Appendix 5
Essential Fish Habitat Text Descriptions
EFH Maps
Habitat associations, biological associations, predator/prey associations, and life histories of species in the Arctic Fishery Management Plan

Essential Fish Habitat Descriptions

General

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is described for FMP-managed species by life stage using guidance from the EFH Final Rule (50 CFR 600.815), including the EFH Level of Information definitions. New analytical tools are used and recent scientific information is incorporated for each life history stage from updated scientific habitat assessment reports. EFH descriptions include both text and maps, if information is available for a species' particular life stage. These descriptions are risk averse, supported by scientific rationale, and account for changing oceanographic conditions, regime shifts, and the seasonality of migrating fish stocks. EFH descriptions are interpretations of the best scientific information.

EFH Text Descriptions

This appendix contains EFH descriptions for fish species within the fishery management unit.

Table 1 EFH information levels for Arctic FMP species

Arctic FMP EFH Species	Life History Stage				
	Eggs	Larvae	Early Juvenile	Late Juvenile	Adult
Arctic cod	1*	1*	1	1	1
Saffron cod	-	-	-	1	1
Snow crab	1	-	-	1	1

1 indicates general distribution data are available for some or all portions of the geographic range of the species

* Logerwell et al. (2015)

EFH Description for Arctic Cod

Eggs, Larvae and Early Juveniles

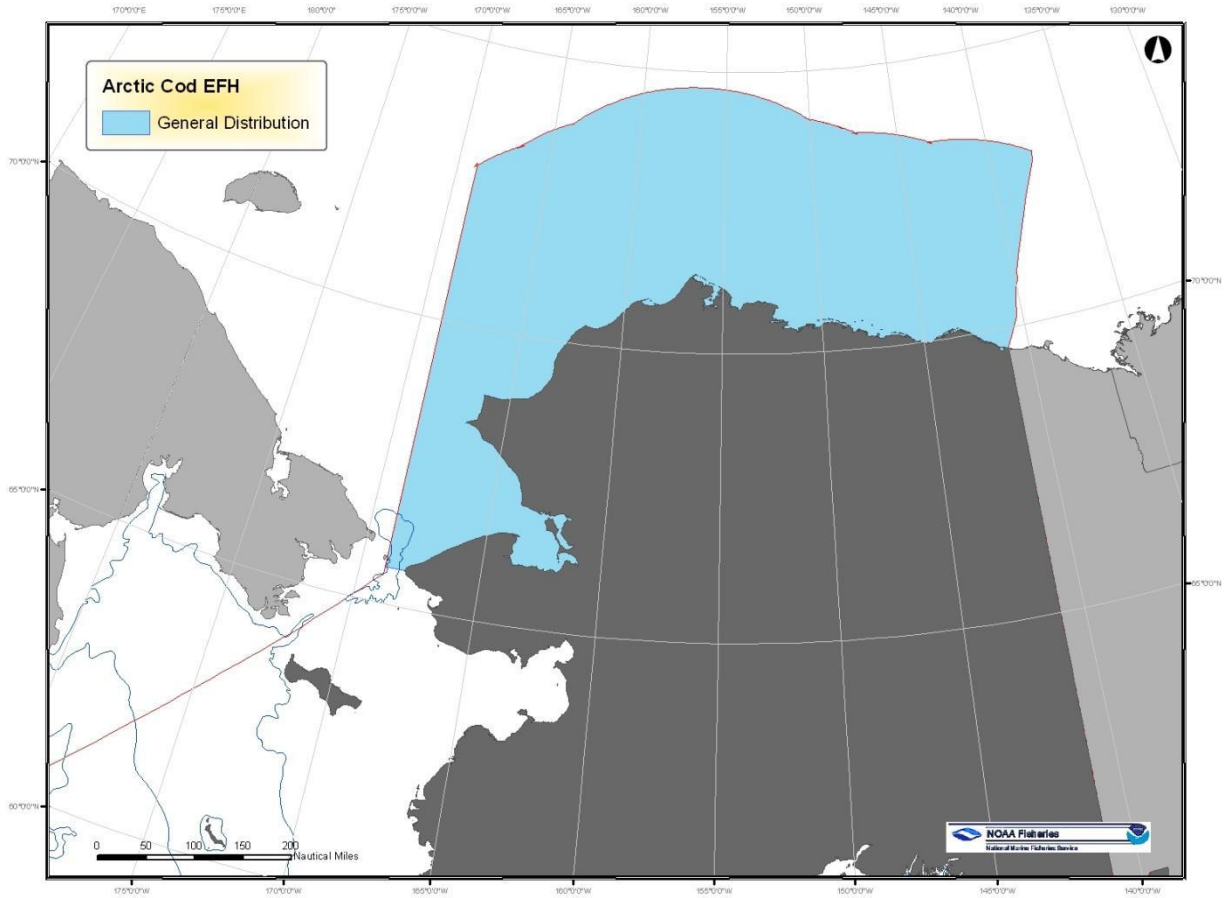
EFH for these life stages of Arctic cod is the general distribution area for these life stages, located in pelagic and epipelagic waters along the shelf (0 to 200 m) and upper slope (200 to 500 m) throughout Arctic waters. This distribution has been confirmed in the Chukchi Sea and is likely also true for the Beaufort Sea, although data are limited to a single survey in the Beaufort Sea (Logerwell et al. 2015).

Late Juveniles

EFH for late juvenile Arctic cod is the general distribution areas for this life stage located in pelagic and epipelagic waters from the nearshore to offshore areas along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout Arctic waters and often associated with ice floes which may occur in deeper waters.

Adults

EFH for adult Arctic cod is the general distribution area for this life stage located in benthic, pelagic and epipelagic waters from the nearshore to offshore areas along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout Arctic waters and often associated with ice floes which may occur in deeper waters.



EFH Description for Saffron Cod

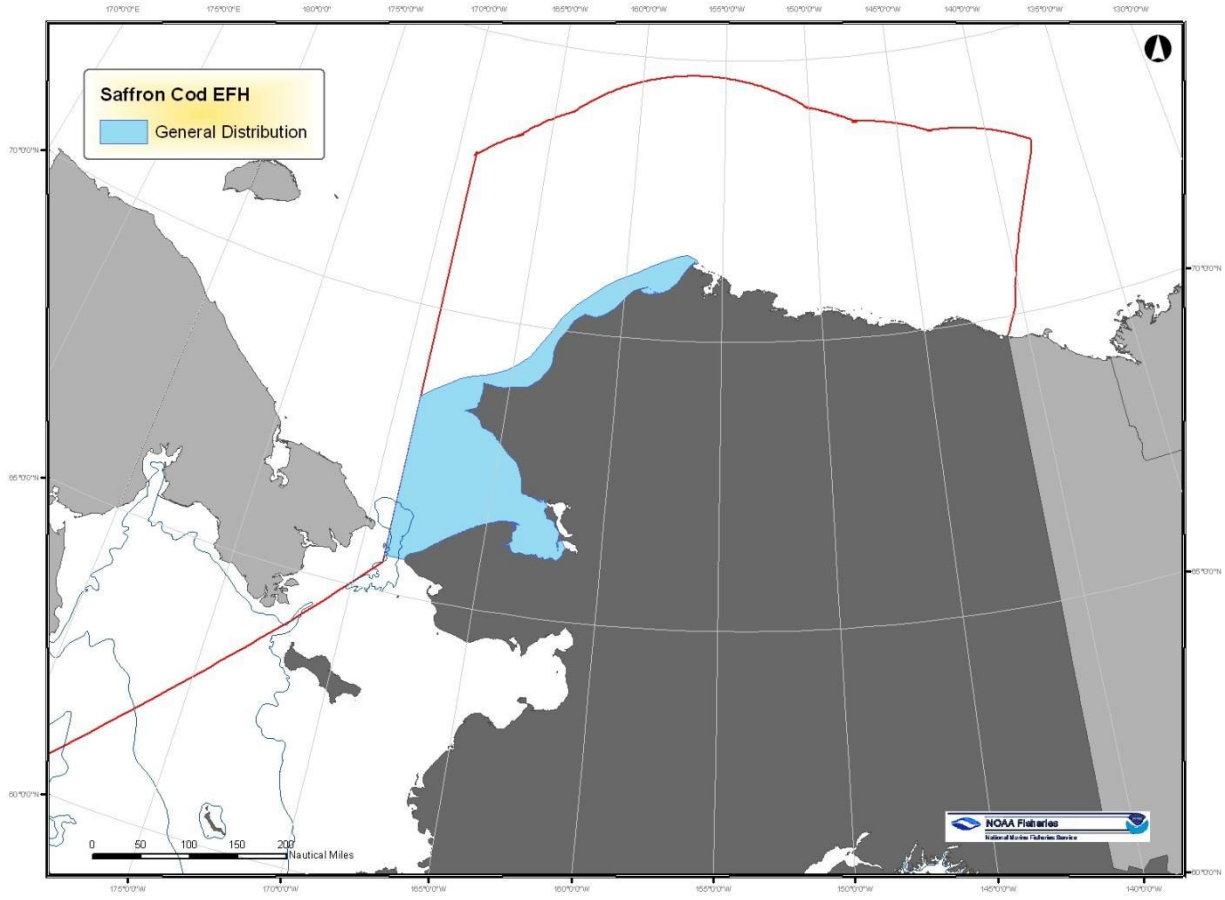
Insufficient information is available to determine EFH for Eggs, Larvae, and Early Juveniles.

Late Juveniles

EFH for late juvenile Saffron cod is the general distribution area for this life stage, located in pelagic and epipelagic waters along the coastline, within nearshore bays, and under ice along the inner (0 to 50 m) shelf throughout Arctic waters and wherever there are substrates consisting of sand and gravel.

Adults

EFH for adult Saffron cod is the general distribution area for this life stage, located in benthic, pelagic and epipelagic waters along the coastline, within nearshore bays, and under ice along the inner (0 to 50 m) shelf throughout Arctic waters and wherever there are substrates consisting of sand and gravel.



EFH Description for Snow Crab (*C. opilio)*

Eggs

Essential fish habitat of snow crab eggs is inferred from the general distribution of egg-bearing female crab (see Adults).

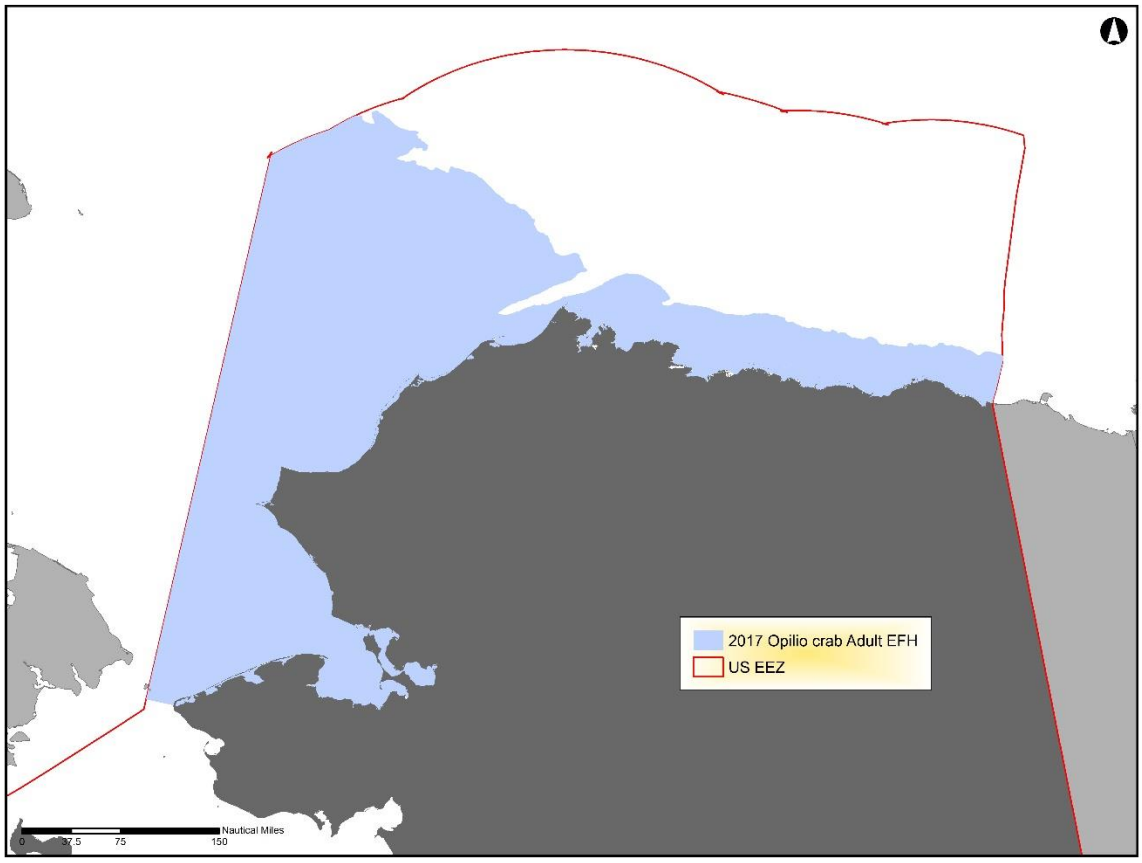
Insufficient information is available to determine EFH for Larvae and Early Juveniles.

Late Juveniles

EFH for late juvenile snow crab is the general distribution area for this life stage, located in bottom habitats along the inner (0 to 50 m) and middle (50 to 100 m) shelf in Arctic waters, wherever there are substrates consisting mainly of mud.

Adults

EFH for adult snow crab is the general distribution area for this life stage, located in bottom habitats along the inner (0 to 50 m) and middle (50 to 100 m) shelf in Arctic waters, wherever there are substrates consisting mainly of mud.



Habitat

Geography and Oceanography of the Arctic The Arctic Ocean has two regional seas that are adjacent to Alaska, the Chukchi Sea, and the Beaufort Sea. The Chukchi Sea is an embayment of the Arctic Ocean bounded on the west by the east Siberian coast of the Russian Federation and on the east by the northwestern coast of Alaska. With an area of about 595,000 km², it extends roughly from Wrangel Island at the eastern side of the East Siberian Sea to Point Barrow and offshore to the 200 m isobath (Weingartner 1997). Along the Alaskan coast of the Chukchi Sea, Kotzebue Sound is a large embayment between Bering Strait and Point Hope. Along the Alaskan Seward Peninsula coast between Point Lay and Wainwright, a chain of nearshore barrier islands forms a lagoon system that becomes estuarine during summer.

Offshore, the Chukchi Sea is relatively shallow with depths generally under 60 meters. Warm, low salinity marine water seasonally freshened by outflow from the Yukon River enters the Chukchi from the south through Bering Strait. During the open water season, water movement is northward through Bering Strait into the Arctic Ocean; circulation is partly subject to wind driven currents. The Chukchi Sea is ice covered for about 8 months, with ice retreat occurring in June and July and ice returning by October. The Beaufort Sea, covering an area of about 476,000 km², lies offshore north of the Alaskan arctic coast and extends generally from the Point Barrow area eastward to the delta of the Mackenzie River and the west coast of Banks Island in the Canadian High Arctic. The Beaufort Sea has a narrow Continental Shelf that extends offshore 50 to 100 km (30 to 60 miles). The Beaufort Sea is characterized by barrier island-lagoon systems extending along shore from the western Mackenzie Delta to the Colville River. Water circulation is dominated by the southern edge of the perpetual clockwise gyre of the Canadian Basin resulting in surface movement that is generally westward with a subsurface Beaufort Undercurrent flowing in the opposite direction (Aagaard 1984). Close to shore in the open water season, surface currents are primarily wind driven, with the predominant direction to the west. However, winds can be either easterly or westerly, and thus alongshore surface currents can flow either direction. Ice covers the sea for up to 9 months.

Both the Chukchi and Beaufort Seas are strongly influenced by seasonal ice cover. Ice directly affects the distribution and annual movement patterns of marine mammals and birds. Ice freezes to the bottom in the fall in shallow nearshore areas, and exhibits a shear zone where shorefast ice interfaces with the constantly moving offshore ice pack. Ice ridges, seafloor gouging, and other ice-related phenomena influence the benthic environment. Sea ice melting in spring nourishes primary production as the ice edge melts and retreats, opening a highly productive estuarine-like nearshore corridor in which anadromous and amphidromous fish, marine fish, shorebirds and other waterfowl flourish; many marine mammals generally remain with the ice pack as it retreats offshore.

Vessel movement in the region is restricted by ice conditions, generally allowing vessel transit during a short one to two month period each summer, although in recent years the length of the vessel transit season has been longer because of warmer water and reduced ice cover (Mellgren 2007; Reiss 2008). The Arctic Council's Arctic Marine Shipping Assessment evaluates impacts of increased arctic shipping activities, if ice continues to melt and shipping lanes open.

Productivity of the Arctic Ocean is considered to be low, probably due to long winters of low light penetration and thus lower plankton production. The Chukchi is more productive, due partly to the influx of nutrients and plankton in waters from the Pacific Ocean and Bering Sea flowing northward through Bering Strait. During summer months production increases as sea ice melts, because water stratification limits summer vertical mixing during the open water season. In the Beaufort during summer, strong west winds may induce upwelling of cold, more nutrient rich waters inshore, and with melting of bottomfast ice, benthic organisms move inshore and support a rich fauna of fish and birds. During winter, seasonal ice freezes to a thickness of two or more meters, through which seals maintain breathing holes and holes to access birthing lairs under snow cover. Polar bears range throughout the Arctic Ocean, and are more

common close to shore during winter months when prey and ice conditions are more favorable. Very little is known of marine fish distribution, abundance, diversity, or habitat use patterns in the winter. Anadromous and amphidromous fishes overwinter in unfrozen pockets of fresh or brackish water in rivers and river deltas.

Background

In 1996, the Sustainable Fisheries Act amended the Magnuson-Stevens Act to require the description and identification of EFH in FMPs, adverse impacts on EFH, and actions to conserve and enhance EFH. Guidelines were developed by NMFS to assist fishery management councils in fulfilling the requirements set forth by the MSA.

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

With respect to type, the information available for almost all species consist primarily of broad geographic distributions based on specific samples from surveys, which have not been linked with habitat characteristics. Furthermore, our ability to precisely define the habitat (and its location) of each life stage of each managed species in terms of its oceanographic (temperature, salinity, nutrient, current), trophic (presence of food, absence of predators), and physical (depth, substrate, latitude, and longitude) characteristics is very limited. Consequently, the information is restricted primarily to the species' position in the water column (e.g., demersal, pelagic), broad biogeographic and bathymetric areas (e.g., 100-200 m zone), and occasional references to known bottom types associations.

Identification of EFH for some species includes historical range information. Traditional knowledge and sampling data have indicated that fish distributions may contract and expand due to a variety of factors including, but not limited to, temperature changes, current patterns, changes in population size, and changes in predator and prey distribution.

The Council first identified EFH in 1998. In preparation of the 1999 EFH Environmental Assessment, EFH Technical Teams composed of stock assessment authors compiled scientific information and prepared the 1999 Habitat Assessment Reports. These reports provided the scientific information baseline to describe EFH. However, where new information does exist, new data helps to fill information gaps in the region's limited habitat data environment.

EFH descriptions were updated in 2005 for the Bering Sea and Aleutian Islands management area and for the Gulf of Alaska for crab, scallops, and groundfish and for all Alaska waters for salmon, including the Arctic Management Area. Stock assessment authors reviewed information contained in the 1999 summaries and applied stock expertise, along with data contained in reference atlases (ADF&G 2007; NOAA 1988 and 1990; NMFS 2005), fishery and survey data (NOAA 1998), and fish identification books (Eschmeyer and Herald 1983; Hart 1973; Mecklenburg et al. 2002), to describe EFH for each life stage using best scientific judgment and interpretation.

In 2005, EFH text and map descriptions for most Council managed species were revised using an analytical approach. The approach focused on fish survey and fishery observer data. For adult and late juvenile life stages, each data set was analyzed for 95 percent of the total accumulated population for the species using GIS. For eggs and larvae, the EFH description is based on presence/absence data from surveys. Where information existed, the area described by these data is identified as EFH. The analyzed

EFH data and area were further reviewed by scientific stock assessment authors for accuracy. This review ensures that any outlying areas not considered were included and gaps in the data were considered.

The EFH section of the Arctic FMP will undergo similar but simpler review. Fish survey and observer data are not available to analyze in this same manner. However, information does exist to describe EFH in the same manner as was completed for other Council FMPs in 1999 and as revised in 2005. Thus, Arctic EFH for each target species by life stage will be described as a general distribution using the best scientific information available.

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