6.5 Alaska Salmon

Because the salmon FMP regulates fisheries in the waters off the entire coast of Alaska and bans net fishing, with exceptions, for salmon off the coast in the EEZ, and also defines management measures for salmon troll fisheries in Southeast Alaska EEZ waters, all water bodies used by anadromous salmon throughout Alaska must be considered for EFH identification. Although much of the salmon troll fishery in SE Alaska occurs within State jurisdictional waters, significant parts of the fishery do occur within the EEZ. As a practical matter, the NPFMC and State of Alaska have effectively implemented this FMP under a joint agreement whereby State fishery regulations also apply within the EEZ. This management deferral by NPFMC to State fishery regulations, however, does not exempt the NPFMC from mandatory requirements to implement EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

Essential Fish Habitat for the salmon fisheries off the coast of Alaska consists of the aquatic habitat, both freshwater and marine, necessary to allow for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to healthy ecosystems. In addition to providing a sustainable fishery, salmon are important “keystone” species that are fundamental to the integrity and health of their ecosystems. Salmon returning from the sea to spawn transport basic nutrients that support the productivity of stream and lake ecosystems, and the salmon themselves provide essential food for numerous consumer species. Loss of these functions would cause a long-term reduction in ecosystem productivity and reduced population viability for dependent species.

As required by regulations, EFH needs to be defined for different stages of the salmon life history. Six life stages were recognized, based on major differences in distribution and habitat requirements. These were 1) eggs and larvae, 2) juveniles in fresh water, 3) juveniles in the estuary, 4) juveniles before their first winter in the marine environment, 5) immature and maturing adults in the marine environment, and 5) adults in fresh water. Habitat requirements within these periods can differ significantly (e.g., juveniles in freshwater require different habitats for summer rearing, winter rearing, and downstream migration). The six major life stages used in this assessment, however, are defined at a geographic scale appropriate for EFH determinations.

As a first step in identifying and describing EFH for Salmon Fisheries off the Coast of Alaska, the Team summarized the available relevant information on the five species of salmon covered in the NPFMC salmon FMP (attached). Salmon have been studied for many years, and as a result, much is known about their distribution, life histories, and habitat requirements. Relationships between salmon productivity and habitat quantity and quality are generally known, and population bottlenecks have been identified for most life stages. In some cases, quantitative models are available for predicting salmon abundance and production as a function of quantity and quality of habitat. Most of this knowledge, however, is in the form of scientific generalizations that can only be applied if the necessary site-specific habitat information is available.

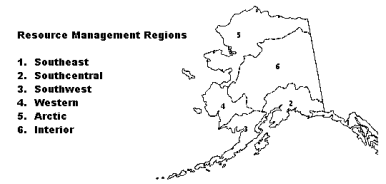

Figure 1. Regional boundaries of the Resource Management Regions established by the Joint Boards of Fisheries and Game.

Because habitat and fish information is lacking for some Alaska watersheds, the Team elected to designate an additional level of information for identifying EFH. A “Level 0" was deemed necessary to accommodate conditions where no systematic sampling has been conducted for the species and life

stage in parts of the known geographic range. They may have been caught opportunistically in small numbers during research or other activities. This condition applies to some water bodies in the Western, Arctic, and Interior Regions of Alaska (Figure 1) where limited survey work has been done.

The level of available information for identifying EFH ranges from Level 0 in regions that have not been systematically surveyed to Level 4 in particular watersheds and landscapes that have been studied intensively. Where direct observations are lacking, the distribution of various life stages could sometimes be inferred from correlated data. In this assessment, for example, the distribution of eggs and larvae was inferred from the distribution of spawning adults. Distribution of juveniles in fresh water, however, can not be inferred this way because rearing areas are often different from spawning areas.

For the purpose of identifying EFH, the distribution of salmon in a watershed can be assumed based on access to salt water, with the upstream limits determined by presence of migration blockages, such as waterfalls and stream segments with steep gradient. According to the Alaska Forest Resources and Practices Act (AS 41.17), an "anadromous water body" means the portion of a fresh water body or estuarine area that (A) is cataloged under AS 16.05.870 as important for anadromous fish; or (B) has been determined by ADF&G to contain or exhibit evidence of anadromous fish, in which case the anadromous portion of the stream or waterway extends up to the first point of physical blockage (Table 1). Therefore, if salmon occur in a stream's estuary, the area of stream up to the first point of physical blockage as defined in Table 1 is presumed to be salmon habitat.

Information levels of EFH assesments currently available for Alaska salmon by regions.

Region I, Southeastern

Species	Eggs and larvae	Juveniles fresh water (fry - smolt)	Juveniles estuarine	Juveniles marine	Adults, immature/ maturing marine	Adults, fresh water
Chinook	1-2	1-2	1-2	1-2	1-2	1-3
Coho	1-3*	2-4*	1-2	1	1	1-3
Pink	1-3	1-3	1-3	1-3	1-3	1-3
Sockeye	1-3	1-4*	1-3	1-2	1-2	1-3
Chum	1-3	1-3	1-3	1-3	1-2	1-3

Region II, Southcentral

Species	Eggs and larvae	Juveniles fresh water (fry - smolt)	Juveniles estuarine	Juveniles marine	Adults, immature/ maturing marine	Adults fresh water
Chinook	1-2	1-3	1	1	1-2	1-3
Coho	1-2	1-2	1-2	1	1-2	1-2
Pink	1-3	1-2	1-2	1-3	1-3	1-3
Sockeye	1-3	1-4	1-2	1	1-2	1-3
Chum	1-3	1-3	1-2	1-3	1-2	1-3

Region III, Southwestern

Species	Eggs and larvae	Juveniles fresh water (fry-smolt)	Juveniles estuarine	Juveniles marine	Adults, immature/ maturing marine	Adults fresh water
Chinook	1-2	1-2	1	1	1-2	1-3
Coho	1-2	1-2	1-2	1	1-2	1-2
Pink	1-2	1-2	1-2	1-2	1-2	1-3
Sockeye	1-3	1-4	1-2	1-2	1-2	1-3
Chum	1-3	1-2	1-2	1-2	1-2	1-3

* Level 3-4 knowledge is available for some stream systems that have been intensively studied, such as the Situk River.

Information Sources

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

Information levels of EFH assesments currently available for Alaska salmon by regions.

Region IV, Western

Species	Eggs and larvae	Juveniles fresh water (fry - smolt)	Juveniles estuarine	Juveniles marine	Adults, immature/ maturing marine	Adults, fresh water
Chinook	1-2	1	1	1	1-2	1-2
Coho	1-2	1	1	1	1	1-2
Pink	1	1	1	1	1	1
Sockeye	1	1	0a	0a	1-2	1
Chum	1-2	0a	0a	0a	1-2	1-2

Region V, Arctic

Species	Eggs and larvae	Juveniles fresh water (fry - smolt)	Juveniles estuarine	Juveniles marine	Adults, immature/ maturing marine	Adults fresh water
Chinook	1	1	1	1	1	1
Coho	1	1	1	0a	1	1
Pink	1	0a	0a	0a	0a	1
Sockeye	1	1	0a	0a	0a	1
Chum	1	0a	0a	0a	0a	1-2

Region VI, Interior

Species	Eggs and larvae	Juveniles fresh water (fry-smolt)	Juveniles estuarine	Juveniles marine	Adults, immature/ maturing marine	Adults fresh water
Chinook	1	1	1	1	1	1
Coho	1	1	1	1	1	1
Pink	1	0a	0a	1	0a	1
Sockeye	1	1	0a	0a	0a	1
Chum	1-2	1	1	1	1	1-2

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

Data for the Catalog come from surveys by aircraft, boat, and foot for purposes of managing fish habitat and fisheries, and the upper limit of salmon is not always observed. Upper points specified in the Catalog usually reflect the extent of surveys or known fish usage rather than actual limits of anadromous fish.

In addition, only a limited number of water bodies have actually been surveyed. Virtually all coastal waters in the State provide important habitat for anadromous fish, as do many unsurveyed small- and medium-sized tributaries to known anadromous fish-bearing water bodies in remote parts of the State. Small tributaries,

flood channels, intermittent streams and beaver ponds are often used for rearing. Because of their remote location, small size, or ephemeral nature, most of these systems have not been surveyed and are not included in the Catalog or Atlas. Because of their importance in some life stages of some salmon species, these areas fall under the framework of EFH.

A good source of habitat information for Southeast Alaska is a Geographical Information System maintained by the USDA Forest Service. This GIS has a "streams layer" for the Tongass National Forest which classifies streams by fish species present and physical attributes (channel type). For coho salmon, the Forest Service has a model that predicts coho salmon smolt production by channel type. Entire watersheds can be modeled to predict smolt yield. The "streams layer" is continuously updated as new information on location and fish species presence is discovered.

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Table 6.9 Criteria for determining the upstream limit of salmon in a stream system. The area downstream of the lowermost migration barrier on a stream is presumed to be salmon habitat where ADF&G has determined that the stream or estuary contains the species. This table was developed by the Department of Fish and Game and Department of Natural Resources as a revision to the Alaska Forest Resources and Practices Act (AS 41.17.950).

Criterion	**Species**				
	Chinook	Coho	Sockeye	Chum	Pink
Max Fall Height. A blockage may be presumed if fall height exceeds:	3.3 m	3.3 m	3.0 m	1.2 m with deep jump pool; 0.9 m without pool	
Pool depth. A blockage may be presumed if the unobstructed water column depth within the pool is less than:	1.25 times fall height, except that there is no minimum pool depth for falls <1.2 m for coho and <0.6 m for other species.				
Steep channel. A blockage may be presumed at the upper end of the reach if channel steepness exceeds the following without resting places for fish:	>70 m @ 12% gradient >30 m @ 16% gradient >15 m @ 20% gradient >8 m @ 24% gradient			>30 m @ 9% gradient	

SUMMARY OF TECHNICAL TEAM RECOMMENDATIONS

Salmon EFH is the aquatic habitat, both freshwater and marine, necessary to allow for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to healthy ecosystems.

Freshwater EFH for the salmon fisheries in Alaska includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in the State.
This represents a vast array of diverse aquatic habitats over an extremely large geographic area. Alaska contains over 3,000 rivers and has over 3 million lakes > 8 ha. Over 15,000 water bodies containing anadromous salmonids identified in the State represent only part of the salmon EFH in Alaska because many likely habitats have not been surveyed. In addition to current and historically accessible waters used by Alaska salmon, other potential spawning and rearing habitats exist beyond the limits of upstream migration due to barrier falls or steep-gradient rapids. Salmon access to existing or potential habitats can change over time due to many factors, including glacial advance or recession, post-glacial rebound, and tectonic subsidence or uplifting of streams in earthquakes.

Marine EFH for the salmon fisheries in Alaska include all estuarine and marine areas utilized by Pacific salmon of Alaska origin, extending from the influence of tidewater and tidally submerged habitats to the limits of the U.S. EEZ.

This habitat includes waters of the Continental Shelf, which extends to about 30-100 km offshore from Dixon Entrance to Kodiak Island, then becomes more narrow along the Pacific Ocean side of the Alaska Peninsula and Aleutian Islands chain. In Bering Sea areas of Southwest and Western Alaska and in Chukchi and Beaufort Seas areas of Northwest and Northern Alaska, the Continental Shelf becomes much wider. In the deeper waters of the Continental Slope and ocean basin, salmon only occupy the upper water column, generally from the surface to a depth of about 50 m. Chinook and chum salmon, however, use deeper layers, generally to about 300 m, and on occasion to 500 m.

Marine EFH for salmon off Alaska therefore, is the subset of habitat that occurs within the 320 km EEZ boundary of the United States in the Gulf of Alaska, Bering Sea, Chukchi, and Beaufort Seas to a depth of 500 m. The range of Alaska salmon extends far beyond this definition of EFH into oceanic waters beyond the EEZ since the documented range of Alaska salmon extends from 42° N latitude north to the Arctic Ocean and to 160° E longitude. Foreign waters (i.e., off British Columbia in the Gulf of Alaska and off Russia in the Bering Sea) and international waters are not included in this salmon EFH. It is estimated this definition of marine waters EFH for Alaska salmon includes perhaps only 60% of the total known oceanic range for these fishes. This marine EFH for Alaska salmon and associated fisheries described above is also EFH for the Pacific coast salmon fishery for those salmon stocks of Pacific Northwest origin that migrate through Canadian waters into the Alaska EFH zone.

Several stocks of Pacific Northwest salmon currently listed as threatened or endangered under the Endangered Species Act (ESA) migrate into the marine waters EFH off Alaska. Many of these and other West Coast stocks initially migrate northward along the coastline as juveniles, usually on the Continental Shelf. As growth occurs and these stocks move into Alaska waters many begin to move seaward into more open oceanic environments. These same stocks may become mixed across broad oceanic areas with Alaska-origin salmon.

The technical team recommends that all habitats within the jurisdictional boundaries of Alaska that are accessible to salmon be identified as EFH for salmon. All of this habitat contributes to production at some level. Although production from individual habitat areas may be small, collectively even small contributions help to sustain salmon fisheries at current levels. Fisheries for coho and pink salmon, for example, depend on the cumulative production from thousands of small streams that are widely distributed across coastal Alaska. To maintain the present healthy status of the ecosystem and fisheries, it must be recognized that any incremental loss of available habitat will result in less-healthy stocks with reduced fishery potential. Policies that accept reductions in Alaska salmon EFH by designating less-essential subsets of existing habitats could cause unacceptable reductions in salmon contributions to fisheries and ecosystems. In the case of threatened or endangered Pacific Northwest stocks reductions in marine waters EFH off Alaska could jeopardize ESA

recovery plans. It is appropriate, therefore, that all salmon habitats in fresh waters within Alaska and marine waters off Alaska be identified as EFH.

In the marine environment, Pacific salmon range throughout the Gulf of Alaska, North Pacific Ocean, and Bering Sea. Virtually all marine waters adjacent to Alaska, from nearshore and coastal areas to the limits of the U.S. EEZ, are utilized by salmon. Large-scale research programs, such as GLOBEC and OCC, currently are addressing the concern that ocean carrying capacity for salmon is limited, and density-dependent restrictions on growth or survival may be occurring at current levels of abundance. If density-dependent interactions are already evident, any reduction or degradation of marine habitats of salmon will result in incremental loss in productivity.

Thus at this time, all existing marine habitat is essential to maintain current levels of abundance and productivity of salmon in Alaska and to help restore depleted Pacific Northwest stocks that migrate into Alaska waters. There is, substantial rationale to justify such an inclusive definition of EFH. Even when habitats remain stable, salmon populations may fluctuate significantly due to factors such as weather, climate, and changes in predator or prey abundance. Salmon use a broader range of freshwater habitat during periods of high abundance. Habitat productivity also varies along with natural long-term disturbance regimes, so that a particular watershed may have low productivity after an event such as a major flood, followed by a period of higher, more stable productivity. Locations of salmon concentrations in freshwater, estuarine, and marine habitats may change unpredictably, so that current areas of known concentration would not adequately cover required habitat. Regime shifts in ocean conditions can also cyclically affect the presence and abundance of food or predators and as a result salmon distribution and survival.

There is a growing body of evidence that such a regime shift is currently underway indicated by further significant declines in marine survivals of salmon in the Pacific Northwest and British Columbia. Now, these same reduced marine survivals are also affecting Alaska salmon stocks where a dramatic 45% reduction in the commercial harvest has occurred over the last two years, from 218 million in 1995 to 121 million in 1997. Designating only that habitat with current high abundance or productivity as EFH ignores the implications of such short- and long-term cycles. The broad range and diversity of salmon habitats must be conserved to provide for periods of abundance, as well as to avoid severely reduced production during poor years.

The recommended definition of salmon EFH is most consistent with existing Federal and State laws and policies that protect anadromous fish and their habitat, such as Alaska Statute Title 16, the Alaska Forest Resources and Practices Act, the National Forest Management Act, the Tongass Land Management Plan, the Clean Water Act, and the Coastal Zone Management Act. These laws and policies conserve anadromous fish habitat and do not exempt portions of it based on relative productivity.

Even with the inclusive definition of EFH recommended here, significant portions of salmon habitat would not be designated as EFH because they are outside U.S. jurisdiction. Examples of specific habitat areas that are not considered EFH for Alaska salmon are l) Canadian parts of the transboundary rivers, including the upper Yukon River where major chinook and chum salmon production contributes to Alaska fisheries; and 2) international waters outside the EEZ.

Based on the foregoing information and attached descriptions of essential habitat for chinook, coho, pink, chum, and sockeye salmon, the following specific definitions of EFH are proposed, by species and life stage, for the salmon fisheries in Alaska. Maps showing the extent of recommended EFH are provided only for immature and maturing adult salmon in marine habitats. These maps show the general distribution and areas of known concentration. Areas of known concentration of maturing and adult salmon in the marine environment have been identified for some species based on bycatch in fisheries, such as chinook, chum, and sockeye salmon bycatch in the Bering Sea trawl fishery. These known concentrations, however, reflect points where fish become concentrated on migration routes from the open ocean to fresh water (e.g., Unimak Pass); they do not indicate exceptional habitats necessary for rearing and maturing. In addition, NMFS research has identified the area off Prince William Sound to Kodiak Island as a possible area of concentration of chum salmon in summer. Current knowledge of salmon distribution in the ocean is inadequate to identify other concentrations or areas of exceptional production.

The concept of "areas of known concentration" as used for marine EFH applies differently to salmon in fresh water. In fresh water, concentrations of salmon reflect locations of specific habitats for spawning, rearing, and migration that are patchily distributed on a finer scale (at the reach level) within watersheds. Freshwater habitat is very heterogeneous, and at a local level, depends on geomorphic, vegetative, hydrologic, and other factors, and also varies along the “river continuum” from headwaters to river mouth. Therefore, the distribution of habitat and fish within specific watersheds must be considered on a case-by-case basis to identify areas of concentration. Such areas of concentration--usually of spawning adult salmon--have been identified for a small number of specific river systems that have been intensively surveyed, primarily in Southeast (Region I), Southcentral (Region II); and Southwestern (Region III) Alaska. By radio tagging, for example, NMFS research has identified areas of concentrated chinook and sockeye salmon spawning in the Taku River, which could be considered areas of known concentration. For the vast majority of watersheds, however, information is insufficient to identify areas of known concentration, particularly for juvenile salmon.

The general distribution of salmon in fresh water includes virtually all the coastal streams to about 70° N latitude. Maps of documented salmon occurrence in fresh water (representing only a subset of salmon EFH) are available in the ADF&G stream Atlas. These maps show presence/absence of anadromous fish in areas that have been surveyed, but do not show fish densities, and therefore, they do not depict areas of known concentration. It would be possible to delineate areas of known concentration of salmon in some watersheds. First, one would identify watersheds with sufficient information and then delineate areas of known concentration within the watersheds. This would only be possible for a small number of watersheds, and generally only for adult salmon. It could be done for juvenile salmon in a few watersheds.

See table of contents for the following tables:

Habitat Associations

Reproductive Traits

Known Life History Traits

EFH Definition for Chinook Salmon

Eggs and larvae: Level 1 and Level 2
Those portions of fresh waters in Alaska within the bounds of ordinary high water where chinook salmon currently or historically occur, that are accessible to adult chinook salmon (or could be cost-effectively made accessible), and that have bottom substrate, water quality, and seasonal flow adequate for the incubation and development of chinook salmon eggs and larvae. Impaired areas with potential for cost-effective restoration are also EFH for chinook salmon. Eggs and larvae require more than 200 days over the period from July to May for incubation in intragravel flows.

Juveniles (freshwater): Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where chinook salmon currently or historically occur, that are accessible to juvenile chinook salmon (or could be cost-effectively made accessible), and that provide adequate water quality and productivity conditions for seasonal or year-round rearing or migration for juvenile chinook salmon. Impaired areas with potential for cost-effective restoration are also EFH for chinook salmon. Juvenile chinook salmon require year-round rearing habitat and also migration habitat from April to September to provide access to the sea.

Juveniles (estuarine): Level 1 and Level 2
The salinity transition zone (ecotone) and contiguous intertidal and nearshore habitats below mean higher high tide in Alaska where chinook salmon currently or historically occur. Chinook salmon smolts and post-smolt juveniles may be present in these estuarine habitats from April through September.

Juveniles (marine): Level 1 and Level 2
Marine waters from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the U.S. EEZ. Juvenile chinook salmon are present in this habitat from April until annulus formation in January/February of their first winter at sea.

Immature and maturing adults (marine): Level 1 and Level 2
Marine waters below mean higher high tide from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the U.S. EEZ. Immature chinook salmon use this marine habitat year-round. Maturing fish generally are considered to be in their ultimate year of life, and thus utilize the habitat from January until September, by which time they have entered freshwater or moved out of the marine EFH in Alaska.

Adults (freshwater): Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where chinook salmon currently or historically occur, that are accessible to adult chinook salmon (or could be cost-effectively made accessible), and that provide suitable water quality, migration access, holding areas, and spawning substrates and flow regimes. Impaired areas with potential for cost-effective restoration are also EFH for chinook salmon. Adult chinook salmon utilize such freshwater habitats in Alaska from April through September.

EFH Definition for Coho Salmon

Eggs and Larvae (Fresh water): Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where coho salmon currently or historically occur, that are accessible to adult coho salmon (or could be cost-effectively made accessible), and that have substrate, water quality, and seasonal flow adequate for the incubation and development of coho salmon eggs and larvae. Impaired areas with potential for cost-effective restoration are also EFH for coho salmon. Eggs and larvae require >150 days of incubation (generally over the period of October to May). Preferred substrate is gravel containing <15% fine sediment (<2 mm diameter).

Juveniles (Fresh water): Levels 1 - 4
Those portions of fresh waters in Alaska within the bounds of ordinary high water where coho salmon currently or historically occur, that are accessible to juvenile coho salmon (or could be cost-effectively made accessible), and that provide adequate water quality and productivity conditions for seasonal or year-round rearing or migration for juvenile coho salmon. Impaired areas with potential for cost-effective restoration are also EFH for coho salmon. Juvenile coho salmon require year-round rearing habitat and also migration habitat from April to November to provide access to and from the estuary.

Juveniles (Estuary): Level 1 and Level 2
Those portions of the salinity transition zone (ecotone) and contiguous intertidal and nearshore habitat below mean higher high tide in Alaska where coho salmon currently or historically occur. Smolts may be present May to August; non-smolts rear in spring and summer.

Juveniles (Marine): Level 0_a and Level 1
Marine waters below mean higher high tide from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the continental shelf and to a depth of 50 meters. Juveniles occupy this area from June to September.

Immature and Maturing Adults (Marine): Level 1 and Level 2
Marine waters below mean higher high tide from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the U.S. EEZ and to a depth of 200 meters. Immature coho salmon use this marine habitat year-round. Immature fish generally enter this habitat in late summer and maturing coho salmon return to fresh water to spawn the following late summer or fall.

Adults (Fresh water): Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where coho salmon currently or historically occur, that are accessible to adult coho salmon (or could be cost-effectively made accessible), and that provide suitable water quality, migration access, holding areas, and spawning substrates and flow regimes. Impaired areas with potential for cost-effective restoration are also EFH for coho salmon. Adult coho may be present in fresh water from July to December.

EFH Definition for Pink Salmon

Egg/Larvae (Fresh water): Levels 1 - 3
Those portions of fresh waters and the intertidal portion of streams in Alaska within the bounds of ordinary high water where pink salmon currently or historically occur, that are accessible to adult pink salmon (or could be cost-effectively made accessible), and that have substrate, water quality, and seasonal flow adequate for the incubation and development of pink salmon eggs and larvae. Impaired areas with potential for cost-effective restoration are also EFH for pink salmon. Eggs and larvae require approximately 225 days of incubation over the period of late summer to early spring. Preferred substrate is medium to course gravel containing <15% fine sediment (<2 mm diameter), 15-50 cm in depth.

Juveniles (Fresh water): Level 0_a and Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where pink salmon currently or historically occur, that are accessible to pink salmon (or could be cost-effectively made accessible), and that provide adequate water quality conditions for seasonal migration for pink salmon fry. Impaired areas with potential for cost-effective restoration are also EFH for pink salmon. Migrating pink salmon fry are in stream systems during spring, generally migrating in darkness in the upper water column. Fry leave streams in 1-15 days, and the duration of migration from a stream may last 2 months.

Juveniles (Estuary): Level 0_a and Levels 1 - 3
Those portions of the salinity transition zone (ecotone) and contiguous intertidal and nearshore habitats below mean higher high tide in Alaska where pink salmon currently or historically occur. Pink salmon juveniles may be present from late April through June.

Juveniles (Marine): Level 0_a and Levels 1 - 3
Coastal waters all along the continental shelf throughout Alaska from mid-summer until December; then moving further off shelf into more pelagic oceanic areas, generally in the upper 50 m of the water column.

Immature and Maturing Adults (Marine): Level 0_a and Levels 1 - 3
Marine waters below mean higher high tide from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the U.S. EEZ and to a depth of 200 meters. Pink salmon are present from fall through the mid-summer in pelagic waters.

Adults (Fresh water): Levels 1 - 3
Those portions of fresh waters and intertidal areas of streams within the bounds of ordinary high water in Alaska where pink salmon currently or historically occur, that are accessible to adult pink salmon (or could be cost-effectively made accessible), and that provide suitable water quality, migration access, holding areas, and spawning substrates and flow regimes. Impaired areas with potential for cost-effective restoration are also EFH for pink salmon. Adult pink salmon may be present in fresh water and the intertidal areas of streams from June through September.

EFH Definition for Chum Salmon

Eggs and Larvae (Fresh water): Levels 1 - 3
Those portions of fresh waters and the intertidal portion of streams in Alaska within the bounds of ordinary high water where chum salmon currently or historically occur, that are accessible to adult chum salmon (or could be cost-effectively made accessible), and that have substrate, water quality, and seasonal flow (including upwelling ground water) adequate for the incubation and development of chum salmon eggs and larvae. Impaired areas with potential for cost-effective restoration are also EFH for chum salmon. Eggs and larvae incubate from late summer to early spring. Preferred substrate is medium to course gravel containing <15% fine sediment (<2 mm diameter); finer substrates can be used in upwelling areas of streams and sloughs.

Juveniles (Fresh water): Level 0_a and Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where chum salmon currently or historically occur, that are accessible to chum salmon (or could be cost-effectively made accessible), and that provide adequate water quality conditions for seasonal migration for chum salmon fry. Impaired areas with potential for cost-effective restoration are also EFH for chum salmon. Migrating chum salmon fry are in stream systems during spring, generally migrating in darkness in the upper water column.

Juvenile Stages (Estuarine): Level 0_a and Levels 1 - 3
Those portions of the salinity transition zone (ecotone) and contiguous intertidal and nearshore habitats below mean higher high tide in Alaska where chum salmon currently or historically occur. Chum salmon juveniles may be present from late April through June.

Juvenile Stages (Marine): Level 0_a and Levels 1 - 3
Those areas of ocean in the State of Alaska and the U.S. EEZ over the continental shelf between 0 and 50 meters in depth.

Immature and Maturing Adults (Marine): Level 0_a and Levels 1 - 3
Marine waters below mean higher high tide from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the U.S. EEZ and to a depth of 200 meters. Chum salmon are present year round in pelagic waters.

Adults (Freshwater): Levels 1 - 3
Those portions of fresh waters and intertidal areas of streams within the bounds of ordinary high water in Alaska where chum salmon currently or historically occur, that are accessible to adult chum salmon (or could be cost-effectively made accessible), and that provide suitable water quality, migration access, holding areas, and spawning substrates and flow regimes. Impaired areas with potential for cost-effective restoration are also EFH for chum salmon. Adult chum salmon may be present in fresh water and intertidal areas of streams from June through January.

EFH Recommendation for Sockeye Salmon

Egg/Larvae (Fresh water): Levels 1 - 3
Those portions of fresh waters in Alaska within the bounds of ordinary high water where sockeye salmon currently or historically occur, that are accessible to adult sockeye salmon (or could be cost-effectively made accessible), and that have substrate, water quality, and seasonal flow (including upwelling ground water) adequate for the incubation and development of sockeye salmon eggs and larvae. Impaired areas with potential for cost-effective restoration are also EFH for sockeye salmon. Sockeye often spawn in lake substrates, as well as in streams. Eggs and larvae are in these habitats from July through May. Preferred substrate is medium to course gravel containing <15% fine sediment (<2 mm diam.); finer substrates can be used in upwelling areas of streams and sloughs.

Juveniles (Fresh water): Levels 1 - 4
Those portions of fresh waters in Alaska within the bounds of ordinary high water where sockeye salmon currently or historically occur, that are accessible to juvenile sockeye salmon (or could be cost-effectively made accessible), and that provide adequate water quality and productivity conditions for seasonal rearing and migration for juvenile sockeye salmon. Impaired areas with potential for cost-effective restoration are also EFH for sockeye salmon. Juvenile sockeye salmon require year-round rearing habitat and also migration habitat from April to November to provide access to the estuary. Fry generally migrate downstream to a lake or, in systems lacking a freshwater lake, to estuarine and riverine rearing areas. Migration of fry and smolts is generally in spring and summer.

Juveniles (Estuary): Level 0_a, Level 1 and Level 2
Those portions of the salinity transition zone (ecotone) and contiguous intertidal and nearshore habitats below mean higher high tide in Alaska where sockeye salmon currently or historically occur. Under-yearling, yearling, and older smolts occupy estuaries from March through early August.

Juveniles (Marine): Level 0_a, Level 1 and Level 2
Coastal waters all along the continental shelf throughout Alaska and the U.S. EEZ from mid-summer until December; generally in the upper 50 m of the water column.,

Immature and Maturing Adults (Marine): Level 0_a, Level 1 and Level 2
Marine waters below mean higher high tide from Dixon Entrance to the Bering Straits, extending from the intertidal to the limits of the U.S. EEZ and to a depth of 200 meters. Sockeye salmon are present year round in pelagic waters. Ocean residence is 1-3 years.

Adults (Fresh water): Levels 1- 3
Those portions of fresh waters and upper intertidal areas of streams within the bounds of ordinary high water in Alaska where sockeye salmon currently or historically occur, that are accessible to adult sockeye salmon (or could be cost-effectively made accessible), and that provide suitable water quality, migration access, holding areas, and spawning substrates and flow regimes. Impaired areas with potential for cost-effective restoration are also EFH for sockeye salmon. Adult sockeye salmon may be present in fresh water from June through September, and sockeye often spawn in lake substrates, as well as in streams.

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General Distribution of Eggs and Larvae, Freshwater Juvenile and Adult Chinook, Chum, Coho, Pink and Sockeye Salmon (Southeast Alaska and GOA)

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General Distribution of Eggs and Larvae, Freshwater Juvenile and Adult Chinook, Chum, Coho, Pink and Sockeye Salmon (Western Alaska and Bering Sea)

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General Distribution of Eggs and Larvae, Freshwater Juvenile and Adult Chinook, Chum, Coho, Pink and Sockeye Salmon (Northern Alaska and Arctic Ocean)