Chapter 5 ESSENTIAL FISH HABITAT

5.1 Background

Essential fish habitat (EFH) has been designated for Federally managed groundfish, coastal pelagics, Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and Puget Sound pink salmon (*O. gorbuscha*) fisheries within the waters of Washington, Oregon, Idaho, and California (PFMC 1999).

In previous consultations for Reclamation's upper Snake River projects, NMFS (2001) stated that:

> [d]esignated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (230.2 miles) (PFMC 1998a, 1998b). Detailed descriptions and identification of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to The Pacific Coast Groundfish Management Plan (PFMC 1998a) and NMFS Essential Fish Habitat for West Coast Groundfish Appendix (Casillas et al. 1998). Detailed descriptions and identifications of EFH for the coastal pelagic species are found in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998b).
>
> Freshwater EFH for Federally managed Pacific salmon includes all those rivers, streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassable barriers identified by PFMC (1999). Chief Joseph Dam, Dworshak Dam, and the Hells Canyon Complex (Hells Canyon, Oxbow, and Brownlee dams) are among the listed man-made barriers that represent the upstream extent of the Pacific salmon fishery EFH. Freshwater salmon EFH excludes areas upstream of longstanding, naturally impassable barriers (e.g., natural waterfalls in existence for several hundred years). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (230.2 miles) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border. Detailed descriptions and identification of EFH for Pacific salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999).

Appendix A to Amendment 14 of the Pacific Coast Salmon Plan (PFMC 1999) listed EFH for Chinook salmon and coho salmon in the Snake and Columbia Rivers downstream from Hells Canyon Dam. EFH was delineated by 4th field hydrologic unit codes (HUCs). An HUC is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the USGS on State

Hydrologic Unit Maps. The fourth level of classification is the cataloging unit, the smallest element in the hierarchy of hydrologic units, representing part or all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature. EFH for the two salmon species was listed without regard for whether the several ESUs of the two species were Federally listed under the ESA. The particular Chinook or coho salmon ESUs that occupied the area were not considered when designating EFH. For this consultation, Reclamation considers both ESA-listed and non-listed Chinook and coho salmon ESUs that spawn, rear, and/or migrate in the action area.

5.2 Proposed Actions

Reclamation's 12 proposed actions include: (1) the future O&M in the Snake River system above Milner Dam; (2) future operations in the Little Wood River system; (3) future O&M in the Owyhee, Boise, Payette, Malheur, Mann Creek, Burnt, upper Powder, and lower Powder River systems; (4) surveys and studies of ESA-listed aquatic snail species in the Snake River above Milner Dam; (5) and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights. The features and facilities of the 12 Federal projects included in Reclamation's proposed actions are all in the Snake River basin upstream of Brownlee Dam, an Idaho Power hydropower facility on the Snake River at RM 285. Chapter 2 and the *Operations Description for Bureau of Reclamation Projects in the Snake River above Brownlee Reservoir* (USBR 2004b) describe the proposed actions.

5.3 Action Area

The action area with regard to EFH consultation includes the farthest upstream point at which Federally managed salmon smolts enter (or adults exit) the Snake River and Columbia River (at, and downstream from, its confluence with the Snake River) to the farthest downstream point at which smolts exit (or adults enter) the migration corridor to the ocean. The action area in the Snake River includes the area immediately downstream from Hells Canyon Dam, or wherever an occupied tributary stream meets the Snake River below Hells Canyon Dam, to the confluence of the Snake and Columbia Rivers. In the Columbia River, the action area includes wherever a tributary stream meets the Columbia River, downstream to the farthest point at the Columbia River estuary and nearshore ocean environment for which designated EFH for groundfish, coastal pelagics, and Chinook and coho salmon might be influenced by the proposed actions.

This area encompasses nine 4th field HUCs beginning just downstream from Hells Canyon Dam and progressing through the lower Snake River and from the mouth of the Snake River in the Columbia River to its mouth. Figure 5-1 and Table 5-1 show the geographic extent and Snake River or Columbia River miles (RM) of these 4th field HUCs. Delineations of some of these 4th field HUCs are estimated from maps and may be approximate.

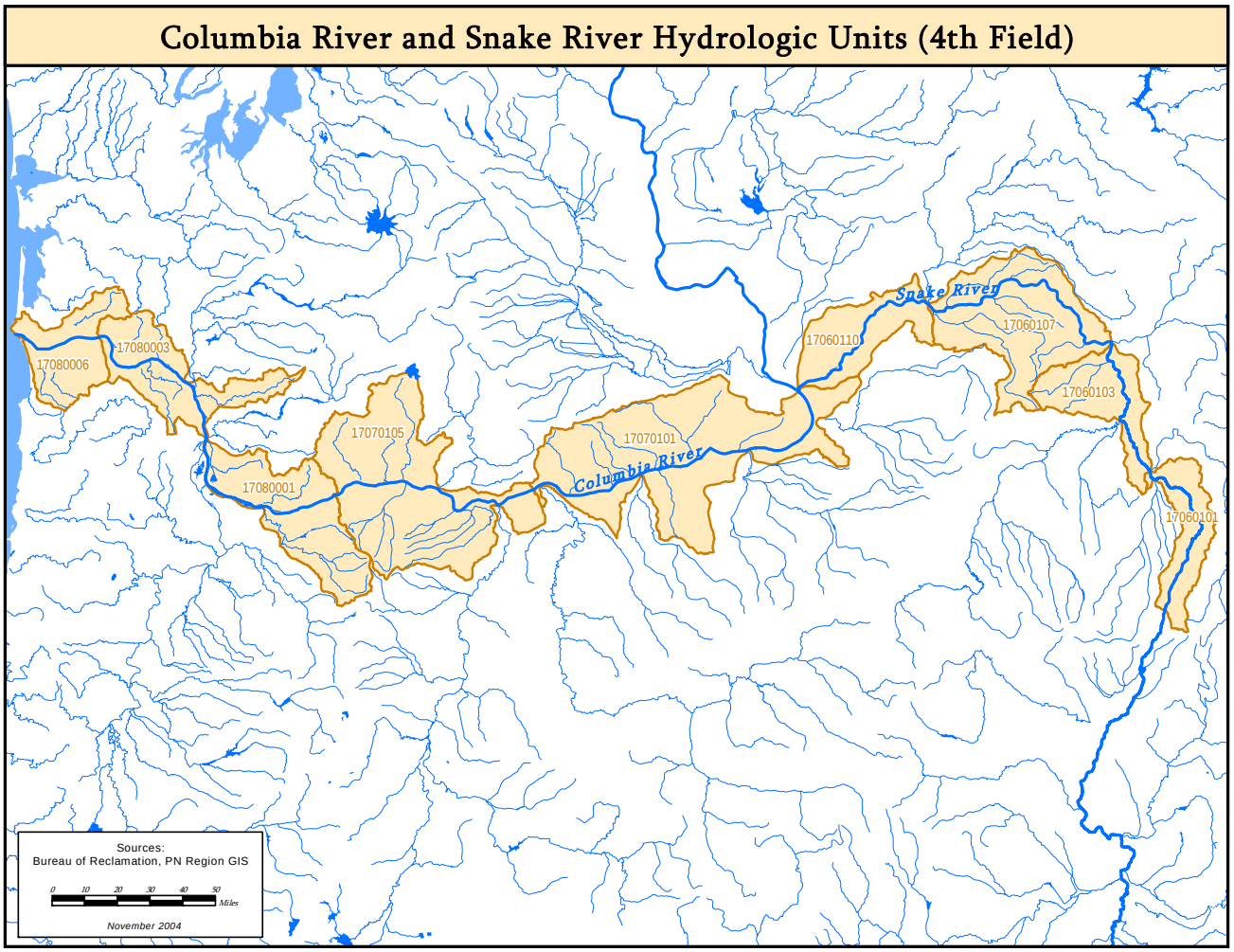

Figure 5-1. Map showing the nine 4th field HUCs in the action area.

Table 5-1. Approximate HUC starting and ending points in the EFH action area.

HUC	Hydrologic Unit Name	From	To
Snake River			
17060101	Hells Canyon	Hells Canyon Dam at RM 246.9	Mouth of Salmon River at RM 188.3
17060103	Lower Snake – Asotin Creek	Mouth of Salmon River at RM 188.3	Mouth of Clearwater River at Lewiston, ID, at RM 139.9
17060107	Lower Snake – Tucannon River	Mouth of Clearwater River at Lewiston, ID, at RM 139.9	Mouth of Tucannon River at RM 62.2
17060110	Lower Snake River	Mouth of Tucannon River at RM 62.2	Mouth of Snake River at RM 0
Columbia River			
17070101	Mid Columbia – Lake Wallula	Mouth of Snake River at RM 324.4	John Day Dam at RM 215.6
17070105	Mid Columbia – Hood	John Day Dam at RM 215.6	Bonneville Dam at RM 146.1
17080001	Lower Columbia – Sandy River	Bonneville Dam at RM 146.1	Mouth of Willamette River at RM 101.5
17080003	Lower Columbia – Clatskanie River	Mouth of Willamette River at RM 101.5	Jones Beach at RM 47
17080006	Lower Columbia River	Jones Beach at RM 47	Mouth of Columbia River at RM 0

EFH is designated for Chinook and/or coho salmon in the nine HUCs in Appendix A of Amendment 14 (PFMC 1999). Table 5-2 shows these nine HUCs with the EFH-designated species, affected ESU, and life history use.

In the case of the lower Snake River HUC (17060110), Table A-1 of Appendix A of Amendment 14 (PFMC 1999) lists only Chinook salmon, while Table A-6 indicates that this HUC has currently accessible but unutilized historical habitat for coho salmon. Similarly, for the Mid Columbia – Lake Wallula HUC (17070101), Table A-1 of Appendix A of Amendment 14 (PFMC 1999) lists only Chinook salmon, while Table A-6 indicates that this HUC is current habitat for coho salmon. Reclamation will focus analysis and discussion on the species listed in Appendix A, Table A-1 (PFMC 1999). EFH listing did not differentiate specific Chinook or coho salmon ESUs, nor consider any ESA listing status. For purposes of this EFH consultation, Reclamation includes all Snake and Columbia River Chinook and coho salmon ESUs, whether ESA-listed or not, that use the Snake and Columbia River action area for either spawning, rearing, or migrating. Many of the ESUs use the action area only for migration.

Table 5-2. Snake River and Columbia River basin HUCs with designated Chinook and coho salmon EFH, ESU, and life history use (from Tables A-1 and A-6 in PFMC 1999).

HUC	Hydrologic Unit Name	Species	Current or Historical Distribution	ESU	Life History Use [1]
17060101	Hells Canyon	Chinook salmon	Current habitat	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon	S, R, M
17060103	Lower Snake – Asotin Creek	Chinook salmon	Currently accessible but unutilized historical habitat	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon	S, R, M M
		Coho salmon	Currently accessible but unutilized historical habitat	None	M
17060107	Lower Snake – Tucannon River	Chinook salmon	Current habitat	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon	S, R, M M
		Coho salmon	Currently accessible but unutilized historical habitat	None	M
17060110 [2]	Lower Snake River	Chinook salmon (Coho salmon)	Current habitat (Currently accessible but unutilized historical habitat)	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon	S, R, M M
17070101 [3]	Mid Columbia – Lake Wallula	Chinook salmon (Coho salmon)	Current habitat (Current habitat)	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon Upper Columbia River spring Chinook salmon Middle Columbia River spring Chinook salmon Upper Columbia River summer/fall Chinook salmon	R, M M M M M
17070105	Mid Columbia – Hood	Chinook salmon	Current habitat	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon Upper Columbia River spring Chinook salmon Middle Columbia River spring Chinook salmon Upper Columbia River summer/fall Chinook Deschutes River summer/fall Chinook salmon	R, M M M M M M
		Coho salmon	Current habitat	Lower Columbia River coho salmon	S, R, M
17080001	Lower Columbia – Sandy River	Chinook salmon	Current habitat	Snake River fall Chinook salmon Snake River spring/summer Chinook salmon Upper Columbia River spring Chinook salmon Middle Columbia River spring Chinook salmon Upper Columbia River summer/fall Chinook Deschutes River summer/fall Chinook salmon Lower Columbia River Chinook salmon	M M M M M M S, R, M

Table 5-2. Snake River and Columbia River basin HUCs with designated Chinook and coho salmon EFH, ESU, and life history use (from Tables A-1 and A-6 in PFMC 1999), continued.

HUC	Hydrologic Unit Name	Species	Current or Historical Distribution	ESU	Life History Use [1]
17080001, cont'd.	Lower Columbia – Sandy River, cont.	Coho salmon	Current habitat	Lower Columbia River coho salmon	S, R, M
				Southwest Washington coho salmon	M
17080003	Lower Columbia – Clatskanie River	Chinook salmon	Current habitat	Snake River fall Chinook salmon	M
				Snake River spring/summer Chinook salmon	M
				Upper Columbia River spring Chinook salmon	M
				Middle Columbia River spring Chinook salmon	M
				Upper Columbia River summer/fall Chinook salmon	M
				Deschutes River summer/fall Chinook salmon	M
				Lower Columbia River Chinook salmon	S, R, M
				Upper Willamette River Chinook salmon	M
		Coho salmon	Current habitat	Lower Columbia River coho salmon	S, R, M
				Southwest Washington coho salmon	M
17080006	Lower Columbia River	Chinook salmon	Current habitat	Snake River fall Chinook salmon (T) 4	M
				Snake River spring/summer Chinook salmon (T)	M
				Upper Columbia River spring Chinook salmon (E)	M
				Middle Columbia River spring Chinook salmon (N)	M
				Upper Columbia River summer/fall Chinook (N)	M
				Deschutes River summer/fall Chinook salmon (N)	M
				Lower Columbia River Chinook salmon (T)	S, R, M
				Upper Willamette River Chinook salmon (T)	M
		Coho salmon	Current habitat	Lower Columbia River coho salmon (T)	S, R, M

1 S = spawning, R = rearing, M = migration

2 EFH is listed for Chinook salmon in HUC 17060110 on Table A-1 (PFMC 1999), while Table A-6 lists current habitat for Chinook salmon and currently accessible but unutilized historical habitat for coho salmon in that HUC (PFMC 1999). Since Table A-1 lists EFH for species within HUCs, Reclamation shall not consider EFH for coho salmon in this HUC.

3 EFH is listed for Chinook salmon in HUC 17070101 on Table A-1 (PFMC 1999), while Table A-6 lists current habitat for both Chinook and coho salmon in the same HUC (PFMC 1999). Since Table A-1 lists EFH for species within HUCs, Reclamation shall not consider EFH for coho salmon in this HUC.

4 ESA listing status as of May 2007 - NMFS ESA Salmon Listings Website: E = Endangered, T = Threatened, N = Not Warranted, U = Undetermined.

Reclamation considers the following Chinook and coho salmon ESUs in this EFH consultation, listed from upstream (closest to the downstream extent of Reclamation's upper Snake River projects) to downstream:

- Snake River fall Chinook salmon
- Snake River spring/summer Chinook salmon
- Upper Columbia River spring Chinook salmon
- Middle Columbia River spring Chinook salmon
- Upper Columbia River summer/fall Chinook salmon
- Deschutes River summer/fall Chinook salmon
- Lower Columbia River Chinook salmon
- Upper Willamette River Chinook salmon
- Lower Columbia River coho salmon

Some of these ESUs are ESA-listed (see Table 5-2 at bottom), while others that are not warranted or have undetermined status for ESA listing have relatively robust populations, although not at historical levels of abundance.

5.4 Status, Life History, Habitat Requirements, and Effects Analysis

The Chinook and coho salmon ESUs are listed and discussed as they are encountered in geographic order proceeding downstream from Hells Canyon Dam to the mouth of the Snake River, then from the upper Columbia River to its mouth.

5.4.1 Snake River Fall Chinook Salmon

5.4.1.1 Species Information

Chapter 4 of the *Comprehensive Analysis* (USACE et al. 2007b) contains information about the life history and population status of the Snake River fall Chinook salmon ESU and is incorporated here by reference. This ESU is currently listed as threatened under the ESA.

Specific to this EFH consultation, many Snake River fall Chinook salmon spawn, rear, and migrate in the mainstem downstream from Hells Canyon Dam, primarily in the Hells Canyon (17060101), Lower Snake – Asotin Creek (17060103), and Lower Snake – Tucannon River (17060107) HUCs. This last HUC is farther

downstream and receives substantial inflow from the Salmon River, Clearwater River, and other tributaries. Spawning in the Lower Snake River HUC (17060110) is uncertain, although the Biological Review Team (BRT) (2003) noted that spawning occurs in small mainstem sections in the tailraces of lower Snake River hydroelectric dams.

Table 5-3 shows the number of adults returning to Lower Granite and Ice Harbor Dams from 1977 to 2006. These fish are primarily destined for the Hells Canyon (17060101) and Lower Snake – Asotin Creek (17060103) HUCs. Fall Chinook salmon also spawn in several of the larger Snake River tributaries downstream from Hells Canyon Dam. Table 5-4 shows the several Snake River tributaries in addition to the mainstem where fall Chinook salmon spawning has been documented. Across most years, spawning occurs predominantly in the Snake River mainstem, as indicated by the redd counts from the mainstem and tributaries (see Table 5-4). This area encompasses the Hells Canyon (17060101) and Lower Snake – Asotin Creek (17060103) HUCs. The Lower Snake River HUC (17060110) supports fall Chinook salmon rearing and migration for all the juveniles produced there or upstream in the mainstem and tributaries. Once juvenile fall Chinook salmon leave the Snake River and enter the Columbia River, they continue to rear and migrate to the ocean through five additional 4th field HUCs.

The number of adult Snake River fall Chinook salmon counted at Lower Granite Dam has increased substantially since 2000, and high numbers of adults have continued to return since 2001 with a peak of 14,960 in 2004 (see Table 5-3). Redd counts in the mainstem Snake River between Asotin, Washington, and Hells Canyon Dam, as reported by Garcia et al. (2006), have also increased and in 2003, 2004, and 2005 numbered 1,512 redds, 1,709 redds, and 1,442 redds, respectively—exceeding the recovery goal of sufficient habitat upstream of Lower Granite Reservoir to support 1,250 redds (Groves and Chandler 2003). However, this 3-year exceedance of the redd recovery goal should be viewed as a positive sign but not in itself as evidence of recovery of Snake River fall Chinook salmon. These numbers may include some hatchery-origin fish spawning in the wild, and abundance of returning adults has varied in the past and may continue to do so in the future. The interim abundance target for fall Chinook salmon is an 8-year geometric mean of 2,500 annual natural spawners (Lohn 2002). The 1996-to-2003 8-year geometric mean for wild fall Chinook salmon is 1,273 fish, which is below Lohn's (2002) interim abundance target of 2,500 fish. Based on counts of adult fall Chinook salmon at Lower Granite Dam in 2004 (14,960 fish), 2005 (11,194 fish), and 2006 (8,048 fish) (see Table 5-3) and the proportion of wild fish in the total adult fall Chinook salmon count in previous years (between approximately 21 and 79 percent annually during the period 1996 through 2006 – see Table 5-5), the 1999-to-2006 8-year geometric mean would be expected to be closer to meeting or exceeding the interim abundance target than in previous years.

Based on numbers of wild fall Chinook listed in Table 5-5, the 1999-to-2006 8-year geometric mean is 2,790 fish.

Table 5-3. Fall Chinook salmon counts at Ice Harbor and Lower Granite Dams from 1977 to 2006.

Year	Ice Harbor Dam		Lower Granite Dam	
	Adult	Jack	Adult	Jack
1977	1,220	536	609	1,284
1978	1,089	504	641	843
1979	1,243	813	497	941
1980	1,140	579	453	328
1981	770	1,332	337	1,414
1982	1,627	1,892	724	1,478
1983	1,771	964	536	977
1984	1,650	795	637	731
1985	1,784	7,421	668	1,446
1986	3,119	2,679	782	1,802
1987	6,755	1,620	944	390
1988	3,847	2,035	629	327
1989	4,638	1,352	707	276
1990	3,470	1,847	383	189
1991	4,489	1,560	633	399
1992	4,636	894	855	102
1993	2,805	332	1,170	39
1994	2,073	1,033	791	255
1995	2,750	2,452	1,067	308
1996	3,851	811	1,308	424
1997	2,767	1,854	1,451	504
1998	4,220	3,491	1,909	2,002
1999	6,532	3,489	3,384	1,863
2000	6,485	9,864	3,696	7,131
2001	13,516	10,170	8,915	8,834
2002	15,248	6,079	12,351	5,727
2003	20,998	10,666	11,732	8,481
2004	21,109	11,167	14,960	7,600
2005	14,677	4,561	11,194	3,236
2006	10,272	6,835	8,048	6,721

Source: FPC 2007

Table 5-4. Number of fall Chinook salmon redds counted in the Snake River and tributaries between Lower Granite and Hells Canyon Dam from 1986 to 2005.

Location	Redds Counted by Year																			
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Snake River (aerial) [1]	7	66	64	58	37	41	47	60	53	41	71	49	135	273	255	535	878	1,118	1,218	1,042
Snake River (underwater)						5	0	67	14	24	33	9	50	100	91	174	235	394	491	400
Subtotal	7	66	64	58	37	46	47	127	67	65	104	58	185	373	346	703	1,113	1,512	1,709	1,442
Lower Clearwater River (RM-410			21	10	4	4	25	36	30	20	66	58	78	179	164	290	520	544	592	433
Potlatch River														7	0	24	3	1	1	0
North Fork Clearwater River [2]			0	0	0	0	0	0	7	0	2	14	0	1	0	1	0	8	2	0
Upper Clearwater River (RM 42-74)							1	0	0	0	0	0	0	2	8	16	4	19	36	54
South Fork Clearwater River							0	0	0	0	1	0	0	2	1	5	0	0	0	0
Middle Fork Clearwater River (RM 75-98)									0	0	0	0	0	0	0	0	0	0	0	0
Selway River									0	0	0	0	0	0	0	0	0	0	0	0
Asotin Creek				0	0	0	0											3	4	6
Grande Ronde	0	7	1	0	1	0	5	49	15	18	20	55	24	13	8	197	111	93	162	129
Salmon River							1	3	1	2	1	1	3	0	0	22	31	18	21	27
Imnaha River		0	1	1	3	4	3	4	0	4	3	3	13	9	9	38	72	43	35	36
Basin Totals	7	73	87	69	45	54	82	219	120	109	197	189	303	586	536	1,302	1,854	2,241	2,562	2,127

1 The targeted search area was the entire Reach from the head of Lower Granite Reservoir to Hells Canyon Dam

2 Searches covered from the mouth to the Ahsanka boat ramp in 2002. Searches covered from the mouth to Dworshak Dam in previous years.

Note: Empty cells indicate no data collected. Some data are broken down into collection method or river mile sections. Data collected by Washington Department of Fish and Wildlife, Nez Perce Tribe, Idaho Power Company, and USFWS.

Source: Garcia et al. 2006

Table 5-5. Fall Chinook salmon escapement and stock composition at Lower Granite Dam from 1975 to 2006.

Year	Lower Granite Dam Escapement	Wild
1975	1,000	1,000
1976	470	470
1977	600	600
1978	640	640
1979	500	500
1980	450	450
1981	340	340
1982	720	720
1983	540	428
1984	640	324
1985	691	438
1986	784	449
1987	951	253
1988	627	368
1989	706	295
1990	335	78
1991	590	318
1992	668	549
1993	952	742
1994	606	406
1995	637	350
1996	919	639
1997	1,007	797
1998	962	306
1999	1,862	905
2000	2,664	1,148
2001	9,875	5,163
2002	9,891	2,116
2003	13,505	3,856
2004	13,146	2,983
2005	10,194	2,602
2006	7,784	2,483

Source: NMFS 2005b and Yuen 2007

Downstream migration proceeds mostly from late May through June, with a small proportion moving past Lower Granite Dam in July and August (see Figure 4-3). As discussed in *Section 4.3.3.2, Snake River Fall Chinook Salmon,* Connor (2004) indicated that subyearling Chinook salmon in the Snake River migrate rapidly in the free-flowing river above Lewiston and may spend a substantial amount of time in Lower Granite Reservoir. In recent years, new information has revealed that many of the later emerging juveniles do not migrate out as subyearlings, but rather over-winter in the lower Snake River reservoirs (and perhaps downstream) and then outmigrate the following spring. Although the proportion of the fall Chinook salmon population that exhibits this life history strategy is unknown, it has been estimated that approximately half of the adult returns to Lower Granite Dam are from this life history strategy (Connor et al. 2005). In addition to the establishment of this "reservoir-type" life history strategy, data have shown that the juvenile migration timing of the subyearling life history has advanced by approximately 1 month since the 1990s (see Figure 4-3), perhaps simply reflecting that more of the late emerging juveniles cease migrating and adopt the reservoir-type life history. The documentation of a second life history strategy has initiated a re-assessment of Snake River flow management and operations of the downstream FCRPS dams.

5.4.1.2 Effects

Based on a comparison of modeled flows, Reclamation's past and ongoing O&M actions combined with proposed flow augmentation will continue to alter Snake River streamflows into Brownlee Reservoir (see Table 3-1). These alterations in streamflow contribute to present conditions of EFH within the action area downstream from Hells Canyon Dam, and these flow alterations are expected to continue into the future as part of the proposed actions. On an annual average basis Reclamation's proposed actions deplete approximately 2.3 million acre-feet of water, which is 6.0 percent of the average flow at Lower Granite Dam and 1.8 percent at McNary Dam on the Columbia River (see Figure 3-1).

Flow alterations affect EFH for fall Chinook salmon in 4th field HUCs in the lower Snake River. Although Reclamation's continuing operations reduces winter inflows to Brownlee Reservoir in average and dry years, the flow reduction does not limit Idaho Power Company's ability to maintain the fisheries-protection flow target of between about 8,500 and 13,500 cfs in October and November for spawning fall Chinook salmon (see Table 3-1). Fall Chinook salmon fry begin migrating downriver and through the lower Snake River reservoirs in the late spring. As discussed in *Section 4.3.1, Streamflows and Fish Survival*, the relationship between flow and smolt survival for inriver migrants during the spring is most evident in dry years.

The shifting of some of Reclamation's proposed action flow augmentation from summer to spring, especially in dry years, will benefit subyearling fall Chinook

salmon migrants in dry years and should benefit the reservoir-type juveniles in all years by helping to maintain cooler water temperatures in the lower Snake River reservoirs.

Reclamation concludes that the proposed actions may adversely affect fall Chinook salmon EFH but the effects will be negligible in the lower Snake River and will diminish progressively downstream. Therefore, effects on EFH are expected to be indiscernible and insignificant in the lower Columbia River migratory corridor.

5.4.2 Snake River Spring/Summer Chinook Salmon

5.4.2.1 Species Information

Chapter 5 of the *Comprehensive Analysis* (USACE et al. 2007b) contains information about the life history and population status of the Snake River spring/summer Chinook salmon ESU and is incorporated here by reference. This ESU is currently listed as threatened under the ESA (70 FR 37160).

The Snake River spring/summer Chinook salmon ESU consists of 30 demographically independent populations (NMFS 2005b). One population inhabits the Imnaha River basin in the Hells Canyon HUC (17060101), while the majority occupies other major tributaries such as the Salmon River, Grande Ronde River, and Clearwater River that flow into the Lower Snake – Asotin Creek HUC (17060103).

Some spawning occurs in tributaries downstream from Hells Canyon Dam in the Hells Canyon HUC (17060101), such as the Imnaha River, but most of the production occurs in tributaries of the Salmon, Grande Ronde, and Clearwater Rivers that flow into but are not part of the Lower Snake – Asotin Creek HUC (17060103). Table 5-6 shows the number of adult wild spring and summer Chinook salmon counted at Lower Granite Dam from 1979 to 2006. Most of these fish are destined for the tributaries in the two uppermost HUCs. Outmigrating juveniles enter the action area from the tributaries, and as they migrate farther downstream, they are subjected to greater river flows from numerous tributary inflows, as well as other physical conditions in the river, including passage at the several hydropower projects.

Adult returns, as counted at Lower Granite Dam, have increased recently, although the 1999-to-2006 8-year geometric mean of 13,462 wild fish is below Lohn's (2002) annual natural spawner interim abundance target of 41,900 fish.

Table 5-6. Estimated adult wild spring/summer Chinook salmon escapement to Lower Granite Dam (includes total counts at Bonneville and Lower Granite Dams for comparison).

Year	Bonneville Dam (Total Fish Count)		Lower Granite Dam (Total Fish Count)		Wild Snake River Fish Count		
	Spring Chinook	Summer Chinook	Spring Chinook	Summer Chinook	Spring Chinook	Summer Chinook	Total
1979	48,600	27,742	6,839	2,714	2,573	2,714	5,287
1980	53,100	26,952	5,460	2,688	3,478	2,404	5,882
1981	62,827	22,363	13,115	3,306	7,941	2,739	10,680
1982	70,011	20,129	12,367	4,210	7,117	3,531	10,648
1983	54,898	18,046	9,517	3,895	6,181	3,219	9,400
1984	46,866	22,421	6,511	5,429	3,199	4,229	7,428
1985	83,182	24,236	25,207	5,062	5,245	2,696	7,941
1986	118,082	26,221	31,722	6,154	6,895	2,684	9,579
1987	98,573	33,033	28,835	5,891	7,883	1,855	9,738
1988	90,532	31,315	29,495	6,145	8,581	1,807	10,388
1989	81,267	28,789	12,955	3,169	3,029	2,299	5,328
1990	94,158	24,983	17,315	5,093	3,216	3,342	6,558
1991	57,339	18,897	6,623	3,809	2,206	2,967	5,173
1992	88,425	15,063	21,391	3,014	11,134	441	11,575
1993	110,820	22,045	21,035	7,889	5,871	4,082	9,953
1994	20,169	17,631	3,120	795	1,416	183	1,599
1995	10,194	15,030	1,105	692	745	343	1,088
1996	51,493	16,034	4,215	2,607	1,358	1,916	3,274
1997	114,071	27,939	33,855	10,709	2,126	5,137	7,263
1998	38,342	21,433	9,854	4,355	5,089	2,913	8,002
1999	38,669	26,169	3,296	3,260	1,335	1,584	2,919
2000	178,302	30,616	33,822	3,933	8,049	846	8,895
2001	391,367	76,156	171,958	13,735	NA[1]	NA[1]	16,477
2002	268,813	127,436	75,025	22,159	NA[1]	NA[1]	33,784
2003	192,010	114,808	70,609	16,422	NA[1]	NA[1]	38,636
2004	107,152	92,413	70,742	8,767	NA[1]	NA[1]	20,967
2005	74,038	79,208	26,028	6,736	NA[1]	NA[1]	9,862
2006	96,456	22,530	22,530	7,058	NA[1]	NA[1]	9,340

1 Not available

Source: Yuen 2007; FPC 2004 and 2007.

5.4.2.2 Effects

Based on a comparison of modeled flows, Reclamation's past and ongoing O&M actions combined with proposed flow augmentation will continue to alter Snake River streamflows into Brownlee Reservoir (see Table 3-1). These alterations in streamflow contribute to present conditions of EFH within the action area downstream from Hells Canyon Dam, and these flow alterations are expected to continue into the future as part of the proposed actions. On an annual average basis Reclamation's proposed actions deplete approximately 2.3 million acre-feet of water, which is 6.0 percent of the average flow at Lower Granite Dam and 1.8 percent at McNary Dam on the Columbia River (see Figure 3-1).

The proposed actions predominantly affect migration for both juvenile fish and adults in the four Snake River HUCs and the five Columbia River HUCs . Snake River spring/summer Chinook salmon outmigrate in the spring as yearlings, when the proposed actions contribute to reduced flows during the spring under most conditions. Flow augmentation, which in the past was delivered in the summer months, now is proposed to be shifted more to the spring months. This shift is expected to reduce some of the effects associated with spring flow reductions and will benefit the spring migrant smolts.

Flow alterations affect EFH for spring/summer Chinook salmon in 4th field HUCs in the lower Snake River to the extent that such alterations affect flow conditions for migration. Flow augmentation will reduce deletion effects in the migration corridor for spring/summer Chinook salmon below Hells Canyon Dam from April through June during drier water years (see Table 3-1). As discussed in *Section 4.3.1, Streamflows and Fish Survival*, the value of flow augmentation for improving smolt survival for inriver migrants is most evident in dry years.

Reclamation concludes that the proposed actions may adversely affect spring/summer Chinook salmon EFH but the effects will be negligible in the lower Snake River and will diminish progressively downstream based on the small percentage of depletions compared to flow at McNary Dam. Therefore, effects on EFH are expected to be indiscernible and insignificant in the lower Columbia River migratory corridor.

5.4.3 Upper Columbia River Spring Chinook Salmon

5.4.3.1 Species Information

Chapter 8 of the *Comprehensive Analysis* (USACE et al. 2007b) contains information about the life history and population status of the Upper Columbia River spring Chinook salmon ESU and is incorporated here by reference. This ESU is currently listed as endangered under the ESA (70 FR 37160).

Outmigrating juvenile fish from this ESU enter the action area when they pass the mouth of the Snake River and enter the Mid Columbia – Lake Wallula HUC (17070101) on their downstream migration. This is approximately 247 miles downstream from Hells Canyon Dam and even farther from Reclamation's upper Snake River projects. These stream-type fish outmigrate actively in the spring.

Returning adults are in the action area up to the time they pass the mouth of the Snake River. Adults are counted at Rock Island Dam. A substantial number of returning adults are from artificial propagation programs in the basin. Up to 80 percent of adults returning to the Methow River in 2001 and an estimated 70 percent returning to the Wenatchee River were of hatchery origin. The peak of the adult return is around the middle of May, based on 10-year average returns at Rock Island Dam (FPC 2007, www.fpc.org/adultqueries/Adult_Query_Graph_Results.asp). In 2007, a pronounced peak occurred in early May about 1 week earlier than the 10-year average peak.

The combined hatchery and wild adult returns were used to calculate the 1999-to-2006 8-year geometric mean, which was then reduced by 80 percent based on the observation that approximately 80 percent of the 2001 return to the Methow River was estimated to be from supplementation adults. This resulted in a geometric mean of 2,665 adults, far below the 6,250 adults listed as Lohn's (2002) interim abundance target.

5.4.3.2 Effects

This ESU spawns and rears upstream from the action area and uses the action area for juvenile and adult migration. Therefore, the proposed action would only potentially effect juvenile and adult migration for the Columbia River EFH for the Upper Columbia River spring Chinook salmon. Reclamation's proposed actions, including flow augmentation delivery, will be attenuated considerably by the time the Snake River enters the Columbia River in the Mid Columbia – Lake Wallula HUC (17070101) because of substantial tributary inflows between Hells Canyon Dam and the mouth of the Snake River. Therefore, the effect of the relatively minor flow changes in the Columbia River on upper Columbia River spring Chinook at this point and downstream is most likely negligible. As discussed in *Section 4.3.1, Streamflows and Fish Survival*, the value of flow augmentation for improving smolt survival for inriver migrants is most evident in dry years. Any beneficial value of augmenting flows on wetter-than-average years is uncertain, but not likely adverse.

Based on the distance downstream from Reclamation's upper Snake River projects where this ESU enters the action area in the Mid Columbia – Lake Wallula HUC (17070101), and the much greater flows in the Columbia River compared to the depletion from Reclamation's proposed actions at this point in the action area,

representing less than 2 percent of total Columbia River flow at McNary Dam (see Figure 3-1). Reclamation concludes that its proposed actions will not adversely affect EFH in the Columbia River for Upper Columbia River spring Chinook salmon.

5.4.4 Middle Columbia River Spring Chinook Salmon

5.4.4.1 Species Information

NMFS concluded that this ESU was not warranted for listing under the ESA (NMFS 2004). It includes stream-type Chinook salmon spawning in the Klickitat, Deschutes, John Day, and Yakima Rivers, excluding the Snake River basin (Myers et al. 1998). Juveniles from this ESU emigrate to the ocean as yearlings. Some artificial propagation programs have been implemented for this ESU. An early attempt at artificial propagation in 1899 was eventually unsuccessful, while programs established in the late 1940s and 1950s were more successful. Substantial artificial propagation occurs in the Deschutes River basin.

A rough estimate of the total inriver returns of this ESU can be made by subtracting hatchery returns and Zone 6 fishery landings from the difference between Bonneville Dam counts and the sum of Priest Rapids and Ice Harbor Dams counts. A 1997 estimate of abundance calculated as described above resulted in a 5-year geometric mean (1992 to 1996) of about 25,000 adults, but this is probably an upper bound of escapement (Myers et al. 1998). From 1998 through 2006, numbers of adult spring Chinook salmon annually counted passing Bonneville, Priest Rapids, and Ice Harbor Dams were approximately one to five times, two to seven times, and one to three times, respectively, greater than in 1997 (FPC 2007). Downstream migrants from the Yakima River population of this ESU enter the action area in the Mid Columbia – Lake Wallula HUC (17070101) when they pass the mouth of the Snake River. This is about 247 miles downstream from Hells Canyon Dam and even farther from Reclamation's upper Snake River projects. Other populations enter the action area farther downstream. The ESU primarily uses the action area for juvenile and adult migration. Spawning and rearing occur in the major tributaries listed above.

5.4.4.2 Effects

The effects of Reclamation's proposed actions diminish substantially with distance downstream from Hells Canyon Dam; effects to EFH for this ESU will likely be minimal. Because of the distance downstream from Reclamation's upper Snake River projects, and the much larger volume of water in the Columbia River compared to the volume of Snake River inflows (see Figure 3-1), the effects of the proposed actions on EFH for this ESU are unquantifiable but likely negligible. Reclamation concludes that its proposed actions will not adversely affect EFH in the Columbia River for Middle Columbia River spring Chinook salmon.

5.4.5 Upper Columbia River Summer/Fall Chinook Salmon

5.4.5.1 Species Information

NMFS concluded that this ESU was not warranted for listing under the ESA (NMFS 2004). It was formerly referred to as Middle Columbia River summer/fall Chinook salmon ESU (Myers et al. 1998) and includes all ocean-type Chinook salmon spawning in areas between McNary and Chief Joseph Dams. A large portion of this ESU consists of the "upriver brights" from the Hanford Reach of the Columbia River that enter the action area as outmigrants once they pass the mouth of the Snake River and enter the Mid Columbia – Lake Wallula HUC (17070101). This is about 247 miles downstream from Hells Canyon Dam and even farther from Reclamation's upper Snake River projects.

The Hanford Reach fall run is the predominant population; the 1990-to-1994 geometric mean was about 58,000 fish (Myers et al. 1998). Long-term trends for the three largest populations are positive, but they are mixed for smaller populations. The summer run is heavily influenced by hatchery releases (Wells Dam stock). Freshwater spawning and rearing habitat has experienced degradation, with hydropower project-related inundation of mainstem spawning grounds and degradation of the migration corridor. However, these conditions exist for the most part on the Columbia River upstream from the action area. A number of improvements have been made to correct degraded conditions for fish passage. The action area downstream from the mouth of the Snake River in the Mid Columbia – Lake Wallula HUC (17070101) and other Columbia River 4th field HUCs is used primarily for rearing and migration.

Typically, summer/fall Chinook salmon in the mid-Columbia region begin spawning in late September, peak in mid-October, and complete spawning in late November (Chapman et al. 1994, cited in Myers et al. 1998). Developing eggs incubate in the gravel for an extended period (5 to 7 months) until they emerge as fry from the gravel in late winter or spring (mid-February to April).

5.4.5.2 Effects

Adults from this ESU spawn outside the action area, but the subyearlings outmigrate and rear throughout the mid- to late summer. As the fry migrate downstream, they enter the action area in the Mid Columbia – Lake Wallula HUC (17070101). Because of the distance downstream from the Hells Canyon Complex where the flow effects of Reclamation's upper Snake River projects would be most significant, and the much larger volume of water in the Columbia River compared to the volume of Snake River inflows (see Figure 3-1), the effects of the proposed actions on EFH for this ESU are unquantifiable but likely negligible. Reclamation concludes that its proposed actions

will not adversely affect EFH in the Columbia River for Upper Columbia River summer/fall Chinook salmon.

5.4.6 Deschutes River Summer/Fall Chinook Salmon

5.4.6.1 Species Information

The ESU includes all naturally spawned populations of Chinook salmon from the Deschutes River. NMFS determined it did not warrant listing under the ESA (NMFS 2004). Spawning and rearing habitat for this ESU comprise approximately 2,687 square miles in the Deschutes River basin of Oregon. Outmigrating juvenile Deschutes River summer/fall Chinook salmon enter the action area when they exit the Deschutes River and enter the Mid Columbia – Hood HUC (17070105) at RM 328.5. This is about 366.9 miles downstream from Hells Canyon Dam and even farther from Reclamation's upper Snake River projects. Fish in this ESU use this HUC and three additional HUCs downstream primarily as a migration corridor.

5.4.6.2 Effects

Adults from this ESU spawn outside the action area, but the subyearlings outmigrate and rear throughout the mid- to late summer. The subyearlings migrate down the Deschutes River and enter the action area when they enter the Columbia River in the Mid Columbia – Hood HUC (17070105). Because of the distance downstream from Reclamation's upper Snake River projects, and the much larger volume of water in the Columbia River compared to the volume of Snake River inflows (see Figure 3-1), the effects of the proposed actions on EFH for this ESU are unquantifiable but likely negligible. Reclamation concludes that its proposed actions will not adversely affect EFH in the Columbia River for Deschutes River summer/fall Chinook salmon.

5.4.7 Lower Columbia River Chinook Salmon

5.4.7.1 Species Information

Chapter 12 of the *Comprehensive Analysis* (USACE et al. 2007b) contains information about life history and population status of the Lower Columbia River Chinook salmon ESU and is incorporated here by reference. This ESU is currently listed as threatened (70 FR 37160). This ESU contains populations downstream from the Klickitat River that enters the action area. This is approximately 391 miles downstream from Hells Canyon Dam and even farther from Reclamation's upper Snake River basin projects. This ESU includes both spring-run and fall-run populations.

The BRT (2003) found moderately high risk for the four Viable Salmonid Population (VSP) categories, and that the majority of these fish appear to be hatchery produced. The artificial propagation programs in the ESU may provide slight benefits to ESU abundance, spatial structure, and diversity, but may have uncertain effects in productivity. Population abundance has increased recently, but the long-term trends in productivity are below replacement for the majority of populations in the ESU (69 FR 33101). Literally millions of hatchery-produced Chinook salmon juveniles are released into the lower Columbia River each year (BRT 2003).

5.4.7.2 Effects

The effects of Reclamation's proposed actions are likely to affect less the EFH of those ESUs farther downstream or farther removed from the action area. Because of the distance downstream from Reclamation's upper Snake River projects, and the much larger volume of water in the Columbia River compared to the volume of Snake River inflows (see Figure 3-1), the effects of the proposed actions on EFH for this ESU are unquantifiable but likely negligible. Reclamation concludes that its proposed actions will not adversely affect EFH in the Columbia River for Lower Columbia River Chinook salmon.

5.4.8 Upper Willamette River Chinook Salmon

5.4.8.1 Species Information

Chapter 15 of the *Comprehensive Analysis* (USACE et al. 2007b) contains information about life history and population status of the Upper Willamette River Chinook salmon ESU and is incorporated here by reference. This ESU is currently listed as threatened (70 FR 37160).

The Willamette/Lower Columbia Technical Recovery Team (WLCTRT 2003) reported that this ESU has a spring run-timing and estimated that seven populations existed historically. All Upper Willamette River spring Chinook salmon, except those migrating to the Clackamas River, must pass Willamette Falls. The 2004 run size at Willamette Falls was the largest in recent years, with 143,700 adult Chinook salmon counted (ODFW 2007). In 2005, 61,000 adults were counted, while 59,700 adults were counted in 2006, and 52,000 adults are projected for 2007. While there is no assessment of the ratio of hatchery-origin to natural-origin fish at Willamette Falls, the BRT (2003) states that the majority are likely hatchery-origin spring Chinook salmon. The Molalla and Calapooia river populations have little to no natural production. The Clackamas, North and South Santiam, and Middle Fork Willamette Rivers populations have some natural production, but hatchery percentages of naturally produced fish are between 64 and 97 percent in these four populations (Good et al. 2005; Cooney et al. 2003).

Despite the substantial hatchery component to the run, adult returns have increased substantially since the mid-1990s when the adult return was around 20,000 fish (estimated from Figure A.2.6.2, BRT 2003). Because of the heavy reliance on artificial propagation in this ESU, the BRT (2003) concluded that most natural spring Chinook salmon populations were extirpated or nearly so, and that the only potentially self-sustaining population is in the McKenzie River. The BRT (2003) noted that productivity of this ESU would be below replacement if it were not for artificial propagation. The BRT (2003) found moderately high risks for all VSP categories.

5.4.8.2 Effects

This ESU spawns, incubates, and rears outside of the action area, only occurring in the action area when juveniles exit the Willamette River and enter the Lower Columbia – Clatskanie River HUC (17080003) or when upstream migrating adults exit the Lower Columbia – Clatskanie River HUC (17080003) and enter the Willamette River. This is 469.4 miles downstream from Hells Canyon Dam and even farther from Reclamation's upper Snake River basin projects. Adults and juveniles use the lower 101 miles of the Columbia River for migration. The effects of Reclamation's proposed actions are likely to have minimal if any effect on the EFH of this ESU. Because of the distance downstream from Reclamation's upper Snake River projects, and the much larger volume of water in the Columbia River compared to the volume of Snake River inflows (see Figure 3-1), the effects of the proposed actions on EFH for this ESU are unquantifiable but likely negligible. Reclamation concludes that its proposed actions will not adversely affect EFH in the Columbia River for Upper Willamette River Chinook salmon.

5.4.9 Lower Columbia River Coho Salmon

5.4.9.1 Species Information

Chapter 13 of the Comprehensive Analysis (USACE et al. 2007b) contains information about life history and population status of the Lower Columbia River coho salmon ESU and is incorporated here by reference. This ESU is currently listed as threatened under the ESA (70 FR 37160). The BRT (NMFS 1991) was initially unable to identify whether an historical coho salmon ESU existed in the Lower Columbia River. Additional information obtained in the mid-1990s indicated that it might be part of a larger coho salmon ESU, and it was combined with the Southwest Washington/Lower Columbia River ESU. In 2001, the BRT (NMFS 2001) concluded that the Lower Columbia River coho salmon ESU is separate from the Southwest Washington coho salmon ESU, based on tagging studies, differing marine distributions, and genetics. It thus warranted designation as a separate ESU.

This ESU is altered from historical conditions and natural production is limited to two Oregon populations in the Sandy and Clackamas Rivers (69 FR 33101). Because the BRT concluded that the hatchery-produced fish contain a significant portion of the historical diversity of Lower Columbia River coho salmon, the progeny of 21 artificial propagation programs are considered, along with the two naturally spawning populations, part of the ESU.

5.4.9.2 Effects

This ESU spawns, incubates, and rears far downstream from Hells Canyon Dam and Reclamation's upper Snake River projects; juvenile outmigrants encounter EFH when they enter the Mid Columbia – Hood HUC (17070105). Because of the distance downstream from Reclamation's upper Snake River projects, and the much larger volume of water in the Columbia River compared to the volume of Snake River inflows (see Figure 3-1), the effects of the proposed actions on EFH for this ESU are unquantifiable but likely negligible. Reclamation concludes that its proposed actions will not adversely affect EFH in the Columbia River for Lower Columbia River coho salmon.

5.5 Summary of Effects Analysis

Reclamation concludes that its proposed actions involving continued operations and routine maintenance at its upper Snake projects may adversely affect EFH for Snake River fall Chinook salmon and Snake River spring/summer Chinook salmon but the effect is expected to be negligible. Upper Snake River flow augmentation provided during the spring migration season will reduce some of the adverse effects and benefit the EFH for these species by providing some additional flow in the Snake River in the drier-than-average years

Reclamation concludes that the proposed actions will not adversely affect EFH for Upper Columbia River spring Chinook salmon, Middle Columbia River spring Chinook salmon, Upper Columbia River summer/fall Chinook salmon, Deschutes River summer/fall Chinook salmon, Lower Columbia River Chinook salmon, Upper Willamette River Chinook salmon, and Lower Columbia River coho salmon.