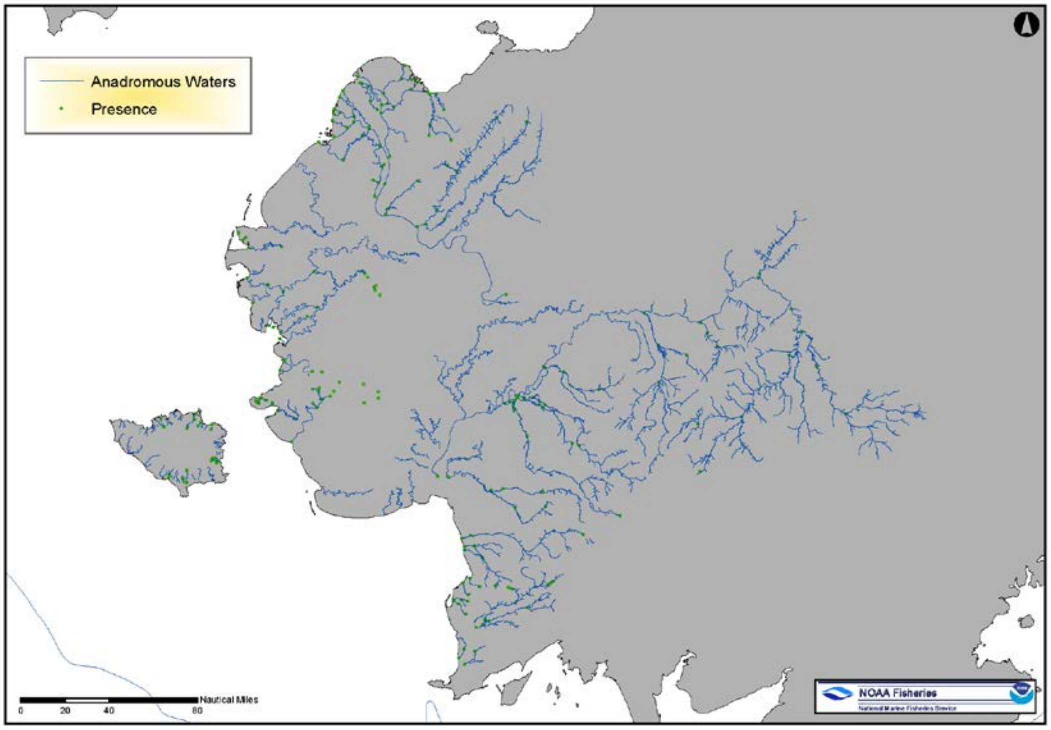


Figure 8 EFH Distribution for Pink Salmon – Arctic Region

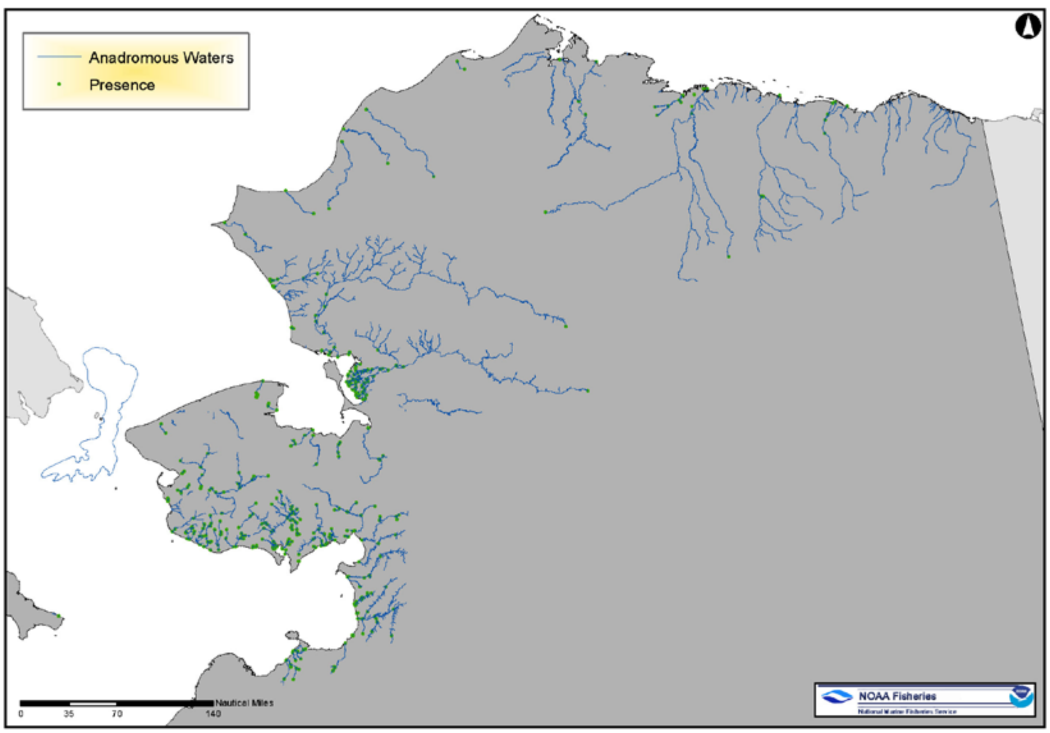


Figure 9 EFH Distribution for Pink Salmon – Interior Region

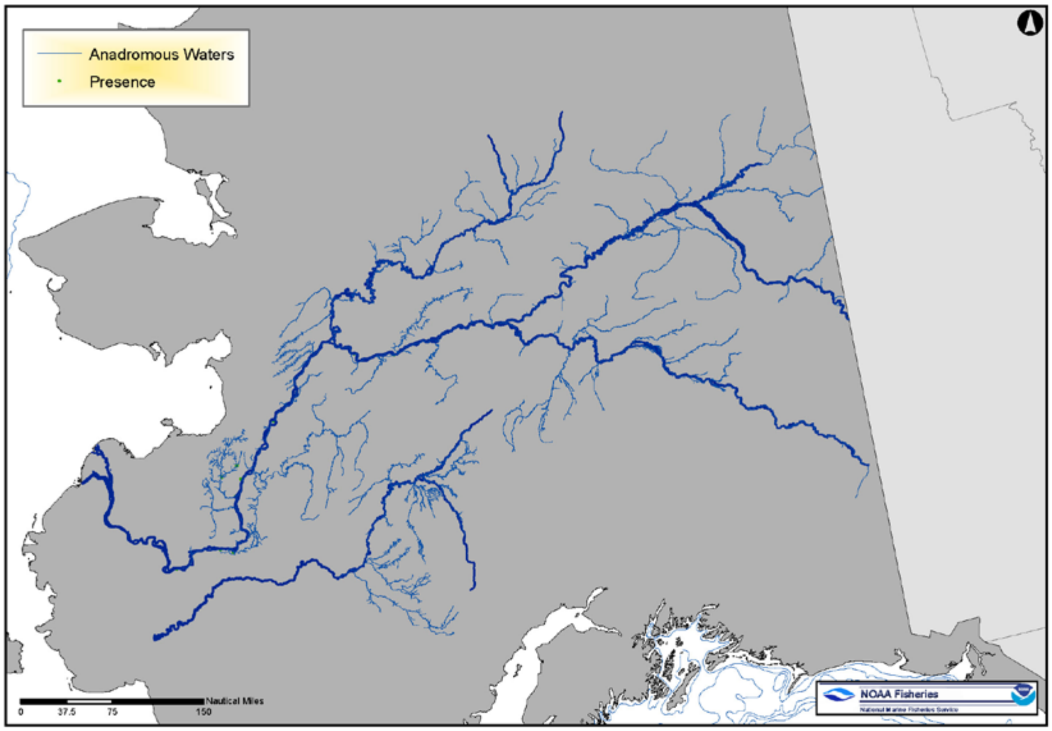


Figure 10 EFH Distribution for Pink Salmon - Marine

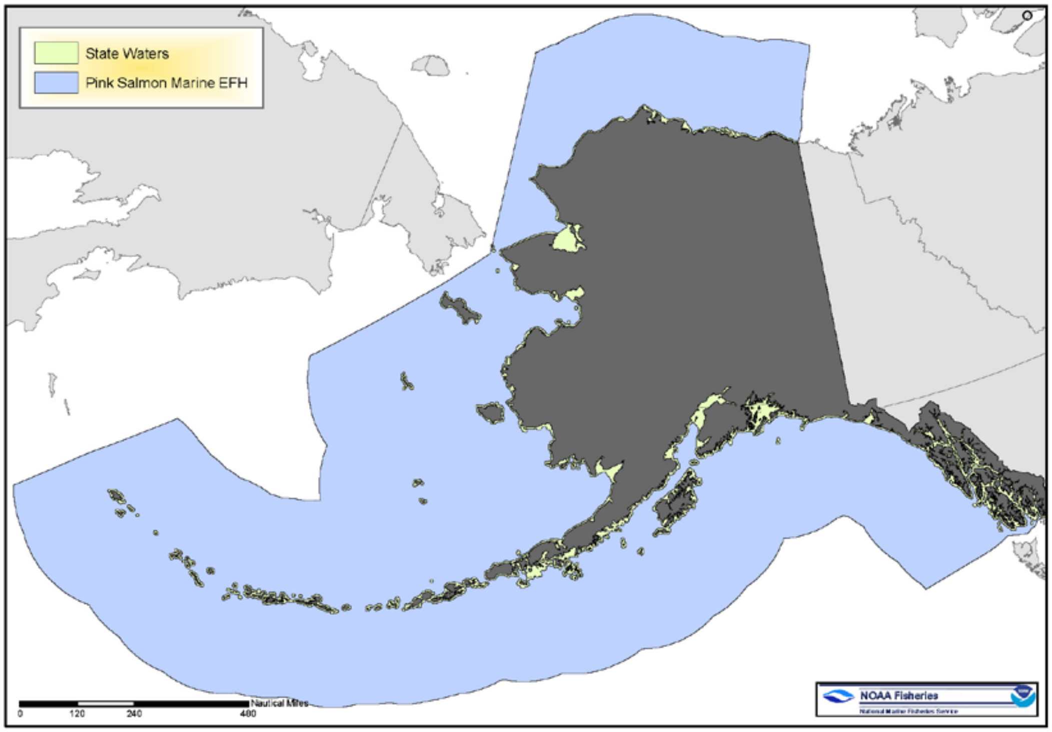


Figure 11 EFH Distribution for Chum Salmon – Southeastern Region

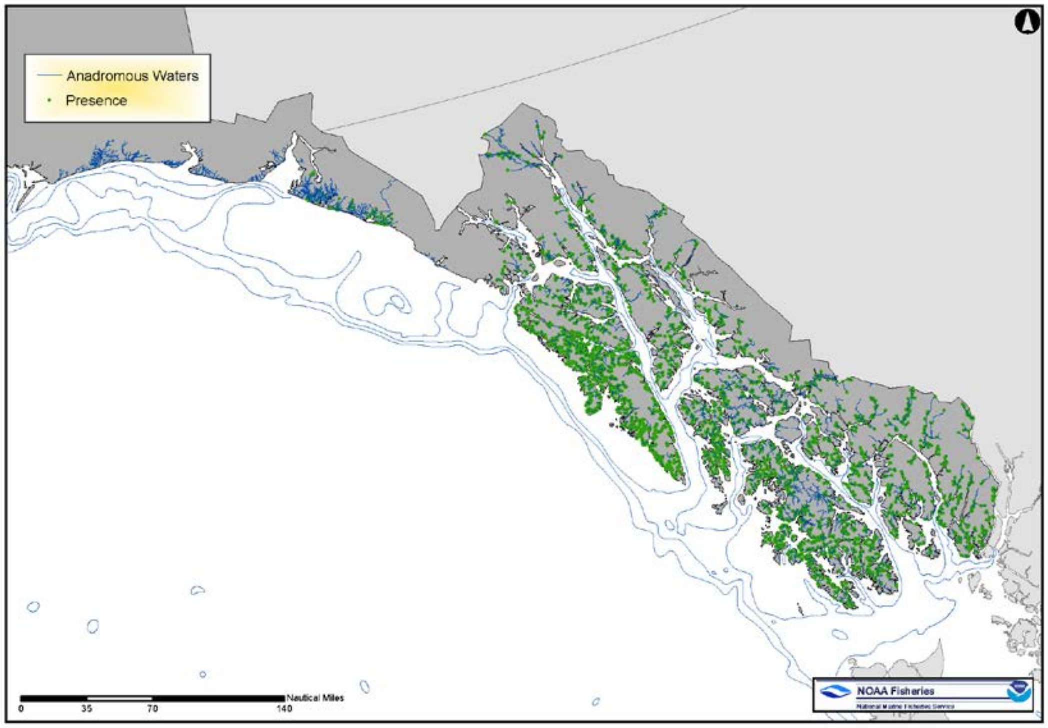


Figure 12 EFH Distribution for Chum Salmon – South-Central Region

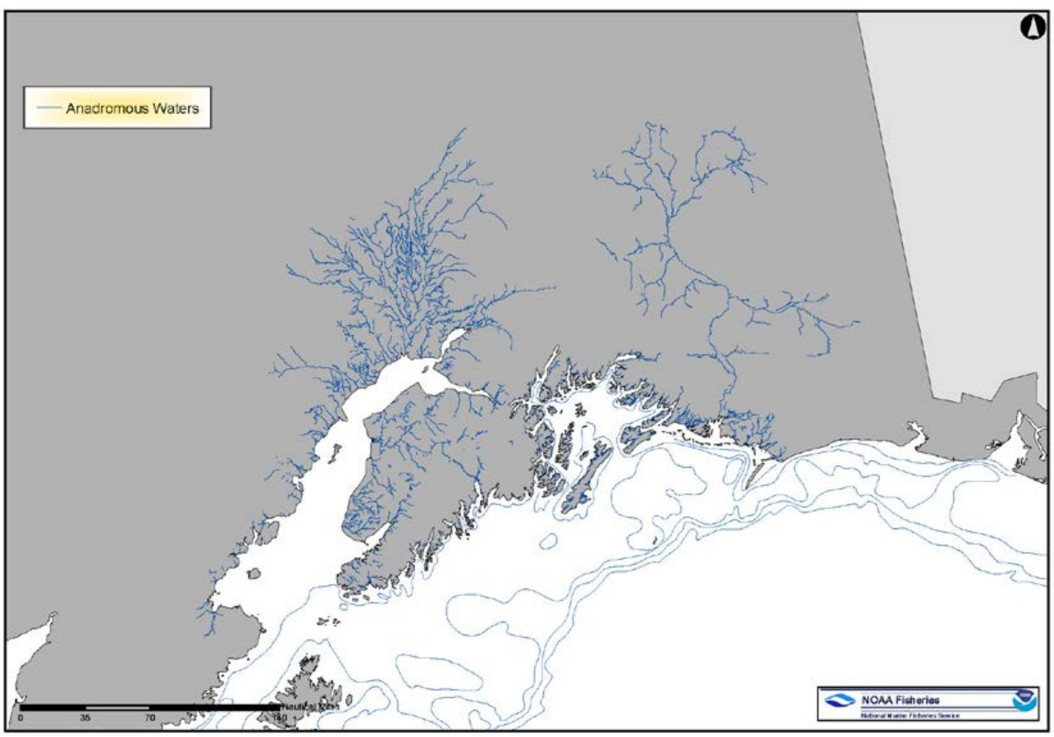


Figure 13 EFH Distribution for Chum Salmon – Southwestern Region

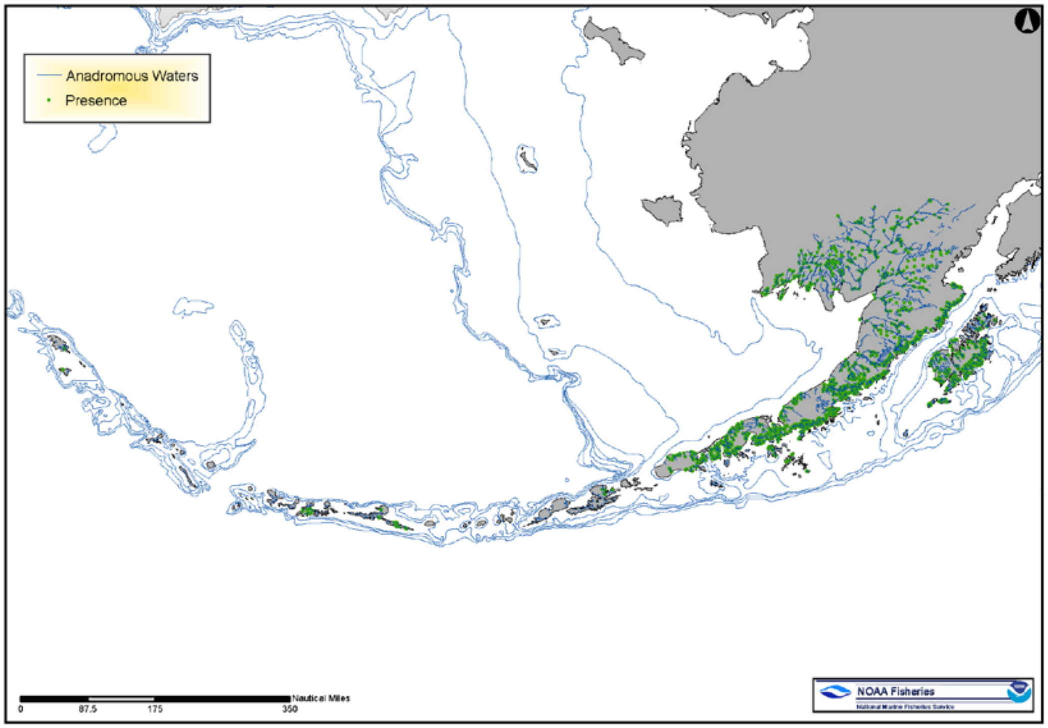


Figure 14 EFH Distribution for Chum Salmon – Western Region

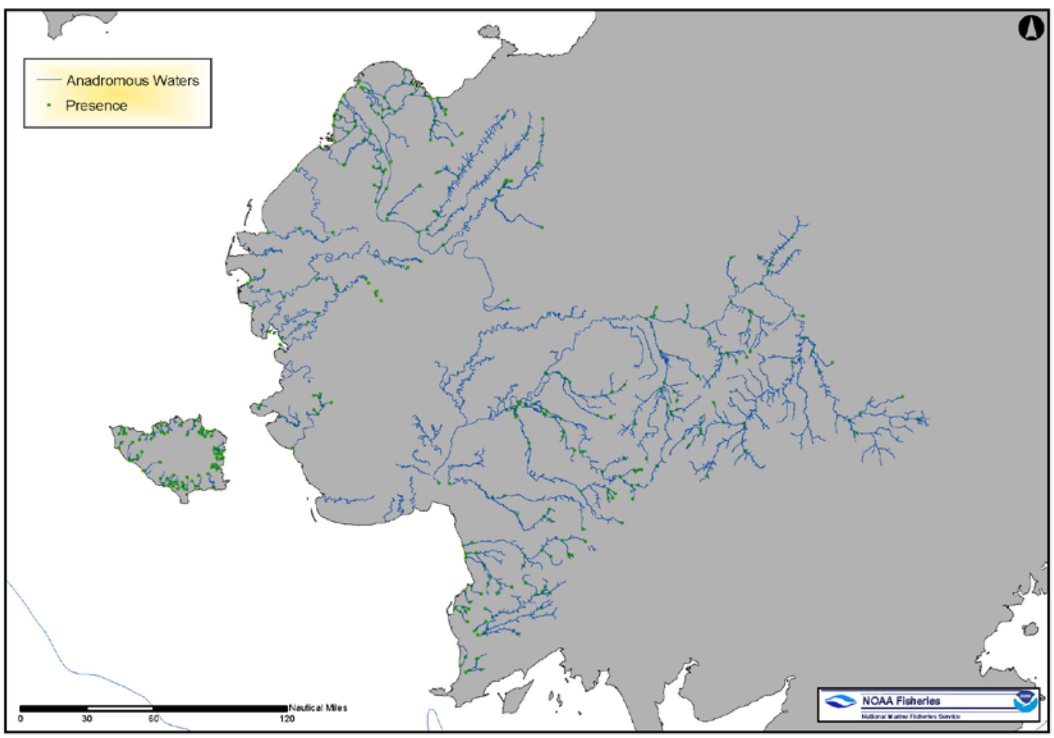


Figure 15 EFH Distribution for Chum Salmon – Arctic Region

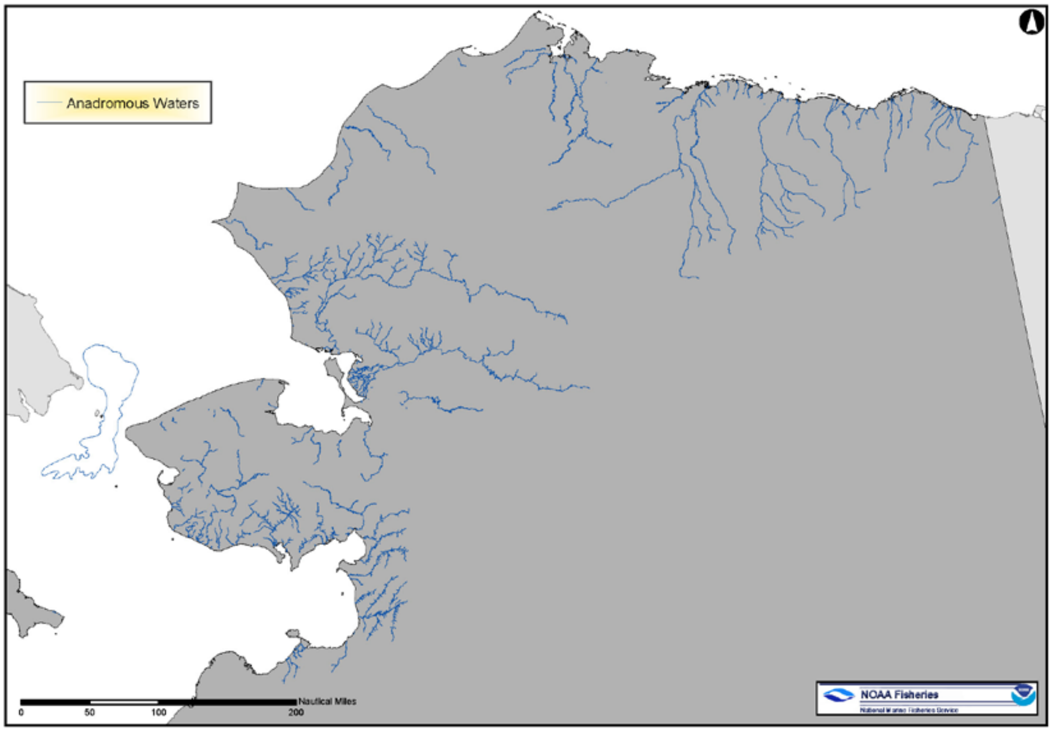


Figure 16 EFH Distribution for Chum Salmon – Interior Region

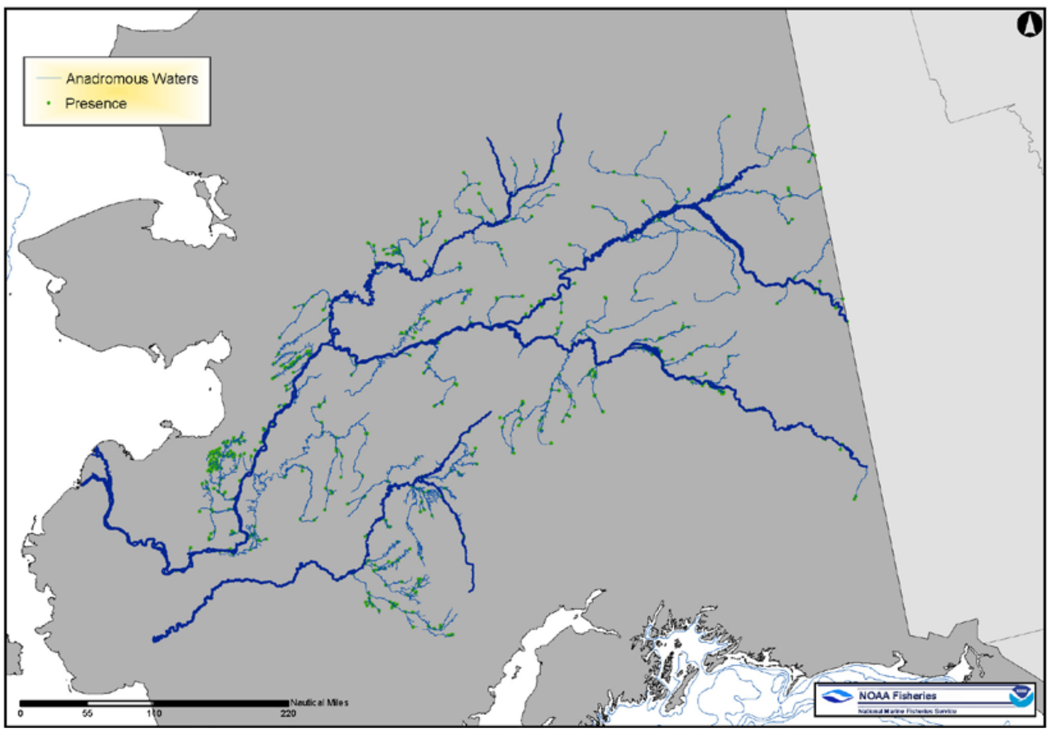


Figure 17 EFH Distribution for Chum Salmon - Marine

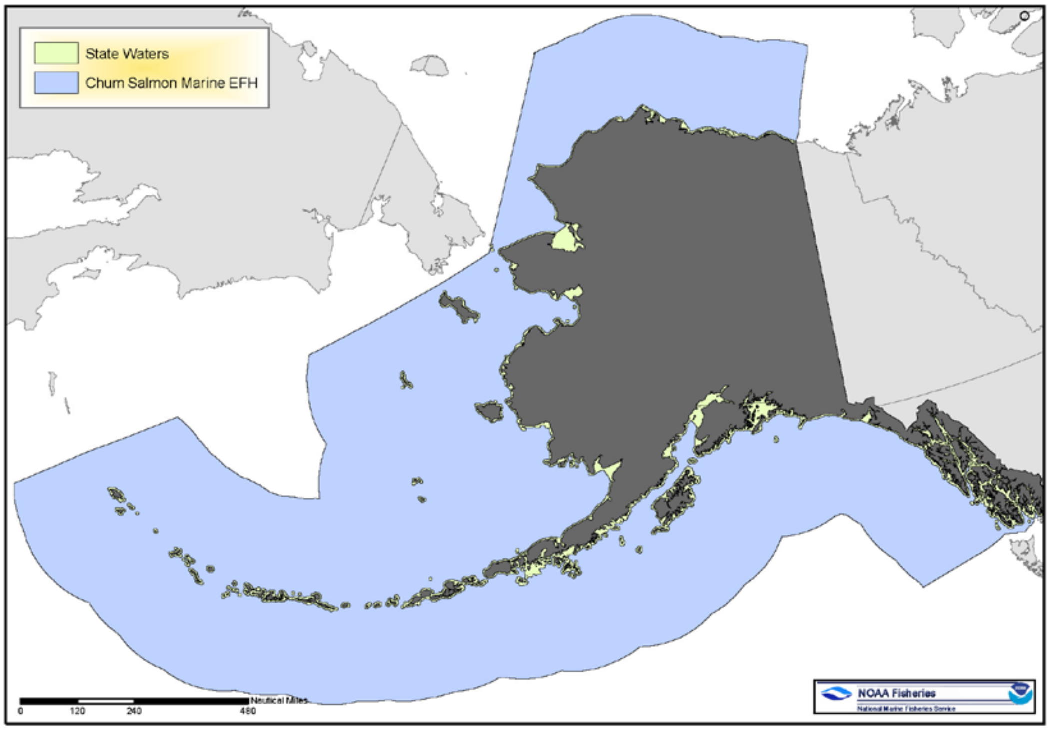


Figure 18 EFH Distribution for Sockeye Salmon – Southeastern Region

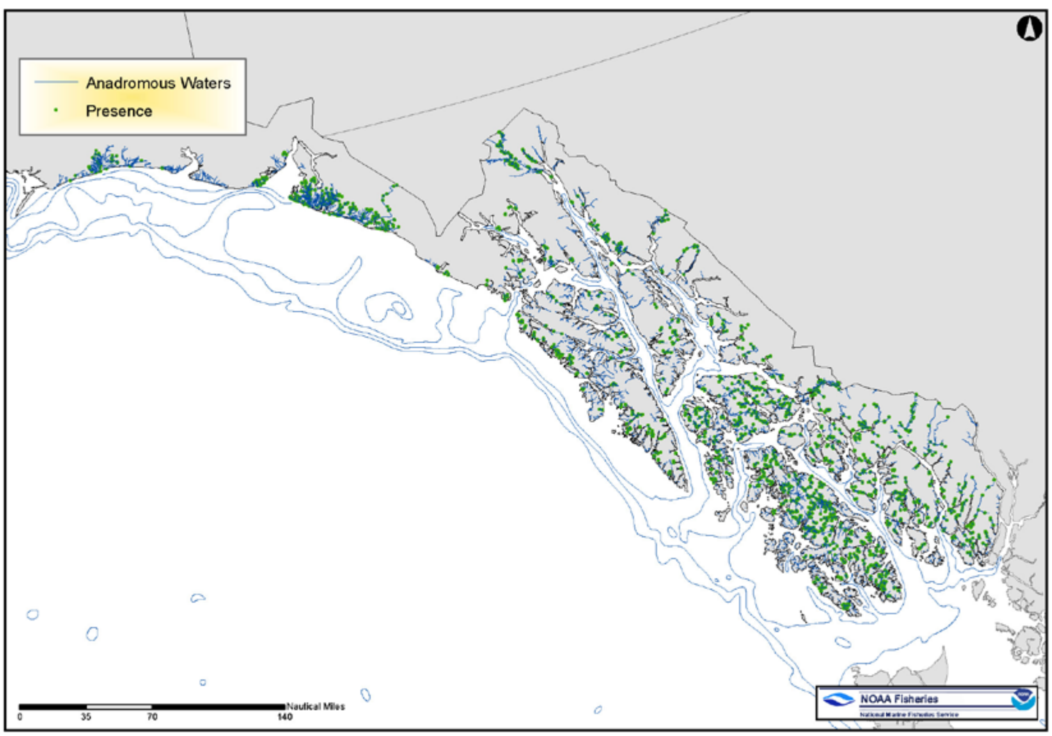


Figure 19 EFH Distribution for Sockeye Salmon – South-Central Region

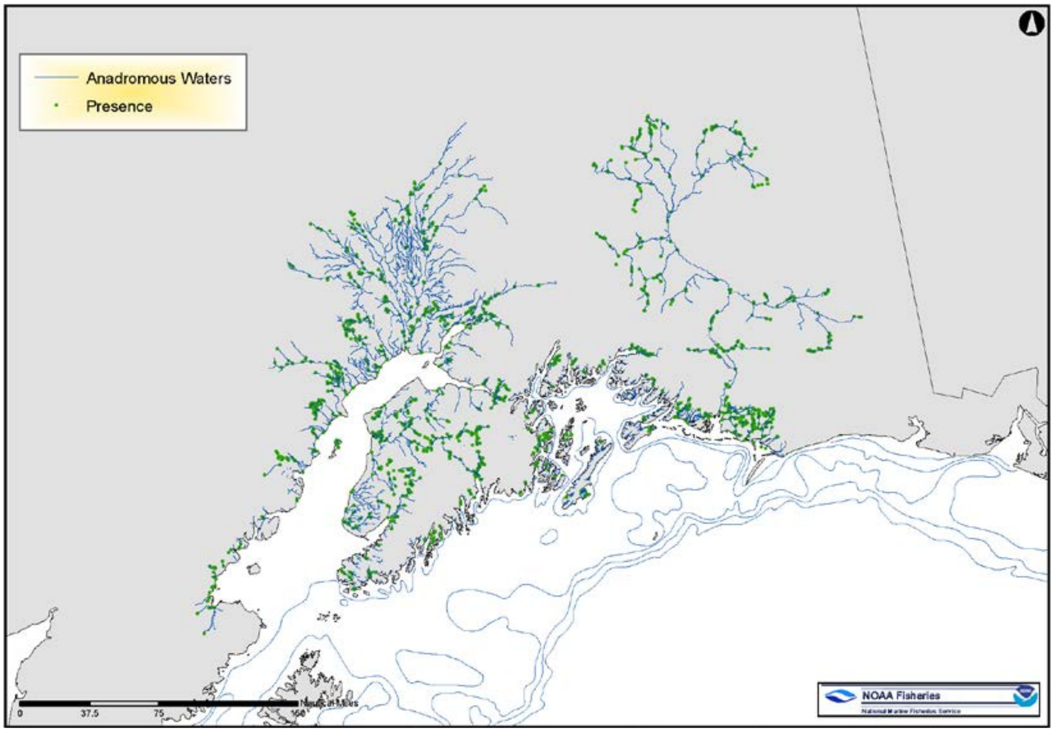


Figure 20 EFH Distribution for Sockeye Salmon – Southwestern Region

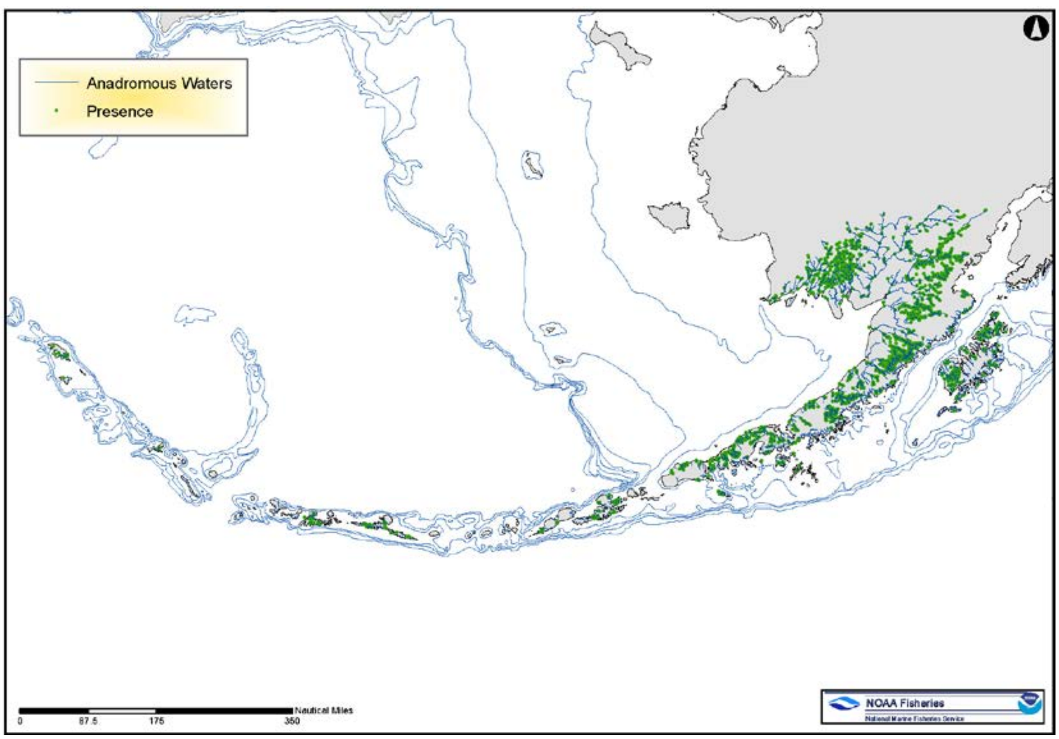


Figure 21 EFH Distribution for Sockeye Salmon – Western Region

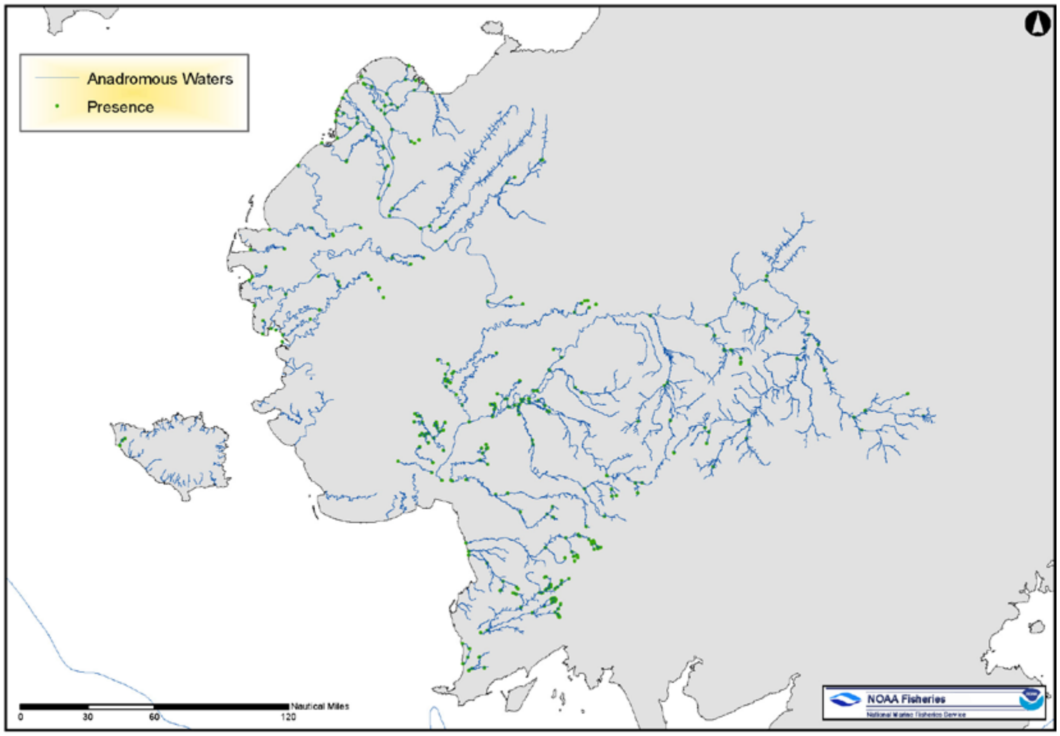


Figure 22 EFH Distribution for Sockeye Salmon – Arctic Region

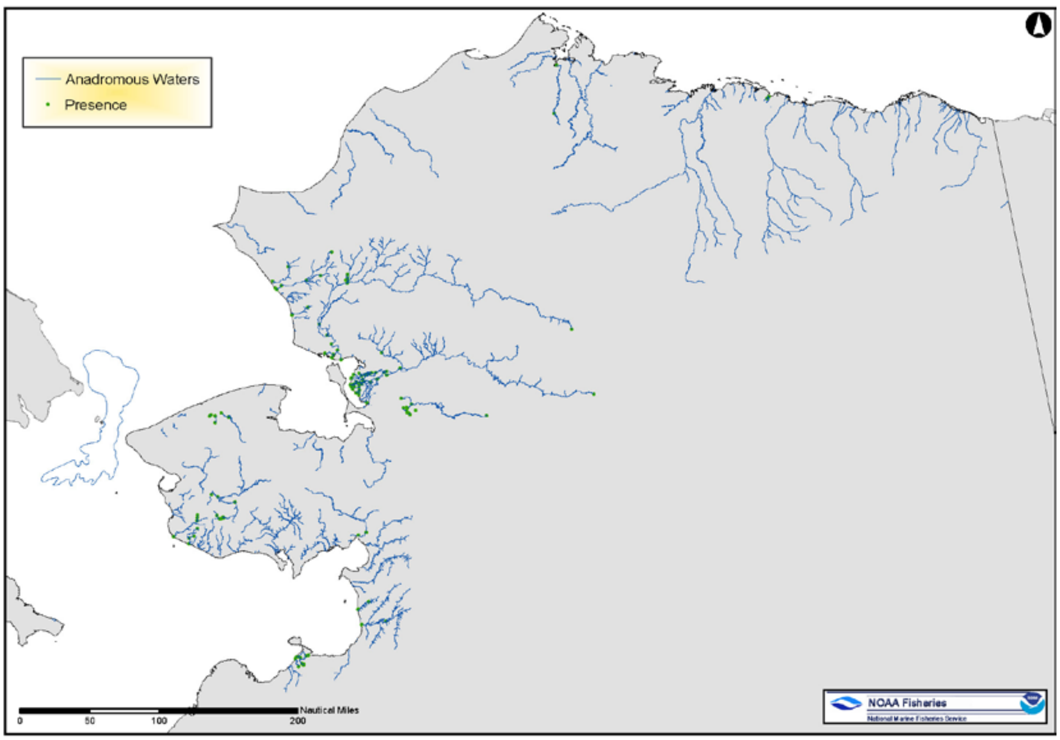


Figure 23 EFH Distribution for Sockeye Salmon – Interior Region

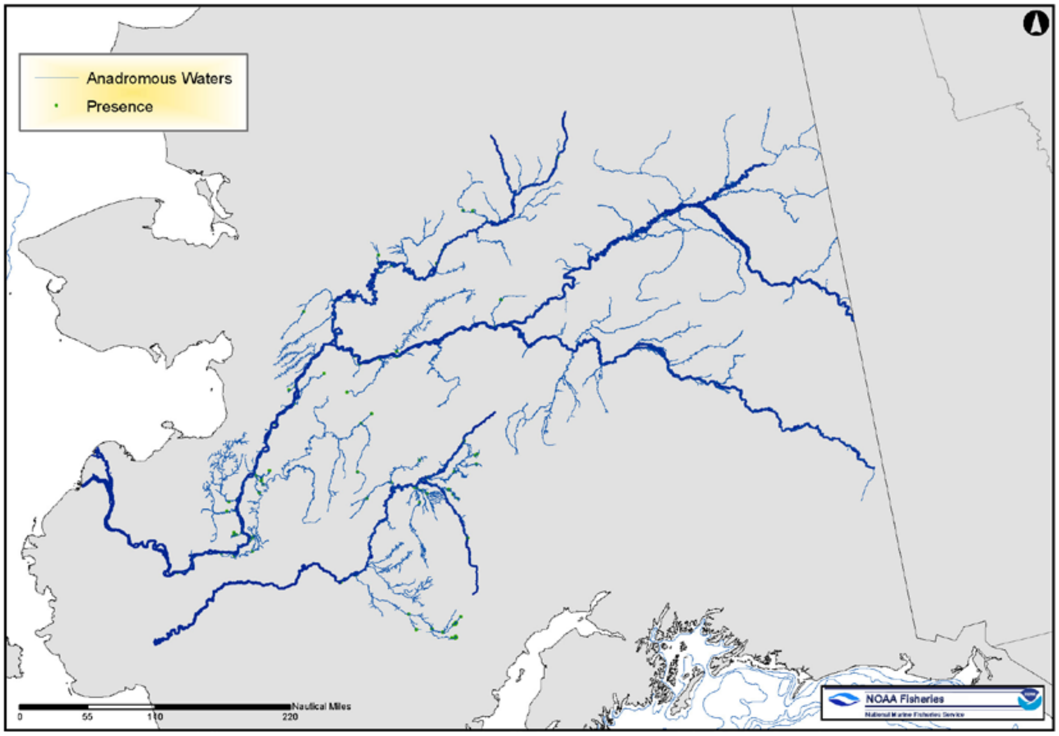


Figure 24 EFH Distribution for Sockeye Salmon – Marine

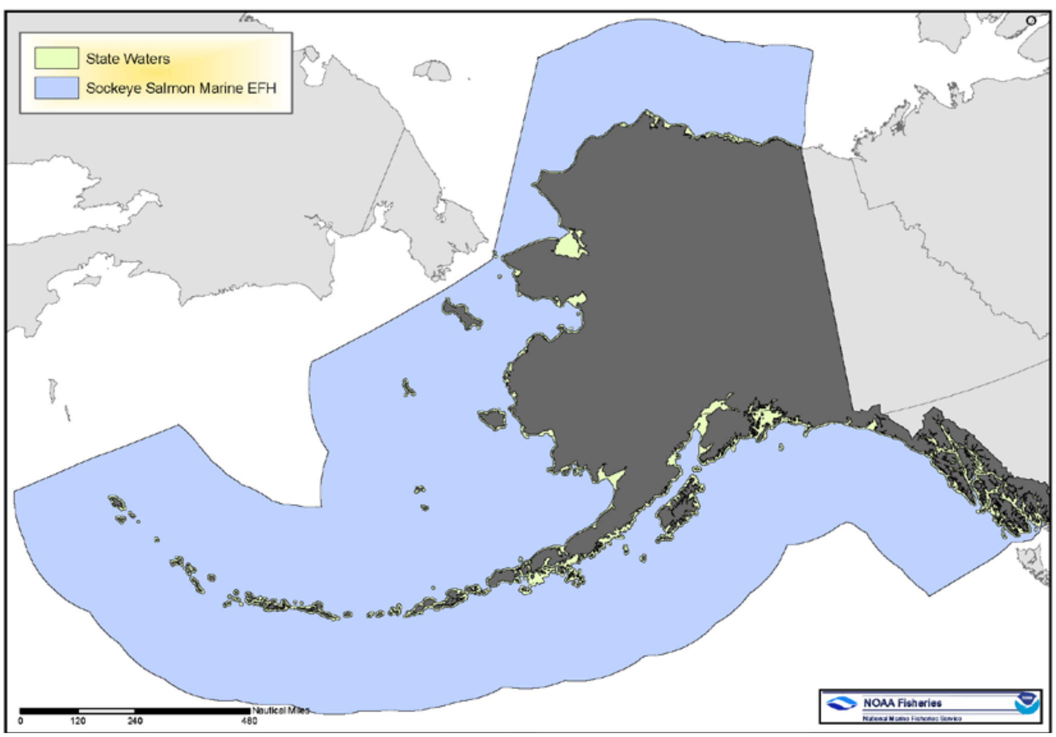


Figure 25 EFH Distribution for Chinook Salmon – Southeastern Region

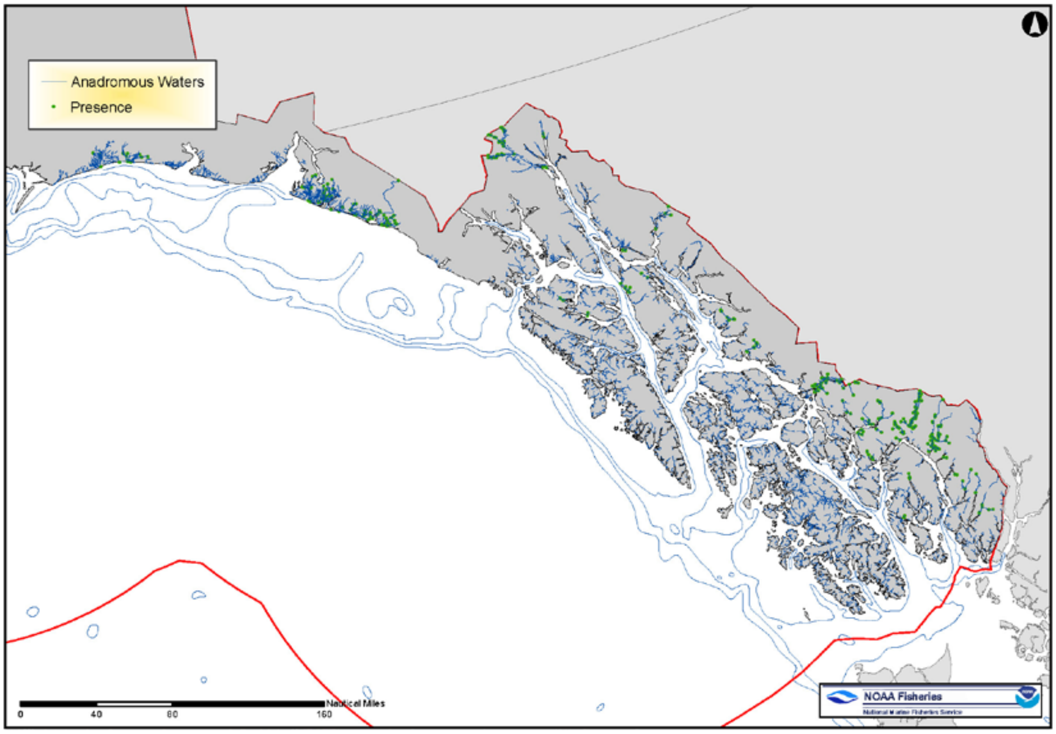


Figure 26 EFH Distribution for Chinook Salmon – South-Central Region

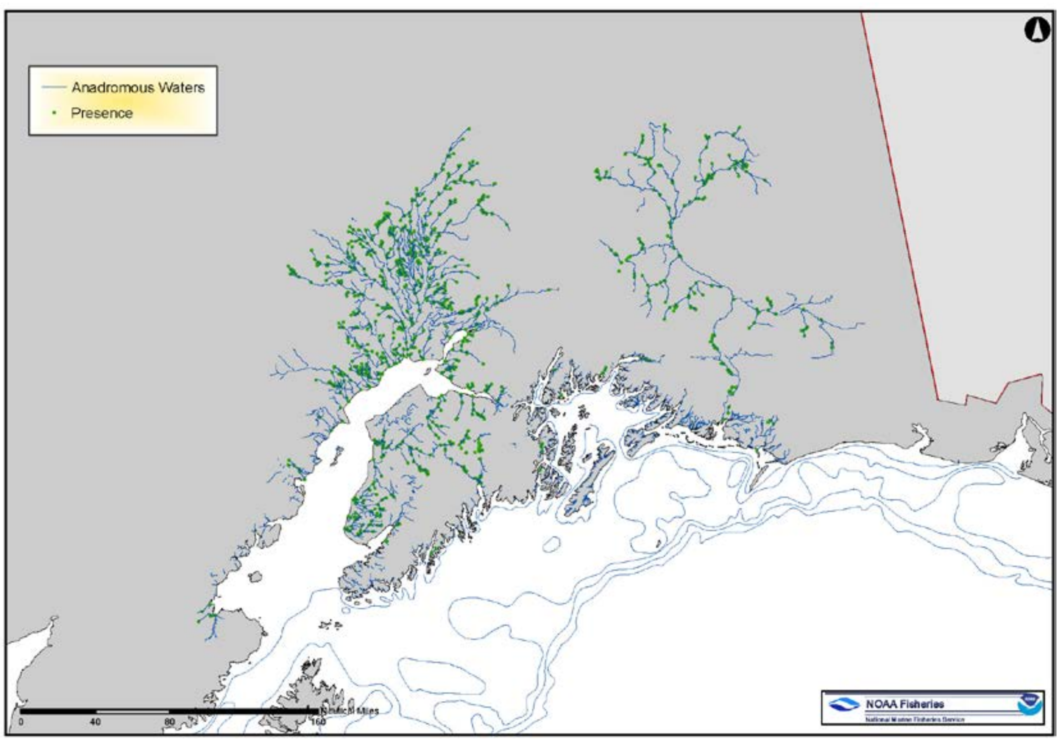


Figure 27 EFH Distribution for Chinook Salmon – Southwestern Region

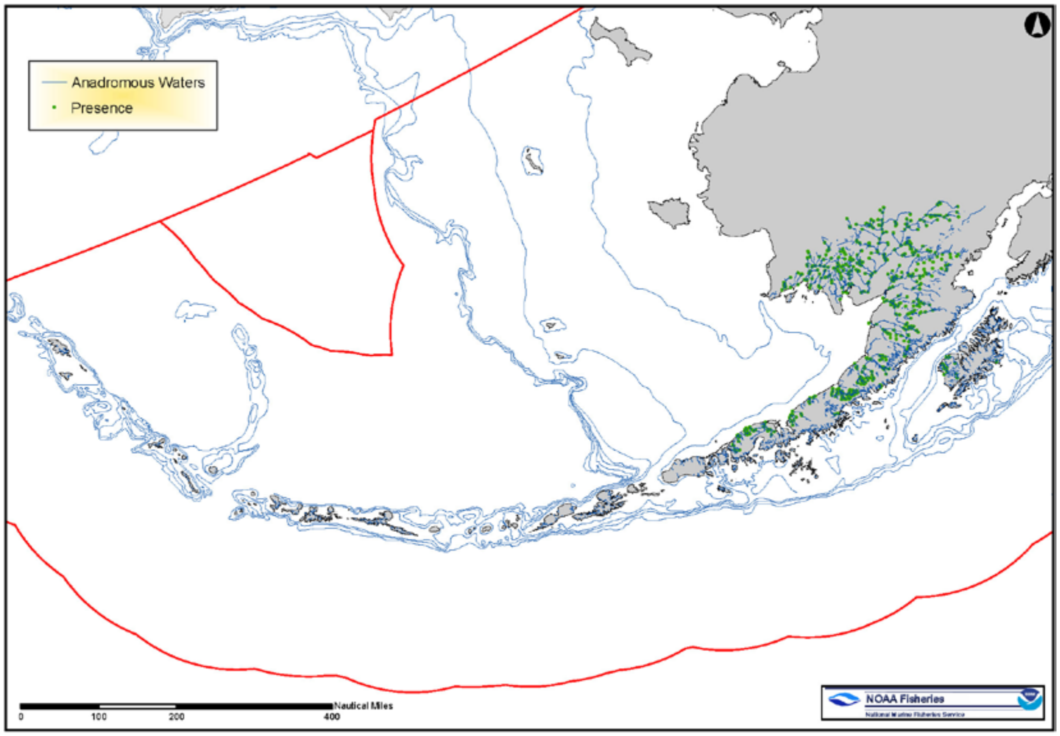


Figure 28 EFH Distribution for Chinook Salmon – Western Region

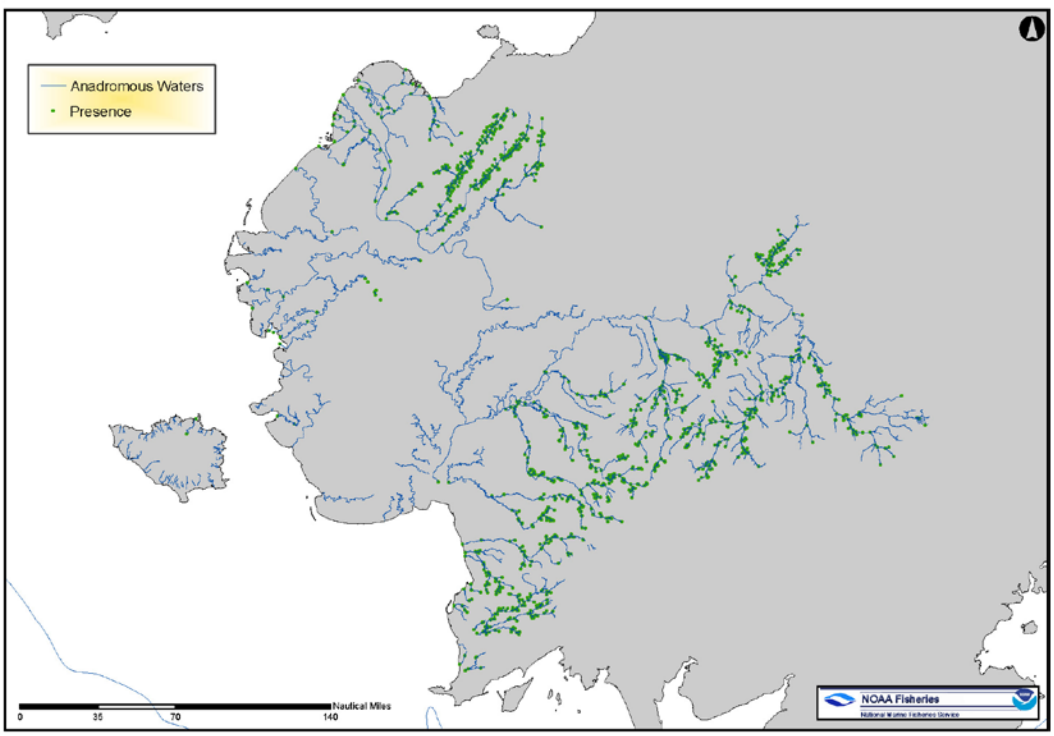


Figure 29 EFH Distribution for Chinook Salmon – Arctic Region

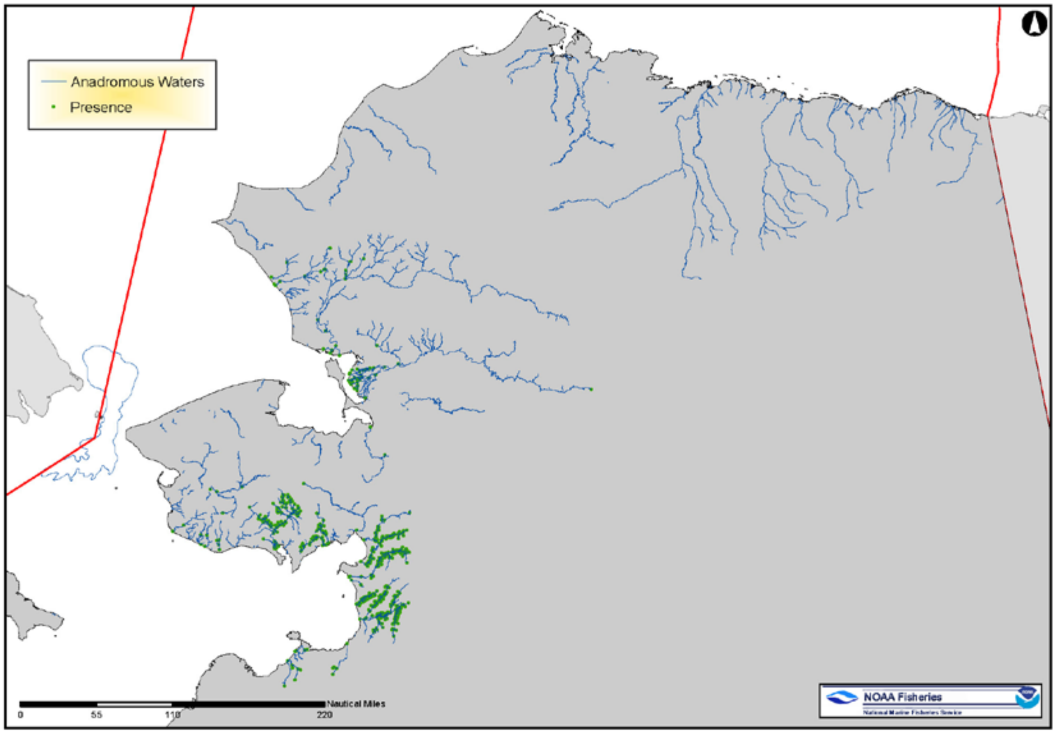


Figure 30 EFH Distribution for Chinook Salmon – Interior Region

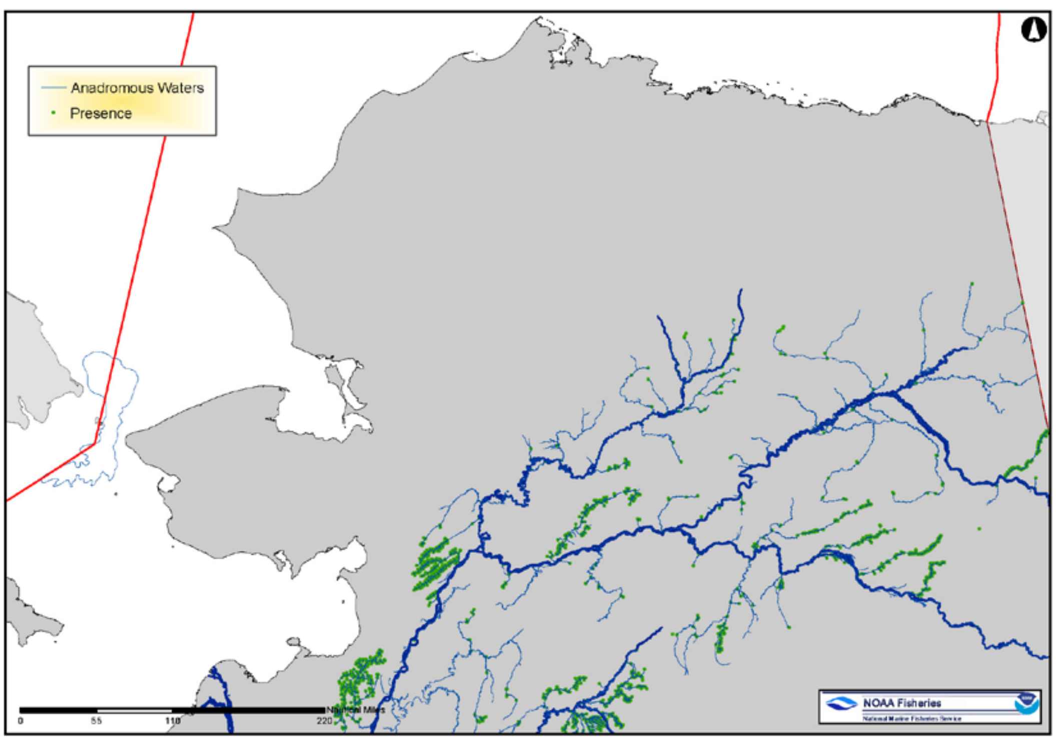


Figure 31 EFH Distribution for Chinook Salmon – Marine

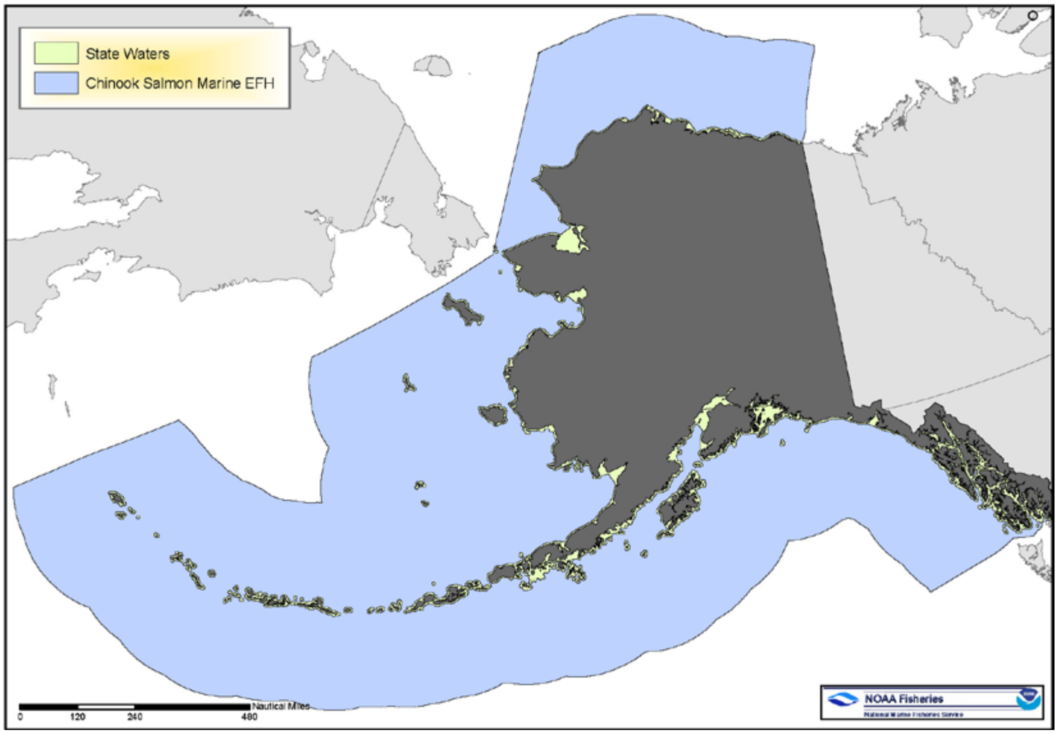


Figure 32 EFH Distribution for Coho Salmon – Southeastern Region

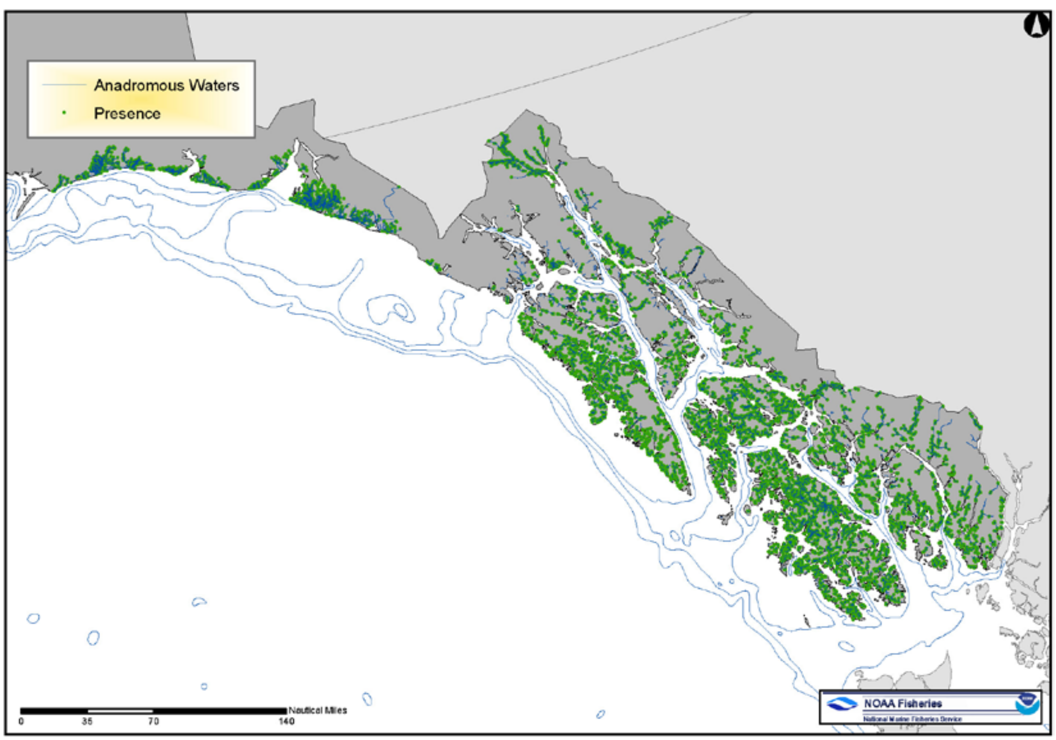


Figure 33 EFH Distribution for Coho Salmon – South-Central Region

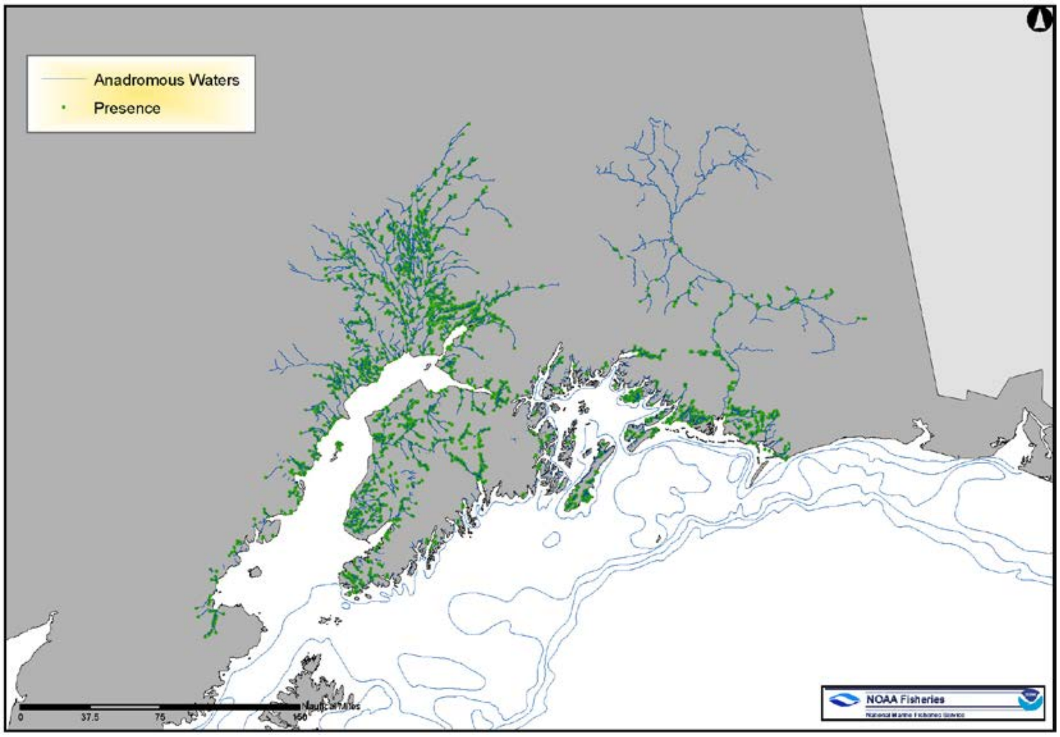


Figure 34 EFH Distribution for Coho Salmon – Southwestern Region

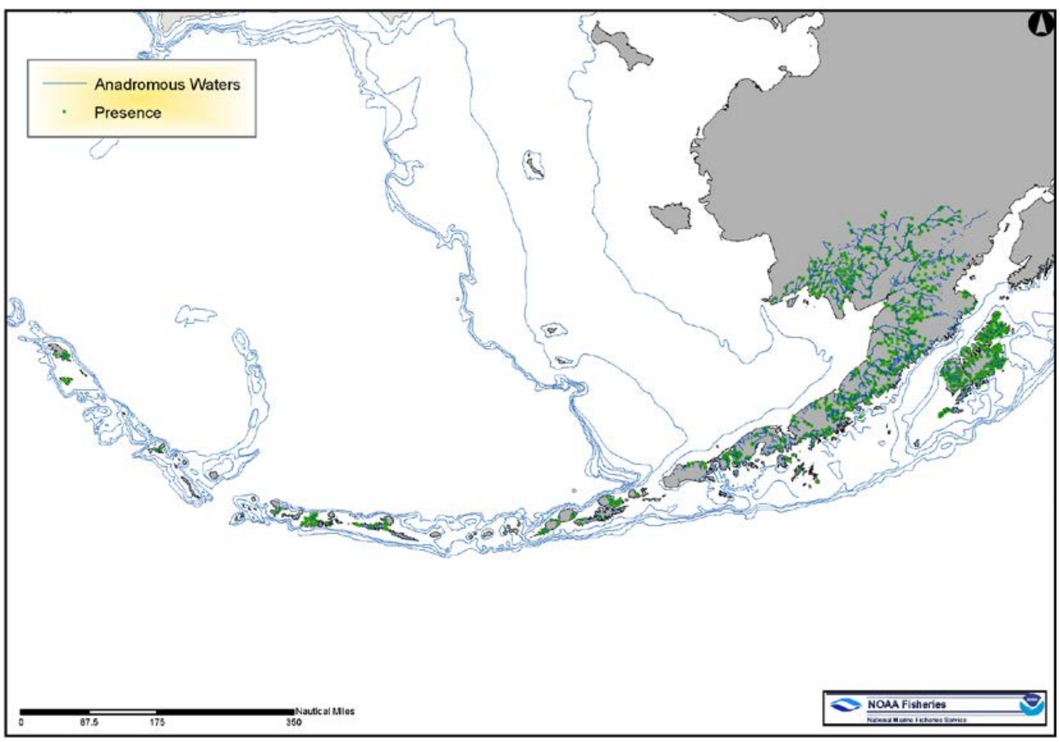


Figure 35 EFH Distribution for Coho Salmon – Western Region

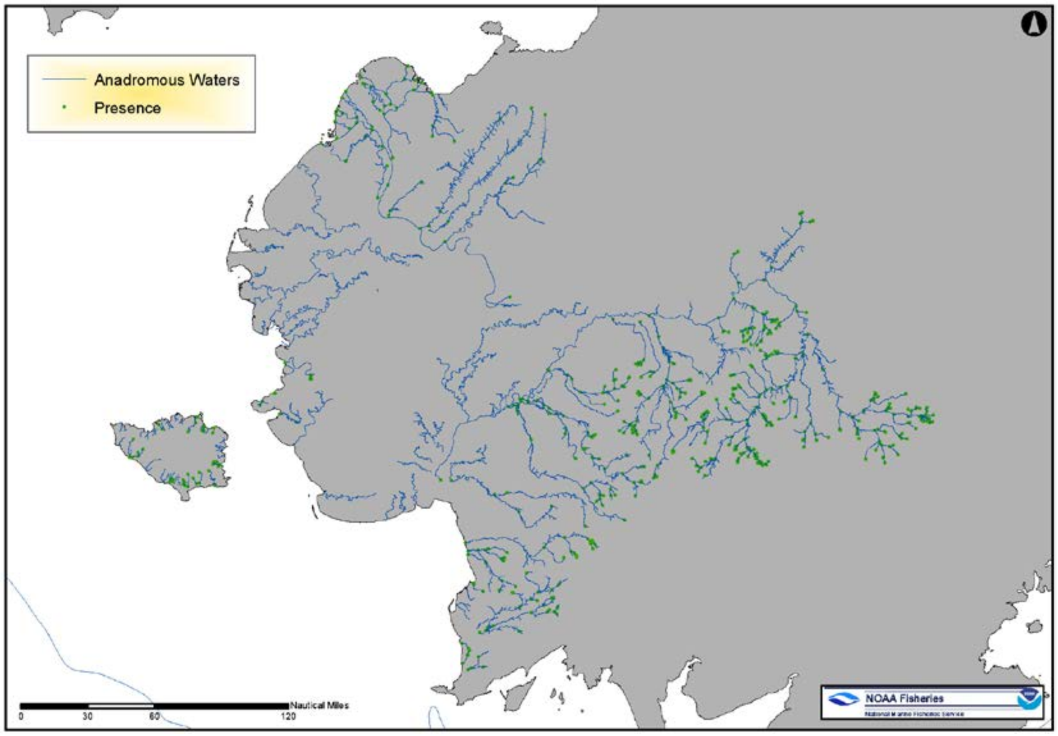


Figure 36 EFH Distribution for Coho Salmon – Arctic Region

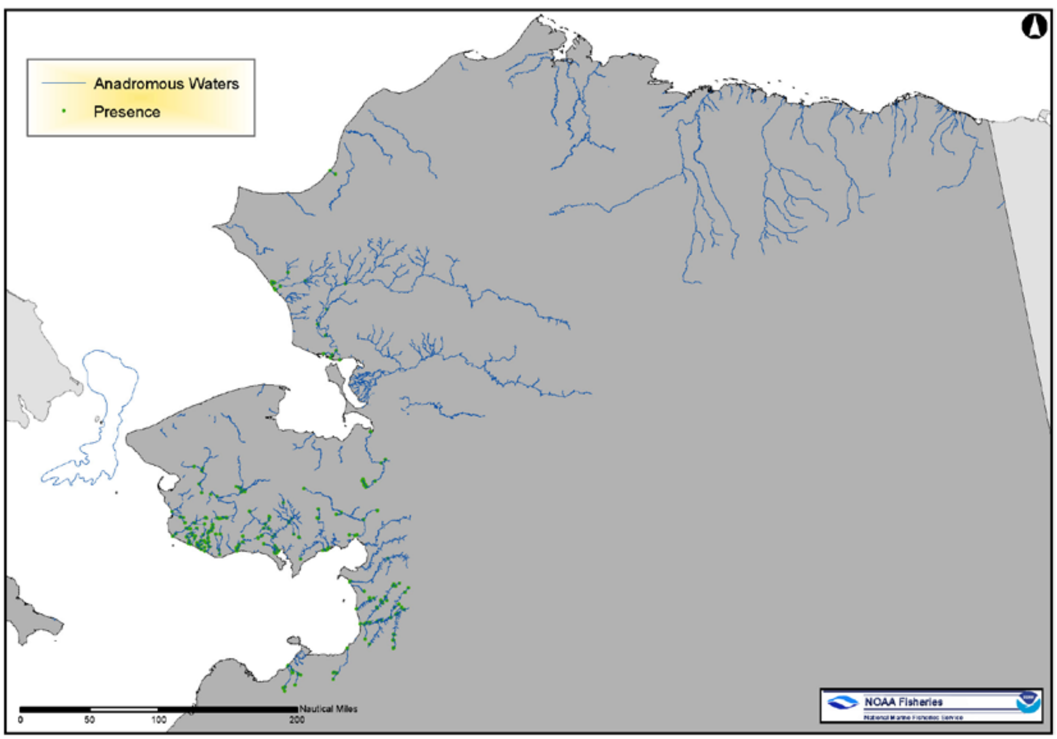


Figure 37 EFH Distribution for Coho Salmon – Interior Region

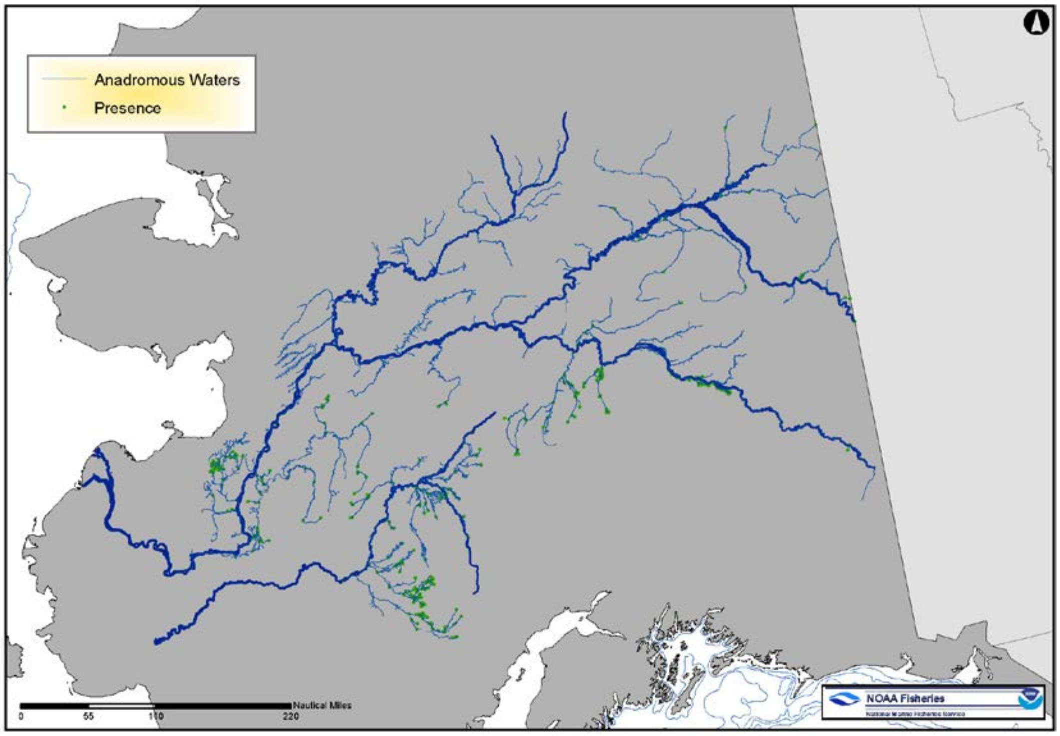
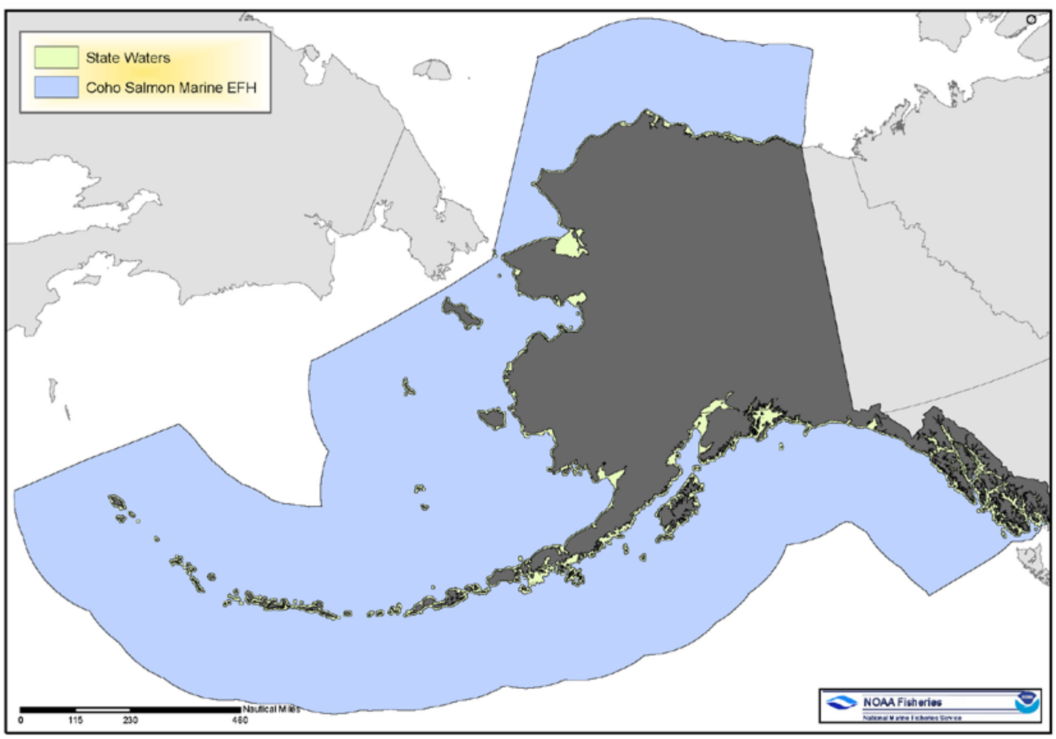


Figure 38 EFH Distribution for Coho Salmon – Marine



A.3.3 Essential Fish Habitat Conservation and Habitat Areas of Particular Concern

The Council established the Aleutian Islands Habitat Conservation Area, the Aleutian Islands Coral Habitat Protection Areas, and the GOA Slope Habitat Conservation Areas 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 Areas (NPFMC 2005). Maps of these areas, as well at the coordinates, are provided below.

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.

A.3.3.1 Aleutian Islands Coral Habitat Protection Area

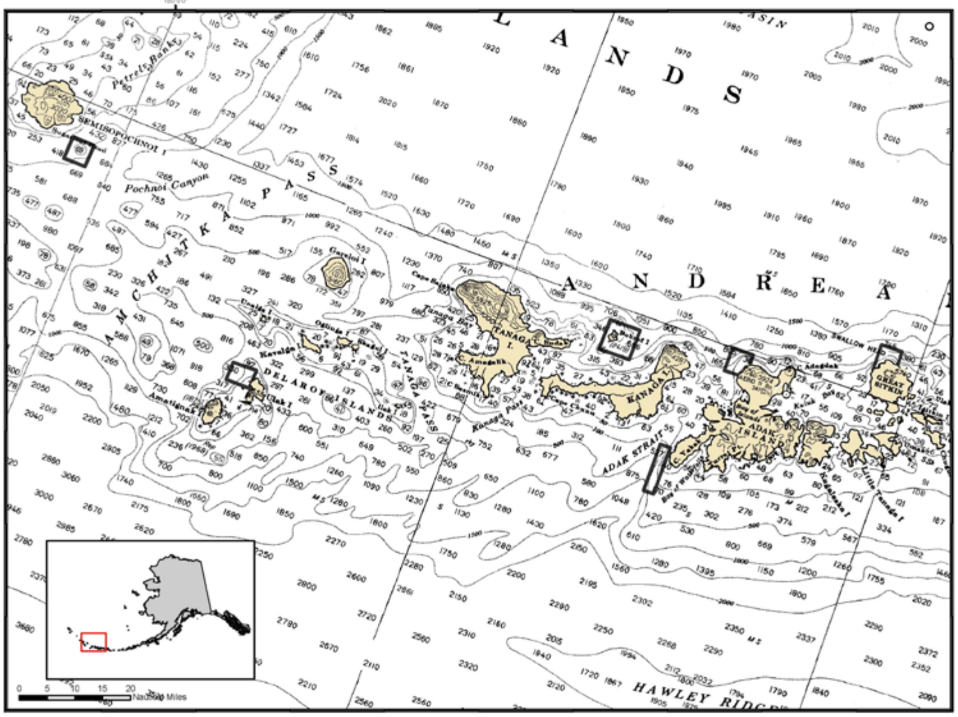
The use of bottom contact gear, as described in 50 CFR part 679, is prohibited year-round in the Aleutian Islands Coral Habitat Protection Areas, see Figure 39. Anchoring by a federally permitted fishing vessel, as described in 50 CFR part 679, is also prohibited. The coordinates for the areas are listed 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 39.00 N	177 3.00 W
	Adak Canyon	51 39.00 N	177 0.00 W

Area number	Name	Latitude	Longitude
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 39 Aleutian Islands Coral Habitat Protection Areas



A.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 40.

Area Number	Name	Latitude	Longitude	Foot note
1	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	
2	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	
3	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	
4	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	
5	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	
6	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	
		52 36.00 N	173 30.00 W	
		52 36.00 N	173 36.00 W	

Area Number	Name	Latitude	Longitude	Foot note
		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	5,7
		52 33.00 N	173 6.00 W	
		52 30.00 N	173 6.00 W	
		52 30.00 N	173 18.00 W	
		52 24.00 N	173 18.00 W	
		52 24.00 N	172 48.00 W	
		52 30.00 N	172 48.00 W	
		52 30.00 N	172 42.00 W	
7	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	

Area Number	Name	Latitude	Longitude	Foot note
		51 54.00 N	173 18.00 W	
8	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	
		52 18.00 N	174 20.04 W	1
		52 19.37 N	174 24.00 W	
9	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	
10	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	

Area Number	Name	Latitude	Longitude	Foot note
		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	
		52 0.00 N	175 30.00 W	
		52 3.00 N	175 30.00 W	
		52 3.00 N	175 36.00 W	
11	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	
12	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	
13	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
14	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
15	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	
		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
16	Tanaga/Kanaga	51 43.78 N	177 24.04 W	1

Area Number	Name	Latitude	Longitude	Foot note
	South	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	
		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	
17	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	
		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	
18	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	
19	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	
20	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	

Area Number	Name	Latitude	Longitude	Foot note
		51 24.00 N	179 48.00 E	
		51 24.00 N	179 54.00 E	
21	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	
		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	
22	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	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	
		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	

Area Number	Name	Latitude	Longitude	Foot note
		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 6.00 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 0.00 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	
23	Amchitka I North	51 42.00 N	179 12.00 E	
		51 42.00 N	178 57.00 E	
		51 36.00 N	178 6.99 E	
		51 36.00 N	179 .00 E	
		51 33.62 N	179 .00 E	2
		51 30.00 N	179 .00 E	
		51 30.00 N	179 8.00 E	
		51 36.00 N	179 8.00 E	
		51 36.00 N	179 2.00 E	
24	Pillar Rk	52 9.00 N	177 0.00 E	
		52 9.00 N	177 8.00 E	
		52 6.00 N	177 8.00 E	
		52 6.00 N	177 0.00 E	
25	Murray Canyon	51 48.00 N	177 2.00 E	
		51 48.00 N	176 8.00 E	
		51 36.00 N	176 8.00 E	
		51 36.00 N	177 .00 E	
		51 39.00 N	177 .00 E	
		51 39.00 N	177 .00 E	
		51 42.00 N	177 .00 E	
		51 42.00 N	177 2.00 E	
26	Buldir	52 6.00 N	177 2.00 E	
		52 6.00 N	177 01 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 20.79 N	175 54.00 E	1
		52 22.38 N	175 54.00 E	
		52 24.00 N	175 54.00 E	

Area Number	Name	Latitude	Longitude	Foot note
		52 24.00 N	175 48.00 E	
		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 42.00 E	
		52 12.00 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	
		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 0.01 E	
		52 0.00 N	177 12.00 E	6
	Buldir donut	51 48.00 N	175 48.00 E	5, 7
		51 48.00 N	175 42.00 E	
		51 45.00 N	175 42.00 E	
		51 45.00 N	175 48.00 E	
27	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	
28	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	
29	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	

Area Number	Name	Latitude	Longitude	Foot note
		51 54.00 N	174 42.00 E	
		51 54.00 N	174 48.00 E	
		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	
30	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 36.00 N	173 36.00 E	
		52 36.00 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	
31	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	
32	Attu I North	53 3.00 N	173 24.00 E	
		53 3.00 N	173 6.00 E	
		53 0.00 N	173 6.00 E	
		53 0.00 N	173 24.00 E	
33	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 8.00 N	172 12.00 E	
34	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 delineatd 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.

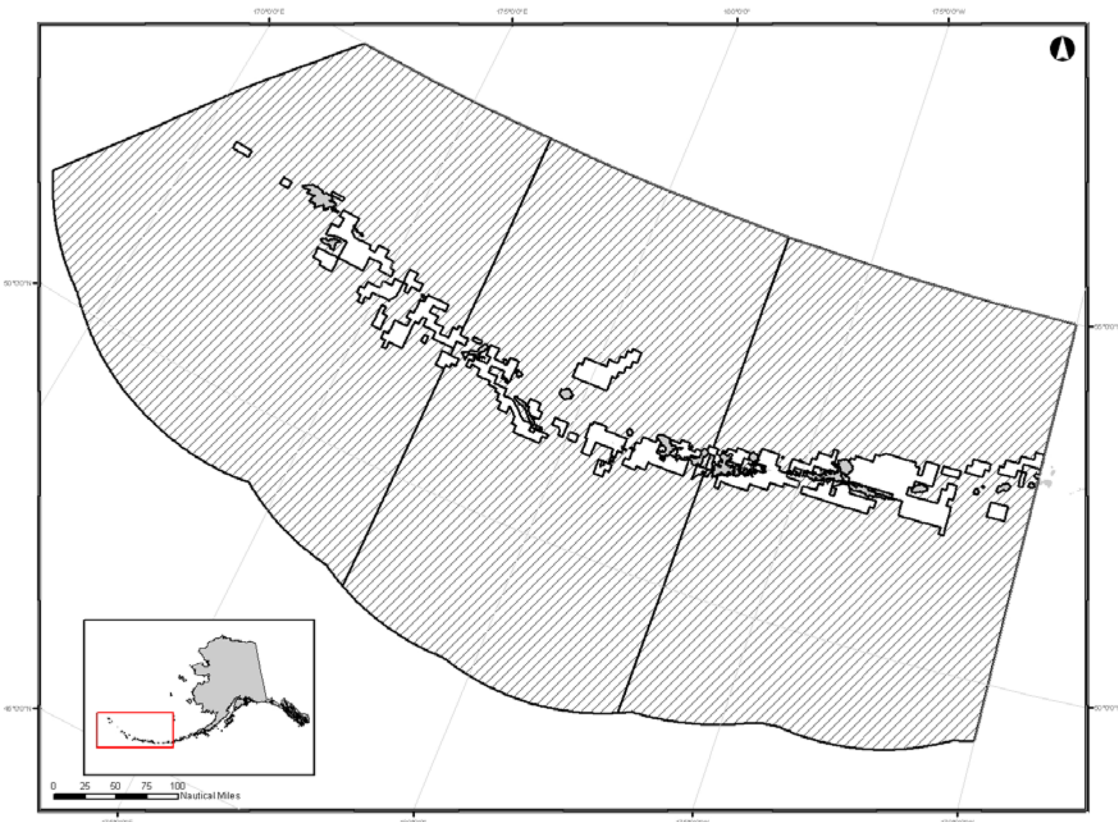
[4] The connection of these coordinates to the first set of coordinates for this area is by a line extending in a counter clockwise direction from these coordinates along the shoreline at mean lower-low water to the first set of coordinates.

[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.

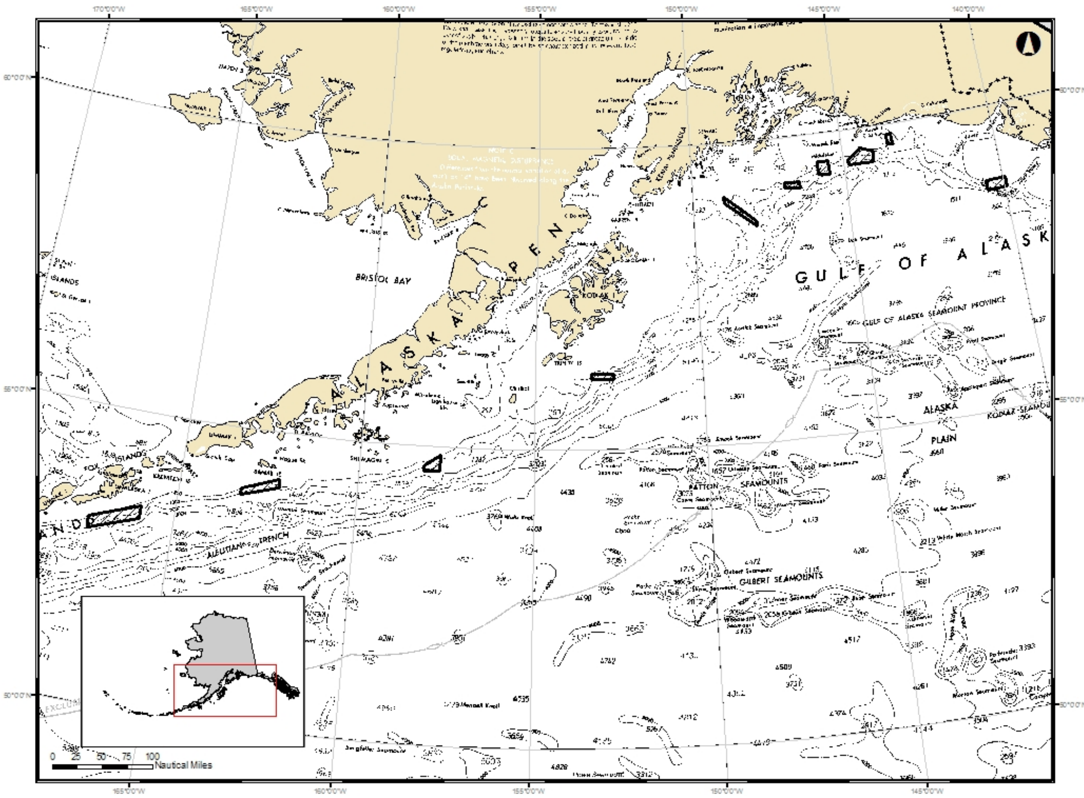
Figure 40 Aleutian Islands Habitat Conservation Area. Polygons are areas open to nonpelagic trawl gear.



A.3.3.3 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 41. 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 41 GOA Slope Habitat Conservation Areas are located within the thick line boxes.



A.3.3.4 Alaska Seamount Habitat Protection Area

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 42. Coordinates for the Alaska Seamount Habitat Protection Areas are listed in the table below.

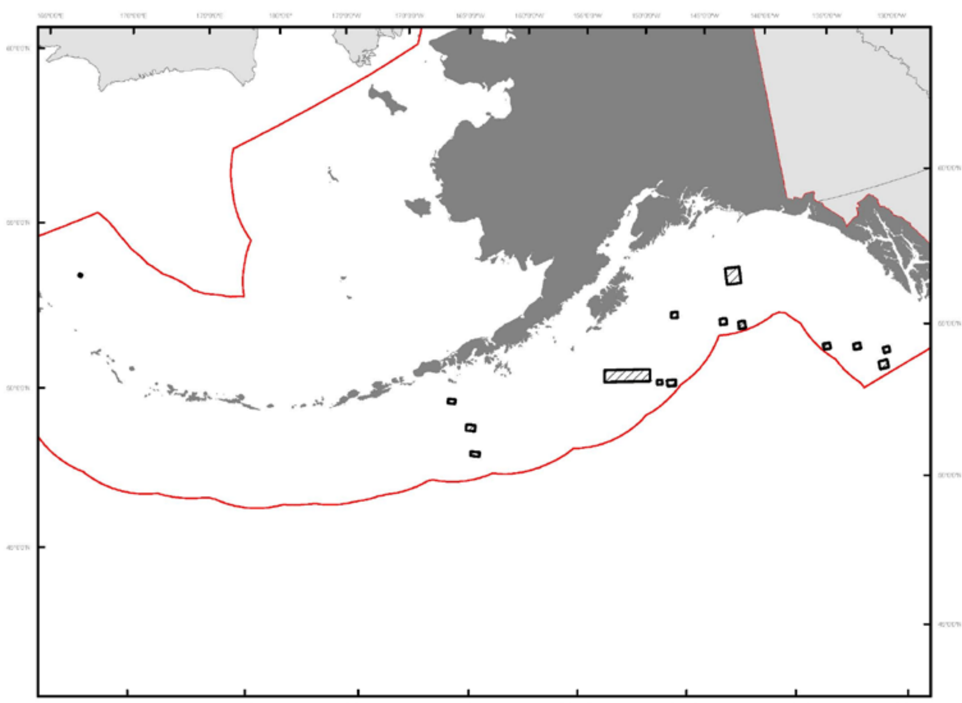
Area Number	Name	Latitude			Longitude		
1	Dickins Seamount	54	39.00	N	136	48.00	W
	Dickins Seamount	54	39.00	N	137	9.00	W
	Dickins Seamount	54	27.00	N	137	9.00	W
	Dickins Seamount	54	27.00	N	136	48.00	W
2	Denson Seamount	54	13.20	N	137	6.00	W
	Denson Seamount	54	13.20	N	137	36.00	W
	Denson Seamount	53	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
	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

Area Number	Name	Latitude			Longitude		
	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

Area Number	Name	Latitude			Longitude		
	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
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 42 Alaska Seamount Habitat Protection Areas are located within the thick line boxes.



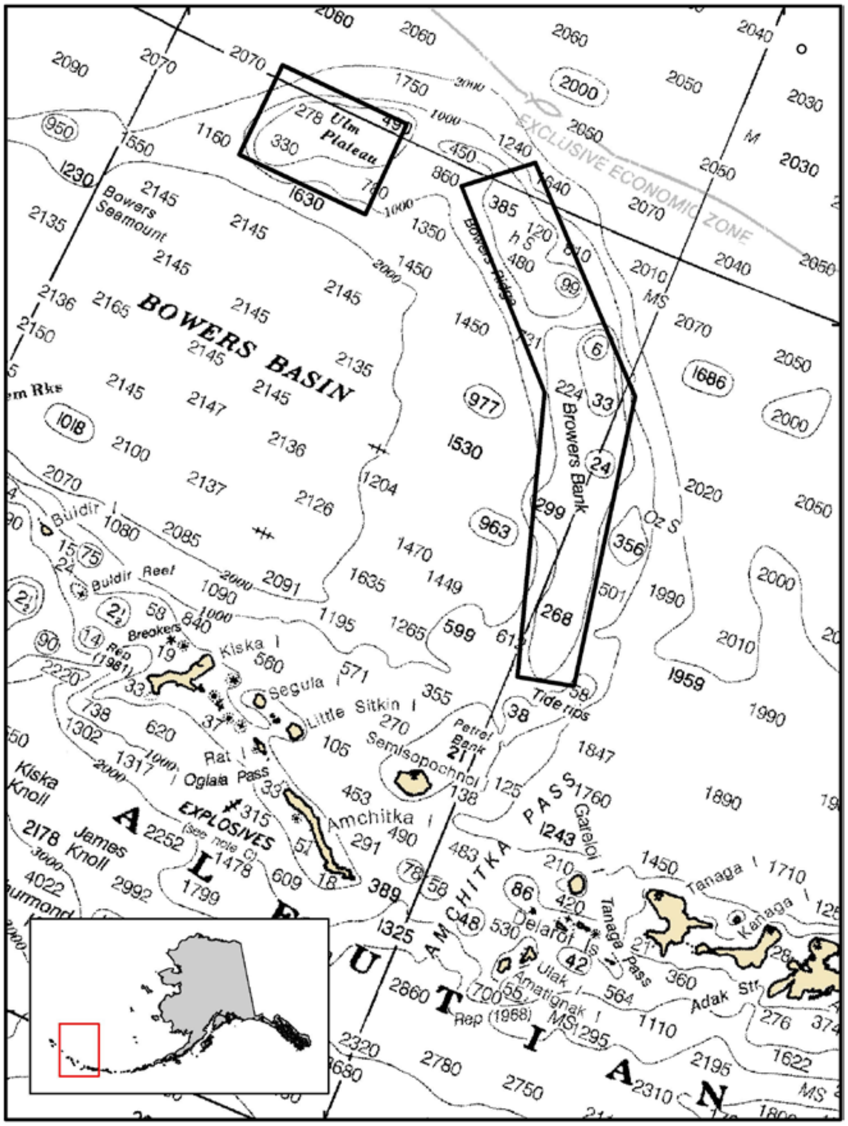
A.3.3.5 Bowers Ridge Habitat Conservation Zone

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 43. 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 43 Bowers Ridge Habitat Conservation Zone



A.3.3.6 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 Figure 24 and Figure 25.

HAPC	Latitude		Longitude	
Cape Ommaney	56	12.51 N	135	7.41 W
	56	12.51 N	135	5.30 W
	56	9.32 N	135	5.30 W
	56	9.32 N	135	7.41 W
Fairweather Ground NW Area	58	28.10 N	139	19.44 W
	58	28.10 N	139	15.42 W
	58	22.00 N	139	15.42 W
	58	22.00 N	139	19.44 W
Fairweather Ground Southern Area	58	16.00 N	139	9.45 W
	58	16.00 N	138	51.34 W
	58	13.10 N	138	51.34 W
	58	13.10 N	139	9.45 W

A.3.3.6.1 GOA Coral Habitat Protection Area

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 Figure 44 and Figure 45.

Area number	Name	Latitude	Longitude
1	Cape Ommaney 1	56 10.85 N	135 5.83 W
	Cape Ommaney 1	56 11.18 N	135 7.17 W
	Cape Ommaney 1	56 9.53 N	135 7.68 W
	Cape Ommaney 1	56 9.52 N	135 7.20 W
2	Fariweather FS2	58 15.00 N	138 52.58 W
	Fariweather FS2	58 15.00 N	138 54.08 W
	Fariweather FS2	58 13.92 N	138 54.08 W
	Fariweather FS2	58 13.92 N	138 52.58 W
3	Fariweather FS1	58 16.00 N	138 59.25 W
	Fariweather FS1	58 16.00 N	139 9.75 W
	Fariweather FS1	58 13.17 N	138 59.25 W
	Fairweather FN2	58 24.10 N	139 14.58 W
4	Fairweather FN2	58 24.10 N	139 18.50 W
	Fairweather FN2	58 22.55 N	139 18.50 W
	Fairweather FN2	58 22.55 N	139 14.58 W
	Fairweather FN1	58 27.42 N	139 17.75 W
5	Fairweather FN1	58 27.42 N	139 19.08 W
	Fairweather FN1	58 26.32 N	139 19.08 W
	Fairweather FN1	58 26.32 N	139 17.75 W
	Cape Ommaney 1	56 10.85 N	135 5.83 W

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 44 GPA Coral HAPC and GOA Coral Protection Areas in the Fairweather Grounds

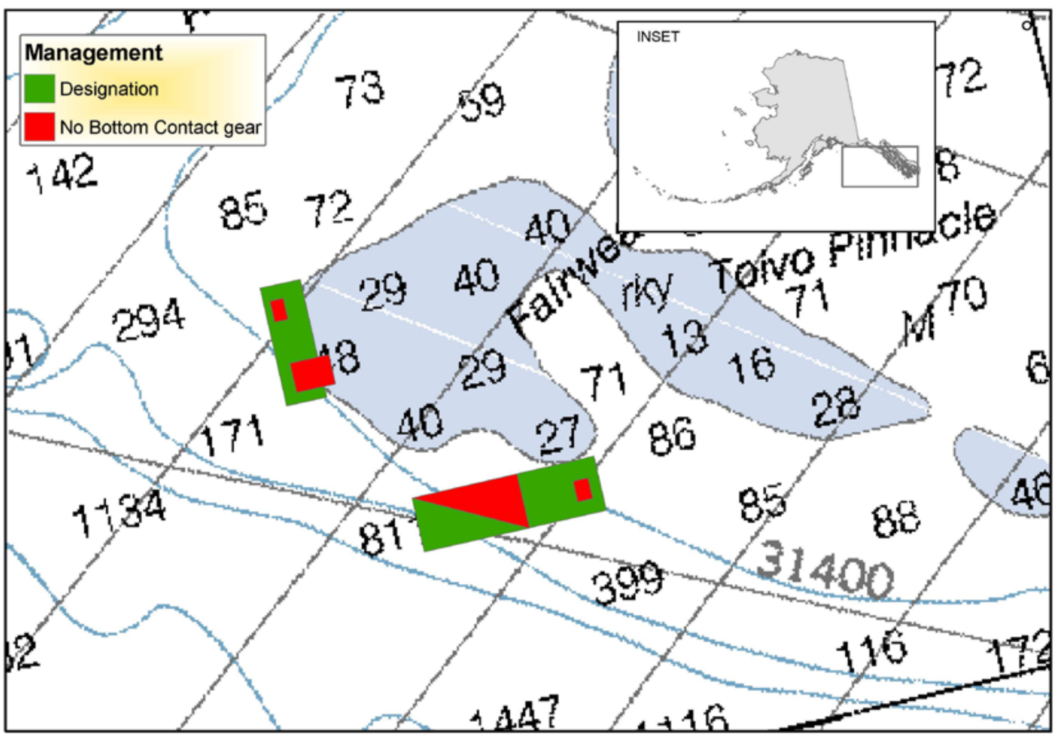
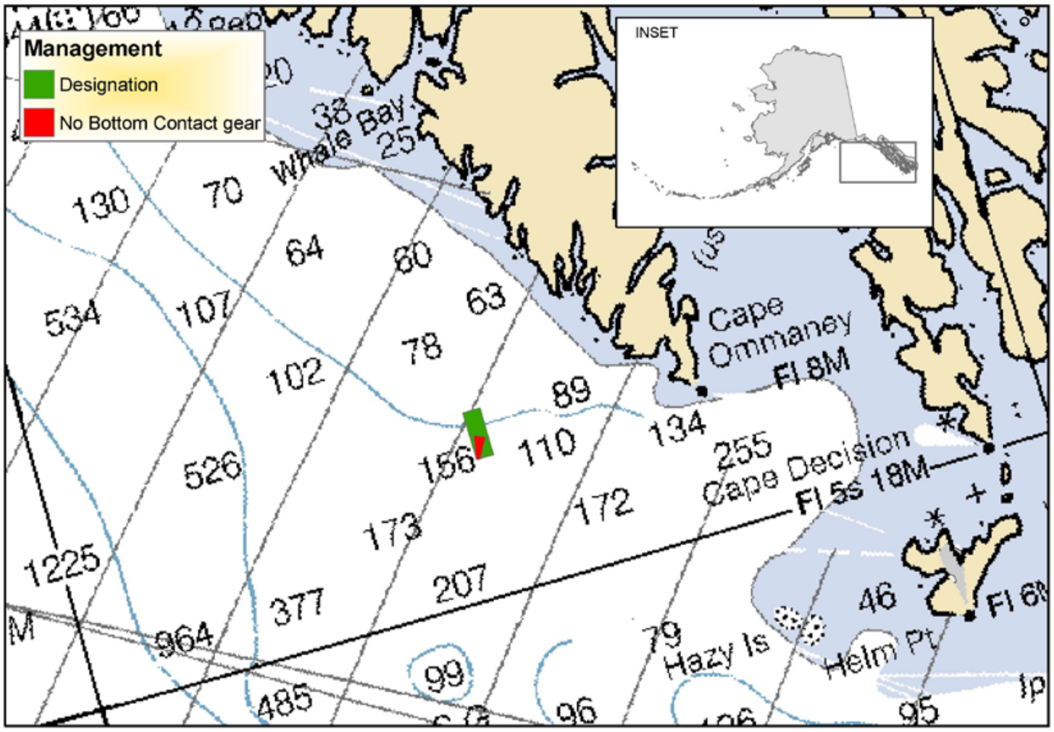


Figure 45 GOA Coral HAPC and GOA Coral Protection Areas near Cape Ommaney



A.3.3.7 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 5 years, to coincide with the EFH 5-year review, or may be initiated at any time 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).

A.4 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 salmon species and the salmon 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 salmon fisheries have a negligible effect on EFH (Witherell 2002). For the salmon fisheries, the analysis found that the effects of EFH are almost non-existent because troll and purse seine gear, which are predominant in the fisheries, generally never touches benthic habitat. Thus, the effects on EFH of the Alaska salmon fisheries are considered minimal and temporary in nature, and the salmon 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 fisheries, as they are currently conducted off of Alaska, affect habitat that is essential to the welfare of salmon 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 salmon 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. If these conclusions are valid, 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 salmon. These habitat changes may or may not affect the welfare of salmon species (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.

Habitat Connections

Five species of Pacific salmon (chinook, chum, pink, coho, and sockeye) are managed under the Alaska salmon FMP. Because all of these species use similar types of habitat, including habitats where fishing activities may occur, fishing effects on EFH were evaluated for all species together.

Spawning/Breeding—Salmon spawn and deposit their eggs in gravel areas of freshwater rivers and streams. Successful spawning depends upon the numbers of spawners, available habitat for spawning and nursery areas, and environmental conditions. Impacts to spawning and breeding of salmon occur when these habitat areas are disturbed, spawning biomass is reduced, or spawners are unable to reach suitable spawning areas.

Feeding—Once salmon smolts begin to enter the ocean, they feed on copepods. As they get larger, they add squid, juvenile herring, smelt, and other forage fish and invertebrate species to their diets. Salmon smolts use the nearshore area after entering the ocean, moving offshore as they get older, using pelagic habitats when at sea.

Growth to Maturity—Salmon feed throughout the open ocean of the North Pacific for up to 6 years (depending upon species) before maturing and returning to their natal rivers to spawn. Growth and mortality of juveniles depend on food availability, predation, bycatch in fisheries, and environmental conditions.

Evaluation of Effects

Issue	**Evaluation**
Spawning/breeding	MT (Minimal, temporary, or no effect)
Feeding	MT (Minimal, temporary, or no effect)
Growth to maturity	MT (Minimal, temporary, or no effect)

Summary of Effects—No commercial fisheries in Alaska are thought to adversely affect salmon spawning habitat given almost no effort (except recreational and subsistence fisheries) in freshwater spawning and rearing areas. Thus, the effects of the fisheries on spawning of salmon are considered minimal and temporary in nature.

Fisheries are considered not to have any impact on freshwater or pelagic habitats used by juvenile salmon. However, fisheries do catch some species eaten by piscivorus species of salmon in the ocean, including squid, capelin, and juvenile herring. Currently, the catch of these prey species is very small relative to overall population size of these species, so fishing activities are considered to have minimal and temporary effects on feeding of all salmon species.

As stated above, fisheries are considered to have minimal effects on prey availability of salmon, including juveniles. Fisheries impacts on juvenile salmon at sea are due to incidental catches in groundfish fisheries. Bycatch in groundfish fisheries is almost nonexistent for pink salmon, coho salmon, and sockeye salmon, but does occur in measurable numbers for chum salmon and chinook salmon taken in trawl fisheries, particularly the pollock trawl fisheries (Witherell et al. 2002). The bycatch amounts are considered to be a small proportion of the stocks and do not cause a substantial impact on salmon populations (Witherell et al. 2002). Thus, fishing activities are considered to have minimal and temporary effects on growth to maturity of salmon.

Fishing activities are considered to have overall minimal and temporary effects on the EFH for all salmon species. Fishing activities only interact with salmon habitat to any degree in the ocean habitats, and the concerns about these interactions center on effects on prey availability and bycatch. Prey of salmon (from copepods up to squid and forage fish) are not subject to directed fisheries removals, and bycatch is not a significant factor in total mortality. Professional judgement led to the conclusion that fisheries do not adversely affect the EFH of salmon species.

A.5 Non-fishing Activities that may Adversely Affect Essential Fish Habitat

The waters and substrates that comprise 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 Act 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, non-water-dependent actions 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 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. Such information is required to 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, so 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.

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.

A.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 discernable, 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.

A.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 best management practices 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.

A.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 U.S 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 (FIFRA). 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 (roads, railroads, power lines, etc.), 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 then ingested by macroinvertebrates, 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 1000 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.

A.5.1.3 Urban and Suburban Development

Urban and suburban development is most likely the greatest non-fishing threat to EFH (NMFS 1998 a, b). 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), 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.

A.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 both 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, as well as (7) the concentration and introduction of PAHs, heavy metals and other pollutants.

Recommended Conservation Measures

The following conservation measures should be viewed as options to avoid and minimize adverse impacts from regarding 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; and 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).
- Maintain roadway and associated stormwater collection systems properly.
- Limit roadway sanding and the use of deicing chemicals during the winter to minimize sedimentation and introduction of contaminants into nearby aquatic habitats.

A.5.2 Riverine Activities

A.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 [AFS] 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 mining in both 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 [NRC] 1999). (Additional information on mining impacts in the marine environment is covered later in this synthesis).

A.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 (1998). 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 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.

A.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.

A.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 U.S., 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.

A.5.2.2.1 Organic Debris

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).

A.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 the 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.

A.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, 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 [PFMC] 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; and plan project design and operation to minimize or mitigate for these changes.
- Use seasonal restrictions for construction, maintenance, and operations 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 which 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.

A.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 eighty-seven 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 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.

A.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).

A.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, 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.

1. Avoid new dredging in sensitive habitat areas to the maximum extent practicable.
2. Reduce the area and volume of material to be dredged to the maximum extent practicable.
3. Avoid dredging and placement of equipment used in conjunction with dredging operations in special aquatic sites and other high value habitat areas.
4. Implement seasonal restrictions to avoid impacts to habitat during species critical life history stages (e.g., spawning season, egg, and larval development period).
5. Utilize BMPs to limit and control the amount and extent of turbidity and sedimentation.
6. 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.
7. Prior to dredging, test sediments for contaminants as per EPA and USACE requirements.
8. Provide appropriate compensation for significant impacts (short-term, long-term, and cumulative) to benthic environments resulting from dredging.
9. Identify excess sedimentation in the watershed that prompts excessive maintenance dredging activities, and implement appropriate management actions, if possible.

A.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.

A.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.

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

A.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.

1. Federal, state, and local resource management and permitting agencies should address the cumulative impacts of fill operations on EFH.
2. Minimize the areal extent of any fill in EFH, or avoid it entirely.
3. Consider alternatives to the placement of fill into areas that support managed species.

4. Fill should be sloped to maintain shallow water, photic zone productivity; allow for unrestricted fish migration; and provide refugia for juvenile fish.
5. 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.
6. Fill materials should be tested and be within the neutral range of 7.5 to 8.4 pH.

A.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, (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.

1. Locate marinas in areas of low biological abundance and diversity.
2. Leave riparian buffers in place to help maintain water quality and nutrient input.
3. Include low-wake vessel technology, appropriate routes, and BMPs for wave attenuation structures as part of the design and permit process.
4. 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.
5. Locate mooring buoys in water deep enough to avoid grounding and to minimize the effects of prop wash.
6. Use catchment basins for collecting and storing surface runoff to remove contaminants prior to delivery to any receiving waters.
7. Locate facilities in areas with enough water velocity to maintain water quality levels within acceptable ranges.

8. Locate marinas where they do not interfere with natural processes so as to affect adjacent habitats.
9. To facilitate movement of fish around breakwaters, breach gaps and construct shallow shelves to serve as "fish benches", as appropriate.
10. Harbor facilities should be designed to include practical measures for reducing, containing, and cleaning up petroleum spills.

A.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)* (http://www.adfg.state.ak.us/special/invasive/invasive.ph).

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.

1. 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.
2. Adhere to regulations and use best management practices outlined in the State of Alaska Aquatic Nuisance Species Management Plan (Fay 2002).
3. Encourage vessels to perform a ballast water exchange in marine waters to minimize the possibility of introducing invasive estuarine species into similar habitats.
4. Discourage vessels that have not performed a ballast water exchange from discharging their ballast water into estuarine receiving waters.
5. Require vessels brought from other areas over land via trailer to clean any surfaces that may harbor non-native plant or animal species (propellers, hulls, anchors, fenders, etc.).

6. Treat effluent from public aquaria displays and laboratories and educational institutes using non-native species before discharge.
7. Encourage proper disposal of seaweeds and other plant materials used for packing purposes when shipping fish or other animals.
8. Undertake a thorough scientific review and risk assessment before any non-native species are introduced.

A.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.

A.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. Both 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).

A.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.

1. 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:

2. Drive piles during low tide when they are located in intertidal and shallow subtidal areas.
3. Use a vibratory hammer when driving hollow steel piles.
4. Implement measures to attenuate the sound should SPLs exceed the 180 dB (re: 1 μPa) threshold.
5. Surround the pile with an air bubble curtain system or air-filled coffer dam.
6. Use a smaller hammer to reduce sound pressures.
7. Use a hydraulic hammer if impact driving cannot be avoided.
8. 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.

A.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.

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

2. 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.
3. Complete each pass of the clamshell to minimize suspension of sediment if pile stubs are removed with a clamshell.
4. Place piles on a barge equipped with a basin to contain attached sediment and runoff water after removal.
5. 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.

A.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.

1. Use upland boat storage whenever possible to minimize need for overwater structures.
2. 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.
3. Design piers, docks, and floats to be multiuse facilities to reduce the overall number of such structures and to limit impacted nearshore habitat.
4. 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.

5. 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.
6. Locate floats in deep water to avoid light limitation and grounding impacts to the intertidal or shallow subtidal zone.
7. Maintain at least 1 foot (0.30 meter) of water between the substrate and the bottom of the float at extreme low tide.
8. Conduct in-water work when managed species and prey species are least likely to be impacted.
9. To the extent practicable, avoid the use of treated wood timbers or pilings.
10. Mitigate for unavoidable impacts to benthic habitats.

A.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.

1. Avoid or minimize the loss of coastal wetlands as much as possible.
2. Do not dike or drain tidal marshlands or estuaries.
3. Wherever possible, use soft in lieu of “hard” shoreline stabilization and modifications.
4. 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.
5. Include efforts to preserve and enhance fishery habitat to offset impacts.
6. Avoid installing new water control structures in tidal marshes and freshwater streams.
7. Ensure water control structures are monitored for potential alteration of water temperature, dissolved oxygen concentration, and other parameters.
8. Use seasonal restrictions to avoid impacts to habitat during critical life history stages.
9. Address the cumulative impacts of development activities in the review process for flood control and shoreline protection projects.
10. Use an adaptive management plan with ecological indicators to oversee monitoring and to ensure that mitigation objectives are met. Take corrective action as needed.

A.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 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 (see also http://www.fs.fed.us/r10/TLMP/F_PLAN/APPEND_G.PDF).

1. 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.
2. 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).
3. Do not store logs in the water if they will ground at any time or shade sensitive aquatic vegetation such as eelgrass.
4. Avoid siting log-storage areas and LTFs in sensitive habitat and areas important for specified species, as required by the ATTF guidelines.
5. Site log storage areas and LTFs in areas with good currents and tidal exchanges.
6. Use land-based storage sites where possible.

A.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).

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.

1. Align crossings along the least environmentally damaging route.
2. 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.
3. Store and contain excavated material on uplands.
4. Backfill excavated wetlands with either the same or comparable material capable of supporting similar wetland vegetation, and at original marsh elevations.
5. Use existing rights-of-way whenever possible.
6. Bury pipelines and submerged cables where possible.
7. Remove inactive pipelines and submerged cables unless they are located in sensitive areas (e.g., marsh, reefs, sea grass, etc.).
8. Use silt curtains or other barriers to reduce turbidity and sedimentaton whenever possible.
9. Limit access for equipment to the immediate project area. Tracked vehicles are preferred over wheeled vehicles.
10. Limit construction equipment to the minimum size necessary to complete the work. Use
11. Conduct construction during the time of year when it will have the least impact on sensitive habitats and species.
12. Suspend transmission lines beneath existing bridges or conduct directional boring under streams to reduce the environmental impact.
13. 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.

A.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, (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.

1. Site mariculture operations away from kelp or eelgrass beds.
2. Do not enclose or impound tidally influenced wetlands for mariculture.
3. Undertake a thorough scientific review and risk assessment before any non-native species are introduced.
4. 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.
5. Provide appropriate mitigation for the unavoidable, extensive, or permanent loss of plant communities.
6. Ensure that mariculture facilities, spat, and related items transported from other areas are free of nonindigenous species.

A.5.4 Coastal/Marine Activities

A.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 waters of the U.S., 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.

1. Locate discharge points in coastal waters well away from shellfish beds, sea grass beds, corals, and other similar fragile and productive habitats.
2. Reduce potentially high velocities by diffusing effluent to acceptable velocities.
3. Determine baseline benthic productivity by sampling before any construction activity.
4. Provide for mitigation when degradation or loss of habitat occurs.
5. Institute source-control programs that effectively reduce noxious materials.
6. Ensure compliance with pollutant discharge permits, which set effluent limitations and/or specify operation procedures, performance standards, or BMPs.
7. Treat discharges to the maximum extent practicable.

8. Use land-treatment and upland disposal/storage techniques where possible.
9. Avoid siting pipelines and treatment facilities in wetlands and streams.

A.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; heads, fins, bones, and entrails; as well as 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.

1. To the maximum extent practicable, base effluent limitations on site-specific water quality concerns.
2. Encourage the use of secondary or wastewater treatment systems where possible.
3. Do not allow designation of new zones of deposit for fish processing waste and instead seek disposal options that avoid an accumulation of waste.

4. Promote sound recreational fish waste management through a combination of fish-cleaning restrictions, public education, and proper disposal of fish waste.
5. Encourage alternative uses of fish processing wastes.
6. Explore options for additional research.
7. Monitor biological and chemical changes to the site of processing waste discharges.

A.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.

1. 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.
2. Design intake structures to minimize entrainment or impingement.
3. Design power plant cooling structures to meet the best technology available requirements as developed pursuant to Section 316(b) of the CWA.
4. 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.
5. Avoid the use of biocides (e.g., chlorine) to prevent fouling where possible.
6. Treat all discharge water from outfall structures to meet state water quality standards at the terminus of the pipe.

A.5.4.4 Oil and Gas Exploration, Development, and Production

Two agencies, the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) 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:

1. Avoid the discharge of produced waters into marine waters and estuaries.
2. Avoid discharge of muds and cuttings into the marine and estuarine environment.
3. To the extent practicable, avoid the placement of fill to support construction of causeways or structures in the nearshore marine environment.
4. As required by federal and state regulatory agencies, encourage the use of geographic response strategies that identify EFH and environmentally sensitive areas.
5. Evaluate potential impacts to EFH that may result from activities carried out during the decommissioning phase of oil and gas facilities.

6. Vessel operations and shipping activities should be familiar with Alaska Geographic Response Strategies (GRS) which detail environmentally sensitive areas of Alaska's coastline.

A.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.

1. 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.
2. Avoid restoration work during critical life stages for fish such as spawning, nursery, and migration.

3. Provide adequate training and education for volunteers and project contractors to ensure minimal impact to the restoration site.
4. Conduct monitoring before, during, and after project implementation.
5. To the extent practicable, mitigate any unavoidable damage to EFH.
6. Remove and, if necessary, restore any temporary access pathways and staging areas used.
7. 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.

A.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.

1. To the extent practicable, avoid mining in waters containing sensitive marine benthic habitat, including EFH (e.g., spawning, migrating, and feeding sites).
2. Minimize the areal extent and depth of extraction to reduce recolonization times.
3. Monitor turbidity during operations, and cease operations if turbidity exceeds predetermined threshold levels.
4. Monitor individual mining operations to avoid and minimize cumulative impacts. .
5. 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).

6. Deposit tailings within as small an area as possible.

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A.6 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.

A.7 Research Approach for EFH

The EFH EIS (NMFS 2005) identified the following research approach for EFH regarding minimizing fishing impacts.

Objectives

Establish a scientific research and monitoring program to understand the degree to which impacts have been reduced within habitat closure areas, and to understand how benthic habitat recovery of key species is occurring.

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?

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.

Research Time Frame

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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