UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

July 8, 2003

John Goll
Regional Director
Alaska OCS Region
Minerals Management Service
949 East 36th Avenue, Room 308
Anchorage, Alaska 99508-4302

Dear Mr. Goll:

The purpose of this letter is to convey the attached Essential Fish Habitat (EFH) Programmatic Consultation document. This document is a result of a request from the Minerals Management Service (MMS) for activities associated with leasing and exploration from proposed lease sales 191 and 199 as well as exploration associated with all other existing leases in the Cook Inlet Planning Area. MMS has completed a Draft Environmental Impact Statement (DEIS) which assesses two lease sales in the Final 2002-2007 five year oil and gas leasing program for the Cook Inlet Outer Continental Shelf (OCS) planning area. In accordance with procedures outlined in the March 12, 2002, EFH finding between our agencies, MMS has provided NMFS with the information for an EFH Assessment in the DEIS.

Under Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), federal agencies are required to consult with the Secretary of Commerce on any action that may adversely affect EFH. NMFS has defined five approaches to meet the EFH consultation requirements: use of existing procedures, general concurrences, programmatic consultations, abbreviated consultations and expanded consultations. Use of programmatic consultations is a process that implements the EFH consultation requirements efficiently and effectively by including many individual actions that may adversely affect EFH in one consultation. NMFS has determined that in accordance with 50 CFR 600.920 (j) of the EFH regulations programmatic consultation is appropriate for lease sales 191 and 199, because sufficient information is available to develop EFH conservation recommendations which will address reasonably foreseeable adverse impacts to EFH.

Lease sale 191 is scheduled for 2004 and lease sale 199 for 2006. The proposed sales include consideration of 517 whole or partial lease blocks in the Cook Inlet planning area, covering about 2.5 million acres. Pursuant to 50 CFR 600.920 (a)(1) EFH consultation is not required for actions that were completed prior to the approval of EFH designations by the Secretary, e.g., previous lease sales. Consultation is required for renewals, reviews, or substantial revisions of actions if the renewal, review or revision may adversely affect EFH. Therefore, the attached programmatic consultation is for the proposed Cook Inlet lease sales 191 and 199 only, and does not cover existing lease sales in the Cook Inlet planning area. However, as discussed between our staffs, NMFS may need to consult on upcoming actions related to those existing leases should MMS determine an adverse effect to EFH may occur. The goal of this programmatic consultation is to address as many adverse effects as possible through programmatic EFH conservation recommendations.

Attachment A to this letter contains the programmatic consultation for the Proposed Action. Sections 1-3 is information submitted to NMFS for the EFH consultation from MMS describing the specific activities, the EFH and managed species affected by those activities, and the nature of those effects. MMS has also included information on other fisheries resources which are not federally managed species under the Magnuson-Stevens Act, e.g. Pacific herring, but recognized as important components of the ecosystem. The programmatic consultation also contains NMFS EFH Conservation Recommendations which MMS will consider during the decision processes for lease sales 191 and 199.

Thank you for the opportunity to coordinate on these proposed lease sales. We look forward to your response in writing, as to whether or not you agree with this programmatic consultation as required by Section 305(b)(4)(B) of the Magnuson-Stevens Act. Should you have any additional questions regarding this matter please contact Ms. Jeanne L. Hanson at 271-5006.

Sincerely,

James W. Balsiger
Administrator, Alaska Region

Attachments

cc: North Pacific Fishery Management Council
Karen Abrams - F/HC
F/AKR4 - HCD staff
F/AKR2 - Lori Durall

Attachment A

PROGRAMMATIC CONSULTATION
COOK INLET PLANNING AREA
OIL AND GAS LEASE SALES 191 AND 199

1.0 Program Description

The Secretary of the Interior oversees the Outer Continental Shelf (OCS) oil and gas program and is required to balance orderly resource development with protection of the human, biological, and physical environments while simultaneously ensuring that the public receives an equitable return for these resources and that free market competition is maintained. Section 18 of the OCS Lands Act requires receipt of fair market value for OCS oil and gas leases and the rights they convey. The Secretary of the Interior is empowered to grant leases to the highest qualified responsible bidder(s) on the basis of sealed competitive bids and to formulate such regulations as necessary to carry out the provisions of the OCS Lands Act. The Secretary of the Interior has designated the Minerals Management Service (MMS) as the administrative agency responsible for the mineral leasing of submerged OCS lands and for the supervision of offshore operations after leases are issued.

The purpose of the proposed federal action, as addressed in MMS' Draft Environmental Impact Statement (DEIS) is to offer for lease, in two separate sales, areas on the Cook Inlet OCS that might contain economically recoverable oil and gas resources. The DEIS addresses these Federal actions as Cook Inlet Sales 191 and 199, respectively. MMS has formally identified the location and extent of the area of study for the DEIS, to include 517 whole or partial blocks (about 2.5 million acres, or 1.01 million hectares). This area is located seaward of the State of Alaska submerged lands boundary and extends from 3 to approximately 30 miles offshore in water depths ranging from approximately 30 to 650 feet.

The Secretary of the Interior has scheduled Sale 191 in 2004, and Sale 199 in 2006. MMS has prepared a single DEIS for the Proposed Actions for each of the sales. Federal regulations allow for several similar proposals to be analyzed in one Environmental Impact Statement (EIS) (40 Code of Federal Regulations [CFR] 1502.4). Thus, the DEIS analyses a range of activities that could be associated with each of the two sales. This DEIS will be used for decisions on Sale 191. MMS will prepare an Environmental Assessment or supplemental EIS for Sale 199. Formal consultation with the public will be initiated for Sale 199 to obtain input for assisting in determining whether the information and analyses in the current DEIS are still valid. A sale-specific Information Request will be issued that specifically describes the action for which MMS is requesting input. The sale process for Sale 191 will require a minimum of 2 years to complete. The sale process for Sale 199 will be somewhat shorter.

The DEIS analyzes the potential environmental impacts in each of the sales, including estimated exploration and development and production activities, on the physical, biological, and human environments. For the purposes of analysis,assumedly exploration would result from both lease sales. In the analysis presented in the DEIS, this exploration, from either or both sales, leads to discovery and development of a single field. Section II.B, of the DEIS, the Proposed Action, contains the details of this exploration and development scenario. This section indicates that the activities associated with the two sales, leasing, exploration, development, and production, could take place anywhere in the Cook Inlet Planning Area although the expected location is the central to northern portions of the sales area. Appendix B of the DEIS, presents additional description and analysis that provide the rationale and basis for the resource estimates and the exploration and development scenario. Section IV.B of the DEIS presents a discussion of potential developmental effects for the Proposed Actions and for alternatives. Section V of the DEIS contains the cumulative effects analysis.

2.0 Essential Fish Habitat Affected by the Program Activities

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For interpreting the definition of EFH "waters" includes aquatic areas and their associated physical, chemical, and biological properties used by fish, and may include areas historically used by fish where appropriate. "Substrate" includes sediment, hard bottom, structures underlying the water, 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.

Five fishery management plans (FMPs) exist for fisheries in Alaska. They cover groundfish in the Gulf of Alaska, groundfish in the Bering Sea and Aleutian Islands, crab in the Bering Sea and Aleutian Islands, and salmon and scallops Statewide. Those relating to this lease sale include the Gulf of Alaska groundfish and Statewide salmon and scallop management plans. Herring and Pacific halibut technically are not species to be evaluated for essential fish habitat under the Act, because the two species are not FMP species. Herring are managed by the State of Alaska and Pacific halibut are managed under the Northern Pacific Halibut Act. However, because adverse impacts to prey, such as herring or other forage fish species, may degrade the quality or quantity of essential fish habitat, our analysis includes the potential effects of the Proposed Action on herring and other forage fish.

The proposed sale is seaward of the State of Alaska submerged lands boundary in Cook Inlet and extends from 3 to 30 miles offshore from Kalgin Island South near Shuyak Island. The proposed sale excludes Shelikof Strait. Based on the NPFMC EFH descriptions, those FMPs relating to this lease sale include the Gulf of Alaska groundfish, scallop and statewide salmon management plans (NPFMC 1999).

EFH has been characterized for the following species: Pacific cod, Atka mackerel, walleye pollock, dover sole, arrowtooth flounder, flathead sole, Pacific ocean perch, rex sole, rock sole, sablefish, sculpins, skates, salmon, and weathervane scallops.

This section discusses the federally managed species (NPFMC 1999) found in the Cook Inlet, Kodiak, and South Alaskan Peninsula regions. MMS analysis relies on population-level impacts; whose definition of a population is defined here as a group of organisms of one species, occupying a defined area (the central Gulf of Alaska, which includes the South Alaskan Peninsula, Kodiak Archipelago, Shelikof Strait, Cook Inlet, and Prince William Sound regions) and usually isolated to some degree from other similar groups. A "stock" is defined here as a subpopulation of the area's population. The descriptions emphasize aspects of the morphology and life history of these species that the Proposed Action might influence.

Maps 3 through 10 and 21 of the DEIS may be of use concerning the distribution of fish accounted for in the following sections.

2.1 Pelagic Finfish

Pelagic fish usually inhabit the water layers above the abyssal zone (waters below 4,000 meters) and beyond the littoral zone (nearshore zone between high and low water marks). Many of these finfish migrate long distances in response to changing environmental conditions for food or reproduction. Some pelagic fish segregate by cohort or life-history stage and use different habitat areas during these different life stages. For example, while some adults may enter Cook Inlet during a particular year (for example, 2004) to spawn after spending years at sea in the North Pacific Ocean, other members of the same population continue to reside at sea and may not enter Cook Inlet for a year or more (for example, 2005, 2006).

Pacific Herring (*Clupea pallasi*)

This comparatively small fish occurs in large schools in the Cook Inlet region in early April and possibly through early fall. The Pacific herring is one of more than 180 species in the herring family *Clupeidae*. Herring are important prey for a wide variety of fish, mammals, and birds. Pacific herring migrate in schools and are found along both shores of the North Pacific Ocean, ranging from San Diego Bay to the Bering Sea and Japan. Herring have a blue-green upper body with silvery sides and lack markings. The body is laterally compressed, and the scales along the underside project in a slightly serrated arrangement. Scales are large and easily removed. These fish may grow to 46 centimeters (18 inches) in length, but a 23-centimeter (9-inch) specimen is considered large.

Pacific herring generally spawn during the spring. In Alaska, spawning first occurs in the southeastern archipelago during mid-March, in Prince William Sound in April and May, and in the Bering Sea during May and June. Spawning is confined to shallow, vegetated areas in intertidal and subtidal zones. Eggs are adhesive, and survival is better for those eggs that stick to intertidal vegetation than for those that fall to the bottom. Milt released by males drifts among eggs and fertilizes them. Eggs hatch in about 2 weeks, depending on water temperature. Herring are iteroparous, spawning every year after reaching sexual maturity at 3 or 4 years of age. The number of eggs spawned varies with the age of the female, averaging 20,000 annually. Average lifespan for these fish is about 8 years in Southeast Alaska and up to 16 years in the Bering Sea. Egg mortality is high. Young larvae drift and weakly swim with ocean currents and are preyed on extensively by other vertebrate and invertebrate fauna. Following metamorphosis of larvae to the juvenile form, they rear in sheltered bays and inlets and appear to remain segregated from adult populations until they mature. In the Cook Inlet region, herring usually first spawn in their second year and may continue to spawn annually for up to 15 years. Herring spawn extensively along much of the Shelikof coastline of Kodiak Island and the South Alaska Peninsula, areas that might be affected by the Proposed Action. Kamishak Bay is one major spawning area that supports a short-season sac-roe fishery.

Herring inhabit distinctly different habitat areas during different periods of the year. After spawning, most adults leave inshore waters and move seaward to feed primarily on zooplankton such as copepods and other crustaceans. They are seasonal feeders and accumulate fat reserves for periods of relative inactivity. Herring schools often follow a diel vertical migration pattern, spending daylight hours near the bottom and moving upward during the evening to feed (http://www.state.ak.us/adfg/notebook/fish/herring.htm).

Pacific sand lance (*Ammodytes hexapterus*)

The Pacific sand lance occurs throughout coastal marine waters of Alaska (Mecklenburg, Mecklenburg, and Thorsteinson, 2002). Their range includes the Bering Sea and eastern North Pacific Ocean. Information reported in the following is from Robards et al. (1999).

Physical characteristics of the sand lance include an elongate and compressed body with diagonal skin folds, a fleshy ridge extending the length of the body on either side of the ventral midline, a single dorsal fin that folds back into a groove, and a projecting lower jaw. The dorsal and anal fins are supported by soft rays only. Sand lance are metallic blue in color dorsally, and silver ventrally. Sand lance generally grow to 20 centimeters (8 inches) or less in length; however, individuals in the Bering Sea grow larger, up to 28 centimeters (11 inches) in length.

Sand lance are abundant in shallow, nearshore areas ranging in depth to 100 meters (55 fathoms), but they are most common at depths less than 50 meters (27 fathoms) and often in as little as 6 meters (3 fathoms). This shallow distribution probably results from their preference for light and accessibility of prey.

Sand lance are a quintessential forage fish, and as a group (there are six species worldwide) are possibly the single most important taxon of forage fish in the Northern Hemisphere. Sand lance are preyed on by numerous species of seabird, marine mammal, and fish, in addition to various land birds and animals. Population fluctuations and distribution of predators are frequently linked to sand lance abundance. Sand lance also play an important role in the ecosystem as a consumer of zooplankton.

Juvenile and adult sand lance exhibit the rather unusual habit of alternating between lying buried in the substrate and swimming in well-formed schools. They typically are associated with fine gravel and sandy substrates up to and including the intertidal zone. Their use of substrates appears to be highly specific. In the natural environment, substrates used by sand lance have been characterized consistently as well washed, drained, and unpacked and typically contain coarse sands with little or no mud and silt. Sand lance also avoid oil-contaminated sediments. Although wide ranging, their preference for specific shallow substrates results in a patchy distribution of groups. Sand lance bury themselves within the substrates during periods of low light, during estivation (i.e., passing hot periods in torpor) and dormant periods, or occasionally in response to predators.

Most investigators have reported that sand lance are abundant in preferred habitats from spring to late summer and uncommon during the remainder of the year. Sand lance are rarely caught in the water column during the winter months and appear to remain inactive or in hibernation while buried in intertidal and shallow subtidal lands. If disturbed during winter on extreme low tides, however, they can move spontaneously and quickly. Juvenile sand lance are caught occasionally in beach seines during the winter, but they normally are found buried in substrates with adults. Feeding occurs primarily in the water column, although epibenthic invertebrates occasionally appear in the diet. Several researchers have shown that for sand lance, vision is far more important than olfaction in feeding. Feeding habits of sand lance change with age. Larvae feed on phytoplankton, diatoms, and dinoflagellates and, after juveniles reach 10 millimeters (less than 1 inch), they feed on nauplii of copepods in summer and euphausiids in winter. Adult fish prey on macrocopepods, chaetognatha, and fish larvae. Overall, copepods are the predominant prey source for postlarval stages. Other prey reported from diets include crustacea, amphipoda, isopod larvae, mysids, gammarid amphipods, harpacticoid copepods, larvaceans, annelids, polychaetes, juvenile bivalves and gastropods, insect flotsam, fish larvae, and invertebrate and fish eggs.

Sand lance typically reach maturity in their second year, although a few individuals remain immature for longer periods. Spawning occurs in late September and October on fine gravel and sandy beaches, soon after summer water temperatures begin to decline. Sand lance approach intertidal sites where spawning sometimes has taken place for decades. Spawning takes place in dense formations. Female sand lance burrow through the substrate while releasing eggs, which results in the formation of scour pits in intertidal sediments. Females are reported to release 1,468-16,081 eggs. Eggs are deposited in the intertidal zone just below the water line. Larvae hatch at a size of approximately 5 millimeters (less than 1 inch) before the spring plankton bloom.

Eulachon/Candlefish/Hooligan (*Thaleichthys pacificus*)

The eulachon is one of five species of smelt (family Osmeridae) found in Alaska. The name is derived from the Chinook language of the Pacific Northwest Native peoples and has several variations, of which hooligan is the most commonly used in Alaska. The eulachon, a very oily fish, also is known as the candlefish because of its traditional use as a candle when dried and fitted with a wick. The genus name, *Thaleichthys*, is Greek for rich fish, which lends to the eulachon's reputation as having flesh of a high oil content.

The eulachon is a small fish up to 10 inches in total length. The front of the eulachon's dorsal fin begins well behind where its pelvic fin is attached to its body, and its gill covers have circular grooves, which distinguishes it from other Alaska fish. Young eulachon have moderately developed canine-like teeth that they lose as they mature; by spawning time, the eulachon usually has no teeth. Eulachon are generally blue-silver in color turning to gray-brown at spawning time, when the males are easily distinguished from the females by tubercles on the head and on the scales along the lateral line, more musculature development along the lateral line, and longer paired pectoral and pelvic fins.

Eulachon are anadromous, spawning and hatching in freshwater. They grow to maturity in the ocean where, as juveniles and adults, they feed mainly on euphasids, a small shrimplike crustacean sometimes called krill. As the spawning season approaches, eulachon gather in large schools off the mouths of spawning streams and rivers. The upstream migration is closely keyed to the water temperature of the stream. In Southeast Alaska, the migration can occur as early as April; while in central and western Alaska, it generally takes place in May. Eulachon move nearshore in early May and spawn in drainages throughout Cook Inlet. Some streams have two separate but overlapping migrations. Males usually outnumber the females during the spawning migration. Eulachon generally spawn in the lower reaches of the river or stream. After spawning, the majority of the eulachon die. Eggs are broadcast over sandy gravel bottoms where they attach to particles of sand and hatch in 21-40 days, depending on the water temperature. Depending on size, egg complements range from 17,300-39,600 per fish, averaging about 25,000 eggs. Newly hatched young are carried by currents to the sea (Hart, 1973), where they feed mainly on copepod larvae and other plankton. After 3-4 years at sea, they return as adults to spawn.

In Alaska, eulachon are seasonally abundant in most major watershed drainages from the Southeast west to Cook Inlet and become less abundant westward out to the Aleutian Islands and to the Pribilof Islands in the Bering Sea. Some drainages with eulachon migrations include the Unik (Eulachon), Stikine, Taku, Mendenhall, and Chilkat rivers in Southeast; the Situk River near Yakutat; the Copper River Delta area near Cordova; and the Kenai, Susitna, and 20-Mile rivers in Cook Inlet. Eulachon also are present in many smaller streams with varying abundance. In the westward margins of their range, eulachon are displaced by a similar-appearing smelt, the rainbow smelt (*Osmerus mordax* [Mitchill]).

Eulachon are important forage fish. Newly hatched and juvenile eulachon are prey for a variety of larger marine fish, such as salmon. Marine mammals including seals, sea lions, and beluga whales also feed on them in abundance when the eulachon gather off the mouths of their spawning streams. Spawning eulachon and spent bodies of spawned-out eulachon are eaten by gulls, eagles, and bears and by the white and green sturgeon in the larger rivers of Southeast Alaska, British Columbia, and the Pacific Northwest. The spent bodies of spawned-out eulachon also contribute to the nutrient cycle as they decompose (http://www.state.ak.us/adfg/notebook/fish/eulachon.htm).

Capelin (*Mallotus villosus* [Muller])

Capelin are a major forage fish of the Cook Inlet region. A small fish (mature specimens are generally 13-20 centimeters [5-8 inches] long) but like salmon, the capelin is classified within the family *Osmeridae* (along with smelts). Populations of capelin are large and range extensively over Alaskan waters, generally inhabiting pelagic waters. Capelin mainly are filter feeders, thriving on planktonic organisms such as euphausiids and copepods.

Capelin spawn on beaches and in deeper waters and are highly specific regarding spawning conditions. Temperature, tide, and light conditions are primary criteria for successful spawning; most spawning takes place at night or in dull, cloudy weather. On the Pacific coast of Canada, capelin spawn on gravelly beaches in various localities in the Strait of Georgia during late September or October. Capelin also spawn in the southwestern Bering Sea in May, and spawning capelin have been harvested from Bristol Bay at about the same time. Capelin eggs attach to beach and bottom gravels. Depending on temperature, hatching ranges from 15-55 days. Most capelin die after spawning. Currently, capelin have no economic value to Alaska; however, the species is used extensively for food by other fish, marine mammals, and seabirds.

Salmonids

The Cook Inlet region is a migratory corridor and early-life rearing area for all five species of Pacific salmon and for Dolly Varden and steelhead trout. These anadromous fish transit much of the area, including Shelikof Strait, as smolt leaving natal (home) freshwater drainages and again later as returning adult spawners. Juvenile salmonids from Prince William Sound following ocean currents also probably transit much of Shelikof Strait and also may enter Cook Inlet. Salmon in the Cook Inlet, Kodiak, and South Aleutian Peninsula regions afford a high value to the commercial-fishing industry.

Pink Salmon (*Oncorhynchus gorbuscha*)

The pink salmon also is known as the "humpback" or "humpy" because of the pronounced, laterally flattened hump that develops on the backs of adult males before spawning. It is native to Pacific and arctic coastal waters from northern California to the Mackenzie River, Canada; and to the west from the Lena River in Siberia to Korea.

The pink salmon is the smallest of the Pacific salmon found in North America, with an average weight of about 1.5-1.8 kilograms (3.5-4 pounds) and average length of 51-63 centimeters (20-25 inches). An adult fish returning to coastal waters is bright steely blue on top and silvery on the sides with many large black spots on the back and entire tailfin. Its scales are very small and the flesh is pink. As the fish approaches the spawning streams, the bright appearance of the male is replaced by brown to black above with a white belly; females become olive green with dusky bars or patches above and a light-colored belly. By the time the male enters the spawning stream, it has developed the characteristic hump and hooked jaws. Juvenile pink salmon are silvery, without the dark vertical bars, or parr marks, of the young of other salmon species.

Adult pink salmon enter Alaska spawning streams between late June and mid-October. Different races or runs with differing spawning times frequently occur in adjacent streams or even within the same stream. Most pink salmon spawn within a few miles of the coast, and spawning within the intertidal zone or the mouth of streams is very common. Shallow riffles where flowing water breaks over coarse gravel or cobble-size rock and the downstream ends of pools are favored spawning areas. The female pink salmon carries 1,500-2,000 eggs, depending on her size. She digs a nest, or redd, with her tail and releases her eggs into the nest. They are immediately fertilized by one or more males and then covered by further digging by the female. The process is commonly repeated several times until all the female's eggs have been spent. After spawning, both males and females die usually within two weeks.

Eggs hatch during early to mid-winter. The alevins, or young fry, feed on the attached yolk-sac material early in their development. In late winter or spring, fry swim up out of the gravel and migrate downstream into saltwater. The emergence and emigration of fry is heaviest during hours of darkness and usually lasts several weeks.

Following entry into seawater, juvenile pink salmon move along beaches in dense schools near the surface, feeding on plankton, larval fish, and occasionally on insects. Predation is intense on very small, newly emerged fry, but growth is rapid. By autumn, at an age of about 1 year, juvenile pink salmon are 10-15 centimeters (4-6 inches) long and move into offshore feeding grounds in the Gulf of Alaska and Aleutian Islands waters. High-seas tag and recapture experiments revealed that pink salmon originating from specific coastal areas have characteristic distributions at sea that are overlapping, nonrandom, and nearly identical from year to year. The ranges of Alaska pink salmon at sea and pink salmon from Asia, British Columbia, and Washington overlap. Frequently, in a particular stream, the other odd-year or even-year cycle will predominate although in some streams both odd- and even-year pink salmon are about equally abundant. Cycle dominance occasionally will shift, and the previously weak cycle will become most abundant (http://www.state.ak.us/adfg/notebook/fish/pink.htm). Spawning pink salmon reach the Cook Inlet region annually in early July, where they spawn in most streams of this region. Pink salmon also sometimes spawn in the intertidal zone in some streams. Pink salmon rear in the North Pacific Ocean for two winters before returning to the Cook Inlet region to spawn and die. Pink salmon are seasonally distributed over most of this region from spring through early fall annually.

Chum Salmon *(O. keta)*

This species ranges to 100 centimeters (40 inches) in length (McPhail and Lindsey, 1970) and 1-6 kilograms (6.6-13.2 pounds) in weight (Mecklenburg, Mecklenburg, and Thorsteinson, 2002). Chum salmon have the widest distribution of any Pacific salmonid. They range south to the

Sacramento River in California and the island of Kyushu in the Sea of Japan. In the north, they range east in the Arctic Ocean to the Mackenzie River in Canada and west to the Lena River in Siberia. Chum salmon are the most abundant commercially harvested salmon species in Arctic, Northwestern, and Interior Alaska but are of relatively less importance in other areas of the State, where they are known locally as "dog salmon" and are a traditional source of dried fish for winter use.

Ocean-fresh chum salmon are metallic greenish-blue on the dorsal surface (top) with fine black speckles. They are challenging to distinguish from sockeye and coho salmon without examining their gills or caudal fin scale patterns. Chum salmon have fewer but larger gillrakers than other salmon. After nearing freshwater, however, chum salmon change color; particularly noticeable are the vertical bars of green and purple, which lead them to be called by the common name, calico salmon. Males develop the typical hooked snout of Pacific salmon and very large teeth, which partially account for their also being called dog salmon. Females have a dark horizontal band along the lateral line; their green and purple vertical bars are not so obvious.

Chum salmon often spawn in small side channels and other areas of large rivers, where upwelling springs provide excellent conditions for egg survival. They also spawn in many of the same places as pink salmon, that is, small streams and intertidal zones. Some chum salmon in the Yukon River travel more than 2,000 miles to spawn in the Yukon Territory. These have the brightest color and possess the highest oil content of any chum salmon beginning their upstream journey. Chum salmon spawning is typical of Pacific salmon, with eggs deposited in redds located primarily in upwelling spring areas of streams. Female chum may lay as many as 4,000 eggs, but fecundity typically ranges between 2,400 and 3,100 eggs. Chum salmon do not remain in freshwater after emerging as fry in contrast to chinook, coho, and sockeye salmon. Chum salmon are similar to pink salmon in this respect, except that chum fry do not move out into the ocean in the spring as quickly as pink fry. Chum fry feed on small insects in the stream and estuary before forming schools in saltwater, where their diet usually consists of zooplankton. By autumn, they emigrate into the Bering Sea or Gulf of Alaska where they spend one or more of the winters of their 3- to 6-year lives. In southeastern Alaska, most chum salmon mature at 4 years of age although there is considerable variation in age at maturity between streams. There also is a higher percentage of chum salmon in the northern areas of the State. Chum salmon vary in size from about 2-14 kilograms (4-30 pounds) but usually range from 3-8 kilograms (7-18 pounds), with females usually smaller than males (http://www.state.ak.us/adfg/notebook/fish/chum.htm). Chum salmon enter the Cook Inlet region beginning in early July, and the spawning runs continue through early August. Chum salmon spawn in many streams throughout the region, with eggs deposited in stream gravels. Fry subsequently move downstream to the ocean where they remain for three to four winters before returning to natal streams to spawn and die.

Coho Salmon *(O. kisutch)*

The last species of Pacific salmon to return to the proposed sale area to spawn, coho salmon enter the region in late July, and runs continue until September. Coho salmon, also called silver salmon, are found in coastal waters of Alaska from Southeast to Point Hope on the Chukchi Sea and in the Yukon River to the Alaska-Yukon border. Coho are extremely adaptable and occur in nearly all accessible bodies of freshwater, from large transboundary watersheds to small tributaries.

Adults usually weigh approximately 3-5 kilograms (8-12 pounds) and are 61-76 centimeters (24-30 inches) long, but individuals weighing 14 kilograms (31 pounds) have been caught. Adults in seawater or newly arrived in freshwater are bright silver with small black spots on the back and on the upper lobe of the caudal fin. They can be distinguished from chinook salmon (*Oncorhynchus tshawytscha*) by the lack of black spots on the lower lobe of the tail and gray gums; chinook have small black spots on both caudal lobes and have black gums. Spawning adults of both sexes have dark backs and heads with maroon to reddish sides. Males develop a prominent hooked snout with large teeth called a "kype." Juvenile coho salmon have 8-12 parr marks evenly distributed above and below the lateral line, with parr marks narrower than the interspaces. The adipose fin is uniformly pigmented. The anal fin has a long leading edge usually tipped with white, and all fins are frequently tinted with orange.

Coho salmon enter spawning streams from July to November, usually during periods of high runoff. Run timing reflects the migratory obstacles encountered by some specific stocks. In some streams with barrier falls, adults arrive in July when the water is low and the falls are passable. In large rivers, adults must arrive early, as they need several weeks or months to reach headwater spawning grounds. Run timing also is regulated by water temperature at spawning grounds; where temperatures are low and eggs develop slowly, spawners demonstrate early run timing to compensate, and where temperatures are warm, adults are late spawners. Adults hold in pools until ripened and then move onto spawning grounds; spawning generally occurs at night. The female digs a redd and deposits 2,400-4,500 eggs. The male fertilizes eggs with sperm as they are deposited. The eggs develop during the winter and hatch in early spring. Embryos remain in the gravel, consuming their egg yolk for nutrition until emerging in May or June. The emergent fry occupy shallow aquatic margins and, as they grow, establish territories that they defend from other salmonids. They live in ponds, lakes, and pools in streams and rivers, usually among submerged woody debris, quiet areas free of current, from which they dart out to seize drifting insects.

During autumn, juvenile coho salmon may travel miles before locating off-channel habitat where they pass the winter free of floods. Some fish leave freshwater in the spring and rear in brackish estuarine ponds and then move back into freshwater in autumn. They spend one to three winters in streams and may spend up to five winters in lakes before emigrating to the sea as smolt. Their time at sea varies. Some males (called jacks) mature and return after only 6 months at sea at a length of about 30 centimeters (12 inches), while most fish stay 18 months at sea before returning to freshwater watersheds as full-sized adults.

Little is known of the oceanic movements of coho salmon. High-seas tagging shows that maturing Southeast Alaska coho move northward throughout the spring and appear to concentrate in the central Gulf of Alaska in June. They later disperse landward and migrate along the coastline until reaching their stream of origin (http://www.state.ak.us/adfg/notebook/fish/coho.htm).

Sockeye Salmon (*O. nerka*)

Sockeye salmon, often referred to as "red" salmon, occur in the North Pacific and Arctic oceans and associated freshwater systems. This species ranges south to the Klamath River in California and northern Hokkaido in Japan to as far north as Bathurst Inlet in the Canadian Arctic and the Anadyr River in Siberia. Aboriginal people considered sockeye salmon to be an important food source and either ate them fresh or dried them for winter use. Today, sockeye salmon support one of the most important commercial fisheries on the Pacific coast of North America and are increasingly sought after in recreational fisheries; they remain an important mainstay of many subsistence users.

Sockeye salmon can be distinguished from chinook, coho, and pink salmon by the lack of large, black spots and from chum salmon by the number and shape of gill rakers on the first gill arch. Sockeye salmon have 28-40 long, slender, rough or serrated, closely set rakers on the first gill arch. Chum salmon have 19-26 short, stout, smooth rakers. Immature and prespawning sockeye salmon are elongate, fusiform, and somewhat laterally compressed. They are metallic green blue on the back and top of the head, iridescent silver on the sides, and white or silvery on the belly. Some fine black speckling may occur on the back, but large spots are absent. Juveniles inhabiting freshwater have the same general coloration as immature sockeye salmon in the ocean, but they are less iridescent. Juveniles also have dark, oval parr marks on their sides. These parr marks are short, less than the diameter of the eye, and rarely extend below the lateral line. Breeding males develop a humped back and elongated, hooked jaws filled with sharp, canine-like teeth. Both sexes turn brilliant to dark red on the back and sides, pale to olive-green on the head and upper jaw, and white on the lower jaw.

Sockeye salmon are anadromous; they live in the sea and enter freshwater systems to spawn. After hatching, juvenile sockeye salmon may spend up to 4 years in freshwater before emigrating to sea as silvery smolt. They grow quickly in the sea, usually reaching 2-4 kilograms (4-8 pounds) after 1-4 years. Mature sockeye salmon travel thousands of miles from ocean-feeding areas to spawn in the same freshwater system where they were born. Little is known about the navigation mechanisms or cues they use on the high seas, although some evidence suggests that they may use cues from the earth's magnetic field. Once near their natal freshwater system, sockeye salmon use olfactory cues to guide them home. Maturing sockeye salmon return to freshwater systems from the ocean during the summer months, and most populations show little variation in their arrival time to the spawning grounds from year to year. Like all Pacific salmon, sockeye salmon die within a few weeks after spawning.

Adult sockeye return to Cook Inlet and the Shelikof Strait region annually in late June, and runs continue through early August. Watersheds with lakes produce the greatest number of sockeye salmon. Spawning usually occurs in rivers, streams, and upwelling areas along lake beaches. The female selects the spawning site, digs a redd with her tail, and deposits eggs in the downstream portion of the redd as one or more males swim beside her and fertilize the eggs as they are extruded. After each spawning act, the female covers her eggs by dislodging gravel at the upstream end of the redd with her tail. A female usually deposits about five batches of eggs in a redd. Depending upon her size, a female produces from 2,000-4,500 eggs. Eggs hatch during the winter, and the young sac-fry, or alevins, remain in the gravel, living off their yolk sacs until early spring. At this time, they emerge from the gravel as fry and move into rearing areas. In watersheds with lakes, juveniles usually spend 1-3 years in freshwater before migrating to the ocean in the spring as smolts. However, in watersheds without lakes, many juveniles migrate to the ocean soon after emerging from the gravel.

Once in the ocean, sockeye salmon grow quickly. Mature sockeye salmon that have spent only 1 year in the ocean are called jacks and, almost without exception, are males. Sockeye salmon return to their natal stream to spawn after spending 1-4 years in the ocean. While returning adults usually weigh between 2 and 4 kilograms (4 and 8 pounds), weights in excess of 7 kilograms (15 pounds) have been reported. In some areas, populations of sockeye salmon remain in freshwater all their lives. This landlocked form of sockeye salmon, called "kokanee," reaches a much smaller maximum size than the anadromous form and rarely grows to be more than 36 centimeters (14 inches) long. While inhabiting freshwater, juvenile sockeye salmon feed mainly on zooplankton (for example, ostracods, cladocerans, and copepods), benthic amphipods, and insects. In the ocean, sockeye salmon feed on zooplankton (for example, copepods, euphausids, ostracods, and crustacean larvae), but they also prey on larval and small adult fish (for example, sand lance) and occasionally squid (http://www.state.ak.us/adfg/notebook/fish/sockeye.htm).

Chinook Salmon *(O. tshawytscha)*

The chinook (king) salmon is the largest of all Pacific salmonids, with weights of individual fish commonly exceeding 14 kilograms (30 pounds). A 57-kilogram (126-pound) chinook salmon taken in a fish trap near Petersburg, Alaska, in 1949 is the largest on record. The largest sport-caught chinook salmon was a 44 kilograms (97 pound) fish taken in the Kenai River in 1986.

The chinook salmon has numerous local names. In Washington and Oregon, chinook salmon are called chinook, while in British Columbia they are called spring salmon. Other names are quinnat, tyee, tule, blackmouth, and king salmon.

In North America, chinook salmon range from the Monterey Bay area of California to the Chukchi Sea, Alaska. On the Asian coast, chinook salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan. In Alaska, this species is abundant from the Southeast Panhandle to the Yukon River. Major numbers make runs into the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine rivers. Important runs also occur in many smaller streams.

Adults are distinguished by black irregular spotting on the back and dorsal fins and on both lobes of the caudal fin. Chinook salmon also have a black pigment along the gum line, which gives them the name "blackmouth" in some areas. In the ocean, the chinook salmon is a robust, deep-bodied fish with a bluish-green coloration on the back, which fades to a silvery color on the sides and white on the belly. Colors of spawning chinook salmon in freshwater range from red to copper to almost black, depending on location and degree of maturation. Males are more deeply colored than the females and also are distinguished by their "ridgeback" condition and hooked nose or upper jaw. Juveniles are recognizable by well-developed parr marks bisected by the lateral line.

Chinook salmon are anadromous; they hatch in freshwater, spend part of their life in the ocean, and then spawn in freshwater. All chinooks die after spawning. Chinook salmon become sexually mature sometime during their second through seventh year and, as a result, fish in any spawning run may vary greatly in size. For example, a mature 3-year-old probably will weigh less than 2 kilograms (4 pounds), while a mature 7-year-old may exceed 22 kilograms (50 pounds). Females tend to be older than males at maturity. In many spawning runs, males outnumber females in all but the 6- and 7-year age groups. Small Chinooks that mature after spending only one winter in the ocean are commonly referred to as "jacks" and usually are males. Alaska streams normally receive a single run of chinook salmon, from May through July.

Chinook salmon often make extensive freshwater spawning migrations to reach their home streams on some of the larger river systems. Yukon River spawners bound for headwaters in the Yukon Territory, Canada, will travel more than 3,219 river kilometers (2,000 river miles) during a 60-day period. Chinook salmon do not feed during the freshwater spawning migration, and their condition deteriorates gradually during the spawning run as their bodies consume stored energy reserves.

Each female deposits from 3,000-14,000 eggs in several gravel redds, which she excavates in relatively deep, moving freshwater. In Alaska, eggs usually hatch in late winter or early spring, depending on the timing of spawning and water temperature. Newly hatched fish, called alevins, live in the gravel for several weeks until they absorb their attached yolk sac. Later, these juveniles, now called fry, wiggle up through the gravel in early spring. In Alaska, most juvenile chinook salmon remain in freshwater until the following spring when they emigrate to the sea in their second year of life. These seaward emigrants are called smolts. Juvenile chinooks in freshwater feed on plankton and insects. In the ocean, they eat a variety of organisms including herring, pilchard, sand lance, squid, and crustaceans. Salmon grow rapidly in the ocean and often double their weight during a single summer season (http://www.state.ak.us/adfg/notebook/fish/chinook.htm).

Spawning chinook salmon enter the proposed sale area during early May and are present in some spawning streams by the end of that month. During this same period, chinook salmon smolt are emigrating downstream to the North Pacific Ocean.

2.2 Groundfish

The term "groundfish" loosely groups the finfish that, for much of their time, remain near the seafloor. Spawning and early life, however, may be in pelagic waters. The following groundfish species are considered commercially valuable in the Cook Inlet, Kodiak, and South Aleutian Peninsula regions.

Pacific Cod (*Gadus macrocephalus*)

The Pacific cod is a largely demersal (bottom-dwelling) fish that may reach a length of 1 meter (3.25 feet). Pacific cod are fast growing, maturing in 3 years. There is concurrently rapid turnover in subpopulations, as predation and commercial fishing take their toll. Pacific cod spawn during an extended period, possibly February through July. The adhesive, demersal eggs hatch in about 13-14 days, depending on water temperature. The resultant larvae are pelagic for a time before entering the benthos. Pacific cod feed on pollock, herring, smelt, mollusks, crabs, shrimp, and other similar-sized marine organisms (Hart, 1973).

Walleye Pollock (*Theragra chalcogramma*)

This codlike species occurs throughout the proposed sale area, with a large spring spawning aggregation in parts of Shelikof Strait. Pollock are found at depths of 20-2,000 meters (11-1,094 fathoms). The species also inhabits pelagic waters in some areas at various times. In size, walleye pollock range to 91 centimeters (36 inches) long; however, they enter the commercial-trawl fisheries at about 25 centimeters (12 inches) long (Hood and Zimmerman, 1986). Adult pollock consume shrimp, sand lance, herring, small salmon, and similar organisms they encounter. Walleye pollock also are cannibalistic.

Walleye pollock spawn in the spring in large aggregations, although there is extended spawning by smaller numbers throughout the year. Eggs may be close to the surface initially and hatch in about 10-20 days (depending on water temperatures). Pelagic larvae remain at the sea surface for up to 30 days, again depending on water temperature (and available food supply). At about a 25 millimeter (1-inch) length (Bakkala, 1989), immature pollock move to deeper waters.

Pacific Ocean Perch (*Sebastes alutus*)

This representative species of the 30 rockfish species so far recovered from the Gulf of Alaska ranges over much of the continental shelf of the Gulf of Alaska westward to the nations of the Russian Commonwealth. This group is unique in that many are very long lived and bear their young alive (as opposed to spawning eggs into the water). The Pacific Ocean perch was formerly a much-sought-after commercial species that was then overexploited.

Adult Pacific Ocean perch usually are found in gravel, rocky, or boulder-strewn substrates in and along the gullies, submarine canyons, and depressions of the upper continental slope. Larvae and juveniles are pelagic until joining adults in these demersal habitats after 2 or 3 years.

Sablefish (*Anoplopama fimbria*)

Sablefish (black cod) are found within the Cook Inlet proposed sale area and is a valued commercial species. However, most are harvested outside the sale area, because this species usually occurs at depths of 366-915 meters (200-500 fathoms). Sablefish are largely demersal in habit with some nocturnal forays into pelagic waters. Sablefish range to 1 meter (40 inches) in length and are a relatively long-lived species (some to 35 years). Sablefish probably spawn during the spring, but little is known about their spawning movements or egg-larval development. The eggs are pelagic as are the early prolarvae. Later larval stages occupy waters 150 meters in depth. Sablefish are indiscriminate feeders on a large variety of benthic and pelagic fauna.

Other Groundfish

Lesser numbers of arrowtooth flounder, yellowfin sole, Atka mackerel, and other groundfish inhabit the Cook Inlet, Kodiak, and South Aleutian Peninsula region. These species generally are in the same habitats as the previously discussed groundfish species.

2.3 Shellfish

"Shellfish" is a collective term that generally refers to harvestable mollusks and crustaceans. The coastal ecosystem of the Gulf of Alaska underwent a shift from an epibenthic community dominated largely by crustaceans to one now dominated by several species of finfish (Anderson, Blackburn, and Johnson, 1997). The reorganization of domineering species in coastal waters resulted from a shift in ocean climate during the late 1970's (Anderson and Piatt, 1999). Analysis of climatological data from the northeast Pacific led Ware (1995) to predict another regime shift to occur in early 2000. If so, cold regime conditions are predicted to enhance crustacean abundance again, while dampening groundfish and salmon numbers (Anderson and Piatt, 1999).

Pacific Weathervane Scallop (*Patinopecten caurinus*)

The Pacific weathervane scallop is one of several species of true scallops, family Pectinidae, found in the eastern North Pacific Ocean. This scallop supports a sporadic but important commercial fishery in Alaska waters from Yakutat to the eastern Aleutians. Weathervane scallops are bivalves, referring to the two flattened, shelly valves that are hinged together. Shell lengths may reach 20 centimeters (8 inches) or larger at maturity. The shells are a brownish color on the outside and have many prominent heavy ribs. Generally weathervane scallops are sexually mature at age 3 or 4 years and are of commercially harvestable size at 6-8 years. Age is determined by counting the annuli, concentric rings on the shell, which are formed with the colder or warmer water temperatures of winter or summer. Scallops are found in beds (areas of abundant numbers), and are dioecious, having separate sexes. Spawning occurs in June and July where the spermatozoa and ova are red into the water. Ova that are fertilized will settle to the bottom. After approximately 1 month, hatching occurs and larvae drift with the tidal currents. Over the following 2-3 weeks, larvae gain shell weight, settle to the bottom, and attach themselves to seaweed. Within 4-8 weeks after settling, juveniles develop the ability to swim. At this time, the juvenile scallop is approximately 0.9 centimeters (0.4 inches) in diameter and assumes the adult form. Growth is very rapid the first few years and is minimal after age 10. Scallops may live for 18 years.

Weathervane scallops have specialized adaptations that facilitate escaping predation or other disturbing conditions. Scallops are the only bivalves whose adult stage is capable of swimming.

This ability is accomplished by the rapid ejection of water from the interior of the shell in a jet-like action. Swimming can be maintained for 15-20 seconds and rarely exceeds 6 meters (20 feet). Another unique adaptation of scallops includes the presence of many jewel-like eyes that are sensitive to changing light or moving objects. Also, scallops have small tentacles that are highly sensitive to waterborne chemicals and water temperature. Prominent heavy ribbing on the shell halves serve as strengthening structures to complete the scallop's defenses.

Weathervane scallops are found on sand, gravel, and rock bottoms from 45-183 meters (150-600 feet). Weathervane scallops feed by filtering microscopic plankton from the water.

2.4 Prey and Prey Habitat

Loss of prey may be an adverse effect on EFH and federally managed species because the presence of prey makes waters and substrate function as feeding habitat, and the definition of EFH includes waters and substrate necessary to fish for feeding. Actions that reduce the availablity of a major prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on EFH if such actions reduce the quality of EFH.

Forage fish are abundant, schooling fish preyed upon by many species of seabirds, marine mammals, and other fish species. They provide important ecosystem functions by transferring energy from primary or secondary producers to higher trophic levels (Springer and Speckman 1997). Ecologically, Pacific herring, Pacific sand lance, are important forage fish in the central Gulf of Alaska. Another common group of forage fish in the central Gulf of Alaska are smelts (Osmeridae), including capelin, eulachon, and rainbow smelt. Euphausiids, commonly called krill, are important prey not only for baleen whales but also for juveniles of many managed fish species. Only one species of bristlemouth (*Gonostomatidae*), the black bristlemouth, is common in the Gulf of Alaska, but it inhabits the depth off the continental shelf (Mecklenburg, Mecklenburg, and Thorsteinson, 2002).

A variety of processes influence the patterns of community structure and prey availability in the Gulf of Alaska's large marine ecosystem that includes Cook Inlet. Bottom-up processes largely relate water temperature with crustacean densities and, thereby, influence predatory fish higher in the trophic web. Conversely, top-down processes also contribute to the community structure of the region. Piscivorous predators such as sea birds, marine mammals, and other fish, including sharks, may limit or slow the ability of depressed forage fish populations from increasing. For example, the total biomass of all forage taxa, including juvenile pollock, may now be limiting because of the enormous food demands of adult groundfish, which outweigh those of sea birds and marine mammals by 1-2 orders of magnitude (Livingstone, 1993; Yang, 1993; Hollowed et al., In press; all as cited in Anderson and Piatt, 1999.).

It is important to note that the inshore-coastal ecosystem of the Gulf of Alaska has undergone a shift from an epibenthic community dominated largely by crustaceans to one now dominated by several species of fish (Anderson and Piatt, 1999). Analysis of historical data revealed that the nearshore Kachemak Bay fish community changed significantly between 1976 and 1996, showing increased diversity and abundance in several taxa, notably gadids, salmonids, pleuronectids, and sculpins (Robards et al., 1999). Ocean climate in the Gulf of Alaska cycles between warm and cold regimes on a multidecadal time scale (Francis et al., 1998; McGowan et al., 1998; both cited in Anderson and Piatt, 1999). During the last reversal from a cold (1947-1976) to a warm regime (1977-present), the Aleutian Low pressure system shifted south and intensified, leading to stronger westerly winds and warmer surface waters in the Gulf of Alaska. Biological consequences included a marked improvement in groundfish recruitment and sharply increased Pacific salmon catches in Alaska (Anderson and Piatt, 1999 citing Francis and Hare, 1994). In contrast, some forage fish populations collapsed to the detriment of predators such as sea bird and marine mammal populations (Piatt and Anderson, 1996; Merrick and Loughlin, 1997). It appears that forage species such as pandalid shrimp and capelin may be leading indicators of decadal-scale changes in northern marine ecosystems because of their short lifespans and low trophic levels (Anderson and Piatt, 1999). It is likely that one or more ocean climate-regime shifts will occur during the lifetime of the Proposed Action.

2.5 Habitat Areas of Particular Concern

Habitat Areas of Particular Concern (HAPC) are those areas defined pursuant to 50 CFR 600.815 (a)(8). In Alaska, there are several habitat types that meet this criterion. These habitat types have important ecological functions, are sensitive and vulnerable to human impacts, and are relatively rare. Currently, these include living substrates in shallow and deep waters, and freshwater waterways used by anadromous fish. Presently, Cook Inlet has not been surveyed for HAPC; however, living substrates in shallow and deep waters (i.e., corals, sponges, mussels, rockweed, and kelp) and freshwater waterways used by anadromous fish (for which there is a commercial fishery) are known to exist in Cook Inlet.

Living substrates such as kelp forests are used by Atka mackerel eggs and adults. Cook Inlet, Shelikof Strait, and Kennedy Entrance have few notable regions of eelgrass and kelp except within Kachemak Bay (Otis and Gretsch, pers. commun.). The Barren Islands and Kachemak Bay nearshore habitats are important to Pacific sand lance (Robards et al., 1999). There are areas of submerged vegetation that are important spawning habitat to Pacific herring in Kamishak Bay that may need additional protection.

Pacific salmon are common anadromous fish that migrate through Cook Inlet to freshwater watersheds feeding into the larger estuary. First-order streams (which flow directly into saltwater) are identified on Map 21 of the DEIS.

Heifetz (2002) reviewed coral distributions in Alaska. Corals in the proposed sale area are mostly Gorgonian and cup corals; the associated commercialfish species are primarily rockfish, Atka mackerel, gadoids (cod), and flatfish (halibut and sole).

Table 2.0

Essential Fish Habitat and Fisheries Resources in the Gulf of Alaska

Species	Scientific Name	Habitat Depth or Distribution
Groundfish		
Pacific Cod	*Gadus macrocephalus*	Shore to 500 m
Atka Mackerel	*Pleurogrammus monopterygius*	Kodiak Banks
Walleye Pollock	*Theragra calcogramma*	<300 m
Sablefish	*Anoplopoma fimbria*	>200 m Shelikof Strait and Kodiak Banks
Other Groundfish		
Skates	*Rajidae*	50-300 m
Sculpin	*Cottidae*	Mostly Shallow
Sharks	*Lamnidae and Squalidae*	Near Coast to Outer Shelf, Particularly Kodiak
Octopus	*Octopoda gilbertianis*	to 500 m
Red Squid	*Berryteuthis magister*	30-1500 m
Shallow Water Flatfish		
Yellowfin Sole*	*Limanda Aspera*	Entire Area South of Ninilchik
Rock Sole*	*Lepidopsetta bileneatis*	Entire Area South of Ninilchik
Starry Flounder	*Platichthys stellatus*	—
Butter Sole	*Isopssetta bileneatus*	—
English Sole	*Parophrys vetulus*	—
Alaska Plaice	*Pleuronectes quadrituberulatus*	<150 m
Sand Sole	*Psettichthys melanostictus*	—
Rex Sole	*Glyptocephalus zachirus*	Off Shelf
Flathead Sole	*Hippoglossoides elassodon*	Entire Planning Areas of Ninilchik
Deep Water Flatfish		
Greenland Turbot (Greenland Halibut)	*Reinhardtius hippglossoides*	—
Dover Sole*	*Microstomaus pacificus*	Shelikof Strait and Off Shelf
Deep Sea Sole	*Embassicthys bathbius*	—
Arrowtooth Flounder	*Atheresthes stomias*	Entire Planning Area
Rockfish		
Shortspine Thornyhead Rockfish*	*Sebastolobus asascanus*	Demersal Shelf Rockfish Complex
Yelloweye Rockfish*	*Sebastes ruberrimus*	100- to 200-m Slope Rockfish Complex
Shortraker Rockfish	*Sebastes borealis*	>25 m
Rougheye Rockfish	*Sebastes aleutianus*	>25 m
Pacific Ocean Perch	*Sebastes alutus*	Summer 180-250 m
Northern Rockfish	*Sebastes pollyspinis*	75- to 125-m Pelagic Shelf Rockfish Complex
Dusky Rockfish*	*Sebastes ciliatus*	Shelikof Strait and Banks

Forage Fish in Lower Cook Inlet Region Identified as Prey of Commercial Fish in the Gulf of Alaska		
Pacific Herring[1]	*Clupea pallasii*	Intertidal to Off Shelf
Eulachon	*Thaleichthys pacificus*	50-1,000 m and in rivers
Sand Lance	*Ammodytidae*	Intertidal to 150 m
Deep Sea Smelts	*Bathylagidae*	Off Shelf (see below)
Northern Smoothtongue	*Leuroglossus schmidti*	Mostly Off Shelf
Stout Blacksmelt	*Pseudobathylagus milleri*	Off Shelf
Slender Blacksmelt	*Bathylagus pacificus*	Off Shelf
Smelts	*Osmeridae*	(See below)
Surf Smelt	*Hypomesus pretiosus*	Beach Surf Spawners
Rainbow Smelt[1]	*Osmerus mordax*	Freshwater Spawn to 150 m
Capelin[1]	*Mallotus villosus*	Beach to 200 M
Bristlemouth	*Gonostomatidae*	See below
Black Bristlemouth	*Cyclothone atraria*	Off Shelf
Lanternfish	*Myctophidae*	Probably Offshelf (see below)
Bigeye Lanternfish	*Protomyctophum thompsoni*	Usually Off Shelf
Blue Lanternfish	*Tarletonbeania crenularis*	Probably Off Shelf
California Headlightfish	*Diaphus theta*	Probably Off Shelf
Brokenline Lanternfish	*Lampanyctus jordane*	Probably Off Shelf
Pinpoint Lampfish	*Nannobrachium regale*	Probably Off Shelf
Pricklebacks	*Stichaeidae*	(See below)
Arctic Shanny	*Stichaeus punctatus*	Subtidal to 50 m
Mosshead Warbonnet	*Chirolophis nugator*	Intertidal, Subtidal
Decorated Warbonnet	*Chirolophis decoratus*	Subtidal to 90 m
Longsnout Prickleback	*Lumpenella longirostris*	Outer Shelf, Upper Slope
Daubed Shanny	*Leptoclinus maculates m*	Bottom, Usually <170 m
Whitebarred Prickleback	*Poroclinus rothrocki*	Bottom 46-128 m
Stout Eelblenny	*Anisarchus medius*	Nearshore to 150 m
Slender Eelblenny	*Pumpenus fabricii*	Intertidal to 100 m
Snake Prickleback	*Lumpenus sagitta*	Shore to 200 m
Blackline Prickleback	*Acantholumpenus mackayi*	Nearshore to 56 m
Lesser Prickleback	*Alectridium aurantiacum*	Intertidal and Subtidal
High Cockscomb	*Anoplarchus purpurescens*	Mostly Intertidal
Slender Cockscomb	*Anoplarchus insignis*	Mostly Subtidal
Ribbon Prickleback	*Phyticthys chirus*	Intertidal to 12 m
Black Prickleback	*Xiphister atropurpureus*	Kodiak Island, Intertidal to 8 m
Gunnels	*Pholidae*	(See below)
Penpoint Gunnel	*Apodichthys flavidus*	Kodiak Island Intertidal
Crescent Gunnel	*Pholis laeta*	Intertidal and Subtidal
Krill	*Euphausids*	seaward to the EEZ
Scallops		
Weathervane scallops	*Patinopectin caurinus*	Intertidal to 150 m
Salmon		
Pink Salmon	*Oncorhynchus gorbuscha*	inland rivers to off shelf
Chum Salmon	*Oncorhynchus keta*	inland rivers to off shelf
Coho Salmon	*Oncorhynchus kisutch*	inland rivers to off shelf
Sockeye salmon	*Oncorhynchus nerka*	inland rivers to off shelf
Chinook Salmon	*Oncorhynchus tshawytscha*	inland rivers to off shelf

Notes: [1] Indicates the three major forage species for which knowledge is abundant.
Off shelf indicates species inhabits deep areas.
Indented shows species; non-indented with light shading indicates major taxonomic group.

Key:
NPFMC = North Pacific Fishery Management Council

*Most abundant in its group or complex; NPFMC uses it to represent habitat for group or complex.
— means no data are available
< = less than
> = greater than
m = meters

Sources:
Habitat Assessment Reports for EFH - Prepared and Compiled by the Technical Teams for EFH of NMFS, NPFMC, and the Alaska Department of Fish & Game, 1998. Species in forage fish families, distribution and some habitat from Mecklenburg et al. (2002).

3.0 Effects on Essential Fish Habitat

Table IV.B-5 of the DEIS contains the list of potential impacts identified by the NPFMC (NPFMC 1999) for petroleum production. Not all of the potential threats in this Table are relevant to these lease sales. This section addresses habitat alteration, topographic alteration, and portions of organism alteration. Water quality alteration and atmospheric depositions are addressed in the water quality (IV.B.1.a) and air quality (IV.B.1.b) sections of the DEIS. Oceanographic alterations, gene pool deterioration, introduction of exotic species, introduction of pathogens/disease, and change in photosynthetic regime. For purposes of this programmatic consultation, the effects from exploration activities will be considered.

3.1 Effects from Exploration

Routine activities associated with a lease sale that may adversely affect EFH, include permitted drilling discharges, and seismic surveys. Accidental activities that may affect EFH include exposure to spilled hydrocarbons. MMS estimates a 19% chance of one or more large oil spills greater than 1,500 barrels from a production facility or greater than 4,600 barrels from a pipeline occurring over the life of the project.

MMS analysis relies on population level impacts; whose definition of a population is defined here as group of organisms of one species, occupying a defined area (the central Gulf of Alaska encompassing the South Alaskan Peninsula, Kodiak Archipelago, Shelikof Strait, Cook Inlet, and Prince William Sound) and usually isolated to some degree from other similar groups.

Except for the occurrence of a large oil spill, the effects of exploration and production related activities on fisheries resources are expected to be essentially the same and are discussed under development and production. Although there may be minor differences in the frequency or type of activities between exploration and production, those differences would not make a measurable difference on fisheries resources.

MMS also estimates a number of smaller oil spills would occur. This section describes the potential effects of oil to fisheries resources including EFH in the lease sale area using the Oil-Spill-Risk Analysis (see Appendix A of the DEIS) model. For example, Table A.1-5 of the DEIS indicates that a 4,600-barrel spill in lower Cook Inlet during summer would have a discontinuous area of approximately 56 square kilometers after 3 days, 265 square kilometers after 10 days, and 1,100 square kilometers after 30 days. Broader areas may be impacted following the initial 30 days.

3.1.1. Drilling Discharges

As discussed in Section III of the DEIS, drilling discharges affect localized areas of the benthos, and their fluid components are diluted rapidly by marine waters. MMS anticipates discharges of drilling muds and cuttings to occur only during exploration drilling operations. MMS anticipates that lessees and operators of new production platforms will be required by the Environmental Protection Agency (EPA) to reinject production and development discharges of produced waters, drilling muds, and cuttings into existing wells. This expectation is based on current new source guidance and EPA's National Pollutant Discharge Elimination System (NPDES) permit program. EPA's goal is to achieve a zero discharge from offshore platforms.

However, drilling muds and cuttings may be discarded into Cook Inlet during exploration if permitted by the EPA. During exploratory-drilling operations bulk drilling mud, usually about 100-200 barrels at a time, is discharged several times during the drilling of a well, when the composition of the drilling mud has to be changed substantially or when the volume exceeds the capacity of the mud tanks.

Washed drill cuttings and a small volume of drilling mud solids are continuously discharged during drilling operations; the discharge rate varies from about 25-250 barrels per day. Section 403(c) of the Federal Water Pollution Control Act (Clean Water Act) regulations allow only a 100-meter radius mixing zone for initial dilution of discharges in OCS waters. The most recent general NPDES permit for Cook Inlet oil and gas discharges (AKG285000; Environmental Protection Agency, 1999) allows discharge of only muds with negligible toxicity as measured by 96 hour lethal concentration for 50% of test organisms (LC_{50}) tests)see Section IV.B.1.a(2)(c) of the DEIS.

Additionally, the waters of Cook Inlet generally are vertically well mixed and strongly influenced by the tidal cycle. EFH is not likely to suffer acute (lethal) toxic effects from exposure to permitted discharges within the federal mixing zone, because (a) the concentrations are of negligible toxicity by EPA standards, (b) discharge concentrations of negligible toxicity would become rapidly diluted within the mixing zone by waters of Cook Inlet as they are swept past the discharge point by strong tidal currents, and (c) the timing of drilling discharges in juxtaposition with the presence of considerable numbers of juvenile and adult fish in the mixing zone for each exploratory or delineation well drilled. Managed species occurring within the mixing zone may experience sublethal effects; however, these effects are slight and not predicted to measurably impact EFH. Eggs, fry, and small prey occurring in or entering the mixing zone during discharge of muds and cuttings may experience lethal and sublethal effects if they are very close (within 1-2 meters) to the discharge point, and volumes of muds and cuttings are red at rates permitted by the EPA (500-1,000 barrels per hour, depending on water depth). Such lethal and sublethal effects most likely would result from physical damage or smothering, resulting from the bulk constituents comprising muds and cuttings. Only very small numbers of eggs, larvae, or prey are believed susceptible to such close exposure, due to the limited periods of high discharge rates; the few exploratory wells (totaling seven wells for both sales) to be drilled over a four year period; and relative to the widespread distribution of EFH in Cook Inlet. Such minor mortality of eggs, larvae, and prey is considered negligible to the population dynamics of managed species in the defined area. Sediment deposition during discharges and physical activities associated with the drilling operations likely would disturb and displace fish from the immediate area. EFH located on the seafloor immediately below the 100-meter mixing zone radius may be temporarily unavailable for fish to occupy because of disturbance from active drilling. Fish and prey would likely utilize the area when drilling activities are not disturbing the seafloor. Fish may reinhabit the immediate drilling area within minutes to hours after drilling or discharging operations cease. This activity is not expected to have anything more than negligible effects on EFH or water quality. See Section IV.B.1.a(2)(a) of the DEIS for additional information on effects to water quality.

3.1.2 Noise (Seismic Surveys and Vessel Operations)

Fish display avoidance reactions to both airgun and vessel sound levels. Demersal and bentho-pelagic finfish living near the bottom escape by descending to the bottom (Pearson, Skalski, and Malme, 1992; LGL, Ltd., 1998). These avoidance reactions are elicited when sound levels exceed fish hearing thresholds by about 30 decibels (Engas and Lokkeborg, 2001). McCauley et al. (2000) found finfish begin to show alarm behaviors such as increasing swimming speeds, tightened schools, and movement toward the sea floor at 156-168 decibels. Some finfish observed in this and other studies even exhibited a "C-turn" response where all the lateral muscles along one side of the fish involuntarily contract, and the finfish darts off in that direction. Smaller finfish were observed to react to 182-195 decibels, while larger fish reacted at higher noise levels up to 203 decibels. Ironically, their alarm response of descending would take them to lower depths where they experience the highest levels of airgun noise. The same authors found that other marine organisms such as of squid, remained close to the water surface at sound levels 156-161 decibels. In these instances, squid would move to that part of their habitat least impacted by the seismic sound waves. Another study found reduced catches of cod and haddock up to 33 kilometers from the seismic testing areas (Engas et al., 1996).

MMS expects site-specific surveys to cover an approximate area of 23 square kilometers (9 square miles), for each exploration site. The total area covered by shallow-hazard surveys would equal 46 square kilometers (18 square miles). Annual exploratory seismic testing likely would affect 23-52 square kilometers (9-20 square miles) of habitat for 2-10 days in late summer or early fall of each year from 2005 through 2010. The physical characteristics of seismic waves that can potentially degrade EFH are (1) the decibel noise volume or how loud a sound is and (2) the frequency of the sound waves. Much like earthquakes, sound volume is measured on a logarithmic scale so that 2 decibels are 10 times louder than 1 decibel (Jasny and Reynolds, 1999). Noise volume, or loudness, is measured in the air in decibels and in water as decibels in micropascals (decibels re 1 micropascal) (Jasny and Reynolds, 1999) or mean peak levels (decibels re 1 micropascal-m). Mean-peak level is defined as the decibel value of the mean of sum of maximum positive and absolute value of minimum negative pressure values. The second physical characteristic of sound that can potentially degrade EFH is frequency, or how high or low the sound is in musical terms. As in radio frequencies, the frequency of seismic testing sound waves is measured in hertz cycles.

Seismic surveys, probably using airguns, would be used during oil and gas exploration and development in the proposed sale area. Airguns are the type of device most frequently used in geophysical surveys in marine waters. Comparison of sounds from airguns indicates that marine fish can hear airgun sounds (Pearson, Skalski, and Malme, 1992). The frequency spectra of seismic-survey devices cover the range of frequencies detected by most fish, for example, 50-3000 Hertz for marine fish in general (Pearson, Skalski, and Malme, 1992; Platt and Popper, 1981, Hawkins, 1981). Available information indicates that marine fish are quite likely to detect airgun emissions nearly 2.7-63 kilometers (1.6-39 miles) from their source, depending on water depth (Pearson, Skalski, and Malme, 1992). In a study investigating the effects of airguns on rockfish behavior, Pearson, Skalski, and Malme, (1992) found the effects were evident as (1) shifts in the vertical distribution of the fish (either up or down), (2) shifts in behavior, and (3) the occurrence of alarm and startle responses. Responses were species specific. The threshold for startle responses was between 200 and 205 decibels; the general threshold for the alarm responses was about 180 decibels. Avoidance and other more subtle behavioral responses may occur, but limitations of the study enclosure prevented their expression.

In work related specifically to seismic exploration, Richardson and Malme (1993) indicate that the maximum decibel level is 242-252 decibels, and that an array of seismic airgun pulses emits considerable energy from below 20-250 Hertz with the strongest around 50-100 Hertz. An Alaskan example is a 1998 request for an incidental Harassment Authorization for seismic exploration in the Beaufort Sea of Alaska (LGL, Ltd., 1998). It indicated airgun noise of 255 decibels and frequencies from 0-188 Hertz would be used for seismic testing. In relation to the decibel level, the application indicated that fish might be unaffected at distances of 30-33 kilometers (16-18 nautical miles) of seismic activities. "Ramp-up," which is a gradual increase in decibel level as the seismic activities begin, can help mitigate the effects on fish large enough to move out of their disturbed habitats before damage occurs (Larson, 2002, pers. commun.).

The effects of seismic-wave frequencies on EFH habitat are less well understood than the effects of decibel levels on EFH. Recent research indicates that particular frequencies common in seismic waves may cause greater effects than the noise level, especially for the important herring prey of commercial fish species. Finfish can hear frequencies of 100-1,000 hertz or more (Yoda , Rogers, and Baxter. 2001; Higgs, 2001). The frequency spectrum of sounds produced by geophysical airgun arrays is within the most sensitive hearing frequencies of many marine finfish (Engas and Lokkeborg, 2001). The effects are not only on finfish "ear" bones, but also swim bladders and the lateral line (the line that can be seen along the side of the finfish from head to tail). The frequency of seismic waves apparently could have as large if not a larger effect on EFH than does the decibel level of seismic waves. The lateral line system is pressure sensitive, and many finfish will likely reveal morphological connections between the lateral line and the swim bladder similar to those recently identified in butterfly fish (Webb, 2001). By virtue of their anatomy, demersal fish can hear better than pelagic finfish (Lychakov and Rebane, 2001) and may be more likely to be affected by sound volume. Furthermore, the seismic waves are propagated down more than sideways (and thus are more likely to affect the demersal finfish bottom habitat).

Herring are a prey species that may be adversely impacted by seismic activity. Herring have a unique "hearing" anatomy connected to the lateral recess (Schilt and Escher, 2001) and may therefore be more affected than other finfish by seismic waves. Herring are in fact taxonomically defined by their unique "hearing" features such as the characteristic coupling of the swim bladder and inner ear and head canal system (Mecklenburg, Mecklenburg, and Thorsteinson, 2002). Lab experiments indicated another herring, American shad, could detect ultrasound up to 180 kilohertz and that they may have evolved this sensitivity in response to predation by echolocating cetaceans (Mann et al., 2001). Mecklenburg, Mecklenburg, and Thorsteinson cited Whitehead (1985) as indicating this "hearing system" probably monitors information necessary for schooling and detection of predators and other hazards. They also indicate that Pacific herring in Alaska reside more offshore in winter and onshore in spring for spawning. Thus, herring, a primary forage prey species, may be most affected by seismic waves as they school and move inshore to spawn. However, the key habitat area for herring is primarily in Kamishak Bay (Map 5 of the DEIS) which is in the southern area and adjacent to the sale area. Therefore, the area itself is not expected to experience seismic surveys.

Finfish inhabiting all depths, surface, pelagic, and demersal could be affected by seismic waves. For several species of finfish, it was demonstrated that it can take more than 58 days for hearing fibers to regenerate after airgun exposure (McCauley and Fewtrell, 2001). The demersal and bentho-pelagic finfish species that use habitat in the lease sale areas would be the most impacted by the noise (decibel) level. The habitats include those of Pacific Ocean perch; northern rockfish; yellow fin sole; weathervane scallop; sculpin; walleye; pollock larvae, eggs, and adults; juvenile rock sole; juvenile Greenland turbot; Pacific cod; halibut; skates; flathead sole, adult and juveniles; arrowtooth flounder, both juvenile and concentration habitat; juvenile rex sole; squid; and octopus.

Given the relative scattered distribution and hypothetical frequency of post seismic surveys expected to occur to cover approximately 161 square kilometers (62.3 square miles) during 14-35 days dispersed over 4 years, the effects of seismic surveys to EFH in the proposed sale area and adjacent waters are not expected to be significant. It is possible that seismic surveys temporarily may displace fish from the proximate area where airguns are in use. Seismic surveys are fleeting operations; hence, any fish proximately displaced due to potential avoidance are likely to backfill the surveyed area in a matter of minutes to hours. Fish of any life stage in close proximity to airgun emissions may suffer sublethal injuries that reduce individual fitness, fecundity, or survival. However, eggs and fry are believed to be widely distributed in Cook Inlet, and seismic surveys are expected to be limited in frequency. Consequently, large numbers of eggs or fry are not likely to be subjected to this harm. MMS expects that seismic surveys would have no measurable lethal effects on EFH in the defined area. Indirect effects are considered to be closely limited in area and time and, therefore, without significance to regional fish populations.

Boat trips during exploration are expected to average 160-360 trips per year over 5 years of exploration. However, the amount of boat traffic associated with oil and gas activities are minimal when compared to the fishing and other commercial traffic that occurs within Cook Inlet. Midsized ships such as tugboats and ferries produce sounds of 150-170 decibels filling the frequency band below 500 Hertz (Jasny and Reynolds, 1999). If each trip is 10 hours, temporary displacement of fish from normal habitats (Pearson, Skalski, and Malme, 1992; LGL, Ltd., 1998) within the travel corridors could add up to 66-150 days per year. The effects from the oil and gas related boat traffic are expected to have similar effects to those associated with commercial fishing activities.

3.1.3 Effects from Oil Spills

Exploratory drilling may occur as a result of the lease sales. Except for the occurrence of a large oil spill, the effects of exploration and production related activities on fisheries resources are expected to be essentially the same and are discussed under development and production. Although minor differences may occur in the frequency or type of activities between exploration and production, those differences would not make a measurable difference on fisheries resources. The following information would therefore remain the same in an exploration scenario.

Numerous bentho-pelagic and demersal finfish and shellfish may be exposed to and killed or harmed by oil spills during the lifetime of the Proposed Action, whether by frequent small spills or one or more large spills. Species that use intertidal and nearshore habitats during their life history are most vulnerable to acute and chronic impacts that may result in lethal and sublethal effects to stocks and subpopulations within affected areas. Some bentho-pelagic and demersal finfish and shellfish produce large amounts of pelagic eggs and larvae that may die or incur sublethal effects if exposed to spilled oil in pelagic habitats. Developing eggs and juvenile stages may suffer sublethal effects as a result of a spill, degrading individual fitness, fecundity, and survival. Species only using waters deeper than 50 meters or more are regarded as primarily at risk only in the event of a pipeline spill at depth, the effects of which are poorly studied. In each oil-spill case, the magnitude of lethal and sublethal effects greatly depends on seasonal timing and environmental factors influencing the concentration and distribution of oil in the waters of Cook Inlet and beyond.

Oil spills affecting EFH resources:

- Cause unnatural mortality to eggs and immature stages, abnormal development, or delayed growth due to acute or chronic exposures in spawning or nursery areas
- Impede the access of migratory fish to spawning habitat because of contaminated waterways
- Alter behavior
- Displace individuals from preferred habitat
- Constrain or eliminate prey populations normally available for consumption;
- Impair feeding, growth, or reproduction
- Contaminate organs and tissues and cause physiological responses, including stress
- Reduce individual fitness and survival, thereby increasing susceptibility to predation
- Parasitism, zoonotic diseases, or other environmental perturbations
- Increase or introduce genetic abnormalities within gene pools
- Modify community structure that benefits some fisheries resources and detracts others

Many species of fish are more susceptible to stress and toxic substances at the egg and larval stages than adult stages. Several studies demonstrated adverse effects of oil on intertidal fish habitat at levels below the water quality guidelines of 15 parts per billion, including mortality to pink salmon embryos at 0.1 part per billion (Heintz, Short, and Rice, 1999). Their study found a 25% reduction in survival during incubation of brood fish exposed to less than 18 parts per billion. Between the end of the exposure and maturity, survival was further reduced by another 15%, resulting in the production of 40% fewer mature adults than the unexposed population. Thus, the true effect of the exposure on the population was 50% greater than was concluded after evaluating the immediate effects. Studies indicate that examination of short-term consequences underestimate the impacts of oil pollution (Heintz et al., 2000). When oil contaminates natal habitats, the immediate effects in one generation may combine with delayed effects in another to increase the overall impact on the population. If small spills enter intertidal habitats, thousands to millions of egg and juvenile stages-habitats could be impacted and last for multiple generations of a subpopulation. Intertidal habitat of capelin eggs and adults, herring eggs, sculpin eggs and adults, yellowfin sole and pink salmon eggs, adult squid, juvenile sablefish, walleye pollock larvae and adults, Pacific cod larvae and adults, eulachon juveniles, and Greenland turbot eggs could experience such adverse effects. However, impacts would affect only subpopulations and would not result in a significant impact to an overall population inhabiting the central Gulf of Alaska. (See Sections IV.B.1.d(3)(b) and IV.B.1.e(3)(c)1 of the DEIS for additional information about oil-spill effects.)

Numerous marine fish species have pelagic egg and larval stages within the project area and may be adversely impacted by small oil spills. Large numbers of juvenile fish, floating eggs, and larvae may be killed when contacted by oil (Patin, 1999). Individuals inhabiting pelagic habitats in the project area and exposed to small oil spills may experience lethal or sublethal effects similarly described above for intertidal habitats. However, the numbers of individuals and generations impacted may be lower because organisms inhabiting intertidal habitats may receive repeated, long-term exposure, while organisms inhabiting pelagic habitats are believed more prone to acute toxicity exposures.

Concentrations of petroleum hydrocarbons are acutely toxic to finfish a short distance from and a short time after a spill event. However, the majority of adult finfish are able to leave or avoid areas of heavy pollution and, thus, avoid acute intoxication and toxicity. Evidence indicates that populations of free-swimming finfish are not injured by oil spills in the open sea (Patin, 1999). Conversely, floating eggs, and juvenile stages of many species can be killed when contacted by oil (Patin 1999), regardless of the habitat. In coastal shallow waters with slow water exchange, oil spills may kill or injure demersal finfish, shellfish, and other invertebrates in addition to cultivated species.

Some demersal or bentho-pelagic species are sensitive to oiled substrates, and may be displaced from preferred habitat that is oiled as a result of a spill. Pinto et al., (1984) found that sand lance avoided sand contaminated with Prudhoe Bay crude oil in an experimental setting. Moles et al. (1994) exposed three species of juvenile Alaskan demersal finfish (rock sole, yellowfin sole, and Pacific halibut) to laboratory chambers containing contaminated mud or sand offered in combination with clean mud, sand, or granule. The finfish were able to detect and avoid heavily oiled (2%) sediment but did not avoid lower concentrations of oiled sediment (0.05%). Oiled sediment was favored over unoiled sediment, if the unoiled sediment was of the grain size not preferred by that species. Oiled sand or mud was always preferred over unoiled granule. The authors concluded that the observed lack of avoidance at concentrations likely to occur in the environment may lead to long-term exposure to contaminated sediment following a spill.

Pollock, sablefish, Pacific cod, eulachon, and Pacific sand lance are federally managed species in the Cook Inlet area. Such finfish may inhabit the benthos or pelagic waters at times. Vertical changes in depth may be responses to factors such as light conditions and foraging opportunities. For example, Pacific sand lance inhabit the water column nearshore during the day, but bury themselves at night in soft bottom sediments. They also are known to overwinter by burying in sediments, with a preference for fine or coarse sand substrate. This makes them particularly vulnerable should oil spills reach nearshore areas.

Potential oil-spill impacts to pelagic finfish in the Gulf of Alaska are best known for salmon and Pacific herring. Salmon are able to detect and avoid hydrocarbons in the water (Weber 1988), although some salmon may not avoid oiled areas and become temporarily disoriented but eventually returning to their home stream (Martin 1992). Adult salmon remain relatively unaffected by oil spills and are able to return to natal streams and hatcheries even under very large oil-spill conditions, as evidenced by pink and red salmon returning to Prince William

Sound and red salmon returning to Cook Inlet after the *Exxon Valdez* oil spill in 1989. When oil from the *Exxon Valdez* spill entered Cook Inlet, the Alaska Department of Fish and Game closed the sockeye salmon commercial fishery in Cook Inlet. This evidently resulted in overescapement of spawning fish in the Kenai River system for the third consecutive year. Overescapement in 1987 was due to a previous spill, a naturally high escapement
occured in 1988. As a result of the repeated overescapements, fisheries managers observed what appeared to be a decline in salmon smolt. Although the mechanism for the apparent decline in smolt abundance is uncertain, the result of overescapement and too many salmon fry to be supported by the available prey may be the cause. The extent of the decline was speculative. Managers originally predicted that adult salmon returns in 1994 and 1995 would be below escapement goals, but the 1994 returns were three times that forecasted. Figures for 1995 are not available at this time, but escapement goals were met, and commercial fisheries did operate.

Some Pacific herring stocks of the Gulf of Alaska were appreciably impacted by past oil spills. Herring populations are dominated by occasional, very strong year classes that are recruited into the overall population (http://www.oilspill.state.ak.us/facts/status_herring.html). The 1988 pre-spill year-class of Pacific herring was very strong in Prince William Sound and, as a result, the estimated peak biomass of spawning adults in 1992 was very high. Despite the large spawning biomass in 1992, the population exhibited a density-dependent reduction in size of individuals, and an unprecedented crash of the adult herring population occurred in 1993.. In 1989 the *Exxon Valdez* oil spill occurred a few weeks before Pacific herring spawned in Prince William Sound. The size of the *Exxon Valdez* oil spill was several magnitudes larger than the 4,600-barrel spill MMS is evaluating. A considerable portion of spawning habitat, and staging areas in Prince William Sound, were contaminated by oil. Adult herring returning to spawn in Prince William Sound in 1989 were relatively unaffected by the spill and successfully left one of the largest egg depositions since the early 1970s . However, the 1989-year class was a minority in the 1993 spawning assemblage, returning to spawn with an adult herring population reduced by approximately 75%, apparently because of a widespread epizootic. A viral disease and fungus may have been the immediate agents of mortality or a consequence of other stresses, such as a reduced food supply and increased competition for food. There have been no "very strong" year classes recruited into the Prince William Sound herring population since 1988. The Pacific herring stock of Prince William Sound is classified as "not recovered" from the *Exxon Valdez* oil spill of 1989.

Many finfish species are most susceptible to stress and toxic substances during the egg and larval stages than adult stage. Intertidal areas contaminated by spilled oil may persist for years and represent a persistent source of harmful contaminants to aquatic organisms. Contamination of intertidal spawning stream areas for pink salmon caused increased embryo mortality and possible long-term developmental and genetic damage (Bue et al., 1993). The embryonic stage of salmon development, is vulnerable because of its long incubation in intertidal gravel and its large lipid-rich yolk, which will accumulate hydrocarbons from chronic, low-level exposures (Moles et al., 1994; Marty et al., 1997; Heintz, Short, and Rice, 1999). Pink salmon (often intertidal spawners) embryos in oiled intertidal stream areas of Prince William Sound continued to show higher mortality than those in nonoiled stream areas through 1993, more than 4 years after the oil spill, but appeared to recover in 1994 (Bue et al., 1993). Experiments conducted by Heintz, Short, and Rice (1999) demonstrate that aqueous-total polycyclic aromatic hydrocarbons concentrations as low as 1 part per billion derived from weathered *Exxon Valdez* oil can kill pink salmon embryos localized downstream from oil sources. Their study also found a 25% reduction in survival during incubation of brood fish exposed to 18 parts per billion. Other studies examining egg and fry survival showed no difference between oiled and unoiled locations (Brannon et al., 1993) except in two cases, one that showed higher mortality at an unoiled stream and another that showed higher mortality at the high-tide station of an oiled stream. These studies did not measure polycyclic aromatic hydrocarbons in stream water or in salmon embryos, were statistically underpowered, and were insufficient in duration to test for the manifestation of adverse effects from low-level polycyclic aromatic hydrocarbon exposures (Murphy et al., 1999). Thus, results published by Murphy et al. (1999) and Heintz, Short, and Rice (1999) negate other scientists' conclusions that polycyclic aromatic hydrocarbon concentration in spawning substrate after the spill was too low to adversely affect developing salmon (i.e., Brannon et al., 1995; Maki et al., 1995; Brannon and Maki, 1996).

Several studies demonstrated indirect and chronically adverse effects of oil to intertidal fish at levels below the water-quality guidelines of 15 parts per billion. Experiments conducted by Heintz, Short, and Rice, (1999) demonstrate that between the end of chronic exposure to embryonic salmon and their maturity, survival was reduced further by another 15%, resulting in the production of 40% fewer mature adults than the unexposed population. Heintz, Short, and Rice (1999) concluded the true effect of the exposure on the population was 50% greater than was concluded after evaluating the direct effects. Additional research found that fewer exposed fish from one experimentally exposed egg brood survived life at sea and returned as mature adults compared to unexposed fish (Heintz et al., 2000). Moreover, Heintz et al. (2000) experimental data show a dependence of early marine growth on exposure level; unexposed salmon increased their mass significantly more than salmon exposed to crude oil as embryos in eggs. Heintz et al. (2000) concluded that exposure of embryonic pink salmon to polycyclic aromatic hydrocarbon concentrations in the low parts per billion produced sublethal effects that led to reduced growth and survival at sea. Studies, therefore, indicate that examination of short-term consequences underestimate the impacts of oil pollution (Heintz et al., 2000; Rice et al., 2000; Ott, Peterson, and Rice, 2001). When oil contaminates natal habitats, the immediate effects in one generation may combine with delayed effects in another to increase the overall impact on the population. If oil spills enter small areas of intertidal habitats, small scale impacts to affected egg and larval habitats could last for one or more generations of a subpopulation.

McGurk and Brown (1996) tested the instantaneous daily rates of egg-larval mortality of Pacific herring at oiled and non-oiled sites; they found that the mean egg-larval mortality in the oiled areas was twice as great as in the non-oiled areas, and larval growth rates were about half those measure in populations from other areas of the North Pacific Ocean. Norcross et al. (1996) collected Pacific herring larvae throughout Prince William Sound in 1989 following the *Exxon Valdez* oil spill. They found deformed larvae both inside and outside of areas considered as oiled. Many larvae exhibited symptoms associated with oil exposure in laboratory experiments and other oil spills. These included morphological malformations, genetic damage, and small size. Growth was stunted during developmental periods. Brown et al. (1996) noted the resulting 1989 year-class displayed sublethal effects in newly hatched larvae, primarily premature hatch, low weights, reduced growth, and increased morphologic and genetic abnormalities. In newly hatched larvae, developmental aberration rates were elevated at oiled sites, and in pelagic larvae genetic damage was greatest near oiled areas of southwestern Prince William Sound. Brown et al. (1996) estimated that oiled areas produced only 16 million pelagic larvae compared with 11 billion in non-oiled areas. Kocan et al. (1996) exposed Pacific herring embryos to oil-water dispersions of Prudhoe Bay crude oil in artificial seawater and found that genetic damage was the most sensitive biomarker for oil exposure, followed by physical deformities, reduced mitotic activity, lower hatch weight, and premature hatching.

Demersal and bentho-pelagic finfish inhabiting oil polluted areas may suffer similar lethal and sublethal effects (for example, egg mortality, developmental aberrations, reduced survival, etc.) as reported for pelagic finfish, although not necessarily of the same magnitude as finfish assemblages using nearshore and intertidal habitats. Pollock sampled from Prince William Sound and Tugidak Island in 1990 following the *Exxon Valdez* oil spill showed evidence of fluorescent aromatic compounds, but these dropped substantially in 1991 (Collier et al., 1993). Overall, Collier et al. (1993) show a continuing exposure of several subtidal fish species.

Rockfish (yelloweye, quillback, and copper) examined for histopathological lesions and elevated levels of hydrocarbons in their bile after the *Exxon Valdez* oil spill indicated significant differences between oiled and control locations (Hoffman, Hepler, and Hansen, 1993). Additionally, at least five rockfish examined were killed by exposure to oil. While the authors noted no population-level effect in these species, these data indicate spilled oil reached and exposed demersal fish to both sublethal and lethal toxic effects.

Moles and Norcross (1998) found that juvenile yellowfin sole, rock sole, and Pacific halibut experienced reduced growth following 30-90 days of exposure to sediments laden with Alaska North Slope crude oil. Changes in fish health bioindicators after 90 days, (i.e., increases in fin erosion, liver lipidosis, gill hyperplasia, and gill parasites) coupled with decreases in macrophage aggregates, occurred at hydrocarbon concentrations (1,600 micrograms per gram) that reduced growth 34-56% among the demersal finfish. Moles and Norcross (1998) concluded that (1) chronic hydrocarbon pollution of nearshore nursery sediments could alter growth and health of juvenile flatfish, and (2) recruitment of juveniles to the fishery may decline because of increased susceptibility to predation and slower growth.

Hydrocarbon exposure in demersal fish often results in an increase in gill parasites (Khan and Thulin, 1991; MacKenzie et al. 1995). Moles and Wade (2001) experimentally tested adult Pacific sand lance's susceptibility to parasites when exposed to oil-contaminated sediments for 3 months. They found that sand lance exposed to highly oiled substrates had the greatest mean abundance of parasites per fish. Chronic exposure to harmful pollutants such as hydrocarbons coupled with increased parasitism degrades individual fitness and survival.

The most serious concerns arise regarding the potential sublethal effects to federally managed species, is exposure to chronic contamination within their habitats (Patin 1999). Recent studies show that the toxicity of oil pollution to aquatic populations has been seriously underestimated by standard short-term toxicity assays, and the habitat damage that results from oil contamination has been correspondingly underestimated (Ott, Peterson, and Rice 2001). These studies show that intertidal or shallow benthic substrates may become sources of persistent pollution by toxic polycyclic aromatic hydrocarbons following oil spills or from chronic discharges (Rice et al., 2000). Bivalves exposed to background contamination of polycyclic aromatic hydrocarbons may experience biological responses at the cellular level, disease, and histopathological changes (Patin, 1999). Finfish sublethal responses include a wide range of compensational changes (Patin, 1999). These start at the subcellular level and first have a biochemical and molecular nature. Recent research, mostly motivated by the *Exxon Valdez* oil spill, has found (1) polycyclic aromatic hydrocarbons are red from oil films and droplets at progressively slower rates with increasing molecular weight leading to greater persistence of larger polycyclic aromatic hydrocarbons; (2) eggs from demersally-spawning fish species accumulate dissolved polycyclic aromatic hydrocarbons red from oiled substrates, even when the oil is heavily weathered; and (3) polycyclic aromatic hydrocarbons accumulated from aqueous concentrations of less than 1 part per billion can lead to adverse sequelae appearing at random over an exposed individual's lifespan (Rice et al., 2000). These adverse effects likely result from genetic damage acquired during early embryogenesis caused by superoxide production in response to polycyclic aromatic hydrocarbons. Therefore, oil poisoning is slow acting following embryonic exposure, and adverse consequences may not manifest until much later in life. The frequency of any one symptom usually is low, but cumulative effects of all symptoms may be considerably higher (Rice et al., 2000). For example, if chronic exposures persist, stress may manifest sublethal effects later in a form of histological, physiological, behavioral, and even populational responses, including impairment of feeding, growth, and reproduction (Patin, 1999). Chronic stress and poisoning also may reduce fecundity and survival through increased susceptibility to predation, parasite infestation, and zoonotic diseases. These can affect population abundance and subsequently community structure.

Oil-spill impacts to stocks or subpopulations of walleye pollock or Pacific sand lance may have serious consequences to higher vertebrate predators, because these finfish are among the most important forage fish in the central Gulf of Alaska and are consumed by many endangered and threatened species of sea birds and marine mammals, and by various fisheries resources. Although frequent small spills or one or more large spills in Cook Inlet may cause local stocks or subpopulations of shellfish, bentho-pelagic, or demersal finfish to decline in abundance requiring multiple generations to recover to its former status, they are not likely to result in a significant impact to an overall population inhabiting the central Gulf of Alaska.

3.1.4 Effects of Oil Spill Response Measures

Dispersants used to mitigate oil slicks can adversely impact finfish, shellfish, and their prey. The Alaska Regional Response Team has prepared a Unified Plan that provides general guidelines, and the Subarea Plan designates where application of dispersants is appropriate. Both plans can be found online at http://www.akrrt.org/plans.shtml. The basic rule of thumb is no application of dispersants in areas shoreward of the 9-meter (5-fathom) isobath and, in some areas, that is increased to the 18-meter (10-fathom) isobath. The Subarea Plan identifies these areas. There also is an ongoing geographic response strategy program to map the entire Alaska coastline, identify sensitive habitats and species of animals at risk, and identify which response tactics should be considered first to limit oil impacts. Such information will be instrumental in minimizing the impacts of an oil spill and response activities to fisheries resources and their habitats.

3.1.5 Combined Probability Analysis

The combined probabilities estimate the probability of a spill occurring from all sources (transportation or platform) and contacting environmental resource areas, land segments, and sea segments during the life of the proposal has been calculated at intervals of 3, 10, and 30 days. The names and locations of environmental resource areas and land and sea segments referred to throughout this section are listed in Tables A.2-31 and 32 of the DEIS.

The relatively low probability of oil occurrence and contact to various environmental resources is illustrated by examination of the highest probabilities. After three days, the combined probabilities (expressed as percent chance) for one or more oil spills of greater than or equal to 1,000 barrels occurring and contacting Tuxedni Bay (ERA 1) is 5%; for outer Kamishak Bay (ERA 4) it is 3% (Table A.2-31). After ten days, the combined probability increases to 5% for outer Kamishak Bay (ERA 4) and to 6% for Tuxedni Bay (ERA 1). After 30 days, the combined probability of one or more oil spills greater than or equal to 1,000 barrels occurring and contacting outer Kamishak Bay or Tuxedni Bay does not change. Fish species inhabiting these resource areas potentially affected by oil spills are adult anadromous fish and eulachon transiting lower Cook Inlet; outmigrating juvenile salmon entering Cook Inlet from natal rivers and streams; herring, true cod, and halibut; and walleye pollock in the vicinity of Cape Douglas. Additionally, pelagic eggs and juvenile stages inhabiting near-surface waters may experience lethal and sublethal effects. For all other environmental resource areas and land segments, estimated combined probabilities (expressed as a percent chance) of one or more spills greater than or equal to 1,000 barrels occurring and contacting are less than 5%.

3.1.6 Large Natural Gas Release

If a natural gas release occurred, mortality could result to finfish or shellfish of varying life stages near the release point. Natural gas condensates in the water column may impact eggs or larvae with lethal and sublethal effects if exposed to high or moderate concentrations. A plume of natural gas vapors and condensates would disperse rapidly and is expected to produce negligible adverse impacts, affecting at most a few individuals.

3.2 Effects to Prey, Prey Habitat, and Other Ecosystem Components

As noted earlier, the primary risk of adverse effects to EFHs from the proposed sale is the potential of a large unlikely oil spill. The National Research Council reviewed the amounts of petroleum inputs into oceans and effects of all these inputs, including oil spills (National Research Council, 2002). The following paragraphs, summarized from that document, demonstrate ways in which oil spills may affect both habitat areas of particular concern such as corals (referred to as biogenically structured habitats) and an ecosystem's ability to regulate itself can be affected by an oil spill.

Biogenically structured biotopes, such as salt marshes where plants and animals are habitat to other organisms, are subject to destruction or alteration by acute oiling events. Indirect effects can be substantial. For example, in the *Exxon Valdez* oil spill (in Prince William Sound) and the *Torrey Canyon* oil spill (off the coast of southeast England), destruction of the algal cover had indirect impacts on limpets and other invertebrates. Such successional, reverberating or cascading indirect effects in a complex ecosystem may be very important but are not captured by laboratory studies.

Fresh petroleum is readily oxidized by microbes, which in turn can serve as a supplementary food source for benthic food webs in shallow water. The decrease in oxygen in the surface layers of the sediments that results from microbial metabolism of petroleum is a limiting factor to benthic organisms. Medium and higher molecular weight aromatic compounds are among the most persistent compounds in both animal tissues and sediments. The half-lives in marine bivalves can be quite long compared to the relatively rapid decline in monoaromatic compounds. Hydrocarbon exposure can occur at concentrations several orders of magnitude lower than concentrations that induce acute toxic effects. Impairment of feeding mechanisms, growth rates, development rates, energetics, reproductive output, recruitment rates, and increased susceptibility to zoonotic diseases are some examples. Early life history stages can be especially vulnerable. Heintz, Short, and Rice (1999) reported embryo mortality of pink salmon with laboratory exposure to aqueous total polycyclic aromatic hydrocarbon concentrations as low as 1 part per billion.

Prey and prey habitats compose the next level of the fish food web. The primary prey of many fish in the Cook Inlet area are zooplankton swimming in the open estuarine and marine waters, benthic animals in the estuarine zone and on the shallow sea bottom, and smaller fish categorized as forage fish. Consuming oiled zooplankton prey has been identified as a likely avenue of oil exposure in fish in the *Exxon Valdez* oil spill. Euphausiids are the most important planktonic prey in oceanic and shallow coastal waters but primarily occur in upwelling waters such as the Kennedy Entrance and at the edges of the Shelikof gully. Copepods are a secondarily important prey. Some of the Cook Inlet species that depend on zooplankton include walleye pollock, Atka mackerel, sablefish rockfish and flatfish, salmon, capelin, eulachon, and Pacific herring. In western Gulf of Alaska areas, euphausiids make up more than 70% of the total consumption of walleye pollock, the dominant small fish prey of larger fish. Copepods and euphausiids more than 85% in weight of age-0 pollock diet (Cianelli and Brodeur, 1997). Section IV.B.1.c –

Lower Trophic-Level Organisms of the DEIS, contains additional information and references on the effects of the lease sale on euphausiids and copepods.

As the complex food web was incorporated into the EFH analysis, MMS also considered ecosystem functions. While there are no federal offshore oil and gas developments in Cook Inlet at this time, ecosystem-level changes are occurring in Cook Inlet from commercial fishing, sports fishing, urban development, shipping, and other commercial developments within the area. Potential effects of this oil and gas sale on the ecosystem components are difficult to separate from the causes of the changes that are already taking place. This is especially true when analyzing the potential effects of this sale on forage fish.

The structure of the forage fish community is a critical component of the ecosystem. The community relationships are complex. A number of commercial fish species such as salmon, cod, and halibut feed on forage fish. A number of forage fish, such as pollock and herring, are also commercially valued fish species

Potential effects of this lease sale or any other development depend on the "regime", or conditions and community or ecosystem structure present at the time. The Cook Inlet commercial and forage fish community and the prey of the forage fish in Kachemak Bay (Bechtol, 1997) and Shelikof Strait (Anderson et al., 1997) has experienced a regime shift since the early 1970's. Since 1976, fish composed an increasing portion of the mean catch weight in Kachemak Bay shrimp surveys (Bechtol, 1997). Pollock appears to have been a dominant species in the Kachemak Bay ecosystem. As the shrimp population declined in the 1980's, the fish component of the survey catch increased dramatically from less than 20% to more than 80%. Walleye pollock always dominated the forage fish catch but their number and range varied widely. They generally trended toward fewer fish (decreasing by two orders of magnitude) spread throughout a greater area (in 22% of tows up to being in 90% of tows). This trend may be a result of a large number of small, young fish growing into fewer but widely distributed large, old fish.

The term "regime shift" is most often associated with the changes in the North Pacific that have resulted in many years of increased salmon runs in Alaska since the early 1970's and a corresponding reduction of salmon runs in Washington and Oregon over the same period. Implicit in the concept of regime shift is that changes occur throughout the ecosystem and a new community structure is formed (Anderson et al., 1997). Results suggest the Bering Sea ecosystem may not have returned to initial conditions after the change in physical state that occurred around 1978 (Decker et al., 1995). It is possible that the ecosystem has now reached a relative stability in which predator species suppress the production of prey species that are limited in abundance. The changes in Kodiak have been correlated with a March nearshore temperature change of about 2 °Celsius that allow cod to remain in the bays through winter instead of migrate offshore (Anderson et al., 1997). While 2 ºCelsius seems like a small change, it can result in a very noteworthy ecological change, especially in cold northern ecosystems.

Two other potential causes of community structural change are overfishing and the accumulation of smaller disturbances or stresses over a number of years. In the latter case, oil-development impacts described above may well be a contributor, adding to the critical mass of changes.

For example, if an oil spill reached Shelikof Strait it could impact the major concentration of pollock reproduction and early growth for the entire central Gulf of Alaska. The smaller eddies that form in certain environmental conditions normally promote higher survival and growth of pollock larvae. However, these same small eddies could also retain and concentrate spilled oil, severely impacting pollock by resulting in decreased survival. The cumulative stresses could have more far-reaching and long-lasting effects on the balance within the ecosystem. Individual small effects could add to stresses already present to alter balances between species that could suddenly shift the system into another very different and unpredicted ecological regime.

3.3 Effects to Habitat Areas of Particular Concern

Living substrates in shallow and deep waters (corals, sponges, mussels, rockweed, and kelp) and freshwater habitats used by anadromous fish were identified by the NPFMC as HAPC (http://www.afsc.noaa.gov/groundfish/HAPC/HAPC.htm).

Waterways used by anadromous fish and living substrates in estuarine, subtidal, and intertidal areas may experience adverse impacts resulting from small, frequent oil spills and/or one or more large oil spills. Impacts may destroy living substrates in shallow and intertidal waters if contacted by moderate to heavy concentrations of oil and subsequently affect proximate community assemblages and structure. Such impacts may take decades for habitats and communities to recover to their pre-oil spill status, although proximate community organization may never be achieved. Recolonization and recovery of impacted habitat areas of concern in estuarine and intertidal waters will depend in part on the magnitude of spill contact, the proximity of source populations, transport vectors and barriers, and amounts of oil entrapped in habitat sediments. Recolonization and recovery can be delayed for months and years depending on a suite of variables.

3.4 Effectiveness of Mitigating Measures

Standard Stipulations and Notices to Lessees, which are listed in Section II.F of the DEIS, are considered mitigation measures. Stipulation No. 1 - Protection of Fisheries relates to conflicts with the fishing community and their gear. It does not relate directly to fish or essential fish habitat.

Stipulation No. 2 could most directly relate to EFH mitigation. Stipulation No. 2 - Protection of Biological Resources applies to biological populations or habitats that are identified by the Regional Supervisor, Field Operations, MMS. The Field Operations Supervisor may require biological surveys and, based on the surveys or other information available, require relocation, modification, or time restrictions of operations. Lessees are required to report any area of biological significance they discover and submit all data obtained in the course of biological surveys. There are no reports indicating that any biological surveys, relocations, or modifications have resulted from Stipulation No. 2 in previous sales.

Oil-spill related ITL clauses notify lessees of legal requirements enforced by other agencies. The ITL clauses to be incorporated in the lease include ITL's No. 3 and No. 5. ITL No. 3 - Sensitive Areas in Oil-Spill-Response Plans identifies specific areas to be considered in oil-spill-response planning. Kamishak Bay has high value for essential fish habitat and is specifically identified for consideration in oil-spill-response planning. The ITL No. 3 also requires prior approval before dispersants are used. ITL No. 5 - Information on Oil-Spill-Response Preparedness advises lessees that they must be prepared to respond to oil spills.

The ITL's No. 4 and No. 6 reaffirm regulations of other Federal and State of Alaska agencies related to water quality. ITL No. 4 - Information on Coastal Zone Management refers to regulations of the State of Alaska, Division of Governmental Coordination whereby state agencies and coastal districts adjacent to the activity review these plans for consistency with their Coastal Management Programs. The ITL No. 6 - Drilling Fluids and Cuttings Discharge during Post-Lease Activities refers to National Pollution Discharge Elimination System permits issued by the Environmental Protection Agency.

4.0 EFH Conservation Recommendations

NMFS and MMS have agreed that the use of a programmatic consultation as outlined in 50 CFR 600.920 (j) is the most expeditious method to implement the EFH consultation requirements of the Magnuson-Stevens Act for the proposed lease sales in the Cook Inlet planning area. MMS has determined that proposed lease sales 191 and 199 could adversely affect EFH. Although this programmatic consultation document discusses potential adverse effects to EFH as a result of activities associated with production and development, this consultation is for activities associated with leasing and exploration only. Should MMS determine that proposed development and production for a specific project would adversely affect EFH, a separate consultation will be necessary at that time.

MMS has determined that adverse effects to EFH from a lease sale would result from routine activities that may including permitted drilling discharges, offshore and onshore construction activities, and seismic surveys. Accidental activities that may affect fisheries resources include exposure to hydrocarbons as a result of an oil spill. The following represent NMFS **EFH Conservation Recommendations**

1. MMS's Proposed Action, described in the Cook Inlet DEIS as Alternative I, consists of the Cook Inlet multiple-sale area which includes 517 whole or partial blocks covering 2.5 million acres in Cook Inlet. The DEIS offers three additional alternatives; the no action alternative and two alternative deferral areas, known as Alternative III and Alternative IV.

NMFS recommends the adoption of Alternative III and IV of the DEIS as preferable to Alternative I.

Rationale - This recommendation was previously provided to MMS under a separate cover dated January 30, 2003 from the NEPA coordinator for the National Oceanic and Atomospheric Administration. Alternative III (lower Kenai Penninsula Deferral), would reduce the potential for adverse effects on subsistence fish resources and associated habitat. Alternative IV (Barren Islands Deferral) offers meaningful benefit to the protection of locally important living marine resources including EFH.

2. Limit the discharge of produced waters into marine and estuaries environments. As a condition of the lease sale, require reinjection of produced waters into the oil formation whenever possible.

Rationale - The DEIS states that produced waters are expected to be reinjected back into the underlying formations as is now done for the Osprey platform. As the DEIS also notes, produced water has been a concern for Cook Inlet because of the types of naturally occurring substances they may carry and the manmade substances that may be added and because of the EPA's Cook Inlet exemption to zero discharge. NMFS understands that this permitting process is the purview of the EPA. However, but for MMS offering this area for lease, there would be no possibility for such an activity to take place.

3. Avoid discharge of muds and cuttings into the marine and estuarine environment. Use methods to grind and reinject such wastes down the well hole or use onshore disposal, and /or use non-toxic drilling muds wherever possible.

Rationale - The DEIS states that drilling muds and cuttings are the most significant discharge during exploration drilling. Again, while these discharges may be regulated by the EPA, it is the actions resulting from the lease sale that make such regulation necessary. The DEIS states that over the next 5 to 10 years municipal wastewater and seafood waste are estimated to contribute double the inputs of oil industry produced waters. To reduce the cumulative effects of all sources, it is important to inject produced waters, muds and cuttings downhole.

4. Encourage the use of geographic response strategies that identify EFH and environmentally sensitive areas and identify appropriate cleanup methods to include the prestaging of response equipment, description of dispersants and any considerations or restrictions for their use in Cook Inlet.

Rationale - Many factors determine the degree of damage from a spill, including the type of oil, size and duration of the spill, geographic location of the spill, and the season. While oil is toxic to all marine organisms at high concentrations, certain species and certain life stages are more sensitive than others. Likewise, response scenarios can vary depending on the species, life stage and geographic area including the type of habitat *impacted. Therefore, it is important that responders have the information and tools necessary to avoid exacerbating damage to EFH as a result of clean-up activities.*

5. Prohibit drilling exploration wells into untested formations during broken ice conditions.

   Rationale - Should a well blowout occur during exploration drilling, hazardous or adverse environmental conditions would make response activities dangerous and difficult.

5.0 Conclusion

Based on our review of the information provided by MMS for the EFH consultation on the federal oil and gas leasing and exploration sales 191 and 199 within Cook Inlet, Alaska planning area , NMFS has provided the EFH conservation recommendations above to avoid and minimize adverse effects to EFH . This programmatic consultation covers the proposed lease sales 191 and 199 only, and does not cover existing lease sales in the Cook Inlet Planning area. This programmatic consultation addresses the incremental step of leasing and exploration. Its purpose is to provide an assessment of those actions on EFH, as well as to recommend conservation measures to avoid and mitigate any potential adverse effects.

The EFH assessment contained in the DEIS, and the additional information provided by MMS, presented information on expected development and production as a result of the lease sales. However, the subsequent phases of OCS development, production, transportation and abandonment will require additional consultation due in part to the uncertainty and variables associated with individual tract development. Should commercially producible quantities of oil be discovered and development and production be proposed, MMS should determine whether the proposed activity may adversely affect EFH, and initiate consultation, if necessary.

6.0 Revision Tracking and Review

This consultation remains in effect for a period of five years. If any changes are made to MMS programs during that time, MMS should contact NMFS so that the conservation recommendations can be revised if necessary. At the end of the five-year period, MMS should provide NMFS with a report on the leasing activities and the tracts in which those activities occurred. This information will be part of the review to determine if the programmatic conservation recommendations need to be revised. This review should be initiated by MMS to ensure that the conservation recommendations are based on the best scientific information currently available.

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Online Resources

http://www.afsc.noaa.gov/groundfish/HAPC/HAPC.htm

http://www.state.ak.us/adfg/notebook/fish

http://www.state.ak.us/adfg/notebook/fish/chinook.htm

http://www.state.ak.us/adfg/notebook/fish/chum.htm

http://www.state.ak.us/adfg/notebook/fish/coho.htm

http://www.state.ak.us/adfg/notebook/fish/dolly_v.htm

http://www.state.ak.us/adfg/notebook/fish/eulachon.htm

http://www.state.ak.us/adfg/notebook/fish/halibut.htm

http://www.state.ak.us/adfg/notebook/fish/herring.htm

http://www.state.ak.us/adfg/notebook/fish/pink.htm

http://www.state.ak.us/adfg/notebook/fish/sockeye.htm

http://www.state.ak.us/adfg/notebook/fish/steelhd.htm.

http://www:afsc.noaa.gov/groundfish/HAPC/HAPC.htm

http://www.state.ak.us/adfg/notebook/shellfsh

http://www.state.ak.us/adfg/notebook/shellfsh/dungie.htm

http://www.state.ak.us/adfg/notebook/shellfsh/kingcrab.htm

http://www.state.ak.us/adfg/notebook/shellfsh/shrimp.htm http://www.state.ak.us/adfg/notebook/shellfsh/tanner.htm

http://www.oilspill.state.ak.us/facts/status_herring.html