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THE HONORABLE MICHAEL H. SIMON

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

NATIONAL WILDLIFE FEDERATION, *et al.*, Plaintiffs, and STATE OF OREGON, Intervenor-Plaintiff, v. NATIONAL MARINE FISHERIES SERVICE *et al.*, Defendants, and NORTHWEST RIVERPARTNERS, *et al.*, Intervenor-Defendants.	Case No. 3:01-CV-00640-SI DECLARATION OF ANTHONY NIGRO IN SUPPORT OF THE STATE OF OREGON'S MOTION FOR SUMMARY JUDGMENT

I, Anthony Nigro, state and declare as follows:

1. I am recently retired from the Oregon Department of Fish and Wildlife (ODFW), for which I worked for over 31 years. For the past decade I was manager of the Ocean Salmon and Columbia River Program (OSCRP) and was responsible for providing policy and program

oversight for fish-related programs within the agency dealing with the mainstem Columbia River. These included Columbia River fish mitigation and recovery planning and implementation, Columbia River fishery management, and Columbia River research, management and operations associated with the Federal Columbia River Power System (FCRPS). I also served as chairman of the Columbia Basin Fish and Wildlife Authority and its Anadromous Fish Caucus, during which I helped direct development of recommendations by the fish and wildlife managers to the Northwest Power and Conservation Council (NPCC) on amendments to the Columbia Basin Fish and Wildlife Program.

2. Prior to my role as OSCRP manager I was the Columbia River Coordinator, where I worked primarily with agency staff, Oregon's NPCC members, and staff from other state fish and wildlife agencies, federal agencies and tribes in the Columbia Basin on planning and implementation of measures in the Columbia Basin Fish and Wildlife Program and the various FCRPS Biological Opinions. During my tenure as coordinator I served on various interagency technical committees formed by NOAA Fisheries under remands of the 1993 through 2004 FCRPS Biological Opinions. I represented the State of Oregon on the Implementation Team, the sovereign group formed and tasked by NOAA Fisheries to help implement the 1995 through 2004 FCRPS Biological Opinions (since replaced by the Regional Implementation Oversight Group). I also supervised the State of Oregon's representatives on the Technical Management Team and other technical committees tasked with implementing the FCRPS Biological Opinion and U.S. Army Corps of Engineers' Columbia River mitigation programs. Other positions I have held with ODFW include Columbia River Investigations research program leader and research project leader for fish predation and sturgeon population assessments in the Columbia Basin.

3. I have authored or coauthored numerous papers and reports on fish research and recovery and population assessments. I have a M.S. in fisheries and wildlife sciences from

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Virginia Tech (1980) and a B.S. in biology from the State University of New York College at Fredonia (1977).

4. I have worked with ODFW staff analyzing the impact of the authorized operations and mitigation measures in the most recent iteration of the Biological Opinion: Endangered Species Act – Section 7(a)(2) Supplemental Biological Opinion, Consultation on Remand for Operation of the Columbia River Power System (2014 BiOp) (Jan. 17, 2004). The 2014 BiOp supplements the 2008 BiOp, as supplemented by the 2010 BiOp. In preparing this declaration, we reviewed these BiOps, the Supplemental Comprehensive Analysis (SCA) (May 5, 2008), and other documents prepared by the federal defendants, the National Marine Fisheries Service (NOAA), the U.S. Army Corps of Engineers (the Corps) and the U.S. Bureau of Reclamation (BOR) (collectively "the Agencies"), as well as other documents in the administrative record and in the scientific literature.

5. The 2014 Supplemental BiOp, which builds on and updates the 2008 Biological Opinion, as supplemented by the 2010 BiOp involves extremely lengthy, dense and technically complex documents spanning thousands of pages, with extensive cross-referencing to other documents of similar scope and depth. I provide this declaration to assist the court in its review of the 2014 BiOp, to determine if the Agencies considered all relevant factors and to explain complex subjects in the record related to operations of the Federal Columbia River Power System (FCRPS) and the biological status and needs of Columbia and Snake River salmon and steelhead.

Effects of the FCRPS

6. The ESA consultation involves the Agencies evaluating the adverse effects of the operations of the FCRPS to determine whether they have insured that those effects, when added to the environmental baseline, will not jeopardize the species or adversely modify the species critical habitat. To provide background context to the most recent iteration of the BiOp, I first

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provide a longer-term perspective and description of the multi-faceted adverse effects of the FCRPS on the habitat that is critical to Columbia and Snake River salmon and steelhead, including adverse effects on outflow, water transit time, high flow, spill and long-term abundance trends.

7. There is general agreement within the scientific community that the FCRPS contribution to the weakened status of interior Columbia River salmon and steelhead is substantial and exceeds the impacts due to other human-caused mortalities (Collins 1976, Committee on the Protection and Management of Pacific Northwest Anadromous Salmonids 1996, PSMFC 1997). In fact, a work group formed during remand of the 2004 FCRPS Biological Opinion estimated the relative impact of the FCRPS ranged from 35% to 74% of the human-caused mortality of Snake River salmon and steelhead (Framework Work Group of the *NWF v NMFS* Collaboration Process 2006, Table 13).

8. Transforming the Columbia Basin from a wild and free-flowing river system to a controlled and regulated system of dams and reservoirs dramatically altered seasonal flows and water velocity, blocked access to and inundated important spawning grounds and impeded fish migration. These changes began in the early 1900s and concluded in 1985 with the closure of Revelstoke Dam on the mainstem Columbia River in Canada (Figure 1). Some dams, such as Bonneville Dam and others on the lower mainstem Columbia and Snake rivers, were outfitted with fish ladders although they still posed a hazard to fish passage. Others, such as Grand Coulee and Hells Canyon dams, blocked all access to habitats above the dams causing significant loss of historical populations (Fulton 1968). Still others, such as Hungry Horse, Libby, Grand Coulee, Dworshak, Brownlee and Mica dams, regulated the flow of water through the river, storing spring snowmelt and modifying the hydrograph of the system by reducing flows during the critical spring and early summer months of juvenile fish out-migration (Figures 1 and 2). Higher flows may still occur in some years due to exceptionally high snow pack and rains, when

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the water flowing down the river exceeds the demand for electricity and the capacity of powerhouses. Examples include a period in the early 1980s, the floods of 1996 and 1997, and the high flows of 2011 and 2012 occurring late spring and early summer. Mainstem dams on the lower Columbia and Snake rivers did not alter seasonal flows substantively, but dramatically slowed water velocity (approximately 4- to 10-fold) due to impounded reservoirs which increase the cross-sectional area and reduce the functional slope of the river (Figure 3) and disrupted hourly flows due to power peaking or load following (Petts 1984).

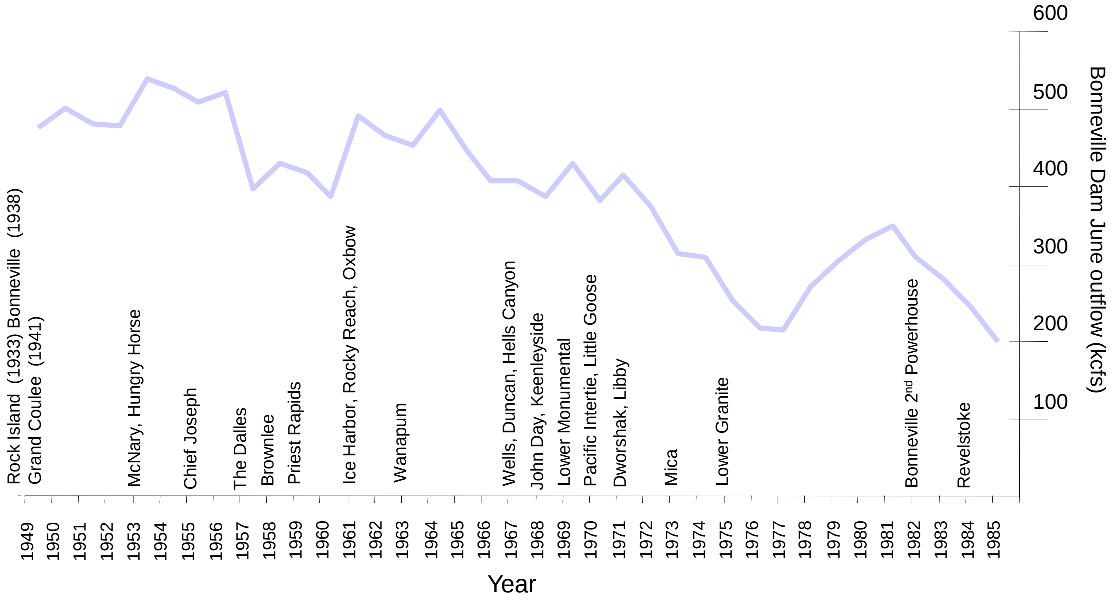

Figure 1. Construction time line of dams in the Columbia Basin from 1933 through 1985 superimposed over the annual average outflow in June at Bonneville Dam. (Flow data from the U.S. Army Corps of Engineers (USACE) and provided on DART http://www.cbr.washington.edu/dart/query/river_graph_text , accessed November 19, 2014).

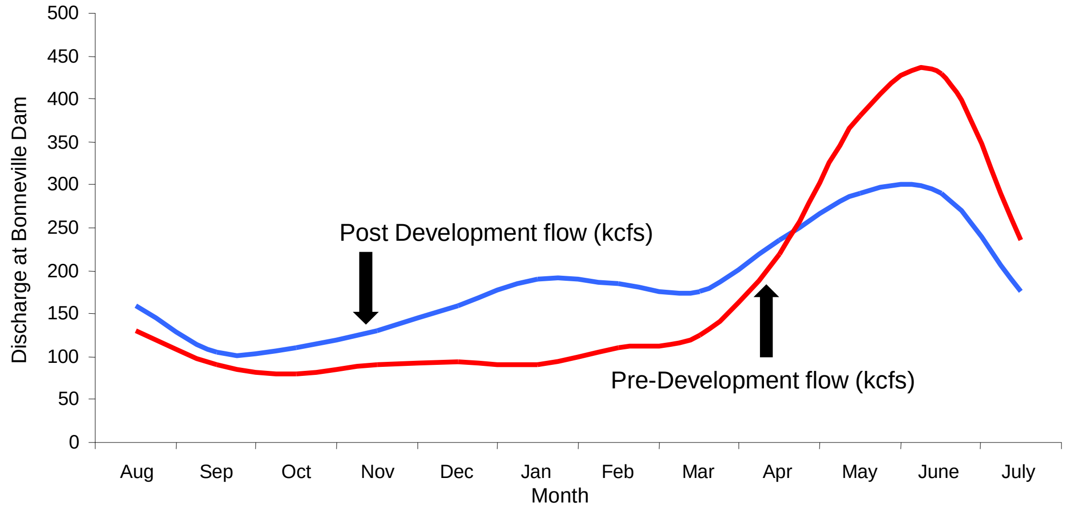

Figure 2. A comparison of average monthly Columbia River flows prior to and after dam development. Pre-development flow data at each project from Columbia River Water Management Group (1983). Post-development flows at Bonneville Dam (monthly average 1980-2013; Flow data from the U.S. Army Corps of Engineers (USACE) http://www.nwd-wc.usace.army.mil/ftppub/project_data/hourly/ on December 7, 2014.

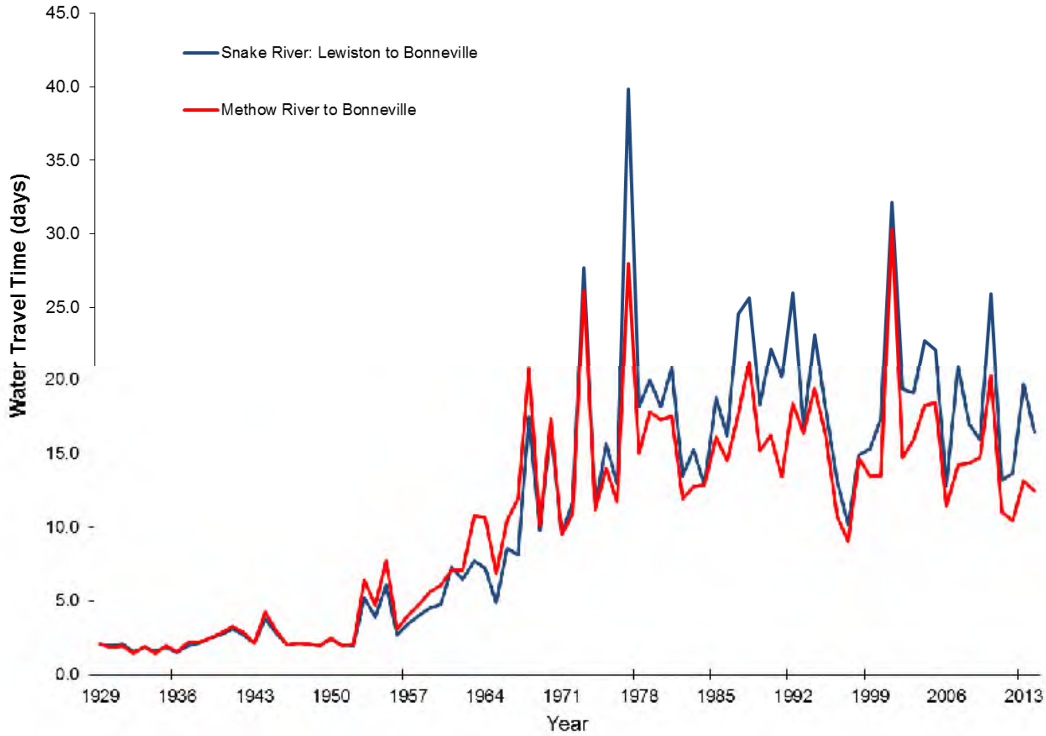

Figure 3. Water transit time (WTT) between 1929 and 2013, measured as the average number of days for a particle of water to travel from Lewiston Idaho to Bonneville Dam and from the Methow River mouth to Bonneville Dam (mean flow April 15-May 31; WTT= Reservoir Volume (ft3)/ Flow (ft3/s), FPC 2009 memorandum 121-09). Pre-development flow data from Columbia River Water Management Group (1983). Post-development flow data at each dam from the U.S. Army Corps of Engineers (USACE) and provided on DART (http://www.nwd-wc.usace.army.mil/ftppub/project_data/hourly/ on December 7, 2014).

9. The impacts of the hydropower system on salmon and steelhead include at least the following:

a. Dams without fishways have blocked access to historical habitats in the Snake River and upper Columbia basins, and eliminated about 55% of the area previously available for salmon and steelhead production (Committee on the Protection and Management of Pacific Northwest Anadromous Salmonids 1996, Fulton 1968).

b. Changes in the hydrograph caused by headwater storage dams have decreased spring and early summer flows, reduced water velocity and curtailed freshets. These changes have increased fish travel time: interfering with the physiological process of smoltification and timing of transition from fresh water to salt water in the Columbia estuary (Bentley and Raymond 1976, Williams et al. 2005).

c. Changes in the hydrograph have altered habitats in the Columbia River estuary: decreasing its capacity to support juvenile salmon during their transition to the ocean (Bottom et al. 2005).

d. Transportation around and passage through the FCRPS has been associated with delayed mortality in the estuary and ocean of transported and in-river migrating juvenile fish (Budy et al 2002, Williams et al. 2005, Muir 2006, Schaller and Petrosky 2007, Zabel et al. 2008).

e. Juvenile fish transportation has been associated with increased straying of adult fish (Keefer et al. 2008c).

f. Impoundments have inundated mainstem spawning and rearing habitats (Committee on the Protection and Management of Pacific Northwest Anadromous Salmonids 1996, Dauble et al. 2003).

g. Impoundments have flooded migration corridors: increasing the cross-sectional area of the river and reducing its functional slope (Raymond 1968, Raymond 1969), slowing water velocity 4- to 10-fold and increasing fish travel times (Figure 3). Increased fish travel time depletes energy reserves and disrupts smoltification.

h. Impoundments contribute to increased water temperatures in the river: decreasing fish condition and increasing the incidence of disease (Williams et al. 2005).

i. Impoundments contribute to the bioaccumulation of toxins in the food web (Rosenberg et al. 1997).

j. Impoundments, passage impediments and disorientation at dams contribute to increased avian, piscivorous, and mammalian predation on migrating salmon (Raymond 1979, Friesen and Ward 1999, Knutsen and Ward 1999).

k. Bypass systems at dams have caused and continue to cause direct mortality, injury, stress, delay and disorientation of juvenile fish attempting to pass on their journey to the ocean (Cada 2001, Johnson 2003, Schaller et al. 2007). Increased number of bypass systems

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encountered as juvenile fish migrate downriver is associated with reduced smolt-to-adult survival (Petrosky and Schaller 2010).

l. Fishways at dams have caused and continue to cause disorientation, delays, stress and direct mortality of adult fish as they navigate past dams in an attempt to return to natal streams (Turner et al. 1983, Turner et al. 1984, Keefer et al. 2008a, 2008b, and 2008c).

m. Load-following operations at dams, implemented to meet demands for electricity at certain times can disorient migrating fish and damage river habitats (Petts 1984).

n. Hatchery programs intended to mitigate for lost natural production caused by the FCRPS may cause genetic and ecological impacts to wild fish populations (Araki et al. 2008, Naish et al. 2008, Kostow 2009).

o. The FCRPS reduces resilience of the Columbia Basin to climate change. Warmer, dryer conditions associated with climate change may further decrease spring and summer flows and increase water temperatures in the Columbia River (Mote et al. 2003).

p. The combined effects of the dams have had profound, cumulative ecological and evolutionary consequences for the status and biodiversity of interior salmon and steelhead. As summarized by Waples et al. (2007):

"*Transformation of the free-flowing Columbia River into a series of slack water reservoirs has relaxed selection for adults capable of migrating long distances upstream against strong flows; conditions now favour fish capable of migrating through lakes and finding and navigating fish ladders. Juveniles must now be capable of surviving passage through multiple dams or collection and transportation around the dams. River flow patterns deliver some groups of juvenile salmon to the estuary later than is optimal for ocean survival, but countervailing selective pressures might constrain an evolutionary response toward earlier migration timing. Dams have increased the cost of migration, which reduces energy available for sexual selection and favours a nonmigratory life history. Reservoirs are a benign environment for many non-native species that are competitors with or predators on salmon*." (abstract, Waples et al. 2007).

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10. As noted in status reviews by the National Marine Fisheries Service (NMFS), a substantial number of populations, perhaps entire Evolutionarily Significant Units (ESUs)[1], were lost because dams blocked access to historical habitats in the Snake River and upper Columbia basins (Fulton 1968, Waples et al. 1991, Busby et al. 1996, Myers et al. 1998). The remaining populations experienced sharp abundance declines with development of the FCRPS (Figure 4, also see Appendix A to this Declaration; data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014).

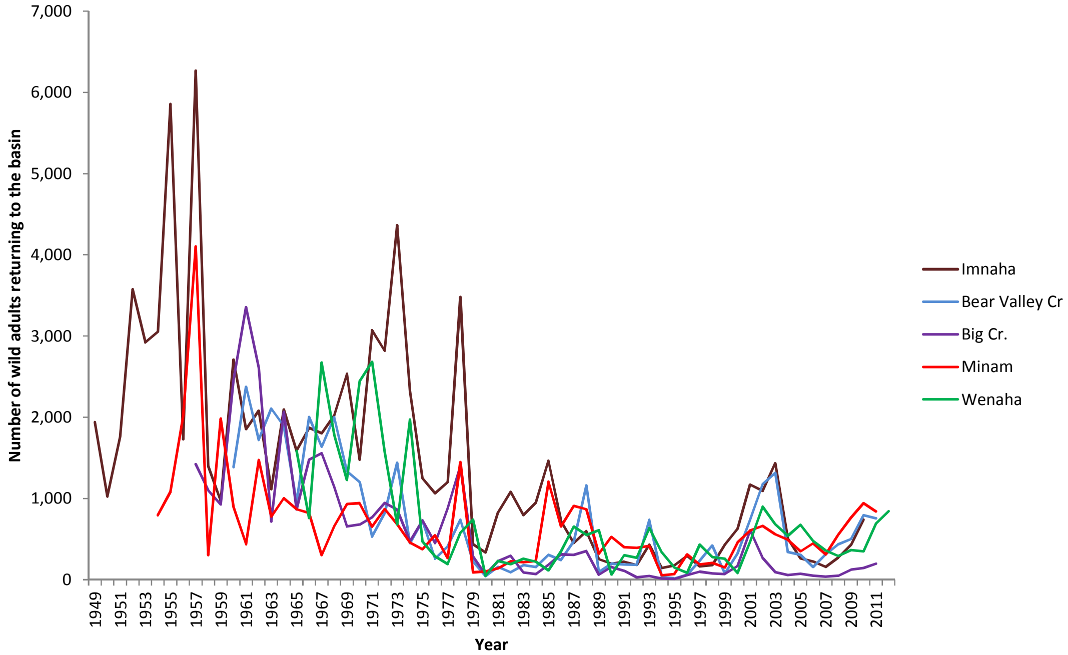

Figure 4. Long-term abundance trends for five wild Spring Chinook salmon populations in the Snake River ESU (1949-2011 return years). See Appendix A for additional population trends. Population data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014.

[1] The correct term for Steelhead is "Distinct Population Segment" or DPS. All listed groups of salmon and steelhead are called "ESUs" for the purpose of this document.

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11. For many Snake River Chinook populations, a higher number of adult offspring returned when the juveniles out-migrated during higher flows and spills: indicating that the operation and configuration of the FCRPS impact salmon production and viability, and that populations are capable of rebuilding under conditions of high flow and spill (Figures 5 and 6, also see Appendix A).

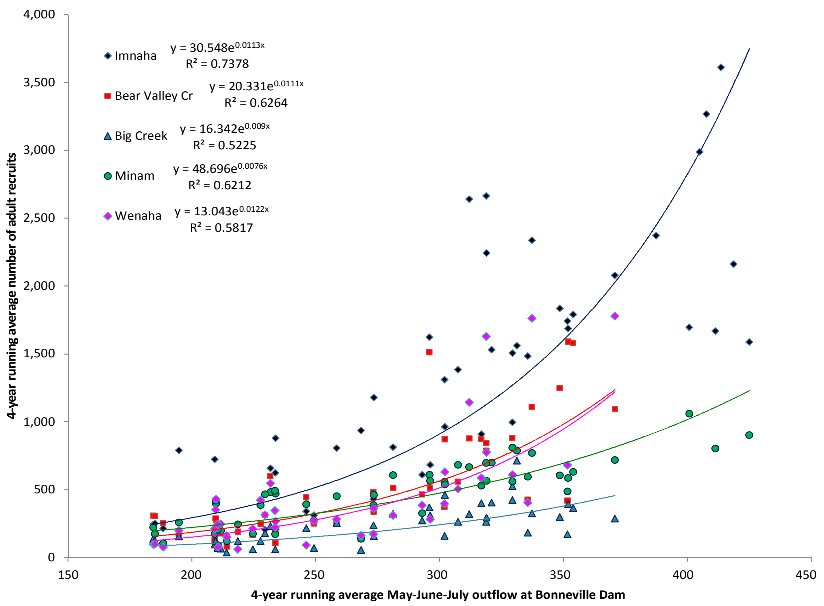

Figure 5. Relationships between spring and summer Columbia River flows, measured as outflow at Bonneville Dam, and returns of adult recruits. Data are shown for five wild Spring Chinook salmon populations in the Snake River ESU (1949 – 2006 brood years). See Appendix A for additional populations. Population data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014. Flow data from the USACE and provided on DART http://www.cbr.washington.edu/dart/query/river_graph_text accessed November 19, 2014.

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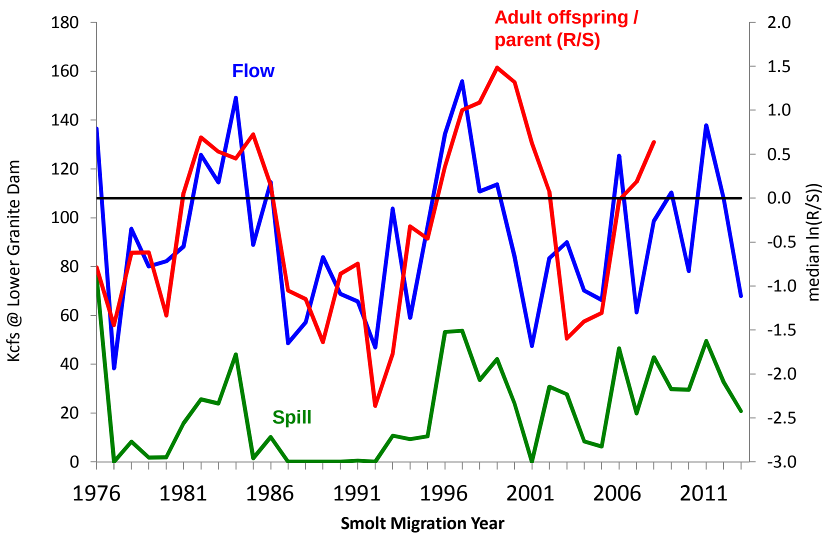

Figure 6. Adult offspring recruits per parent for Snake River spring Chinook and corresponding flow and spill levels at Lower Granite Dam over time. Horizontal line is the replacement line where adult recruits equal parents. Populations are declining when below this line and building when above. Idaho population abundance and productivity (to spawning grounds) estimates were generated by Idaho Department of Fish and Game, Nez Perce Tribe and NMFS staff. These estimates are consistent with the run reconstructions developed for the Interior Columbia Technical Recovery Teams (ICTRT 2007) and updates for the 5-year ESA Status Reviews; data from NOAA's Salmon Population Summary database (SPS) https://www.webapps.nwfsc.noaa.gov/apex/f?p=261:1:0::NO::P1_ARCHIVE_NOTE_CHECK:1&cs=343AAA063C1F0BA2DE9723C47BA549E22# on November 15, 2013). Spawner estimates (denominator) represent adult (age > 4) spawners on the spawning grounds, and were expanded from redd counts (in most cases) or based on weir counts. Recruits to the spawning grounds (numerator) represent returning natural-origin adults to the spawning grounds, and are generated from age structured estimates of natural adult spawners in subsequent years. Seasonal average flow and seasonal average spill at Lower Granite Dam over the April 3 to June 20 period for each of the migration years analyzed, from the U.S. Army Corps of Engineers (USACE) http://www.nwd-wc.usace.army.mil/ftppub/project_data/hourly/ on December 7, 2014

Current Status of ESA-Listed Salmon and Steelhead

12. Next, to assist the court in understanding complex terms and analyses related to the current status of the ESA-listed species and how their status is determined, I explain the concepts of minimum viable abundance, as compared to recent abundance trends and the average productivity concept of Recruits/Spawner (R/S). I then explain how these indicators relate to the current status of the species. These concepts were explained to a certain extent previously in the Amended Declaration of Edward Bowles in Support of the State of Oregon's Motion for Summary Judgment ¶¶ 22-29 (ECF Doc. 1633).

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13. The historic annual run of wild salmon and steelhead into the Columbia River is estimated to have been between 7.5 million and over 10 million. (Chapman 1986, Committee on the Protection and Management of Pacific Northwest Anadromous Salmonids 1996). In the early 1990s, the abundance of Snake River and upper Columbia salmon and steelhead populations declined to the lowest levels ever recorded. *See* Appendix A to this declaration.

14. The status of salmon and steelhead can be determined by comparing various population metrics, such as abundance and productivity (recruits/spawner), to benchmarks described in the conservation biology literature. A review of the literature, along with guidance for how the science should be applied, was developed by NMFS (McElhany et al. 2000). According to the NMFS review, common benchmarks include population abundance, population growth or productivity, and spatial structure and diversity.

15. Population abundance is typically measured against a “minimum viable” abundance level. Minimum viable abundance is just large enough for the population to maintain adaptability to its environment and continue to persist over time (Soulé 1987). Populations whose abundance is less than the minimum viable threshold are subject to two risks that lower their ability to persist over time:

a. The loss of adaptive genetic traits and accumulation of maladaptive genetic traits caused by mutation and genetic drift. This erodes a population’s adaptability to its environment, decreasing its likelihood of persisting over time (Nei et al. 1975, Lande and Barrowclough 1986).

b. Extinction due to random demographic events. A period of poor environment or some other event that causes an episode of poor survival is more likely to push an already small population to extinction (Lande 1988).

16. The minimum abundance for a population of a vertebrate species to be viable has been estimated to be between 1000 to 5000 adults (Culotta 1995, Traill et al. 2007). Factors that

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influence the "correct" minimum viable abundance include the degree to which generations overlap, population subdivision and isolation, and the stability or volatility of population size (Lande and Barrowclough 1986). The Interior Columbia River Technical Recovery Team (ICTRT) has identified minimum viable benchmarks for all interior Columbia salmon and steelhead populations (Table 1). The ICTRT abundances for many populations are smaller than what is typically recommended by the scientific literature ("*The main point is that 500 is too low*." Culotta 1995 p 32). Thus these abundance levels are clearly minimums that do not represent recovery since healthy populations should approach 10,000 organisms to ensure long-term persistence (Culotta 1995).

17. Population growth or productivity is commonly measured as the number of adult offspring produced per parent. This metric can be used to describe the ability of a population below its minimum viable abundance level to increase and maintain its abundance at a stable viable level (Soulé 1987). A fish population that is at a stable, viable abundance will, on average, produce enough adult offspring to replace their parents. If fewer offspring are produced, the population will decline; likewise more offspring results in population growth. This dynamic can be represented as follows, where R represents the number of adult offspring ("recruits") and S represents the number of parents ("spawners"):

When $R/S = 1.0$ the population replaces itself and is stable;

When $R/S < 1.0$ the population declines;

When $R/S > 1.0$ the population grows.

18. Population spatial structure and diversity is commonly considered at the meta-population and ESU level using population-level abundance and growth or productivity metrics. In the Columbia Basin, salmon and steelhead populations, meta-populations and ESUs have been described by NMFS in an effort to address this viability factor (McElhany et al. 2000).

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McElhany et al. (2000) also emphasize the need to hold individual populations to a level of viability to protect the spatial structure and diversity of the ESUs (McElhany et al. 2000).

19. As described by NMFS in its most recent listing review (NMFS, 2011a, 2011b, 2011c), Columbia River salmon species were first listed under the Endangered Species Act (ESA) in the early 1990s, including Snake River sockeye salmon (first listed in 1991 as "endangered"), and Snake River spring and fall-run Chinook salmon (first listed in 1992 as "threatened"). Further ESA listings followed, including Snake River and Upper Columbia steelhead (first listed in 1997 and currently listed as "threatened") and Upper Columbia spring Chinook and Mid-Columbia steelhead (first listed in 1999 and currently listed as "endangered" and "threatened").

20. In its 2011 review, NMFS determined that, although there have been some improvements in population status and the total abundance of some ESUs has increased since the original listings in the 1990s, the collective risks to persistence of the Upper Columbia, Snake and Mid-Columbia salmon and steelhead ESUs have not changed significantly, nor has the status of the ESUs improved significantly, since the previous five-year review in 2005. In summary:

a. In most cases, any increases in abundances of ESUs since the original listings are relatively minor compared to historic conditions, and the populations remain well below minimum viable abundance thresholds.
b. The average productivity (R/S) of many populations remains below replacement.
c. The combination of low abundance and poor productivity continue to place populations at high risk.
d. For several ESUs, particularly Snake River Sockeye, Snake River Fall Chinook, and both Upper Columbia ESUs, all natural spawning populations remain dominated by hatchery fish. The extremely high hatchery fractions on the natural spawning grounds (over 70% hatchery fish in most cases) mean that the returning naturally-produced fish in these

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ESUs are largely, if not entirely in the case of sockeye, the offspring of hatchery fish. This condition precludes any determination that the populations are self-sustaining without hatchery support, as is required by NMFS's hatchery policy (70 Fed. Reg. 37204 (2005)).

e. The population structures of the Snake River Sockeye, Snake River Fall Chinook, and both Upper Columbia ESUs have been compromised by extirpations of entire populations. Either additional self-sustaining populations must be established, or the remaining populations must be secured at very low risk and at a high probability of persistence. Neither of these requirements has been met.

f. Where recovery plans are in place, none of the ESUs have met the criteria in the plans that would justify a change in listing status.

Thus NMFS concluded that the previous threatened or endangered listings be retained for all inland Columbia Basin ESUs.

21. Although most populations have increased in abundance since the record lows of the 1990s, they remain small relative to historical abundances (Figure 4, also Appendix A, data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014). In fact, according to abundance updates reported in the 2014 FCRPS Biological Opinion (Table 1; {NMFS000080} and {NMFS000082}),), most of the populations in the interior Columbia Basin ESUs are averaging below the minimum abundance viability thresholds that have been set by the ICTRT, and some of the populations remain below 100 spawners per year. Nine populations in the Snake River Spring/Summer Chinook ESU fell to annual abundances of only zero to ten adults sometime during the last 20 years—that is 39% of the total number of populations listed in Table 1 for the ESU. These extremely low abundances place the populations at high risk levels where they may suffer impacts of genetic drift and random extinction events (Lande and Barrowclough 1986, Lande 1988).

Table 1. 10-year geomean abundances from 2014 FCRPS BiOp Table 2.1-5 and Table 2.1-5 (page 80 and 82{NMFS000080; NMFS000082}). Blue Bold abundances meet or exceed minimum population viability. **Red Bold** abundances remain below 100 fish/year.

ESU	Population	Abundance	
		2014 update	ICTRT AbundanceThreshold
Snake River Spring/Summer Chinook	Tucannon	375	750
	Catherine Creek	137	1000
	Lostine/Wallowa	370	1000
	Minam	489	750
	Imnaha	460	750
	Wenaha	436	750
	Upr Grande Ronde	**65**	1000
	SFk Salmon	813	1000
	Secesh	605	750
	EFk SFk Salmon	282	1000
	Big Cr	181	1000
	Bear Valley	471	750
	Marsh Cr	221	500
	Sulphur Cr	**58**	500
	Camas Cr	**47**	500
	Loon Cr	**77**	500
	Lemhi	**81**	2000
	Valley Cr	101	500
	Yankee Fk	**16**	500
	Upr Salmon	360	1000
	Lwr Salmon	125	2000
	Efk Salmon	320	1000
	Pahsimeroi	223	1000
Snake R. Fall Chinook	Snake River MS	**4655**	3000
Upr. Col. Spring Chinook	Wenatchee	568	2000
	Methow	398	2000
	Entiat	148	500
Upr. Col. Steelhead	Wenatchee	978	1000
	Methow	609	1000
	Entiat	139	500
	Okanogan	178	1000
Snake River steelhead	Up Grande Ronde	1341	1500
	Joseph	**2187**	500
Mid Columbia Steelhead	Deschues East	**2129**	1000
	Deschutes W	663	1000
	Fifteenmile	**615**	500
	Upr Yakima	202	1500
	Naches	556	1500
	Toppenish	**556**	500
	Status	**1039**	1000
	John Day Lwr MS	1480	2250
	John Day NF	**1927**	1500
	John Day Upr MS	608	1000
	John Day MF	693	1000
	John Day SF	490	500
	Umatilla	**2364**	1500
	Walla Walla	927	1000

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22. The persistent low population abundances are currently coupled with low productivity, as measured by adult recruits per spawner (R/S). Currently, for most of the salmon and steelhead populations in the interior Columbia Basin ESUs the average adult R/S < 1.0, including for 100% of the Snake Fall Chinook, Upper Columbia Spring Chinook and Upper Columbia Steelhead populations; and for 65% of the Snake River Spring/Summer Chinook populations (Figure 7; {NMFS000090}). This means that the populations are not, on average, able to replace themselves, much less grow to and stabilize at larger, more viable sizes. The combination of low abundance persistently below viability thresholds, and low productivity precluding population growth, places the populations at a very high risk of extinction (NMFS 2011a, 2011b, 2011c).

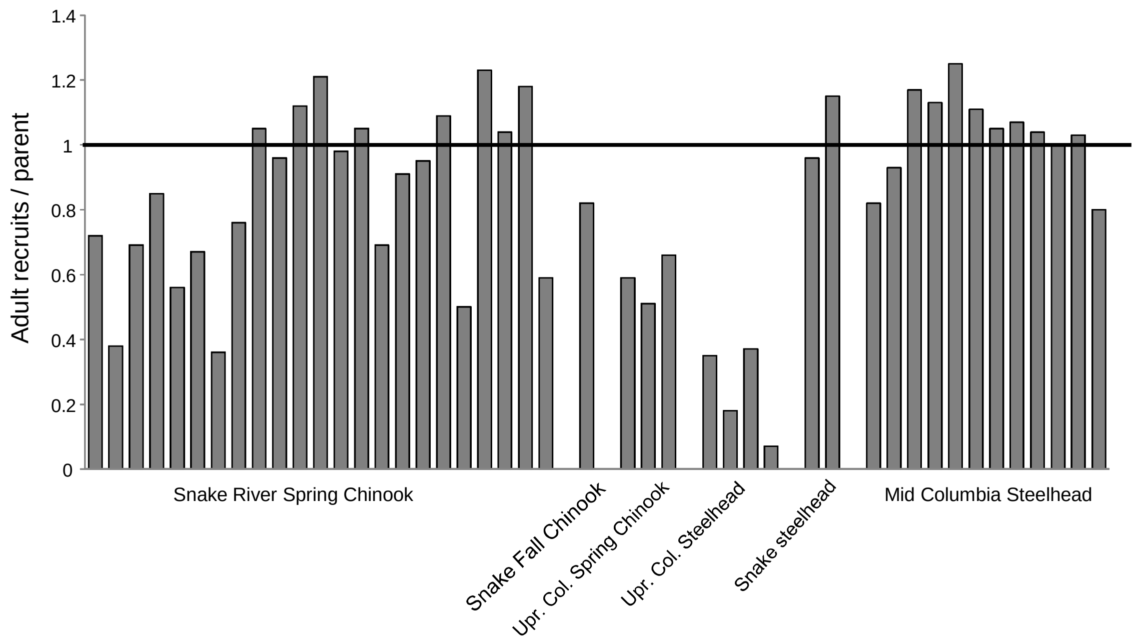

Figure 7. The most recent 10-year geomean (average) adult recruits per spawner (R/S) for individual populations in the interior Columbia Basin ESUs, as reported in the 2014 FCRPS Biological Opinion, Table 2.1-9 (page 90; {NMFS000090}), and Table 2.1-10 (page 91). The line at R/S = 1.0 represents replacement; populations with values below the line were not, on average, able to replace themselves over the past decade.

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23. Production of adult offspring is a function of the number of juvenile smolts produced by the parents, which occurs in natal freshwater tributaries prior to entry into the FCRPS, and the survival of those smolts to adults, which includes survival of juvenile and adult fish associated with migrating through the FCRPS. Juvenile smolt production and their survival after they leave their natal streams are studied using Passive Integrated Transponder (PIT) tag technology, coupled with tributary monitoring. Once the number of smolts produced by a population is estimated, simple algebra can be used to calculate the survival that is needed to either replace the parent population, or if the population is currently too small, produce a population size that is larger and more viable. This survival rate is commonly referred to as the smolt-to-adult return or SAR. The combinations of smolts/spawner and SAR values that result in population replacement or population growth, if abundance is less than viable, can be calculated and displayed as an isocline. In Figure 8, the median observed smolts/spawner versus SAR values have been calculated and plotted against a replacement line for Snake River spring/summer Chinook populations. For most populations, the observed SARs (the dots in the figure) are below the replacement isocline, confirming that these populations are unable to replace themselves, and are thus subject to abundance declines.

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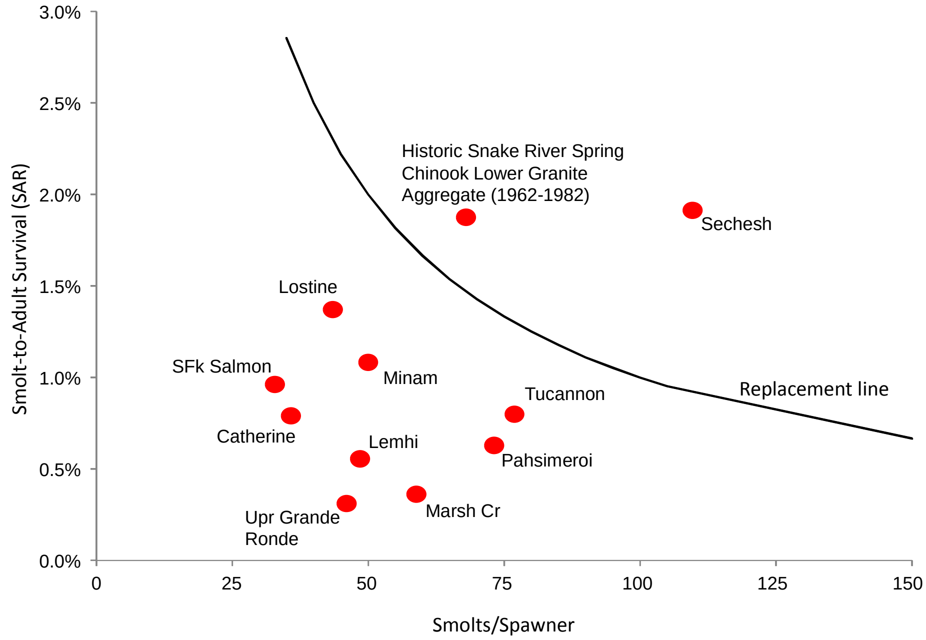

Figure 8. Median smolts/spawner and SAR values for 10 Snake River spring/summer Chinook populations, and an "historic" aggregate of the Snake River spring/summer Chinook ESU (dots), compared to an isocline of smolts/spawner vs SAR values that are needed for the populations to replace themselves (data from Petrosky et al. 2001, Gallinat and Ross 2012, Copeland et al. 2014, BPA https://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=P137067 accessed Dec. 5, 2014).

24. When population abundances are only tens of fish and remain this low for a prolonged period, extinction risk is significantly increased (Nei et al. 1975). Under these circumstances, population growth to a stable, viable abundance level, rather than just achieving replacement, is the goal. As stated above, the same algebra used to calculate a replacement SAR can be used to calculate an SAR needed to reach a target abundance, such as the ICTRT minimum viable abundance thresholds. The SAR values would be those required to reach the abundances given the underlying population productivity.

Smolt to Adult Return (SAR) Survival Rate as a Relevant Factor of Population Growth

25. In the following paragraphs I explain and illustrate the relationship between productivity in the tributary habitat (smolts per spawner) and the rate of survival necessary through the FCRPS and back to the natal stream (smolt to adult returns (SAR)). I then explain

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and illustrate that the rate of survival associated with passage through the FCRPS is the primary limiting factor preventing population growth to a minimum viable population target. This explanation is to assist the court to determine if the Agencies considered all relevant factors and to explain complex subject areas. This topic was explored briefly in the Bowles Declaration ¶¶ 30-32.

26. BPA has contracted with regional scientists to collect smolt abundance, productivity and survival data for interior Columbia spring Chinook populations needed to evaluate habitat improvements. Recent studies by NMFS scientists and BPA contractors used these smolt abundance data in Beverton-Holt productivity analyses to explore density-dependent mortality and population growth in tributaries (Walters et al. 2013, Copeland et al. 2014, Thorson et al. 2014). These same smolt data (from BPA https://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=P137067 accessed Dec. 5 2014 and Copeland et al. 2014) were used to produce both Beverton-Holt and Ricker analyses for Marsh Creek and nine other Snake River spring/summer Chinook populations (Figure 9 and Appendix A) and solve for SAR values needed to achieve either the population's ICTRT minimum viable abundance or current S_{max}, which is the number of spawners that produces the maximum number of smolts (R_{max}).

27. The choice of using a Beverton-Holt versus Ricker model depends on the expectation of how the population might act at high densities. A Beverton-Holt curve, such as that used to model the same smolt data in Walters et al. (2013) or Thorson et al. (2014) assumes that the rate of increase in smolt production slows incrementally to an infinitesimal level at high spawner densities. The Ricker curve assumes that smolt production declines at spawner densities above S_{max}. Corresponding minimum SARs that are required to maintain a stable population at the target size are similar regardless of which model is used (for Marsh Creek, Ricker model minimum SAR > 2.3%; Beverton-Holt minimum SAR >2.1%). The ICTRT minimum viable

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size of 500 adults is used as an example target abundance in Figure 9, but as stated earlier, any target abundance could be used. In the Marsh Creek example, the ICTRT minimum viable size (500) is less than S_{max} (630).

28. Ricker models are used below and in Appendix A to estimate SARs needed to achieve target abundances because they assume density dependence effects at high spawner densities and are thus more conservative than Beverton-Holt models. However both models could be expected to produce similar minimum SAR values.

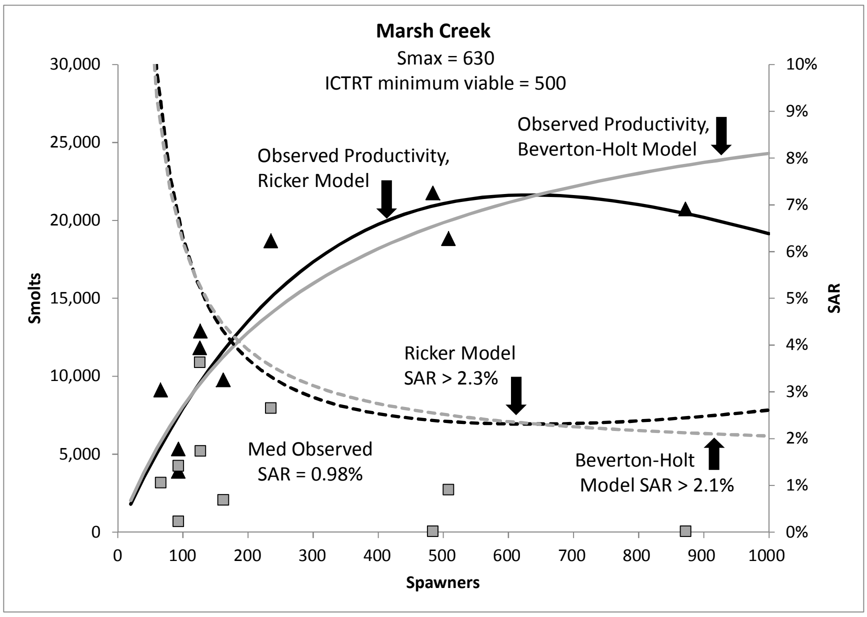

Figure 9. A comparison of SAR calculations for Marsh Creek, a Snake River spring Chinook population, using a Ricker model (black line) vs a Beverton-Holt model (grey line). Marsh Creek data from Copeland et al. 2014.

29. The results for four Snake River spring/summer Chinook populations are presented in Figure 10 (also see Appendix A for other populations). The SAR values required for the populations to grow to their target levels (the grey lines) vary by adult abundance, since higher survival is needed if the starting adult abundance is lower. Given the current freshwater production capability of the populations, the observed SARs (the squares) are less than what is needed for the populations to reach the abundance targets (most of the squares are below the grey

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lines). This is to be expected given the observed SARs are also less than what is needed for the same populations to merely replace their current abundance (Figure 8).

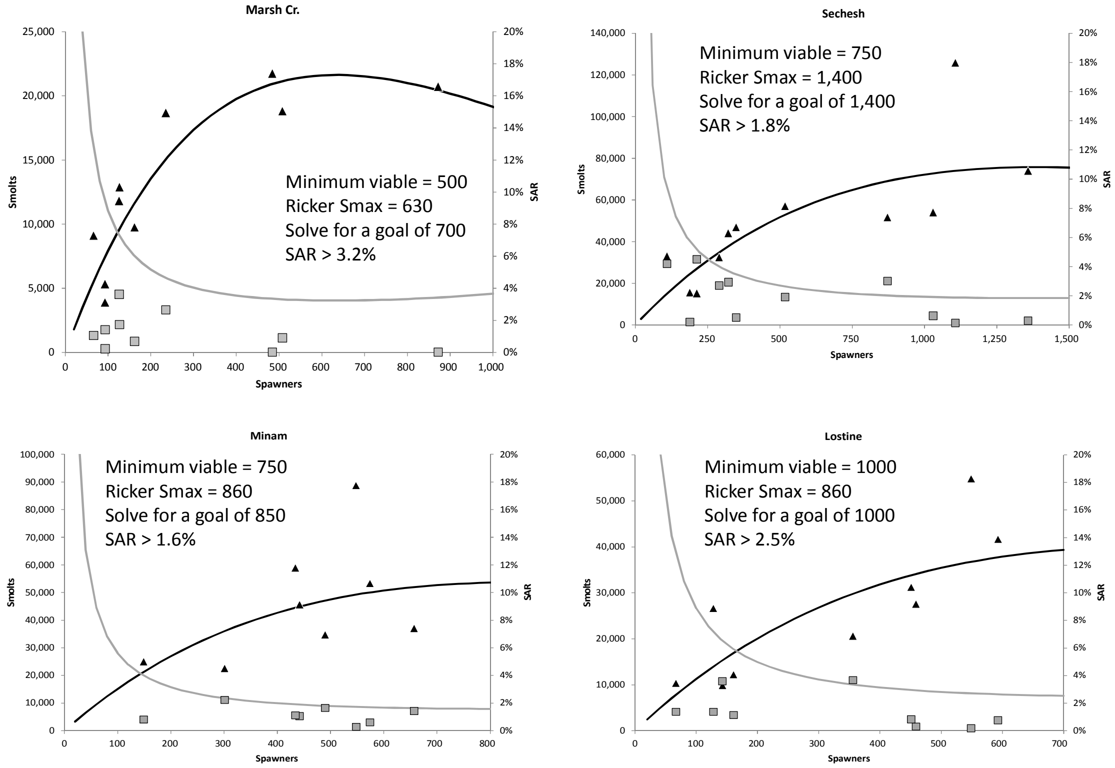

Figure 10. Ricker productivity curves (black lines) for four populations of Snake River spring Chinook, including the empirical spawner and smolt data (triangles) that were used to fit the models (left axis); and the corresponding SAR values (right axis, grey lines) calculated from the Ricker modeled smolts that would be needed to return target adult abundances back to the tributaries. Observed SAR values are also shown (squares) (smolt, spawner and SAR data from Copeland et al. 2014, and BPA https://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=P137067 accessed Dec. 5 2014).

30. The effects of the FCRPS on SARs of ESA-listed salmon and steelhead can be evaluated by comparing their SARs to SARs for a population that crosses fewer dams. As an example, the SARs of Snake River spring/summer Chinook populations can be compared to SARs for wild spring Chinook populations in the Warm Springs River, located in the Deschutes basin, and the John Day River. Unlike the Snake River spring Chinook populations that are

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above eight FCRPS dams, the spring Chinook population in the Warm Springs River is above two dams and in the John Day River is above three dams.

31. The use of the Warm Springs and John Day River spring Chinook salmon populations as a reference is based on similarity of several life-history characteristics (Myers et al. 1998). The Snake River and Mid-Columbia Chinook salmon populations are generally similar in terms of adult return and spawn timing, smolt size, and emigration timing from their respective tributaries (Myers et al.1998). Exploitation by ocean fisheries is estimated to be 1% or less for populations from both regions (PFMC 2011).

32. For the Warm Springs, the smolt production and observed SAR data (Figure 11) are from years that overlap the data sets in Figure 10 and Appendix A, so the Snake River and Warm Springs populations generally shared similar river and ocean environments, except for the number of dams passed. The observed SARs for the Warm Springs population (median observed SAR = 2.3%) are much higher than for the Snake River populations (median observed SARs range from 0.3% to 1.9%, Appendix A). Further, the observed median SAR for the Warm Springs population is approximately the same as the minimum SAR needed to reach its abundance target.

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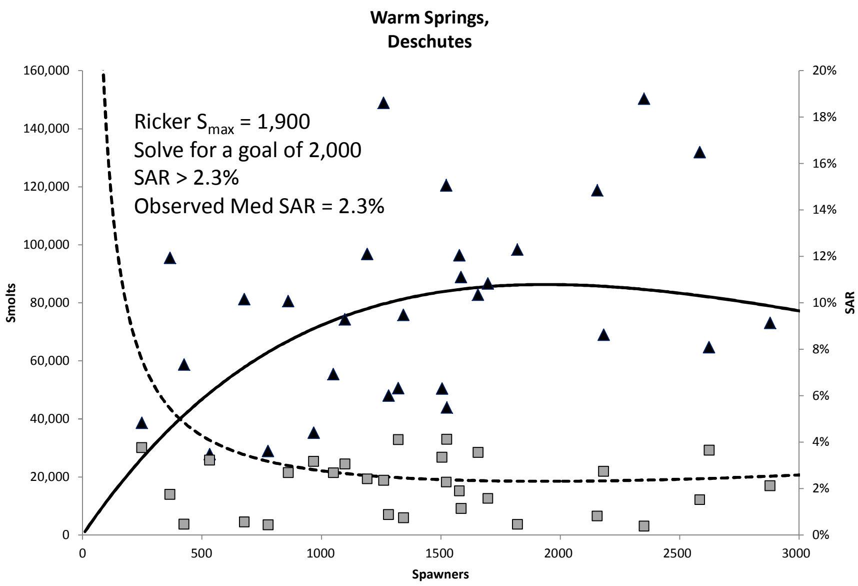

Figure 11. A Ricker productivity curve (black line) for the Warm Springs wild spring Chinook population, including the empirical spawner and smolt data (triangles) that were used to fit the models; and the corresponding SAR values (dashed lines) calculated from the Ricker modeled smolts that would be needed to return target adult abundances back to the tributaries. Observed SAR values are also shown (squares). For this population, the required minimum SAR values (curve) and the median observed SAR values are similar. The population, located in the Deschutes basin, is above only two FCRPS dams. Data is from Manion et al. 2012.

33. Schaller et al (2014) compared SARs between the Snake River populations and their downriver counterparts from the John Day River based on brood years 1998-2006. On average, SARs for the Snake River were 27% of those for the John Day River. Results were similar to those found by Schaller and Petrosky (2007) whose estimates of Snake River SARs were 23% of those for the John Day River and Petrosky and Schaller (2010) whose estimates of Snake River SARs were 34% of those for the John Day River.

34. Schaller et al (2014) also compared indices of differential mortality between the Snake River populations and their downriver counterparts from the John Day River based on brood years 1954-2004. Estimates of relative survival for Snake River Chinook populations using several different methods ranged from 15% to 26% of those for the John Day River. Results were consistent with, although on the low side of relative survival estimates from four

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earlier investigations, which ranged from 23% to 57% (Schaller et al. 1999, Deriso et al. 2001, Schaller and Petrosky 2007, and Hinrichsen and Fisher 2009).

35. Delayed or latent mortality has been a topic of regional consideration for many years. Williams et al. (2005) defined latent mortality associated with the FCRPS as "any mortality that occurs after fish pass Bonneville Dam as juveniles that would not occur if the FCRPS dams did not exist." The 2000 FCRPS Biological Opinion and Williams et al. (2005) identified a suite of potential mechanisms that might result in delayed mortality to include: changes in migration timing; injuries or stress incurred during migration through juvenile fish bypass systems, turbines, or spill at dams that does not cause direct mortality; disease transmission or stress resulting from the artificial concentration of fish in bypass systems or barges; depletion of energy reserves from prolonged migration; altered conditions in the estuary and plume as a result of FCRPS construction or operation; and disrupted homing mechanisms. In addition, the 2000 FCRPS Biological Opinion recognized that delayed mortality is an important potential effect of the FCRPS and affects both transported and in-river migrants: "*NMFS agrees that there may be some nonzero minimum level of delayed mortality of nontransported fish. However, NMFS has no basis for defining that level.*" Williams (2005) reached a similar finding: "*clearly some level of latent mortality exists. However, we have very limited capability to precisely estimate the overall magnitude of hydropower system-related latent mortality for either transported fish or nondetected in-river migrants*." Finally, in a recent review of the Comparative Survival Study the Independent Scientific Advisory Board (ISAB) concluded "*that the available evidence demonstrates that fish bypass systems are associated with some degree of latent mortality, but that its magnitude and the factors responsible for latent mortality remain poorly understood and inadequately evaluated*" (ISAB 2012-1 page 8).

Habitat Actions as a Compensation for FCRPS Impacts

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36. Reliance on freshwater tributary habitat improvements to avoid jeopardy to ESA-listed Snake River spring/summer Chinook salmon does not consider the relevant factor of whether tributary habitat improvements can compensate for diminished survival through the FCRPS, as one commenter stated:

> "*Snake River spring/summer chinook habitat … encompasses about 14 million acres. Roughly half is in federal Wilderness Areas, National Recreation Areas, Wild and Scenic Rivers, and undeveloped National Forest roadless areas.*
>
> *In short, Snake River salmon spawn in the largest contiguous wilderness and roadless land complex in the lower 48 states. There is no shortage of high-quality spawning and rearing habitat. The shortage of fish is due to the acute direct and delayed mortality associated with the four lower Snake River dams and the Corps/NMFS barging program*." (Chaney 2000).

37. Analyses of available smolt and adult data indicate many of the Snake River spring Chinook populations have high enough freshwater productivity to reach their minimum viable abundance thresholds, but remain below these thresholds because of low SARs (Petrosky et al. 2001). For example, for the Secesh, Minam, Marsh Creek, Tucannon and South Fork Salmon populations, S_{max} for smolt production is currently higher than the ICTRT minimum viable abundance thresholds set for them (Appendix A). These populations appear to be capable of producing enough smolts now, according to the results of Ricker models, even though some of these populations are in less than pristine habitats. However, as pointed out in the discussion of SARs above, the survival of smolts associated with passage through the FCRPS is inadequate to sustain even minimum viable adult returns to their natal basins. This can be demonstrated using smolt data from the Marsh Creek spring Chinook population.

38. In Marsh Creek, under the observed productivity, as defined by the Ricker curve fitted to actual smolt and spawner data (the black line in Figure 12 fitted to the black triangles) an SAR greater than 2.3% is required for the spring Chinook population to grow to and stabilize at the ICTRT minimum viable abundance of 500 spawners (the SAR values that form the black

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dashed line). If either the intrinsic productivity or capacity is increased (i.e. the Ricker parameters, α or β are increased), an increased number of smolts occurs and the SAR required for the population to grow to and stabilize at the ICTRT minimum viable abundance of 500 spawners decreases. In this example (Figure 12), α and β were increased by 20% (the two grey solid productivity lines), and new SARs were calculated (the grey dashed lines). The result is an improvement in smolt production and a reduction in the required SAR from 2.3% to 1.9%. This SAR, however, is still much greater than the current median observed SAR for this population of 0.98%.

39. The Marsh Creek spring Chinook population resides in relatively pristine tributary habitats, much of which is located in designated wilderness areas (no habitat to improve). Also, it is 100% wild (no hatchery fish to remove). However, even if it were possible to increase the population's intrinsic productivity or capacity by 20%, survival associated with passage through the FCRPS dams would still have to increase from its current observed levels for the population to stabilize at minimum viability levels of 500 fish.

40. In the 2008 FCRPS Biological Opinion, the jeopardy analysis assumed no survival improvements from tributary habitat improvements or hatchery risk reductions for the Marsh Creek population because it was an all-wild population in a wilderness area (2008 FCRPS BiOp, tables 8.3.3-1 and 8.3.5-1, pages 265-267). Thus the only option to increase the abundance of this population to the 500 adult fish target set by the ICTRT as a minimum viable abundance threshold is to increase SARs from the current 0.98% to greater than 2.3%, i.e. to increase survival through the FCRPS.

41. There are ESA-listed Snake River spring/summer Chinook populations where it appears that freshwater productivity can be improved to help reach their minimum viable abundance goals, i.e. S_{max} is currently below the minimum abundance thresholds. Examples include the Lemhi, Pahsimeroi, Catherine Creek and Upper Grande Ronde (Appendix A). As

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with Marsh Creek , the potential effects of increasing freshwater productivity on the SARs necessary to meet a minimum viable abundance level for these populations can be evaluated using available smolt and adult data. In the example below, the analysis uses data from spring/summer Chinook in the Pahsimeroi (Figure 13).

42. Under the observed productivity, as defined by the Ricker curve fitted to actual smolt and spawner data (the black line in Figure 13 fitted to the black triangles) an SAR greater than 14.2% is required for the spring Chinook population to grow to and stabilize at the ICTRT minimum viable abundance of 1,000 spawners (the SAR values that form the black dashed line). If either the intrinsic productivity or capacity is increased (i.e. the Ricker parameters, α or β are increased), an increased number of smolts occurs and the SAR required for the population to grow to and stabilize at the ICTRT minimum viable abundance of 1,000 spawners decreases. In this example (Figure 13), α and β were both increased by 62% (the grey solid productivity line), and new SAR was calculated (the grey dashed line). This example increases α and β by 62% because the 2014 FCRPS Biological Opinion states that it has already improved by this amount (2014 FCRPS BiOp, Table 3.1-1, page 272). The result is an improvement in smolt production and a reduction in the required SAR from 14.2% to 5.8%. As with the Marsh Creek example, this SAR, however, is still much greater than the current median observed SAR for this population of 0.63%; necessitating increases in survival through the FCRPS.

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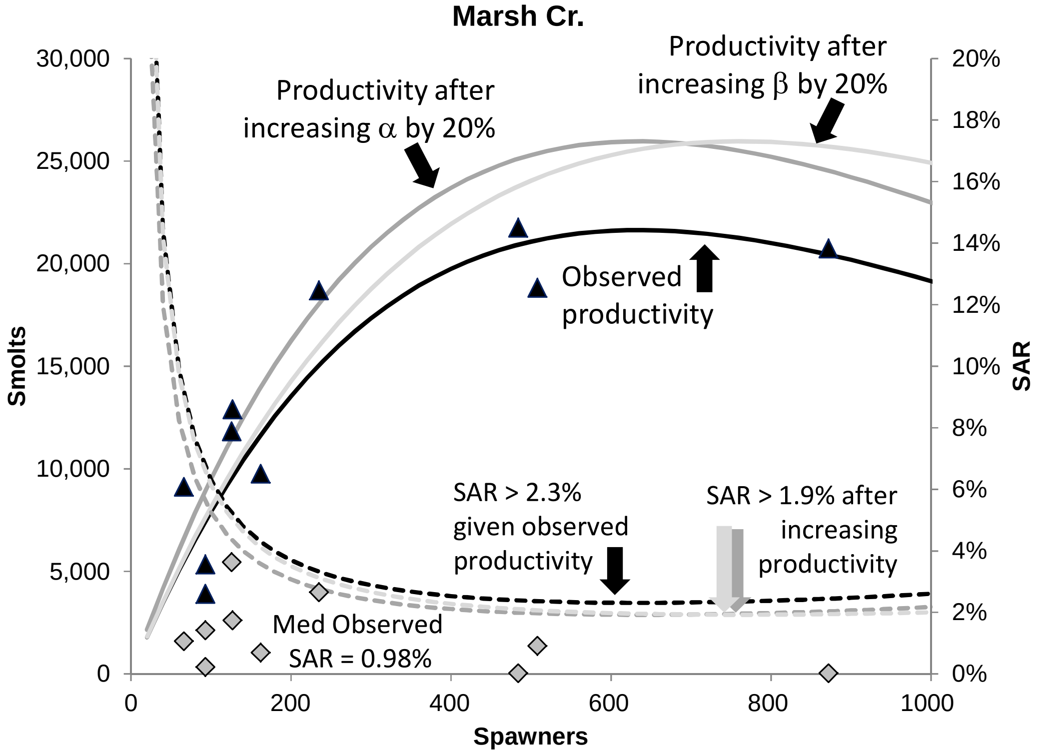

Figure 12. Changes in the SAR of the Marsh Creek spring Chinook population required to stabilize at 500 spawners if freshwater productivity is improved by increasing either the α or the β parameter in the Ricker productivity model for the population by 20%. Marsh Creek data is from Copeland et al. 2014.

43. There is no empirical evidence that demonstrates that freshwater productivity in the Pahsimeroi actually has improved by the 41% targeted in the 2008 FCRPS Biological Opinion or the 62% reported in the 2014 Biological Opinion. The Pahsimeroi smolt data used in Figure 13 is through brood year 2007 (Copeland et al. 2014), and the habitat benefits are purported to have occurred by 2011 (2014 FCRPS BiOp, Table 3.1-1, page 272). It could be argued that some years are required before the benefits would be empirically observed as adult returns because of the age distribution and generation time of spring Chinook. However, the stated 62% improvement in freshwater productivity should result in increased smolt production, and no such increase is evident from the available data.

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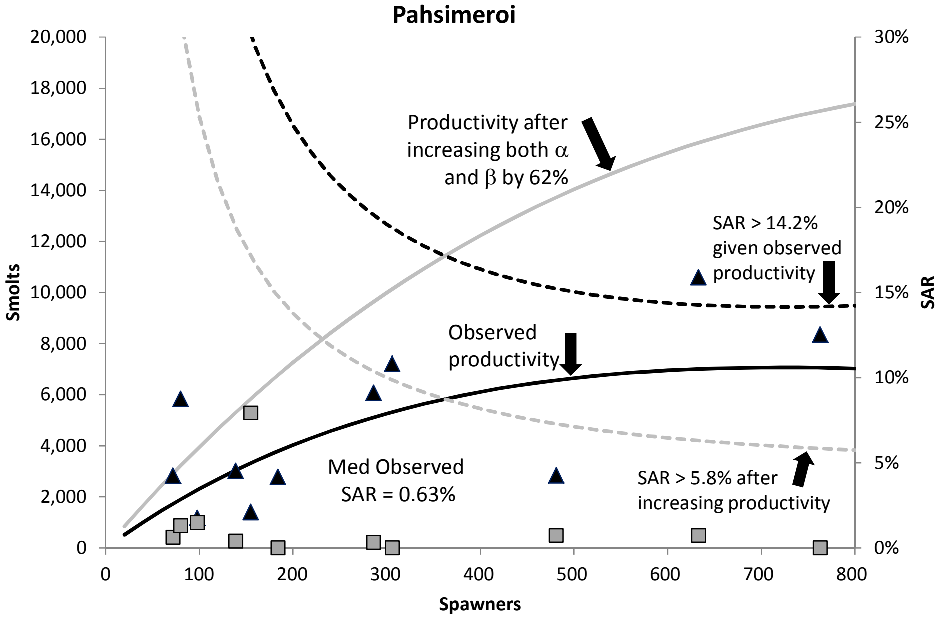

Figure 13. Changes in the SAR of the Pahsimeroi spring Chinook population required to stabilize at 1,000 spawners if freshwater productivity is improved by increasing the α and β parameter in the Ricker productivity model for the population by 62%. Pahsimeroi data is from Copeland et al. 2014.

44. Improvements in freshwater production of smolts alone will not allow populations to overcome FCRPS-related mortality. A substantial improvement in survival after the smolts leave the tributaries is also required. Without concurrent improvements in SARs, the benefits of improved tributary habitats cannot adequately compensate for FCRPS impacts. Without these mainstem improvements, tributary habitat measures cannot realistically improve population viability beyond what is currently observed for populations in pristine habitats, which remain well below minimum viable levels.

Demonstrating Survival Benefits from Habitat Actions

45. The 2014 FCRPS Biological Opinion relies upon tributary habitat improvements together with other non-hydropower system actions to overcome FCRPS-related mortality (Table 3.1-1 {NMFS000272} and RPA Action 35 Table 5 { ACE_0001335 and Appendix A at ACE_0001440}. Although it seems likely, in concept, that improvements in degraded tributary

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habitat would improve the status of salmon and steelhead, benefits of habitat improvement actions are rarely empirically documented. As one researcher with NMFS noted:

> "*The percentage of floodplain and in-channel habitat that would have to be restored in* (a) *modeled watershed to detect a 25% increase in coho salmon and steelhead smolt production (the minimum level detectable by most monitoring programs) was 20%. However, given the large variability in fish response (changes in density or abundance) to restoration, 100% of the habitat would need to be restored to be 95% certain of achieving a 25% increase in smolt production for either species*." (Abstract, Roni et al. 2010)

46. As discussed earlier, populations from pristine wilderness areas continue to struggle as a result of FCRPS impacts and there is significant uncertainty about the magnitude of the benefits of habitat projects contemplated in the 2014 Biological Opinion. This uncertainty is of particular concern given that it may be extremely difficult to detect and measure any benefits from tributary habitat improvements (Roni et al. 2008, Roni et al. 2010).

According to the 2014 FCRPS Biological Opinion, the approach to identifying and implementing habitat projects was to first identify the factors that limit habitat function, then implement actions to address those limiting factors, and finally measure survival improvements that resulted from the actions (2014 FCRPS BiOp Section 3.1.1.1 page 230). The benefits of habitat actions are measured in units of "Habitat Quality Improvement" (HQIs). Although it is not entirely clear what an "HQI" is, it appears to be geographically, rather than biologically based. That is, the metrics appear to be "miles of stream" or "acres of wetland". (FCRPS 2011 Annual Progress Report Section 3 pages 45-54). Although these metrics are measurable, they do not explicitly reflect the responses of the salmon or steelhead populations using the habitat. Instead, habitat projects should be evaluated by measuring changes in intrinsic productivity, smolt production, survival and capacity. These biological metrics are needed to evaluate the contributions of habitat actions to efforts to avoid jeopardy.

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Despite the uncertainties about whether the biological benefits of habitat projects can be detected and measured and the lack of empirically based documentation of these benefits, the 2014 FCRPS Biological Opinion states that substantial benefits from habitat actions have indeed already accrued, and in some cases have exceeded expectations (2014 FCRPS BiOp, Table 3.1-1, starting on page 272).

Implementation of Habitat Actions

47. Habitat actions are not being implemented as planned. An in-depth review (Appendix B) revealed that many of the habitat actions that were proposed in the 2008 FCRPS Biological Opinion {NMFS026570} are either behind schedule or have been replaced by another action without explanation. In some basins, no habitat actions have been completed, even though there was an expectation that something would be done by 2011. In other basins, different actions than those originally proposed have been implemented. The original proposed actions were intended to address specific, priority limiting factors. These original actions were changed to different actions without any discussion of whether or not the new actions address the same limiting factors. Of the 48 populations that had limiting factors identified in the FCRPS Comprehensive Evaluation (2014 FCRPS Biological Opinion, RPA 35, Table 5) and had a specific metric provided to measure actions that addressed those limiting factors, 36 of the populations (75%) had actions that either were not completed within the expected time frame, or were only partially completed, or had some other action/metric completed instead. Where an alternative action was completed, there is no discussion whether it addressed the original limiting factor. Also, some limiting factors appear to have been dropped and new ones added, again with no explanation. Where HQIs were deemed insufficient to accomplish the anticipated results, the Action Agencies, without consulting the expert panels, added new actions with vague and unspecified benefits.

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Effects of Climate Change on Predictions of Benefits from Habitat Actions.

48. The HQI values in the FCRPS Biological Opinion appear to be set in the context of current climate conditions, including current water temperatures, current hydrographic conditions, and recent ocean survivals. NMFS has not explained how the predicted HQI values might be affected by changes in climate. Climate change has been predicted to change tributary habitats and salmon survival in the Pacific Northwest in at least the following ways:

a. Climate change is expected to change the hydrologic cycle in river basins that are currently dominated by snow pack. Increases in surface temperatures will cause less winter precipitation to fall as snow in interior Columbia Basin tributaries, including in the North Cascades (upper Columbia ESUs) and Rockies (Snake ESUs). The melting of winter snow also will occur earlier in spring. Even without any changes in amounts of precipitation, both of these effects will lead to a shift in peak river runoff to winter and early spring, away from late spring, summer and fall (Mote et al. 2003, Barnett et al. 2005). According to scientists with NMFS, the effects will be particularly severe in higher elevation tributaries, such as the upper Salmon and Methow basins (Battin et al. 2007).

b. Climate change will further aggravate existing human-caused stressors on the hydrographs of tributaries, including the effects of forest clearing, irrigation, channelization, urbanization, and dams (Edmonds et al. 2003, Palmer et al. 2009).

c. Climate change is expected to increase incidences of heatwaves and droughts and the associated effects of climate extremes such as below average precipitation, below average stream flow, decreased forest growth and increased risk of fire (Melack et al. 1997, Mote et al. 2003).

d. Climate change is expected to increase water temperatures in tributaries during the summer, fall and winter (Isaak et al. 2012).

e. Climate change will negatively affect pristine habitats that tend to be at higher elevations in the Columbia Basin (Battin et al. 2007).

f. Climate change, and associated warmer, dryer conditions, is likely to further decrease late spring and summer flows and increase water temperatures in the Columbia River, thus decreasing salmon survival during migration (Mote et al. 2003).

g. Changes in the timing of run off related to climate change may modify estuary habitats, including seasonal changes in salinity and nutrient supply that could influence salmon survival during entry to the ocean (Melack et al. 1997).

h. Changes in climate are likely to have adverse effects on salmon and steelhead survival in the ocean (Levin 2003, Behrenfeld et al. 2006).

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49. It is likely, in the face of climate change, that more comprehensive habitat rehabilitation will be required just to offset existing human-induced stressors in tributaries, even if such actions were not expected to also overcome the impacts of the FCRPS. Climate change is likely to further degrade tributary habitat, including currently pristine habitat, and decrease the benefits of individual habitat rehabilitation actions. The effects of climate change on the mainstem Columbia Basin migration corridor, the estuary and the ocean are also likely to further decrease SARs, requiring even larger compensatory benefits from tributary habitat actions. According to NMFS scientists, climate change could be factored into habitat restoration (Battin et al. 2007), but NMFS has not explained how, or if, it was taken into consideration in the evaluation of the HQIs in the 2014 FCRPS Biological Opinion.

Hydropower System Operations

50. The 2014 FCRPS Biological Opinion makes several changes to the juvenile fish transportation program, planned spill levels at specific dams, and timing of when specific levels of spill will occur. These changes will reduce the number and proportion of ESA-listed juvenile salmon and steelhead that are passed by the dams over the spillways.

51. Changes in Voluntary Spill for Fish Passage: The 2014 FCRPS Biological Opinion reduces spring spill from previous levels by adopting an earlier transition date to summer spill and reduces summer spill by adopting juvenile fish passage criteria that could terminate summer spill as early as the first week of August for Snake River dams.

52. The 2014 FCRPS Biological Opinion allows reductions in voluntary spring spill for fish passage up to 20 days earlier than currently occurs at Snake River projects and up to 15 days earlier at Columbia River projects by replacing the spring spill to summer spill transition date of June 21 with a criterion that would allow spill to be reduced from spring levels to summer levels when 95% of wild spring juvenile migrants have passed Lower Granite Dam, but no earlier than June 1 (Table 1.3-1. Table 2 {NMFS000039}; also RPA action 29 revised T 2

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{ACE_0001328}). Retrospective analyses for the years 2004-2013 indicate that reductions in spring spill would have occurred at least two weeks earlier than the current June 21 transition date if this criterion was in place (FPC 2013 - Technical Memorandum 120-13). These changes will affect late-migrating yearling Chinook salmon, steelhead, or sockeye smolts, along with most subyearling Chinook. In addition, the 2014 Biological Opinion (page 346) describes operations that make adjustments (reductions) to allow for performance standards and other testing.

53. The 2014 FCRPS Biological Opinion (see footnote 4, Table 2 of Figure 1.3-1) allows curtailing summer spill for fish passage as early as August 1, but it does not describe how this will affect those juvenile fish that migrate thereafter or those that disperse to habitats in mainstem reaches of the Columbia and Snake rivers.

54. Bulk spill patterns: Spilling flow earmarked for juvenile fish passage through a single spill bay is referred to as a bulk spill pattern. Distributing the same flow across multiple spill bays is considered a uniform spill pattern. Bulk spill typically results in higher total dissolved gas (TDG) levels than uniform spill (Pickett and Harding 2002). The outcome is that a bulk spill pattern more rapidly elevates TDG above water quality standards and forces reductions in spill earlier than would be achieved using a uniform spill pattern (Pickett and Harding 2002; FPC 2014 - Technical Memorandum 10-14, page 9). Using a bulk spill pattern also promotes the development of eddies in the tailrace which is commonly considered to impede tailrace egress of juvenile fish that have passed the dam (FPC 2013 - Technical Memorandum 120-13, page 9). Regional fisheries managers recommended adopting a uniform spill pattern at Lower Monumental Dam in 2011 to reduce large eddy development in the tailrace, and thus improve conditions for juvenile fish passage (SOR 2011-02).

Benefits of Spill Greater than that Contemplated in the 2014 FCRPS Biological Opinion

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55. Under alternative spill operations that do not exceed state water quality standards, CSS analyses suggest that both Snake River Chinook and steelhead SARs could be improved to average about 2%. Additional spill that exceeds current state water quality standards could allow for SARs to average over 3% for Chinook and over 4% for steelhead (Hall and Marmorek 2013).

56. Recent research findings (Haeseker et al. 2012; Petrosky and Schaller 2010; Schaller et al. 2014; Tuomikoski et al. 2011, 2012 and 2013) and the ISAB (2014-2) corroborate the value of spill for juvenile fish passage and demonstrate that higher spill levels throughout the FCRPS correspond to higher smolt-to-adult returns (SARs). The Independent Scientific Advisory Board (ISAB) noted that " *spill should be considered the default recommendation rather than simply one of the [bypass technology] alternatives*" (ISAB Report 1999-4). Based on empirical data, Comparative Survival Study (CSS) scientists have assessed the probability of achieving minimum desired (> 2%) SARs or undesirable (<1%) SARs when managing spill at current Biological Opinion levels versus managing spill to higher levels of total dissolved gas (TDG). In this context, desired SARs are the regional SAR goals (an average SAR of 4% with a range of 2% to 6%) established in the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program (NPCC 2009). CSS scientists found that under prescribed FCRPS Biological Opinion spill operations there is a 14% probability of exceeding 2% SARs for Snake River Chinook and a 60% chance that SARs will fall below 1% (Tuomikoski et al. 2013, page F-33 {NMFS041144}). They reported that since 1998 Snake River Chinook SARs have exceeded 2% only 10% of the time and fallen below 1% about 65% of the time (Hall and Marmorek 2013).

57. <u>Changes in Juvenile Fish Transportation</u>: The 2014 FCRPS Biological Opinion proposes to change the start date for juvenile fish transportation at Lower Granite Dam to a date as early as April 21st, which is earlier than what has been implemented since 2007. Changes in transportation operations proposed in the 2014 Supplemental Biological Opinion are summarized

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in Table 1.3-1 page 37, and in IP RPA Action 30. Briefly, the RPA action will initiate juvenile fish transportation at Lower Granite Dam April 21 to April 25 unless the Corps adopts a Technical Management Team recommendation that proposes a later start date (no later than May 1) to achieve the goal of transporting about 50% of juvenile steelhead. The remaining two Snake River collector dams (Little Goose and Lower Monumental) will initiate transport operations 4 and 7 days after transportation at Lower Granite Dam starts, respectively.

58. Biological Effects of Changes in the Start Date for Juvenile Fish Transportation at Lower Granite Dam: Beginning juvenile fish transportation at Lower Granite Dam on April 21, rather than in late April or early May, as is currently done, will result in more juvenile salmon and steelhead being transported in the Snake River and thus fewer fish migrating in-river with spill. A Technical Work Group found that uncertainty about the benefits of transportation to Snake River spring/summer Chinook and steelhead was sufficient to not support a maximized juvenile fish transportation strategy after April 20, and that sockeye did not appear to benefit at all from transportation (NOAA Fisheries 2007; ISAB 2008-5). Keefer et al. (2008c) found for Snake River spring Chinook salmon and steelhead that *"the proportion of adults successfully homing was significantly lower, and unaccounted loss and permanent straying into non-natal rivers was higher, for barged fish of both species. On average barged fish homed to Lower Granite Dam at rates about 10% lower than for in-river migrants. Barged fish were also 1.7-3.4 times more likely than in-river fish to fall back downstream past dams as adults, a behavior strongly associated with lower survival. These results suggest that juvenile transport impaired adult orientation or homing abilities, perhaps by disrupting sequential imprinting processes during juvenile out-migration."*

59. Ancillary Effects of Changes in Juvenile Fish Transportation: A summary of straying in the Columbia River Basin found higher straying rates among adults that were transported as juveniles compared to those that migrated in river (Keefer and Caudill 2012).

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They found that the absolute number of strays also tended to increase with smolt abundance, as SAR's increased, and as transport proportion increased. Their findings indicated that strays from large donor populations can numerically overwhelm native fish in small recipient populations, even at low (~1%) stray rates. Given that adults straying from the Snake River are entering mid-Columbia River tributaries, especially the Deschutes and John Day rivers, these factors may impact population viability, genetic and physiological fitness, and other population level attributes, with notable impacts on the Mid-Columbia steelhead ESU (Berwick et al. 2009).

Dam Passage Performance

60. The 2014 Biological Opinion uses "forebay-to-tailrace" survival at individual dams as a primary metric for evaluating the effects of the FCRPS on juvenile salmon and steelhead (USACE 2012). Under this performance standard, yearling Chinook and steelhead that pass all eight FCRPS projects have an overall dam passage survival standard of 72% (96% survival at each of eight dams ($96\%^8$) = 72%). For subyearling Chinook, this overall standard is 56% ($93\%^8$). As already discussed, there are additional stressors associated with passage through the FCRPS that are not reflected in this performance measure; therefore, the forebay-to-tailrace performance should not be misunderstood as representing the overall impacts of passage through the FCRPS.

61. Estimates of "forebay-to-tailrace" survival of juvenile salmon and steelhead contemplated in the 2014 FCRPS Biological Opinion {NMFS 000358} are the results of either virtual-paired release acoustic tag studies, when current studies are implemented, or historical studies (USACE 2009). Serious technical concerns have been raised by regional scientists about these estimates. The Independent Scientific Review Panel's review of the USACE dam survival monitoring plan notes that handling effects from implantation of acoustic tags and tag burden could bias survival estimates at a greater rate than assumed (ISRP 2009). The ISRP questioned whether the tagged juvenile fish represent the at-large populations and proposed what it

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considered an essential additional objective: to determine a "true" survival (not merely rejecting a null hypothesis of departing from the FCRPS Biological Opinion performance standard). The ISRP also called upon investigators to provide the survival data collected (e.g. acoustic tag data) to the region and anticipated that adaptive changes to the survival monitoring will likely be needed. The call for timely and complete sharing of data is particularly important because it has not been available, and has thus precluded independent confirmation of results.

62. In addition to concerns raised by the ISRP, concerns have been raised about the limited range of flow conditions under which estimates have been made and flawed or biased experimental designs of the tests (Fish Passage Center 2013). These concerns have raised doubts among regional scientists that forebay-to-tailrace survival estimates do not represent the full range of environmental conditions present when juvenile fish pass the dams and are biased high. Examples include:

a. Most performance standards tests have been conducted during 2011 and 2012 when flows were above average and at times exceeded power house capacity necessitating involuntary spill (i.e. more spill occurred than was planned). These above-average flow years do not reflect juvenile fish passage during average or low-flow years when annual fish operations plans allow for reduced spill operations.

b. Performance standards testing has not generally been conducted under the conditions prescribed by the FCRPS Biological Opinion (FPC 2013 – Technical Memorandum 138-13). As described above, tests conducted in 2011 and 2012 reflect high flow conditions. In fact, the test at The Dalles Dam in 2010 was the only test in which average spill did not exceed FCRPS Biological Opinion levels over the study period and results indicated that the forebay-to-tailrace survival standards were only met for yearling Chinook (Table 2). Attached hereto, following my signature, is a true and correct copy of Table 2 accurately representing the conditions of the performance standards testing.

c. Performance standards tests use radio and acoustic tags and do not represent at-large populations of juvenile salmon and steelhead. As an example, during 2013 performance testing, 15,462 juvenile fish were handled. Among these 2,110 were excluded because they were too small to tag (13.6%) and another 694 (4.5%) were "excluded for condition" (Skalski 2013e, Table 3.1, page 35). As a result, performance standards tests only represent the survival of larger, healthier fish from the run-at-large and estimates are thus biased high.

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d. Survival estimates generated using a single-release (historical study results) or virtual paired-release design are subject to biases associated with violation of assumptions about survival rates of control groups and different transport and handling mortality rates among release groups (Beeman et al. 2011, FPC 2011 – Technical Memorandum 37-11, FPC 2012 – Technical Memorandum 11-12, FPC 2012 – Technical Memorandum 31-12).

63. Attached hereto as Appendix A is a true and correct copy of population information for individual interior salmon and steelhead populations, for all data available, developed using data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014; and US v OR TAC fall Chinook and Snake River sockeye run reconstructions.as further explained therein.

64. Attached hereto as Appendix B is a true and correct copy of Oregon Department of Fish and Wildlife East Region Comments on Tributary Habitat Projects (Jan. 17, 2014).

65. Following Appendix B is a true and correct copy of the literature cited in this declaration.

I declare under penalty of perjury that the foregoing is true and correct.

DATED this 16th day of December, 2014.

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Table 2. Summary of performance standards testing results and test conditions. Estimated 115/120%, 120%, and 125% spill caps are from the Experimental Spill Management modeling exercises. Numbers in parentheses for these columns are the number of study days when actual spill exceeded these total dissolved gas spill caps (adapted from FPC 2013 - Technical Memorandum 138-13)

Project	Year	Species	Study Period	Dam Survival (SE)	BiOp Spill	Avg. Spill (Range)	115/120% Cap (Kcfs)	120% Cap (Kcfs)	125% Cap (Kcfs)	Surv. Data Source
LGS	2012	CH1	4/24-5/25	0.98 (0.01)	30%	33% (26-46%)	40 (10 of 32)	51 (5 of 32)	70 (2 of 32)	Skalski et al 2013a
		ST	4/24-5/25	0.99 (0.01)	30%	33% (26-46%)	40 (10 of 32)	51 (5 of 32)	70 (2 of 32)	
LMN	2012	CH1	4/24-5/25	0.99 (0.01)	Gas Cap (20-29 Kcfs)	37.6 Kcfs (23.6-90.4 Kcfs)	30 (16 of 32)	44 (5 of 32)	80 (1 of 32)	Skalski et al 2013b
		ST	4/24-5/25	0.98 (0.01)	Gas Cap (20-29 Kcfs)	37.6 Kcfs (23.6-90.4 Kcfs)	30 (16 of 32)	44 (5 of 32)	80 (1 of 32)	
MCN	2012	CH1	4/27-5/30	0.96 (0.01)	40%	51% (41%-61%)	150 (29 of 34)	140 (29 of 34)	230 (1 of 34)	Skalski et al 2013c
		ST	4/27-5/30	1.00 (0.02)[A]	40%	51% (41%-61%)	150 (29 of 34)	140 (29 of 34)	230 (1 of 34)	
JDA	2011	CH1	4/27-5/29	0.97 (0.01)	30-40%	37% (30-46%)	146 (14 of 33)	146 (14 of 33)	190 (10 of 33)	Weiland et al 2013
		ST	4/27-5/29	0.99 (0.01)	30-40%	37% (30-46%)	146 (14 of 33)	146 (14 of 33)	190 (10 of 33)	
JDA	2012	CH1	4/27-5/30	0.97 (0.01)	30-40%	37% (40-44%)	146 (10 of 34)	146 (10 of 34)	190 (0 of 34)	Skalski et al 2013d
		ST	4/27-5/30	0.97 (0.003)	30-40%	37% (40-44%)	146 (10 of 34)	146 (10 of 34)	190 (0 of 34)	
TDA	2010	CH1	4/28-6/1	0.96 (0.01)	40%	40% (39-40%)	140 (0 of 35)	135 (0 of 35)	269 (0 of 35)	Johnson et al 2011
		ST	4/28-6/1	0.95 (0.01)	40%	40% (39-40%)	140 (0 of 35)	135 (0 of 35)	269 (0 of 35)	
TDA	2011	CH1	4/29-5/30	0.96 (0.01)	40%	42% (37-50%)	140 (15 of 32)	135 (15 of 32)	269 (0 of 32)	Skalski et al 2012
		ST	4/29-5/30	0.99 (0.01)	40%	42% (37-50%)	140 (15 of 32)	135 (15 of 32)	269 (0 of 32)	
BON	2011	CH1	4/26-5/31	0.96 (0.02)	100 Kcfs	174.9 Kcfs (99.2-293.3 Kcfs)	100 (19 of 36)	100 (19 of 36)	215 (15 of 36)	Ploskey et al 2013
		ST	4/26-5/31	0.96 (0.02)	100 Kcfs	174.9 Kcfs (99.2-293.3 Kcfs)	100 (19 of 36)	100 (19 of 36)	215 (15 of 36)	

[A] To generate the 99% estimate used in the BPA presentation, a different set of detection arrays were used than any other study for the express purpose of achieving a survival estimate of <100%. However, this revised estimate does not meet the precision requirements. Presented here is the 100.01% survival generated by the study design

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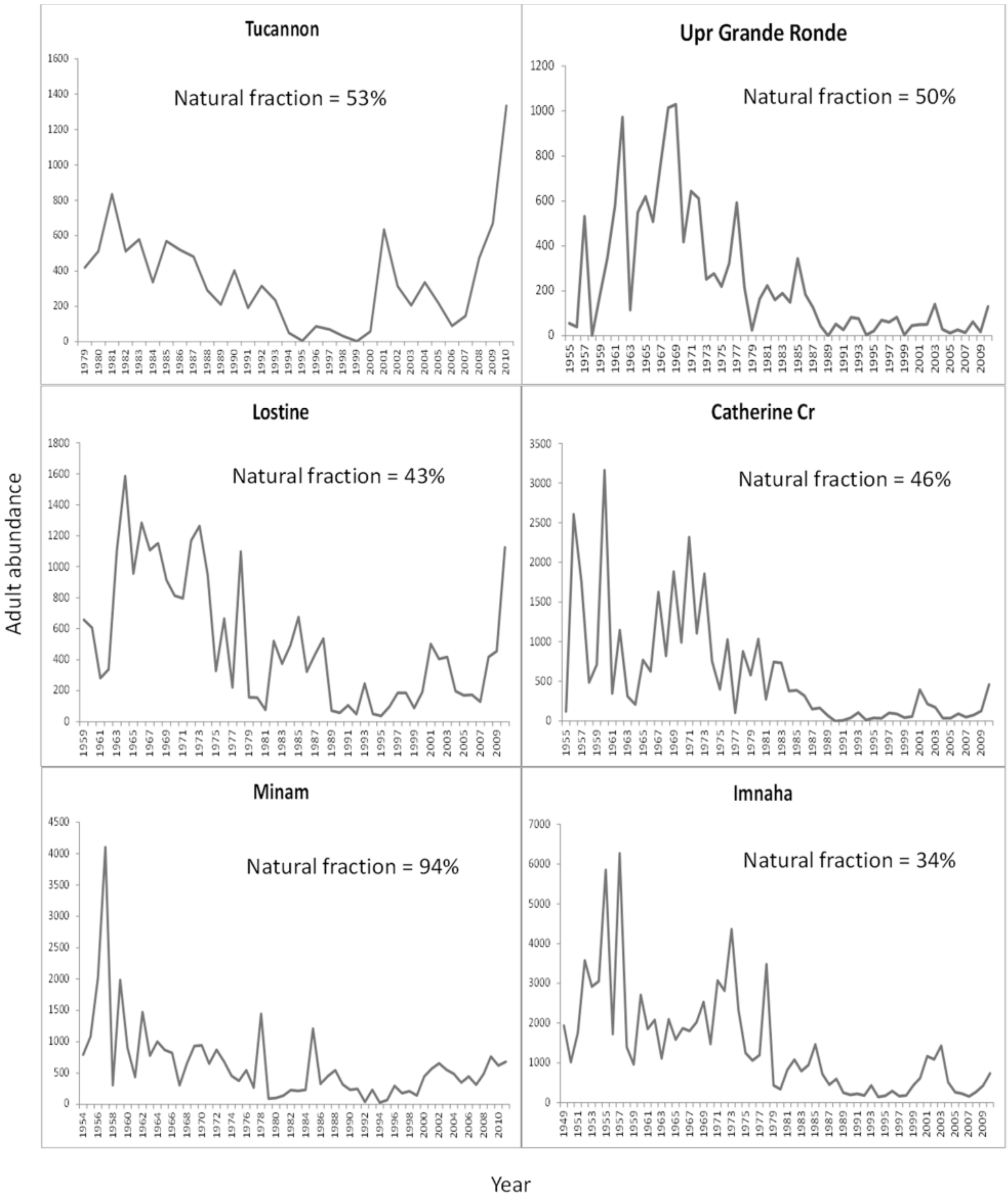
Appendix A

Adult abundance of Snake River and upper Columbia ESUs

This section of Appendix A presents long-term abundance trends for individual interior salmon and steelhead populations, for all data available. Abundances are of wild or naturally-produced fish, except for the Snake River sockeye which are all hatchery fish. Many populations have naturally-spawning hatchery fish on their spawning grounds. In these cases, some of the naturally-produced fish may be the offspring of hatchery fish. Each figure also presents the "natural fraction", which is the proportion of the parents of the fish shown that were themselves wild or natural fish. A population that has a "natural fraction = 100%" is a completely wild population. The lower the natural fraction, the higher the proportion of hatchery fish on the spawning grounds. For example, the Snake River sockeye is made up of 0% wild fish (or 100% hatchery fish). Data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014; and US v OR TAC fall Chinook and Snake River sockeye run reconstructions.

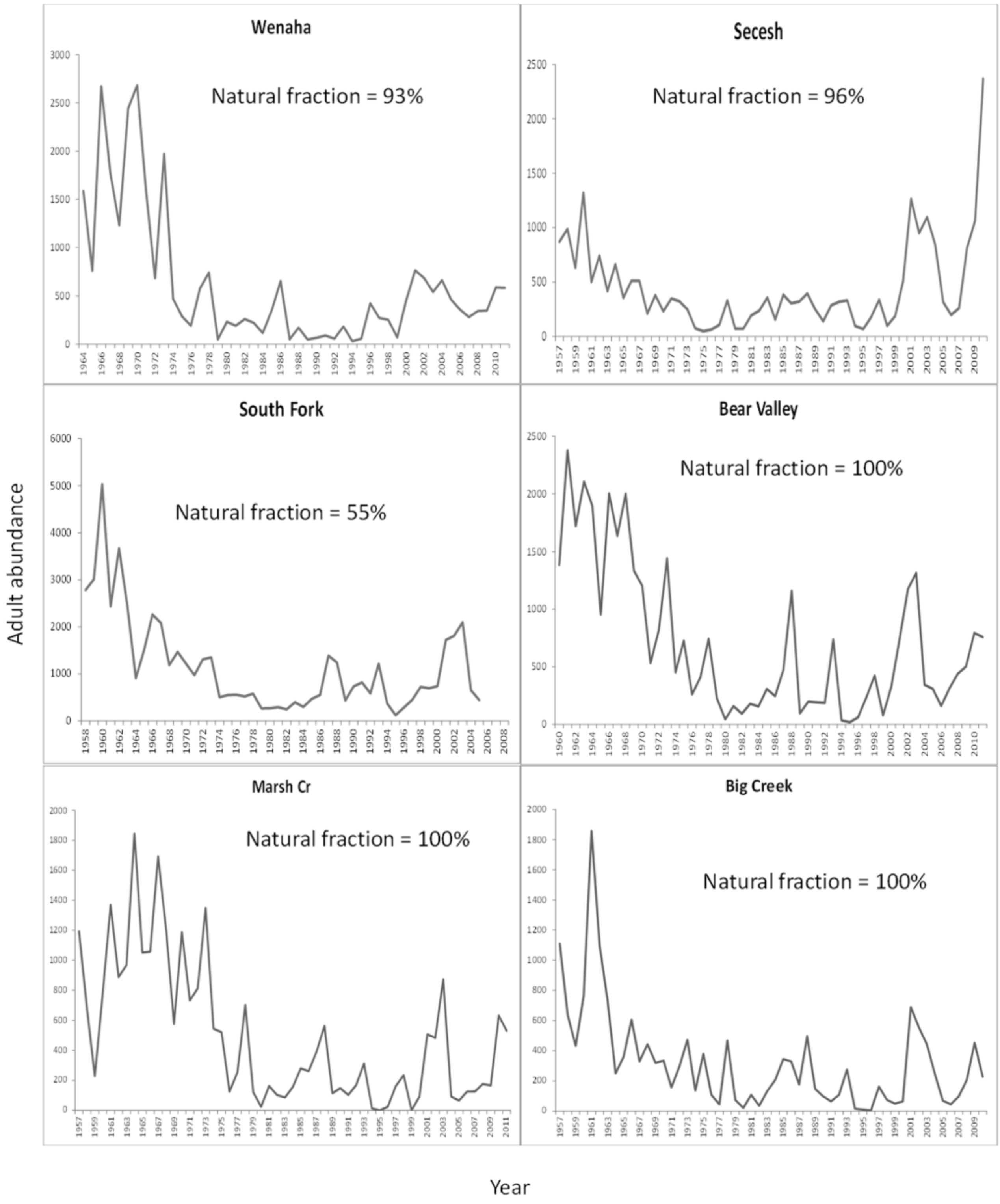
Appendix A

Snake River spring/summer Chinook



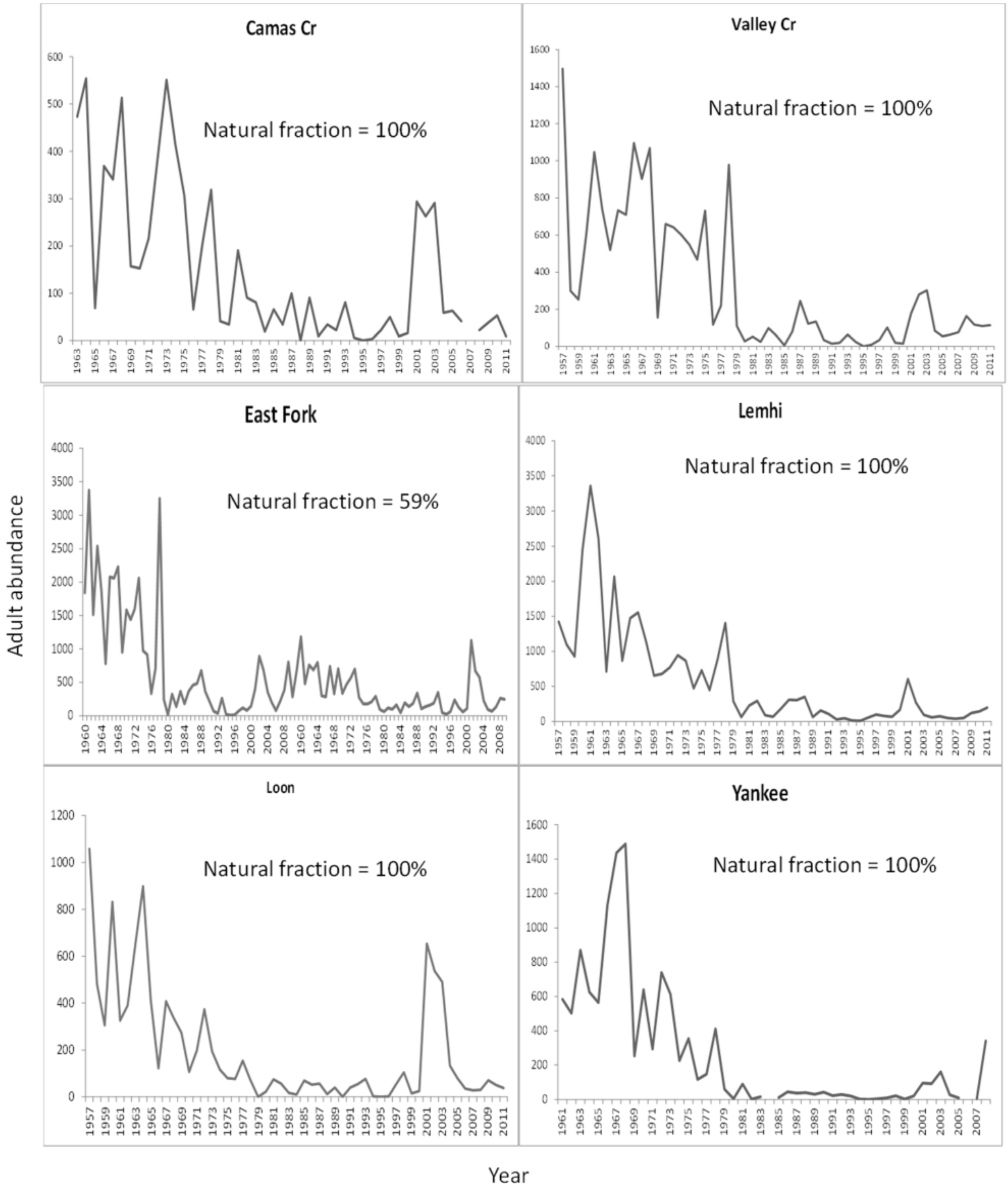
Appendix A

Snake River spring/summer Chinook, cont.



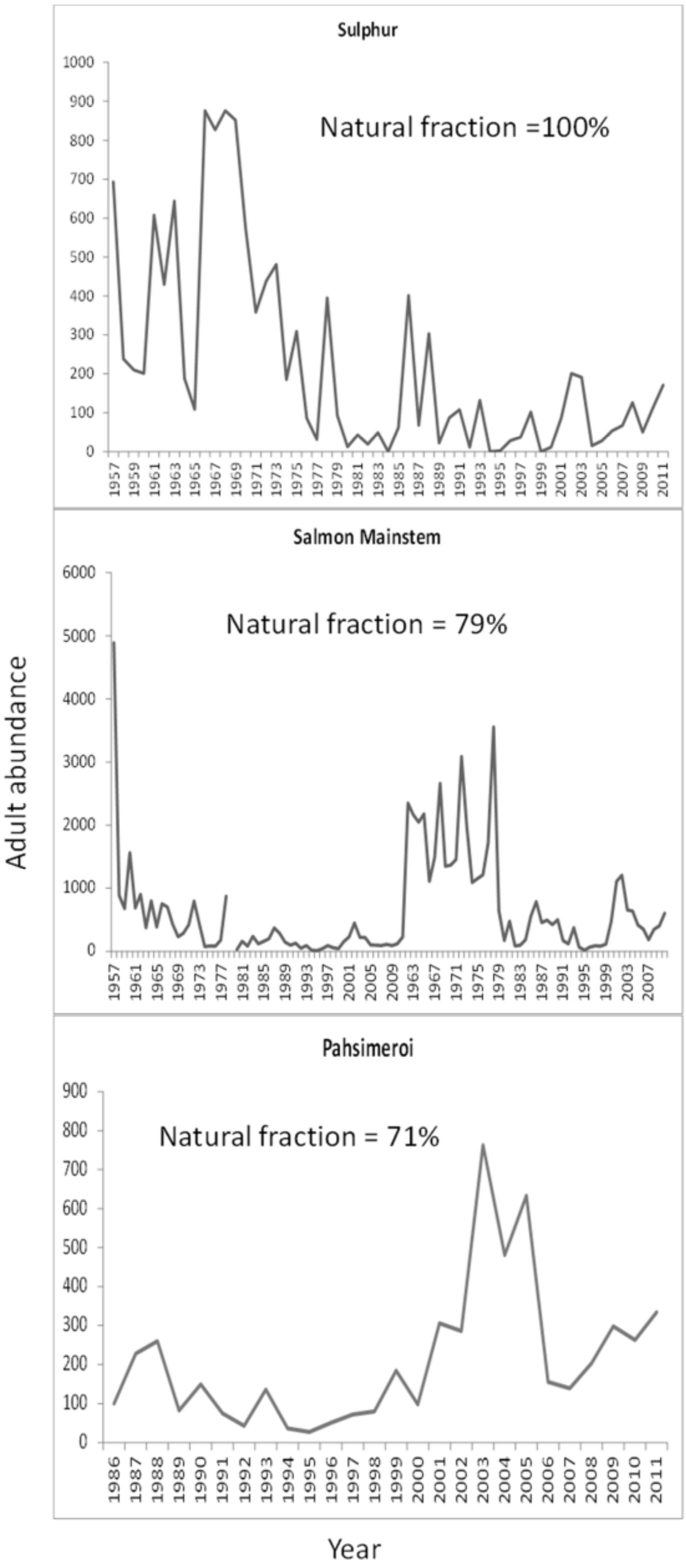
Appendix A

Snake River spring/summer Chinook, cont.



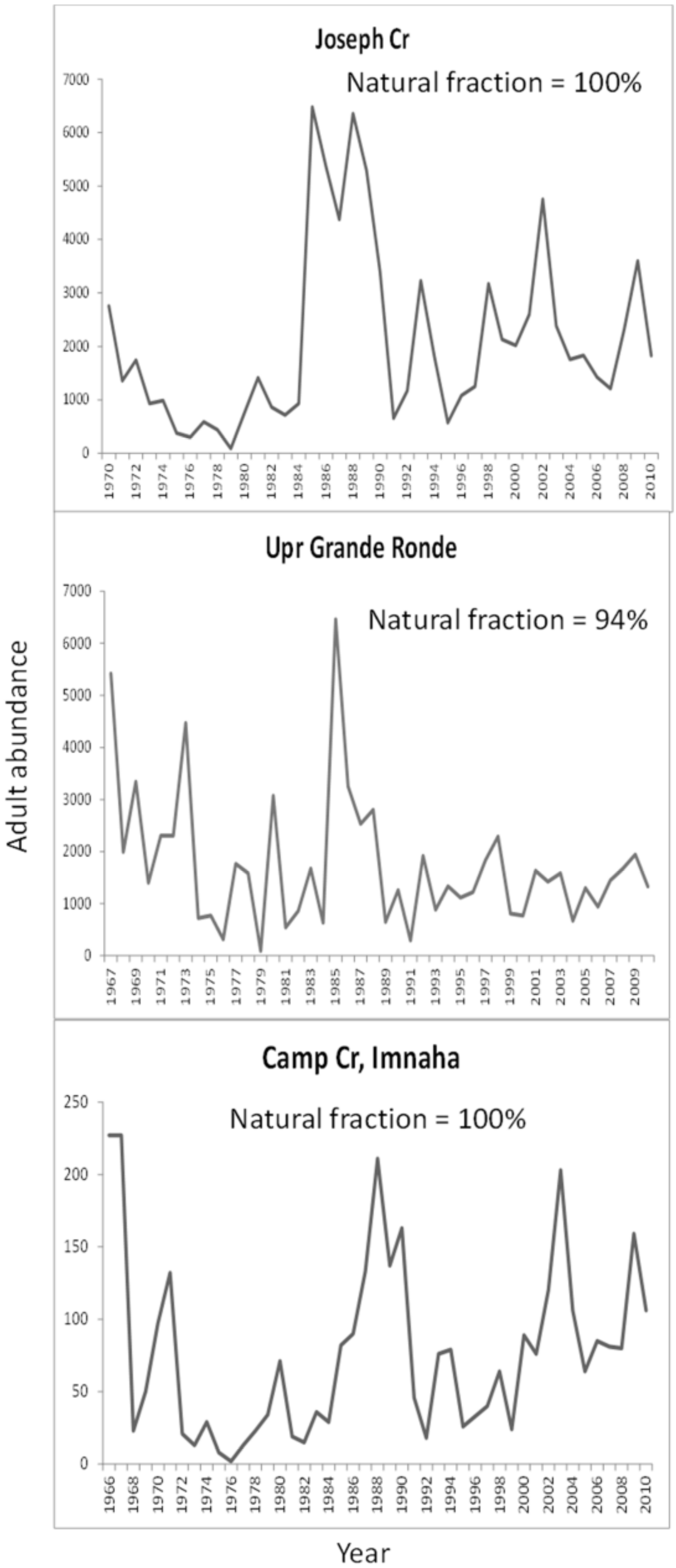
Appendix A

Snake River spring/summer Chinook, cont.



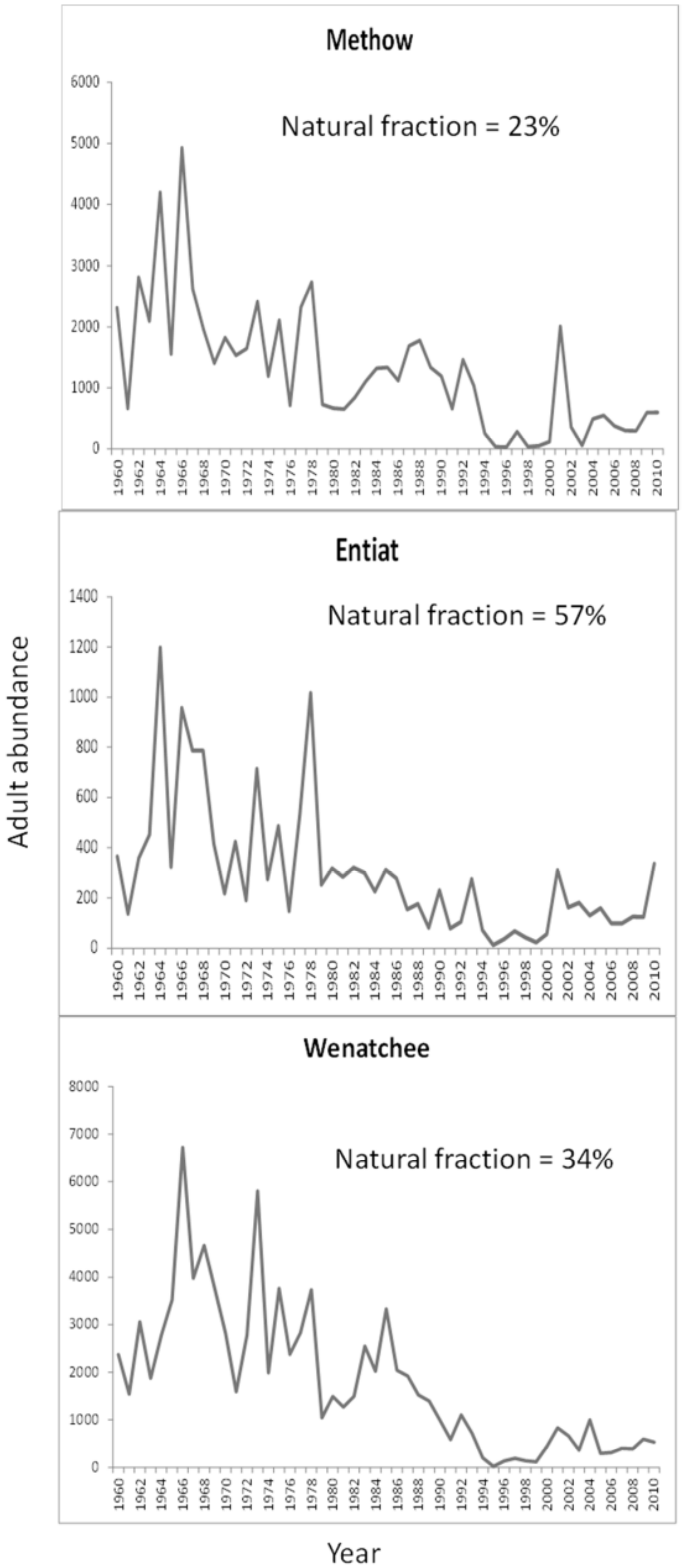
Appendix A

Snake River Steelhead DPS



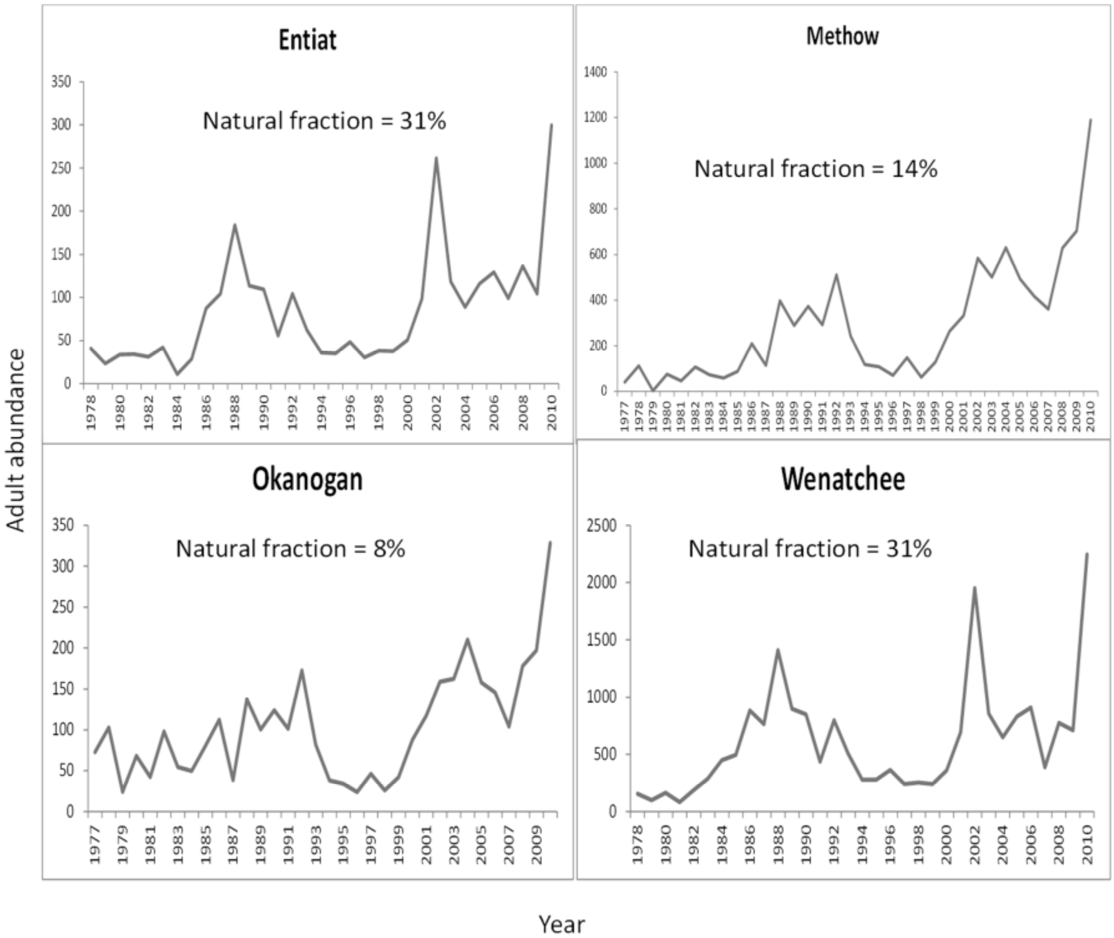
Appendix A

Upper Columbia River Spring Chinook ESU



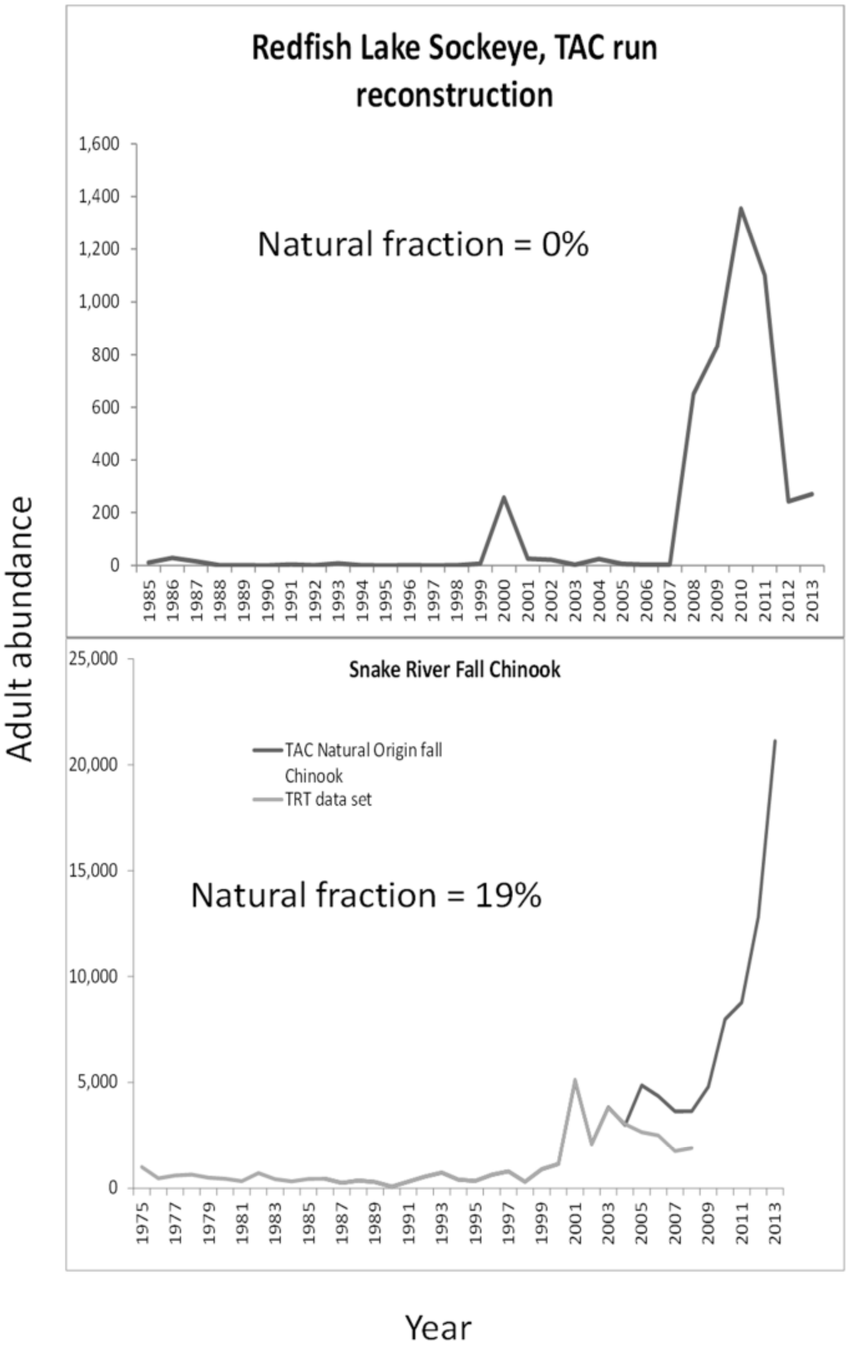
Appendix A

Upper Columbia River Steelhead DPS



Appendix A

Snake River Fall Chinook and Snake River Sockeye ESUs

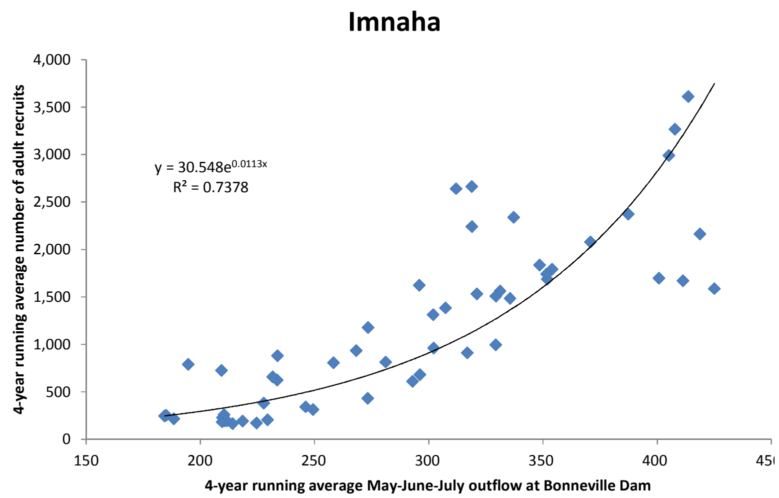


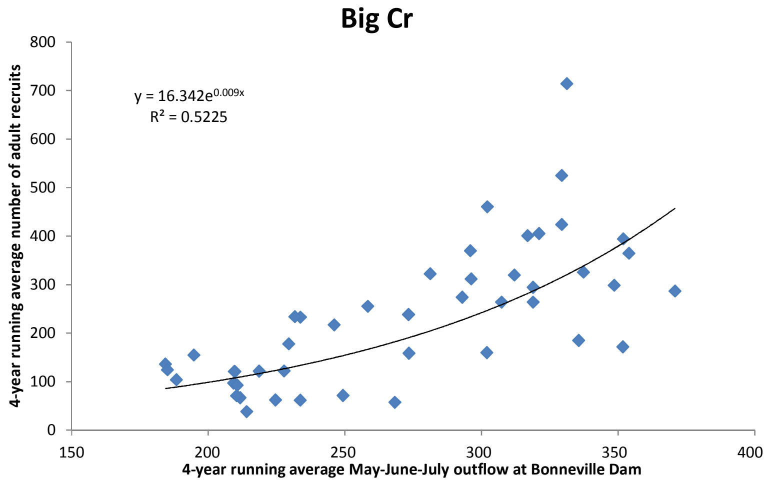
Appendix A

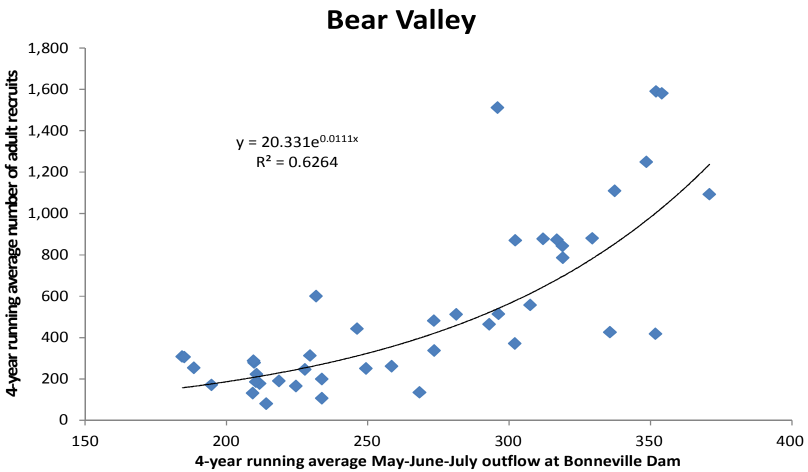
Correlations between increased spring and summer Columbia River flows and increased returns of adult recruits in populations of Snake River spring/summer Chinook

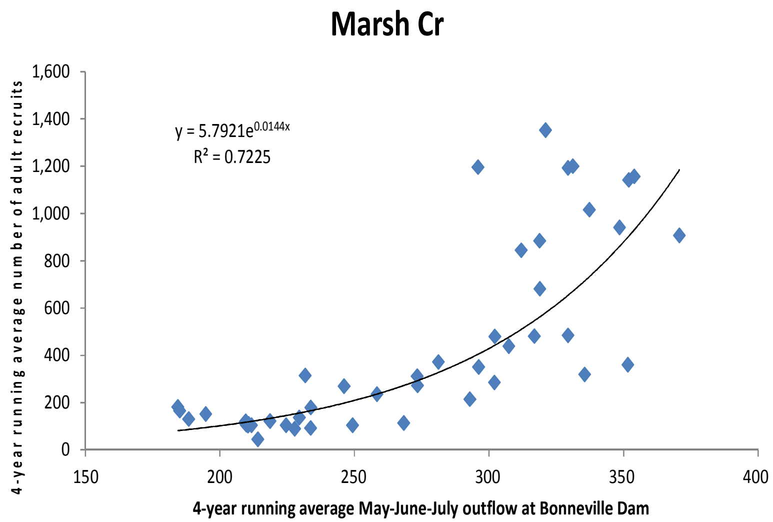
This section of Appendix A presents relationships between spring and summer Columbia River flows, measured as outflow at Bonneville Dam, and returns of adult recruits. Data are shown for wild Spring Chinook salmon populations in the Snake River ESU (1949 – 2006 brood years as available per each population). Chinook data from NMFS http://www.nwfsc.noaa.gov/trt/mapsanddata.cfm , accessed November 19, 2014 and flow data from DART http://www.cbr.washington.edu/dart/query/river_graph_text , accessed November 19, 2014.

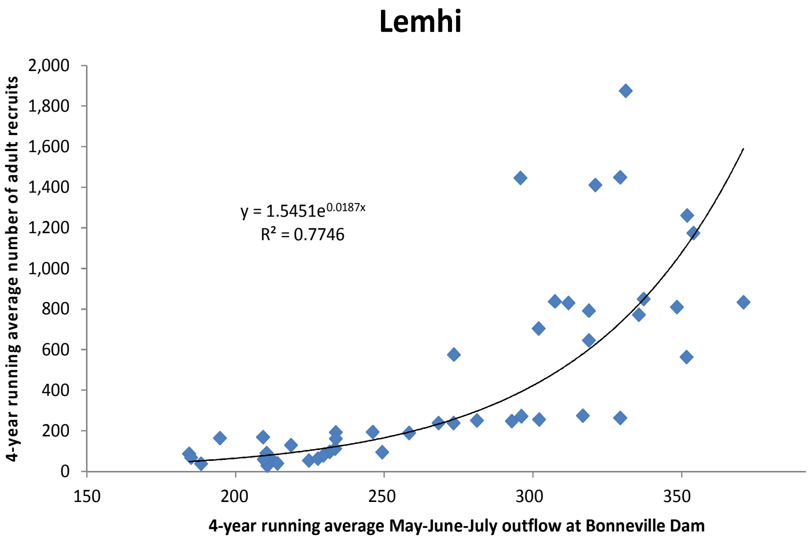
Appendix A

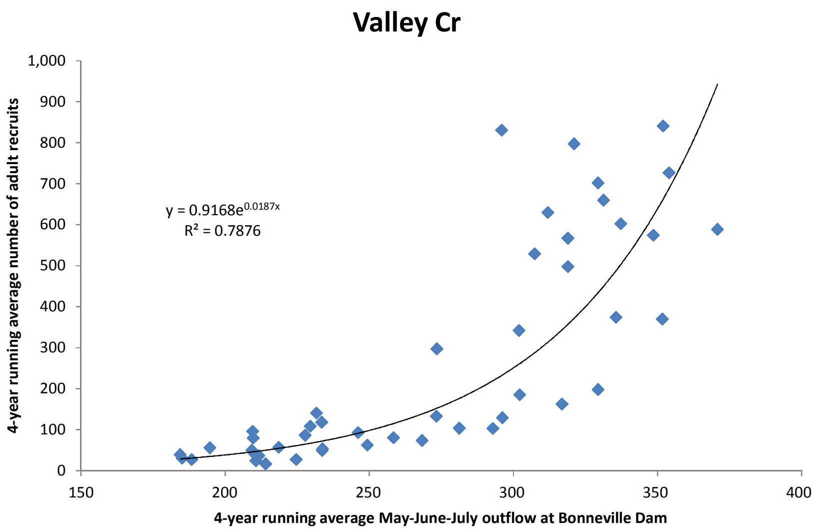

Imnaha
y = 30.548e^0.0113x
R² = 0.7378
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam

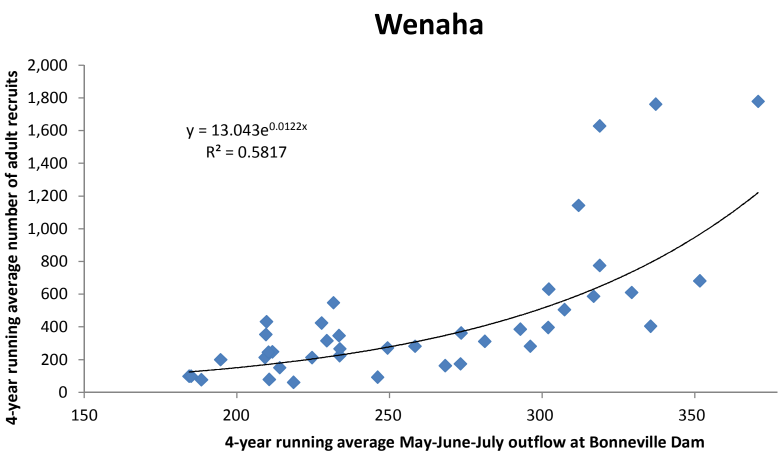

Big Cr
y = 16.342e^0.009x
R² = 0.5225
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam

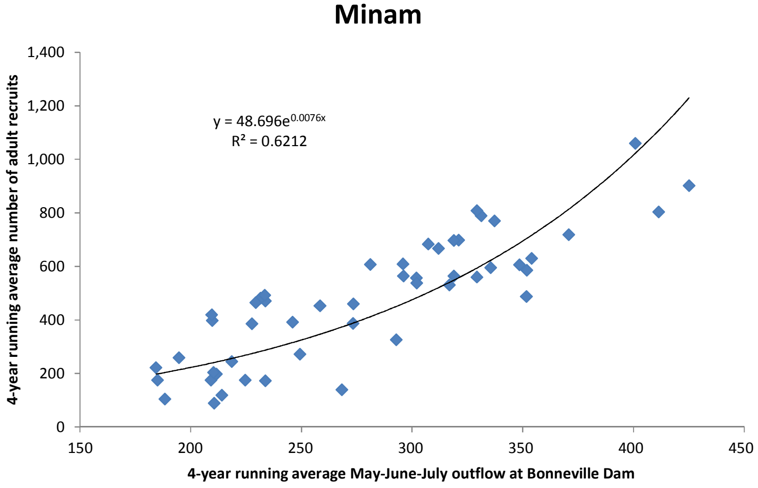

Bear Valley
y = 20.331e^0.0111x
R² = 0.6264
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam


Marsh Cr
y = 5.7921e^0.0144x
R² = 0.7225
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam


Lemhi
y = 1.5451e^0.0187x
R² = 0.7746
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam


Valley Cr
y = 0.9168e^0.0187x
R² = 0.7876
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam

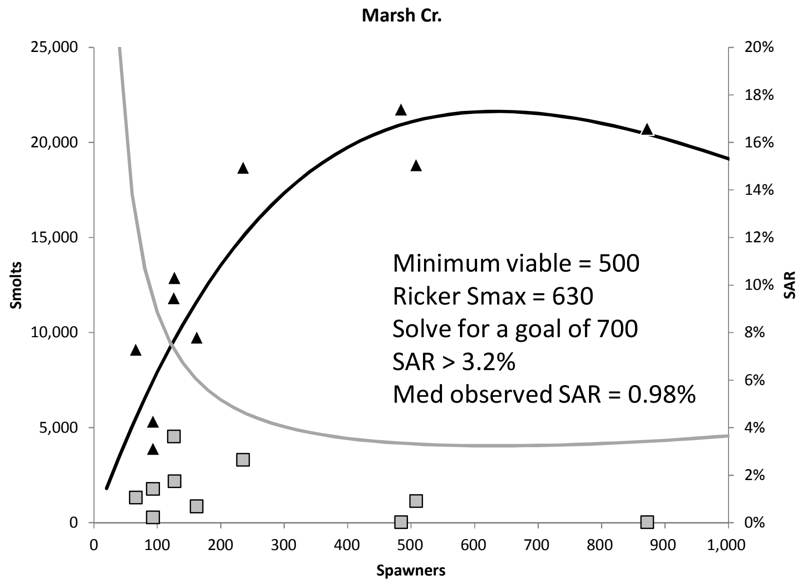

Wenaha
y = 13.043e^0.0122x
R² = 0.5817
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam

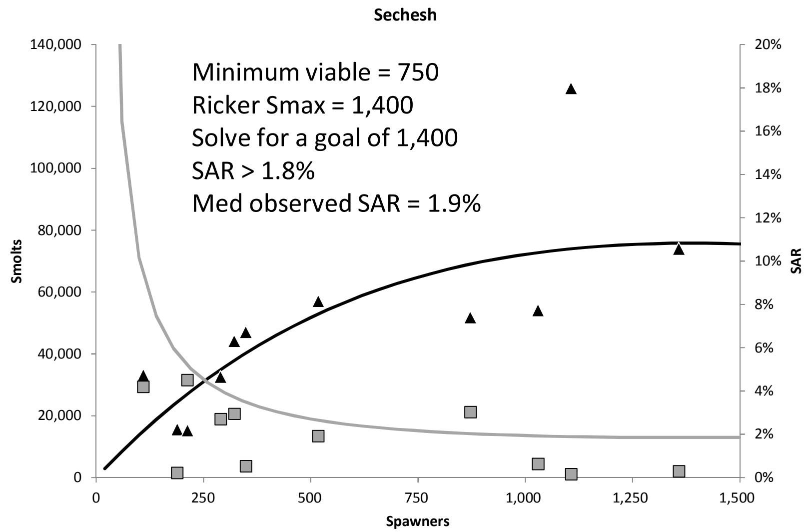

Minam
y = 48.696e^0.0076x
R² = 0.6212
4-year running average number of adult recruits
4-year running average May-June-July outflow at Bonneville Dam

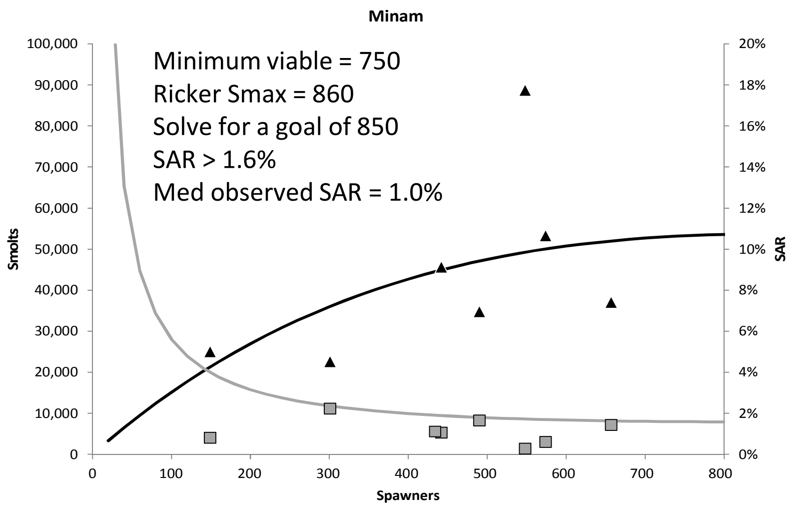
Ricker functions for Snake River spring/summer Chinook smolt production, and minimum required SARs needed to reach minimum viable abundances

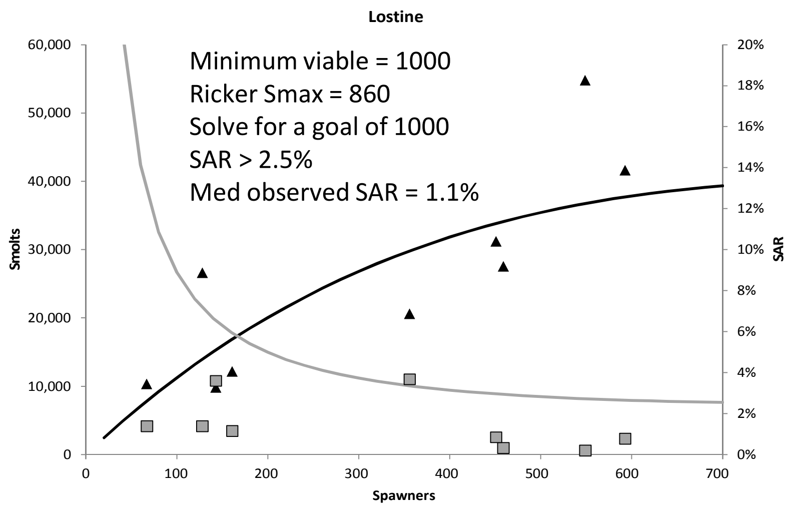
Ricker productivity curves (black lines) for populations of Snake River spring Chinook, including the empirical spawner and smolt data (triangles) that were used to fit the models (left axis); and the corresponding SAR values (right axis, grey lines) calculated from the Ricker modeled smolts that would be needed to return target adult abundances back to the tributaries. Observed SAR values are also shown (squares). The SAR number in the captions are the lowest minimum SAR for the population, which occurs when the spawning population is near S_{max} (at capacity) and at replacement. Required SARs are greater at all other spawner abundances. Smolt and spawner data from Gallinat and Ross 2012, Copeland et al. 2014, Oregon Department of Fish and Wildlife unpublished data.

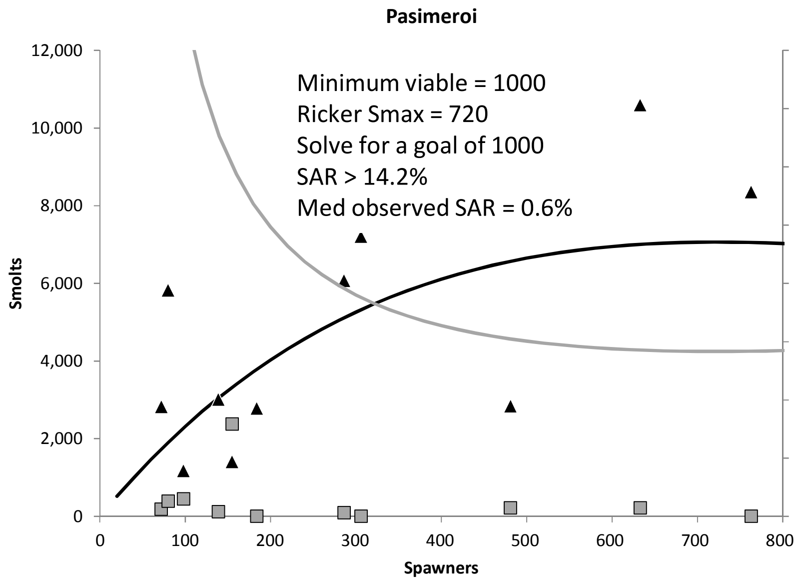
Appendix A

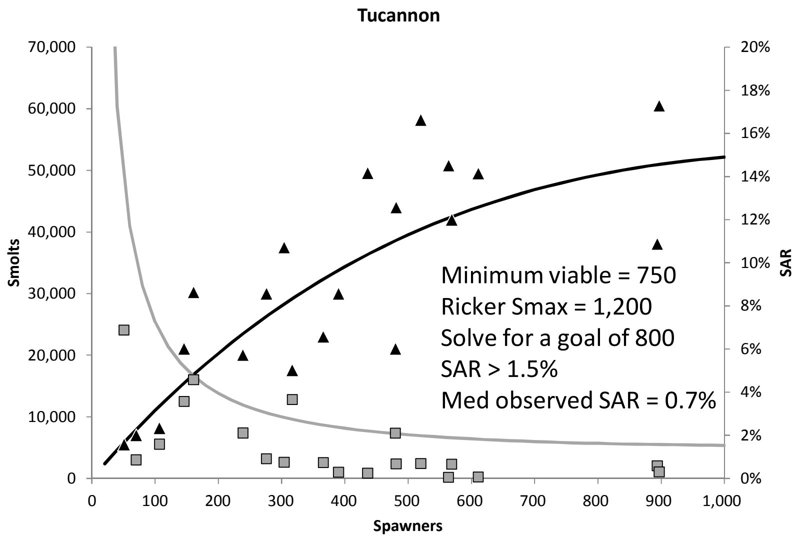

Marsh Cr.
Minimum viable = 500
Ricker Smax = 630
Solve for a goal of 700
SAR > 3.2%
Med observed SAR = 0.98%
Smolts
SAR
Spawners
25,000
20,000
15,000
10,000
5,000
0
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0
100
200
300
400
500
600
700
800
900
1,000

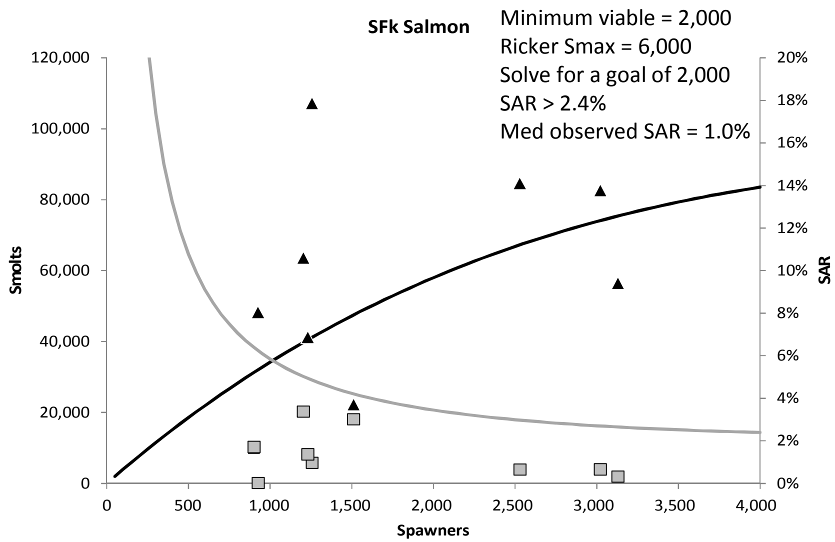

Sechesh
Minimum viable = 750
Ricker Smax = 1,400
Solve for a goal of 1,400
SAR > 1.8%
Med observed SAR = 1.9%
Smolts
SAR
Spawners
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0
250
500
750
1,000
1,250
1,500

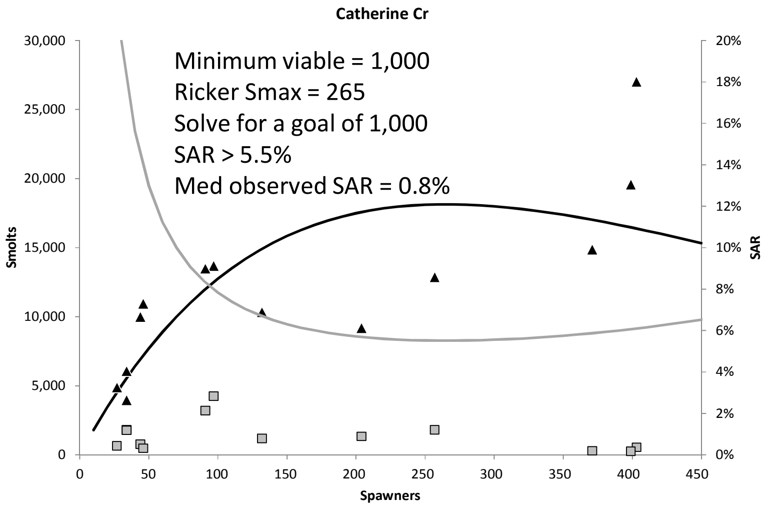

Minam
Minimum viable = 750
Ricker Smax = 860
Solve for a goal of 850
SAR > 1.6%
Med observed SAR = 1.0%
Smolts
SAR
Spawners
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0
100
200
300
400
500
600
700
800

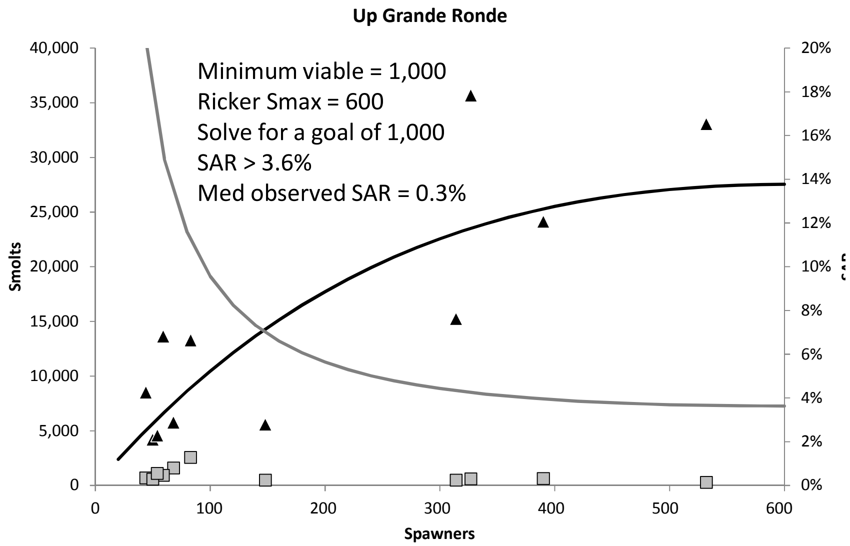

Lostine
Minimum viable = 1000
Ricker Smax = 860
Solve for a goal of 1000
SAR > 2.5%
Med observed SAR = 1.1%
Smolts
SAR
Spawners
60,000
50,000
40,000
30,000
20,000
10,000
0
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0
100
200
300
400
500
600
700

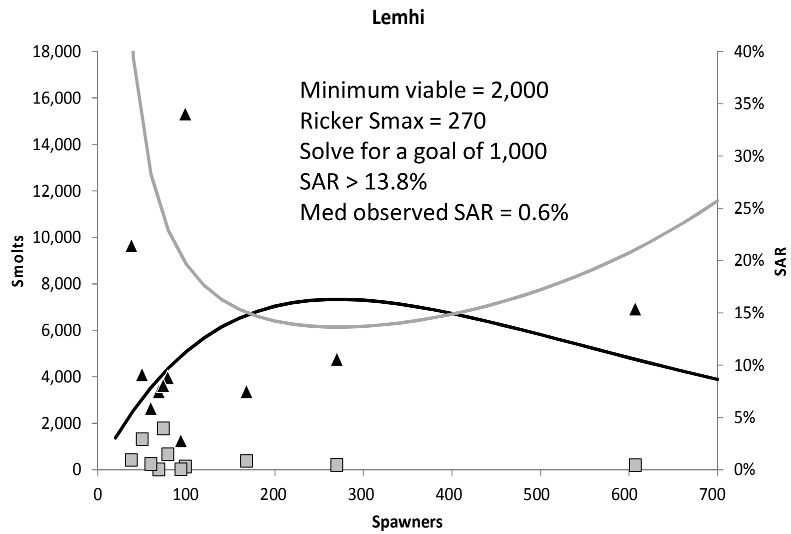

Pasimeroi
Minimum viable = 1000
Ricker Smax = 720
Solve for a goal of 1000
SAR > 14.2%
Med observed SAR = 0.6%
Smolts
Spawners


Tucannon
Minimum viable = 750
Ricker Smax = 1,200
Solve for a goal of 800
SAR > 1.5%
Med observed SAR = 0.7%
Smolts
SAR
Spawners


SFk Salmon
Minimum viable = 2,000
Ricker Smax = 6,000
Solve for a goal of 2,000
SAR > 2.4%
Med observed SAR = 1.0%
Smolts
SAR
Spawners


Catherine Cr
Minimum viable = 1,000
Ricker Smax = 265
Solve for a goal of 1,000
SAR > 5.5%
Med observed SAR = 0.8%
Smolts
SAR
Spawners


Up Grande Ronde
Minimum viable = 1,000
Ricker Smax = 600
Solve for a goal of 1,000
SAR > 3.6%
Med observed SAR = 0.3%
Smolts
Spawners


Lemhi
Minimum viable = 2,000
Ricker Smax = 270
Solve for a goal of 1,000
SAR > 13.8%
Med observed SAR = 0.6%
Smolts
SAR
Spawners

Appendix B

ODFW East Region Comments on the Tributary Habitat Projects in the *2014 Endangered Species Act Section 7(a)(2) Supplemental Biological Opinion, Consultation on Remand for Operation of the Federal Columbia River Power System, NWR-2013-9562* (January 17, 2014, NMFS Northwest Region)

1. Introduction

ODFW staff reviewed the Action Agencies' 2014-2018 habitat mitigation projects, as described in the FCRPS 2013 Comprehensive Evaluation and 2014-2018 FCRPS Implementation Plan, to assess: (1) the certainty of RPA 35 Table 5 habitat action implementation and habitat quality improvement (HQI), and (2) NOAA Fisheries' determination that the RPA, as amended through the 2014 Supplemental Biological Opinion, is not likely to jeopardize the continued existence of ESA-listed Interior Columbia Basin salmon and steelhead.

1.1 The Action Agencies Methods for determining habitat benefits:

The Action Agencies (U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration) used three different processes to determine specific habitat actions and estimate habitat quality improvement/survival benefits (HQI) in the 2013 Comprehensive Evaluation (2013 CE) and 2014-2018 FCRPS Implementation Plan (2014-2018 IP): the 2012 Expert Panel process, the 2004 Biological Opinion "Appendix E Method", and the Tributary Habitat Supplemental Actions process.

Supplemental actions were developed for the seven populations (four Snake River spring/summer Chinook populations, two Snake River summer steelhead populations, and one Upper Columbia spring Chinook population) where 2012 Expert Panel projected HQIs did not achieve the FCRPS BiOp RPA Action 35, Table 5, 2018 HQI targets. Per the 2014-2018 IP, the "Action Agencies developed the menu of proposed supplemental actions together with Fish Accord and other tribal partners in order to assure enough projects to meet or exceed HQIs for all RPA Action 35, Table 5 populations[1]" (2014-2018 IP, p. 279). The supplemental habitat actions are expansions of habitat projects and/or project elements that were identified through the 2012 Expert Panel process[2]. These supplemental actions were reviewed by the Action Agencies and were not evaluated by the 2012 Expert Panels, state fish and wildlife agencies (such as ODFW), watershed, or other relevant regional partners. The Action Agencies consider the 2012 Expert Panel Actions and the Supplemental Actions to represent the "full menu" of 2012 – 2018 RPA 35, Table 5 projects and associated 2018 projected HQIs for these seven populations.

In addition, the Action Agencies have initiated the Catherine Creek Atlas Process which is a supplemental strategy to identify "additional habitat improvement opportunities to the ones in Appendix B of the 2014-2018 Implementation Plan" (2013 Comprehensive Evaluation, Table 35, footnote 11, page 150). "HQIs for projects evaluated by the expert panels, supplemental actions identified in Appendix B of the 2014-2018 Draft IP, expansions of existing projects, and supplemental actions that develop from the Catherine Creek Atlas process will be evaluated by

[1] Per 2013 CE, Appendix A, Grande Ronde/Imnaha Adaptive Management Plan for 2013-2018 (pp A-9 to A-18): The Action Agencies worked with Fish Accord partners "to review projects [Accord partners] submitted to the 2012 Expert Panel for evaluation to determine the potential for expanding projects in areal extent (e.g., acres or miles), size or configuration, or modifying the projects to incorporate new features (e.g., logs vs. engineered log jams). Together the Action Agencies and the [Accord partner] developed a menu of supplemental actions that expanded project scope for projects reviewed by the expert panels and included land acquisition to facilitate implementation of long-term habitat improvement and changes in land management." In addition to the development of an acquisition portfolio, "the [Accord partner] identified elements of projects evaluated by the expert panels that are expected to deliver habitat improvements beyond what was determined by the expert panels during the 2012 workshops. Specific actions that were expanded after the 2012 workshop include culvert replacement; revetment removal; floodplain and side channel re-activation; flow enhancement; and placement of structures to encourage sediment recruitment. Additionally, some of the proposed habitat improvement actions developed in conjunction with changes in grazing management, development of riparian exclosures, and development of off-channel watering structures are anticipated to deliver benefits beyond which were accounted during the 2012 expert panel workshops." "These supplemental efforts are presented in the 2014-2018 Draft IP Appendix B Tributary Habitat Supplemental Actions table and are intended to "shore up" expectations for delivery of HQIs by 2018 and beyond." "In addition, the Action Agencies have adopted a strategy for achieving the complete HQI for Catherine Creek by 2018" (i.e., the Catherine Creek Atlas process).

[2] Per 2014-2018 IP, the term "projects" typically refers to Bonneville Power Administration (BPA) project numbers and names and may include multiple contracts with individual sponsors to complete on-the-ground habitat protection and/or restoration actions. The term "actions" is equivalent to BPA work element names and "treatment metrics" are the habitat measures associated with individual work elements (e.g., action/work element = acquire water instream; treatment metric = cubic feet per second (cfs) of flow protected).

the 2015 expert panel. Results from the 2015 expert panel evaluations of these projects are expected to exceed the 2018 RPA Action 35, Table 5 HQIs" (2013 CE, Appendix A, page A-18).

2. ODFW's Review Methodology

Our review focused primarily on the five spring/summer Chinook (Catherine Creek, Upper Mainstem Grande Ronde River, Upper Mainstem Salmon River above Redfish Lake, Yankee Fork, and Entiat River) and two summer steelhead (Lochsa River and South Fork Clearwater River) populations for which the Action Agencies used a post-Expert Panel, supplemental action process to develop 2018 HQI projections. Six of these populations are priority populations. In the Action Agencies' 2007 Comprehensive Analysis, the populations designated "priority populations" were those for which the life-cycle analysis in the CA indicated that the specified tributary habitat survival improvements were needed to produce increased adult R/S to the spawning grounds (i.e., to achieve productivity metrics of R/S >1). Four of these priority populations (Catherine Creek, Upper Mainstem Grande Ronde River, Yankee Fork, and Entiat River spring/summer Chinook) were identified in the top 10 list of non-hydro action beneficiaries in the 2008 FCRPS Biological Opinion (Table 18, page 97, Declaration of Edward Bowles in support of the State of Oregon's motion for summary judgment).

We assessed 2013 Comprehensive Evaluation Section 2, Table 35 data to determine the percentage of RPA 35, Table 5 HQI performance standards achieved through 2009 and 2011, projected percentage of 2018 RPA 35, Table 5 HQIs based on the 2012 Expert Panel identified projects[2], and percent increase in projected 2018 RPA 35, Table 5 HQI resulting from the addition of supplemental projects[2] (ODFW Table 1a).

We evaluated 2010-2012 RPA 35, Table 5 habitat metrics[2] data in 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1 for all populations in order to compare habitat treatment metrics identified by the expert panels for implementation during 2010-2012 (i.e., planned RPA 35 2010-2012 metrics) versus the actual habitat metrics completed during the same time period (i.e., RPA 35 2010-2012 completed metrics). For those populations with one or more planned habitat metrics that were wholly or partially incomplete by 2012, we summarized the number of treatment metrics that fell within the following categories: metric not implemented; metric partially implemented; and metric not implemented but other metrics reported instead. We also calculated percent disagreement between partially implemented metrics and associated planned metrics (ODFW Table 2).

We compared the population-specific treatment metric[2] data in 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1, 2014-2018 Implementation Plan Appendix A – Project Lists, and 2014-2018 Implementation Plan Appendix B, Table B-1 and totaled the planned habitat metrics associated with the 2013-2018 Expert Panel Actions and Supplemental Actions. We also calculated percent disagreement between the 2013-2018 Expert Panel planned treatment metrics and 2013-2018 Supplemental Action planned treatment metrics (ODFW Table 3) in order to determine inconsistencies between the two habitat action identification processes used by the Action Agencies.

Additionally, we reviewed the 2014 Supplemental BiOp and Action Agencies' documents for information and RPA actions related to the Middle Columbia River adult steelhead tributary bypass and downstream passage through the FCRPS to see if this emerging hydrosystem limiting factor was addressed in the documents.

3. Habitat Improvement Actions Assessment

3.1. Comparison of Achieved (2007-2011) and Projected (2012-2018) FCRPS BiOp RPA 35, Table 5 Habitat Quality Improvements (HQI)

FCRPS 2013 Comprehensive Evaluation, Section 2, Table 35 (pages 150-155) summarizes the RPA 35, Table 5, HQIs achieved from 2007 to 2011 and projected from 2012 through 2018 for each population. ODFW Table 1a summarizes RPA 35, Table 5 HQIs achieved through 2011 and projected through 2018 for the seven supplemental action spring/summer Chinook and summer steelhead populations. For comparison, ODFW Table 1b provides RPA 35, Table 5 achieved and projected HQI data for the other four non-hydro action beneficiary spring/summer Chinook and summer steelhead populations (identified in Table 18, page 97, Declaration of Edward Bowles in support of the State of Oregon's motion for summary judgment).

Supplemental actions were not identified for these latter four populations as they are projected to exceed their respective RPA 35, Table 5, 2018 HQI standards.

a. By 2009, only the Grande Ronde River Upper Mainstem spring/summer Chinook population had met the estimated FCRPS BiOp RPA Action 35, Table 5, 2007-2009 HQIs. The other six populations were 25% - 100% below their respective 2007-2009 HQI targets (ODFW Table 1a).
b. By 2011, none of the seven populations had achieved the FCRPS BiOp RPA Action 35, Table 5 total estimated 2007-2018 HQIs. These populations were 62% - 100% below their respective 2007-2018 Table 5 HQI targets (ODFW Table 1a).
c. Per the 2012 Expert Panel evaluations, none of the seven populations are projected to meet the FCRPS BiOp RPA Action 35, Table 5 total estimated 2007-2018 HQIs and are expected to be 7% - 78% below their respective performance targets (ODFW Table 1a).
d. The supplemental actions result in an 8% - 360% increase in 2018 Table 5 HQI projections over expert panel estimates for the seven populations. The Action Agencies method of combining the supplemental actions with the expert panel estimates results in six of the seven populations meeting or exceeding the projected percentage of 2018 HQI (ODFW Table 1a).
e. The Catherine Creek spring Chinook population is not projected to meet its 2018 Table 5 HQI performance standard under the total projects (expert panel and supplemental) scenario and is therefore the focus of an additional habitat action identification methodology described in the 2013 CE, the Catherine Creek Atlas process.

3.2. Comparison of FCRPS BiOp RPA 35, Table 5 Planned (2010-2012) and Completed (by 2012) Tributary Habitat Metrics

FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1 (2013 CE Sec 3 Att 2-Table 1; pages 67-87) summarizes population-level tributary habitat metrics (i.e., habitat actions) planned and/or completed in 2007-2012. ODFW Table 2 summarizes the RPA 35, Table 5, 2010-2012 planned metrics from 2013 CE Sec 3 Att 2-Table 1 that were not completed by 2012.

a. Of the 48 populations with 2010-2012 Planned Metrics identified in 2013 CE Sec 3 Att 2-Table 1, 36 populations (75%) had one or more limiting factor specific, planned metrics that were wholly or partially incomplete in 2010-2012 (*n = 78*; ODFW Table 2).
b. Of the 78 2010-2012 planned metrics not completed by 2012, 48 (62%) were not implemented [including 28 (36%) planned metrics not implemented and 20 (26%) planned metrics not implemented with other limiting factor specific metrics reported instead], and 30 (38%) were partially implemented (ODFW Table 2).
c. For the 20 planned, unimplemented metrics with alternate metrics reported, 2013 CE Sec 3 Att 2-Table 1 did not specify: (1) if achieving the planned metric proved infeasible, (2) which completed metrics represented comparable replacement metrics and how comparable was evaluated, and/or (3) if the metric results represented supplemental or expanded project results.

3.3. Comparison of FCRPS BiOp RPA 34 and 35 Completed (2007-2012) and Planned (2013-2018) Tributary Habitat Metrics

ODFW Table 3 summarizes FCRPS BiOp RPA 34/35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. ODFW Table 4a, b, and c summarizes FCRPS BiOp RPA 35, Table 5 HQIs achieved (2007-2012), projected (2012-2018), and associated tributary habitat metrics for the Catherine Creek spring Chinook population.

a. The supplemental actions claim to result in considerable, percent increases (3% - 258%) in 2013-2018 metrics for the six priority populations (Catherine Creek spring/summer Chinook, Grande Ronde River Upper Mainstem spring/summer Chinook, Yankee Fork spring/summer Chinook, Entiat River spring/summer Chinook, Lochsa River summer steelhead, and South Fork Clearwater River summer steelhead).

b. Three populations (Grande Ronde River Upper Mainstem spring/summer Chinook, Entiat River and South Fork Clearwater River summer steelhead) had new treatment metrics assigned through the supplemental actions process that were not identified in the 2012 expert panel process.
c. We were unable to assess the change between the 2012 expert panel and supplemental action metrics for the Salmon River Upper Mainstem above Redfish Lake as supplemental metric data was not provided in 2014-2018 IP, Appendix B, Table B-1 for this population.
d. The locations of the supplemental actions are not identified, making it impossible to evaluate feasibility and likelihood of success.
e. Per 2013 CE Appendix A, some of the projects being developed from those evaluated by the 2012 expert panel have "already increased significantly in scope." CC-37 is provided as the only example. Appendix A, however, fails to include the caveat that some projects being developed have also decreased in scope. For example, the CC-44 project decreased by one side channel and one alcove from initial (30%) to final design drawings. The Catherine Creek Atlas is currently under development and specific restoration priorities or projects have not been identified to date.
f. The suite of completed and projected treatment metrics is inconsistent between the various Action Agencies' documents. For example, 'stream miles protected' and 'stream miles improved' are listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists and 'structures addressed' is listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists.

3.4. Action Agencies' Tributary Habitat Action Identification Processes

a. The 2013 CE and 2014-2018 IP do not substantiate how the Expert Panel, Appendix E, Supplemental Projects, and Catherine Creek Atlas processes are comparable in terms of producing repeatable, scientifically robust, habitat improvement/survival estimates, across the populations and subsequent ESUs/DPSs.
b. The supplemental actions process, as described in the 2013 CE and 2014-2018 IP, was not open, transparent, objective, or science based. Supplemental actions and metrics were not evaluated by the 2012 Expert Panels, state fish and wildlife agencies, and/or watershed partners. Peer-review is expected to occur during the 2015 Expert Panel process.
c. The 2013 CE and 2014-2018 IP do not cite peer-reviewed, salmon habitat restoration literature, salmon/steelhead recovery plans, and/or research and monitoring reports.
    i. The 2013 CE and 2014-2018 IP do not substantiate, via cross-reference to literature, plans, and/or reports, the supplemental action process of expanding projects in areal extent, size/configuration, or incorporation of new features to improve habitat quality and survival benefits.
    ii. Limiting factor prioritization information should be listed in 2013 CE Sec 3 Att 2-Table 1 as not all limiting factors are equivalent priority for improving salmon and steelhead viability.
    iii. Where applicable, adopted ESA Recovery Plan prioritized actions (e.g., action identification numbers and action priority rankings) should be referenced in the 2013 CE Sec 3 Att 2-Table 1 to ensure that proposed RPA habitat mitigation actions are consistent with recovery plan habitat protection and restoration actions.

4. Summary

The Action Agencies' used the supplemental action process to develop habitat mitigation actions and final 2018 RPA 35, Table 5 HQI projections because they deemed the 2012 Expert Panel estimates as "extremely conservative" (2013 CE, Appendix A, page A-4). During 2010-2012, 36 of the 48 salmon and steelhead populations had RPA 35 treatment metrics that were unimplemented or partially implemented. This indicates that the expert panels tend to overestimate the number of actions and associated treatment metrics that will be completed. Therefore, the 2012 Expert Panel projections for the seven supplemental action, spring/summer Chinook and steelhead populations represent liberal estimates of RPA 35, Table 5, habitat action effects that are uncertain to occur based on habitat mitigation metrics completed and HQI achievements to date (ODFW Tables 1a, 2, 3, and 4). As stated previously, none of the seven populations are projected to meet the 2018 FCRPS BiOp RPA Action 35, Table 5 HQI and are expected to be 7% - 78% below their respective performance standards based on the 2012 Expert Panel estimates. The supplemental actions result in considerable increases in 2013-2018 RPA 35 Table 5 treatment metrics and projected 2018 HQI improvements over the 2012 Expert Panel estimates (ODFW Tables 1a and 3). Given that these supplemental actions will be vetted by the expert panels in 2015 and may not be implemented until 2016 or thereafter, the supplemental HQI projections result in an overstatement of 2018 RPA 35 Table 5 habitat mitigation actions and effects that are not certain to occur.

The Catherine Creek Atlas process is ongoing with no specific restoration priorities or projects identified to date. The Upper Grande Ronde Atlas process is scheduled to begin in late 2014. Subsequently, Atlas project information will likely not be available for the 2015 Expert Panel to evaluate and estimate associated HQIs. Current Catherine Creek projects (e.g., CC-44) have decreased in areal extent, size and configuration, and/or treatment actions. While the Action Agencies anticipate that the "results from the 2015 expert panel evaluations of these [Atlas] projects are expected to exceed the 2018 RPA Action 35, Table 5 HQIs" (2013 CE, Appendix A, page A-18), such results and 2018 RPA 35 HQI exceedance are uncertain to occur.

Tributary bypass and subsequent Middle Columbia Steelhead adult entrapment above the mainstem Columbia River dams is a potentially significant factor limiting the viability of the Middle Columbia River Steelhead Distinct Population Segment (Carmichael, Ruzycki, and Tattam 2012). While not addressed in the 2014 FCRPS Supplemental BiOp, this emerging hydrosystem mortality factor has been discussed in several forums that NOAA staff facilitated and/or participated in including, but not limited to: Middle Columbia Steelhead Recovery Steering Committee Meetings (April 27, 2012), Northwest Power and Conservation Council Briefing on the Mid-Columbia Steelhead Recovery Plan's Implementation (May 9, 2012), and Snake River Coordination Group Meetings (May 7, 2013). The Action Agencies and NOAA Fisheries should consider the feasibility of enhancing FCRPS RPA 32 (Fish Passage Plan) to include actions for improved adult downstream passage and survival.

5. Conclusions

The 2014 Biological Opinion relies heavily on tributary habitat improvement actions and their associated projected survival benefits to address the survival gaps for listed salmon and steelhead populations. We agree with NOAA Fisheries' that the Action Agencies have improved their accounting of proposed 2014-2018 implementation actions to include the population-level limiting factors addressed, proposed habitat treatment metrics, and associated umbrella projects. However, significant accounting gaps remain in the 2013 CE and 2014-2018 IP [as described in Section 3.2(a)-(c), 3.3(b)-(f), and 3.4(a)-(c.iii) above]. Additionally, past implementation performance and the considerable inflation of projected habitat quality improvement due to supplemental actions indicate that habitat mitigation and RPA 35, Table 5, 2018 HQI attainment is uncertain in occurrence and effectiveness, especially for the seven high extinction risk spring/summer Chinook and steelhead populations in the Snake River and Upper Columbia River basins.

Subsequently, we disagree with NOAA Fisheries' determination and conclude that:

- The Action Agencies did not developed an implementation plan for habitat mitigation that has a reasonable certainty of occurrence and effectiveness [as described in Sections 3.1(a)-(e), 3.2 (a)-(c), 3.3 (a)-(f), and 4], therefore prospective habitat mitigation will not satisfy the performance standards of RPA 35, Table 5 actions;
- The Action Agencies did not use the best available, science-based methodology to determine the efficacy of habitat actions [as described in Section 3.4(a)-(c.iii)]; and
- Given the aforementioned deficiencies, the RPA, as amended through the 2014 Supplemental Biological Opinion, is likely to jeopardize the continued existence of ESA-listed Interior Columbia Basin salmon and steelhead.

References and Supporting Materials

BPA (Bonneville Power Administration), USACE (US Army Corps of Engineers), and USBR

(US Bureau of Reclamation). 2013. Endangered Species Act Federal Columbia River Power System 2014–2018 Comprehensive Evaluation.

BPA (Bonneville Power Administration), USACE (US Army Corps of Engineers), and USBR (US Bureau of Reclamation). 2014. Endangered Species Act Federal Columbia River Power System 2014–2018 Implementation Plan.

Carmichael, R.W., J.R. Ruzycki, and I.A. Tattam. 2012. Potential FCRPS impacts to Oregon’s Middle Columbia River steelhead populations resulting from adult entrapment above mainstem Columbia River dams.

Table 1a. FCRPS BiOp RPA 35, Table 5 Habitat Quality Improvements (HQIs) achieved from 2007-2012 and projected for 2012-2018 for the seven spring/summer Chinook and summer steelhead populations with supplemental projects per FCRPS 2013 Comprehensive Evaluation, Section 2, Table 35. [**Bold** entries represent priority populations; Blue entries indicate calculations that were not included in 2013 Comprehensive Evaluation Section 2 Table 35].

		From RPA Action 35, Table 5		Results from Expert Panel Evaluations					Including Menu of Supplemental Projects	Percentage at or above 2018 Table 5 Habitat Quality Improvement			
ESU	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions	Habitat Quality Improvement Achieved through 2009	Percentage of RPA Action 35 Table 5, 2009 Habitat Quality Improvement Achieved	Habitat Quality Improvement Achieved through 2011	Percentage of RPA Action 35 Table 5, 2018 Habitat Quality Improvement Achieved through 2011	Habitat Quality Improvement Achieved through 2011 + 2012-2018 Estimates	Habitat Quality Improvement Achieved through 2011 + 2012-2018 Estimates	Percentage of 2018 Habitat Quality Improvement through 2011 (based on Expert Panel Evaluations)	Projected Percentage of 2018 Habitat Quality Improvement Based on Expert Panel Identified Projects through 2018	Projected Percentage of 2018 Habitat Quality Improvement Based on Full Menu of Identified Projects Available through 2018	Percent Increase in Projected Percentage of 2018 Habitat Quality Improvement Estimates (Expert Panel Estimate versus Expert Panel + Supplemental Projects Estimate)
Snake River Spring/Summer Chinook	**Catherine Creek**	4	23	3	75	5	22	11	15	22	48	65	36
Snake River Spring/Summer Chinook	**Grande Ronde River Upper Mainstem**	2	23	2	100	4	17	5	23	17	22	100	360
Snake River Spring/Summer Chinook	Salmon River Upper Mainstem above Redfish Lake	14	14	4	29	5	36	13	14	36	93	100	8
Snake River Spring/Summer Chinook	**Yankee Fork**	10	30	0	0	0	0	21	43	0	70	143	105
Upper Columbia Spring/Summer Chinook	**Entiat River**	10	22	1	10	3	14	9	24	14	41	109	167
Snake River Summer Steelhead	**Lochsa River**	6	16	4	67	6	38	8	17	38	50	106	113
Snake River Summer Steelhead	**South Fork Clearwater River**	5	14	2	40	4	29	13	17	29	93	121	31

Table 1b. For comparison to Table 1a, FCRPS BiOp RPA 35, Table 5, HQIs achieved and projected for the additional four non-hydro action beneficiary populations. Data Source: FCRPS 2013 Comprehensive Evaluation, Section 2, Table 35. [**Bold** entries represent priority populations; Blue entries indicate calculations that were not included in 2013 Comprehensive Evaluation Section 2 Table 35; NA = not applicable].

		From RPA Action 35, Table 5		Results from Expert Panel Evaluations					Including Menu of Supplemental Projects	Percentage at or above 2018 Table 5 Habitat Quality Improvement			
ESU	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions	Habitat Quality Improvement Achieved through 2009	Percentage of RPA Action 35 Table 5, 2009 Habitat Quality Improvement Achieved	Habitat Quality Improvement Achieved through 2011	Percentage of RPA Action 35 Table 5, 2018 Habitat Quality Improvement Achieved through 2011	Habitat Quality Improvement Achieved through 2011 + 2012-2018 Estimates	Habitat Quality Improvement Achieved through 2011 + 2012-2018 Estimates	Percentage of 2018 Habitat Quality Improvement through 2011 (based on Expert Panel Evaluations)	Projected Percentage of 2018 Habitat Quality Improvement Based on Expert Panel Identified Projects through 2018	Projected Percentage of 2018 Habitat Quality Improvement Based on Full Menu of Identified Projects Available through 2018	Percent Increase in Projected Percentage of 2018 Habitat Quality Improvement Estimates (Expert Panel Estimate versus Expert Panel + Supplemental Projects Estimate)
Snake River Spring/Summer Chinook	Pahsimeroi River	41	41	41	100	62	151	70	70	151	171	NA	NA
Upper Columbia Summer Steelhead	**Methow River**	2	4	2	100	2	50	7	7	50	175	NA	NA
Upper Columbia Summer Steelhead	**Okanogan River**	12	14	1	8	7	50	17	17	50	121	NA	NA
Upper Columbia Summer Steelhead	**Wenatchee River**	1	4	2	200	2	50	6	6	50	150	NA	NA

Table 2. FCRPS BiOp RPA 35, Table 5, 2010-2012 planned metrics not completed by 2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35].

ESU/DPS	Population	Limiting Factors	Metric Category	RPA 35 2010-2012 Metric listed as Planned but not reported as 2010-2012 Completed	RPA 35 2010-2012 Completed Metrics	Planned Metric Count	Metric Not Implemented	Metric Partially Implemented	If Partially Implemented, % of Planned Metric Completed	Metric Not Implemented, Other Metrics Reported Instead
Snake River Spring/Summer Chinook	**Catherine Creek+**	Degraded riparian, excess fine sediment, water temperature	WQ/Riparian	Treat 90 wetland acres	No wetland acres completed. 53 riparian acres protected, 77.2 riparian acres improved	1				1
Snake River Spring/Summer Chinook	**Grande Ronde River Upper Mainstem+**	Degraded riparian, excess fine sediment, water temperature	WQ/Riparian	Remove 0.4 miles of road	No road removal miles completed. 27 riparian acres protected, 124.5 riparian acres improved	1				1
Snake River Spring/Summer Chinook	Imnaha River Mainstem	Barriers	Passage	Improve access to 0.5 miles	No metrics completed.	1	1			
		Degraded riparian, excess fine sediment, water temperature	WQ/Riparian	Treat 5 road miles, Treat approx 5 riparian/stream miles	No road miles metrics completed. 0.06 stream miles improved , 1 riparian acre protected	2		1	1.2	1
Snake River Spring/Summer Chinook	Lostine River	Barriers	Passage	Improve access to 37 miles	2 barriers improved 20 miles	1		1	54.1	
		Lack of diverse habitats	Complexity	Reconnect 0.75 miles	0.25 miles improved	1		1	33.3	
		Degraded riparian, excess fine sediment, water temperature	WQ/Riparian	Treat < 10 wetland acres, Treat 1.0 miles of floodplain or riparian	No wetland acres or floodplain/riparian miles treated metrics completed. 0.7 stream miles improved	2				2
Snake River Spring/Summer Chinook	**Tucannon River**	Degraded riparian, excess fine sediment, water temperature	WQ/Riparian	Protect approx 5.5 miles of stream	0.8 stream miles protected, 4.3 stream miles improved	1		1	14.5	
Snake River Spring/Summer Chinook	Big Creek	Barriers	Passage	Improve access to approx 22 miles	1 barrier improved 2.5 miles	1		1	11.4	
		Excess fine sediment	WQ/Riparian	Decommission approx 15 miles road	No metrics completed.	1	1			
Snake River Spring/Summer Chinook	Secesh River	Barriers	Passage	Improve access to approx 12 miles	1 barrier improved 0.8 miles	1		1	6.7	
		Excess fine sediment	WQ/Riparian	Decommission approx 45 miles road	No road miles metrics completed. 14.4 stream miles improved, 1 riparian acre improved	1				1

Table 2. FCRPS BiOp RPA 35, Table 5, 2010-2012 planned metrics not completed by 2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35].

ESU/DPS	Population	Limiting Factors	Metric Category	RPA 35 2010-2012 Metric listed as Planned but not reported as 2010-2012 Completed	RPA 35 2010-2012 Completed Metrics	Planned Metric Count	Metric Not Implemented	Metric Partially Implemented	If Partially Implemented, % of Planned Metric Completed	Metric Not Implemented, Other Metrics Reported Instead
Snake River Spring/Summer Chinook	South Fork Salmon River	Barriers	Passage	Improve access to approx 18.6 miles	3 barriers improved 10.7 miles	1		1	57.5	
		Excess sediments	WQ/Riparian	Enhance/restore approx 3 riparian miles	No riparian miles metrics completed. 1 riparian acres improved	1				1
Snake River Spring/Summer Chinook	East Fork Salmon River	Low stream flow	Flow	Protect/acquire 3 cfs	No metrics completed.	1	1			
		Barriers	Passage	Improve access to 1.9 miles	1 barrier improved 1 mile	1		1	52.6	
		Excess fine sediment, altered riparian	Complexity	Protect approx 0.5 riparian miles	No metrics completed.	1	1			
Snake River Spring/Summer Chinook	Pahsimeroi River	Fish entrainment	Entrainment	Install 3 fish screens	No metrics completed.	1	1			
Snake River Spring/Summer Chinook	Lower Mainstem Salmon River Below Redfish Lake+	Fish entrainment	Entrainment	Install 4 fish screens	3 screens addressed	1		1	75.0	
		Barriers	Passage	Improve access to approx 17 miles	No metrics completed.	1	1			
		Lack of complex habitat	Complexity	Add 500-1000 ft side channel	No metrics completed.	1	1			
Snake River Spring/Summer Chinook	Upper Mainstem Salmon River Above Redfish Lake+	Low stream flow	Flow	Protect approx 11 cfs instream flow	No metrics completed.	1	1			
Snake River Spring/Summer Chinook	Valley Creek	Low stream flow	Flow	Protect approx 4 cfs instream flow	No metrics completed.	1	1			
		Fish entrainment	Entrainment	Install 4 fish screens	No metrics completed.	1	1			
		Barriers	Passage	Improve access to 4 miles	No metrics completed.	1	1			
Upper Columbia River Spring Chinook	**Entiat River+**	Low stream flow	Flow	Protect 6.5 cfs	No metrics completed.	1	1			
Upper Columbia River Spring Chinook	**Methow River**	Low stream flow	Flow	Protect approx 15 cfs of instream flow	3.9 cfs protected	1		1	26.0	
		Riparian & floodplain function, sediment, temperature	WQ/Riparian	Restore approx 18.6 riparian miles	No riparian miles metrics completed. 5.7 stream miles treated, 227.9 riparian acres protected, 9.7 riparian acres improved	1				1

Table 2. FCRPS BiOp RPA 35, Table 5, 2010-2012 planned metrics not completed by 2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35].

ESU/DPS	Population	Limiting Factors	Metric Category	RPA 35 2010-2012 Metric listed as Planned but not reported as 2010-2012 Completed	RPA 35 2010-2012 Completed Metrics	Planned Metric Count	Metric Not Implemented	Metric Partially Implemented	If Partially Implemented, % of Planned Metric Completed	Metric Not Implemented, Other Metrics Reported Instead
Upper Columbia River Spring Chinook	**Wenatchee River**	Low stream flow	Flow	Protect approx 7.5 cfs instream water	1.2 cfs protected	1		1	16.0	
		Barriers	Passage	Improve access to approx 7.2 miles	14 barriers improved 4.1 miles	1		1	56.9	
		Complexity and connectivity	Complexity	Reconnect approx 1.2 miles side channel	No miles side channel completed. 0.1 instream miles improved	1				1
		Riparian & floodplain function	WQ/Riparian	Protect/enhance approx 8.4 riparian miles	No riparian miles metrics completed. 1 stream miles improved	1				1
		High stream temperatures		Treat approx 0.2 stream miles	No stream miles metrics completed. 6 riparian acres improved	1				1
Snake River Summer Steelhead	Clearwater River Lower Mainstem	Riparian and channel alteration, channel incision, high summer temperature, sediment, nutrients	WQ/Riparian	Treat approx 0.2 road miles	No metrics completed.	1	1			
Snake River Summer Steelhead	**Lochsa River**+	Barriers	Passage	Improve access to 15 miles	3 barriers improved 9.8 miles	1		1	65.3	
		Degraded riparian conditions, poor water quality, elevated stream temperatures, excess find sediments	WQ/Riparian	Treat 170 riparian acres, Treat 1575 riparian/upland acres, Treat 7.9 road miles, Remove 75.2 road miles	No riparian acres treated, riparian/upland acres treated, or road miles removed metrics completed. 56.1 stream miles improved, 14.5 road miles treated	4	3			1
Snake River Summer Steelhead	**Lolo Creek**	Barriers	Passage	Improve access to 23.2 miles	4 barriers improved 5.5 miles	1		1	23.7	
		Loss of complexity	Complexity	Treat 3 riparian miles	No metrics completed.	1	1			
		Poor water quality, elevated stream temperatures, excess fine sediment	WQ/Riparian	Treat 30 riparian/upland miles, Treat 15.1 road miles	No riparian/upland miles or road miles treated completed. 2 stream miles improved	2	1			1
Snake River Summer Steelhead	**South Fork Clearwater River**+	Barriers	Passage	Improve access to 23.6 miles	4 barriers improved 1 mile	1		1	4.2	
		Loss of complexity	Complexity	Add structures to 5.5 stream miles	1.8 instream miles improved	1		1	32.7	
		Degraded riparian conditions, excess fine sediment	WQ/Riparian	Treat 34.1 riparian miles, Treat 100 upland acres, Remove 76.5 road miles	No riparian miles treated, upland acres treated or road miles removed metrics completed. 2.5 stream miles protected, 19 stream miles improved, 333 riparian acres	3	2			1

Table 2. FCRPS BiOp RPA 35, Table 5, 2010-2012 planned metrics not completed by 2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35].

ESU/DPS	Population	Limiting Factors	Metric Category	RPA 35 2010-2012 Metric listed as Planned but not reported as 2010-2012 Completed	RPA 35 2010-2012 Completed Metrics	Planned Metric Count	Metric Not Implemented	Metric Partially Implemented	If Partially Implemented, % of Planned Metric Completed	Metric Not Implemented, Other Metrics Reported Instead
Snake River Summer Steelhead	Grande Ronde River Lower Mainstem Tributaries	Excess sediments	WQ/Riparian	Road decommissioning	No metrics completed.	1	1			
Snake River Summer Steelhead	Grande Ronder River Upper Mainstem	Degraded riparian conditions		Reconnect/add 0.4 miles channel habitat	No metrics completed.	1	1			
		Poor water quality, low dissolved oxygen	WQ/Riparian	Remove 0.4 road miles	0.1 road miles treated	1		1	25.0	
Snake River Summer Steelhead	Wallowa River	Degraded riparian conditions, excess fine sediment	WQ/Riparian	Treat < 10 wetland acres	No wetland acres metrics completed.	1	1			
Snake River Summer Steelhead	Imnaha River	Degraded riparian conditions, excess fine sediment	WQ/Riparian	Treat approx 10 riparian/stream miles, Decommission approx 5 road miles	No road miles metrics completed. 0.06 stream miles improved, 1 riparian acre protected	2	1	1	0.6	
Snake River Summer Steelhead	Asotin Creek	Degraded riparian conditions, high water temperatures	WQ/Riparian	Protect approx 15 riparian miles	No riparian miles metrics completed. 3.2 stream miles protected, 13.5 stream miles improved	1				1
Snake River Summer Steelhead	Tucannon River	Degraded riparian conditions, high water temperatures	WQ/Riparian	Protect approx 5.5 miles of stream bank	0.8 stream miles protected, 4.3 stream miles improved	1		1	14.5	
Snake River Summer Steelhead	**Lower Middle Fork Salmon River (Big, Camas, and Loon Creeks)**	Excess fine sediment	Complexity	Decommission approx 15 miles road	No metrics completed.	1	1			
Snake River Summer Steelhead	East Fork Salmon River	Low stream flow	Flow	Protect/acquire 7.5 cfs instream water	6.2 cfs protected	1		1	82.7	
		Barriers	Passage	Improve access to 3.9 miles	1 barriers improved 1 mile	1		1	25.6	
Snake River Summer Steelhead	Lemhi River	Degraded riparian conditions, excess sediments, high water temperatures	WQ/Riparian	Protect approx 50 riparian miles	No riparian miles metrics completed. 8.5 stream miles protected	1				1
Snake River Summer Steelhead	Pahsimeroi River	Fish entrainment	Entrainment	Install 4 fish screens	1 screen addressed	1		1	25.0	
		Barriers	Passage	Improve access to approx 30 miles	12 barriers improved 19.5 miles	1		1	65.0	
Snake River Summer Steelhead	**Secesh River**	Barriers	Passage	Improve access to approx 12 miles	1 barrier improved 0.83 miles	1		1	6.9	
		Excess sediment	WQ/Riparian	Decommission approx 45 miles road	No road miles metrics completed. 14.4 stream miles improved, 1 riparian acre improved	1				1

Table 2. FCRPS BiOp RPA 35, Table 5, 2010-2012 planned metrics not completed by 2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2 - Table 1. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35].

ESU/DPS	Population	Limiting Factors	Metric Category	RPA 35 2010-2012 Metric listed as Planned but not reported as 2010-2012 Completed	RPA 35 2010-2012 Completed Metrics	Planned Metric Count	Metric Not Implemented	Metric Partially Implemented	If Partially Implemented, % of Planned Metric Completed	Metric Not Implemented, Other Metrics Reported Instead
Snake River Summer Steelhead	**South Fork Salmon River**	Excess sediment, high water temperatures	WQ/Riparian	Enhance/restore approx 3 riparian miles	No riparian miles metrics completed. 0.5 stream miles protected, 0.1 stream miles improved, 10 riparian acres protected, 1 riparian acre improved	1				1
Snake River Summer Steelhead	**Entiat River**	Low stream flow	Flow	Protect 6.5 cfs	No metrics completed.	1	1			
Snake River Summer Steelhead	**Methow River**	Low stream flow	Flow	Protect approx 15 cfs of instream water	3.9 cfs protected	1		1	26.0	
Snake River Summer Steelhead	**Okanogan River**	Mechanical injury	Entrainment	Install 30 fish screens	1 screen addressed	1		1	3.3	
		Riparian & floodplain function, high stream temperatures	WQ/Riparian	Protect/enhance approx 17 riparian miles, Protect/enhance approx 246 riparian acres, Protect approx 3540 acres land, Treat 15 miles road	No riparian miles, land acres, or road miles metrics completed. 2.9 stream miles protected, 9 stream miles improved, 66.1 riparian acres protected, and 77.7 riparian acres improved	4	2	1	58.5	1
Snake River Summer Steelhead	**Wenatchee River**	Low stream flow	Flow	Protect approx 7.5 cfs instream water	1.2 cfs protected	1		1	16.0	
		Barriers	Passage	Improve access to approx 7.2 miles	14 barriers improved 4.5 miles	1		1	62.5	
		Complexity and connectivity	Complexity	Reconnect approx 1.2 miles side channel	0.08 instream miles improved	1		1	6.7	
		Riparian & floodplain function, high stream temperatures	WQ/Riparian	Protect/enhance approx 8.4 riparian miles	No riparian miles metrics completed. 1.0 stream miles improved, 3.5 riparian acres improved	1				1
					sum	*78*	*28*	*30*		*20*
					%		36	38		26

Appendix B

Table 3. FCRPS BiOp RPA 34 and 35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. Data sources: RPAs 34 & 35 total metrics completed 2007-2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; metrics associated with 2013-2018 Expert Panel Actions per FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and additional metrics associated with 2013-2018 supplemental actions per FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35; *indicates metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists; ^indicates metrics listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists; No Data indicates metrics for which percent increase could not be calculated (i.e., new supplemental action metrics without equivalent metrics identified through the 2012 expert panel process); gray hatched cells indicate populations without supplemental actions].

ESU/DPS	Population	Metric Category	Limiting Factors to Be Addressed by 2013-2018 Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metrics Associated with 2013-2018 Expert Panel Actions	Additional Metrics Associated with 2013-2018 Supplemental Actions	Total Metrics Associated with 2013-2018 Expert Panel Actions + Supplemental Actions *(Sum of Columns G & H)*	Percent Increase in 2013-2018 Metrics due to Supplemental Actions	RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018) *(Sum of Columns F, G, & H)*
Snake River Spring/Summer Chinook	**Catherine Creek**+	Flow	9.2 Decreased Water Quantity	Acre-feet protected	381.2	3,230		3,230		3,611.20
				cfs protected	1.7	3	3	6	100	7.70
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	12	14	1	15	7	27.00
			2.3 Mechanical Injury	Access miles improved	126.8	30.8		30.8		157.60
				Screens addressed		1		1		1.00
		Complexity	6.1 Bed & Channel Form 6.2 Instream Structural Complexity	Instream miles improved	20.8	19.2	12.45	31.65	65	52.45
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		1.5		1.5		1.50
			4.2 LWD Recruitment	Riparian miles protected		1		1		1.00
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	77.2	1,520		1,520		1,597.20
			5.2 Floodplain Condition	Riparian acres protected	53					53.00
			7.2 Increased Sediment Quantity	Wetland acres improved		98		98		98.00
			8.1 Temperature	Road miles improved		22		22		22.00
			8.2 Oxygen	Stream miles protected*	10.6					10.60
			8.4 Turbidity	Stream miles improved*	22.3					22.30
Snake River Spring/Summer Chinook	**Grande Ronde River Upper Mainstem**+	Flow	9.2 Decreased Water Quantity	Acre-feet protected		1,782		1,782		1,782.00
				cfs protected		6.5	14	21	215	20.50
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	13	3	2	5	67	18.00
			2.3 Mechanical Injury	Access miles improved	107.6	5	12	17	240	124.60
				Screens addressed			2	2	No Data	2.00
		Complexity	6.1 Bed & Channel Form 6.2 Instream Structural Complexity	Instream miles improved	61.9	43.8	38	82	87	143.70
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		31	17.4	48.4	56	48.40
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	183					183.00
			5.2 Floodplain Condition	Riparian acres protected	27	24		24		51.00
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved		59		59		59.00
			8.2 Oxygen	Stream miles protected*	0.85					0.85
			8.4 Turbidity	Stream miles improved*	30.1					30.10

Table 3. FCRPS BiOp RPA 34 and 35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. Data sources: RPAs 34 & 35 total metrics completed 2007-2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; metrics associated with 2013-2018 Expert Panel Actions per FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and additional metrics associated with 2013-2018 supplemental actions per FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35; *indicates metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists; ^indicates metrics listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists; No Data indicates metrics for which percent increase could not be calculated (i.e., new supplemental action metrics without equivalent metrics identified through the 2012 expert panel process); gray hatched cells indicate populations without supplemental actions].

ESU/DPS	Population	Metric Category	Limiting Factors to Be Addressed by 2013-2018 Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metrics Associated with 2013-2018 Expert Panel Actions	Additional Metrics Associated with 2013-2018 Supplemental Actions	Total Metrics Associated with 2013-2018 Expert Panel Actions + Supplemental Actions *(Sum of Columns G & H)*	Percent Increase in 2013-2018 Metrics due to Supplemental Actions	RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018) *(Sum of Columns F, G, & H)*
Snake River Spring/Summer Chinook	Salmon River Upper Mainstem above Redfish Lake+	Flow	9.2 Decreased Water Quantity	Acre-feet protected			*Metrics associated with supplemental actions for this population were not provided in the 2014-2018 IP, Appendix B, Table B-1.*			
				cfs protected	54.1	14				68.10
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	1	5				6.00
			2.3 Mechanical Injury	Access miles improved	3	18.5	*Per the 2013 CE, Appendix A, Upper Salmon River Adaptive Management Plan for 2013-2018 (page A-21), the Salmon River Upper Mainstem above Redfish Lake Chinook population is not a Table 5 priority population. "A habitat improvement project in Pole Creek, a tributary to the Upper Salmon River, doubled in scope since evaluation by the 2012 expert panel. The Action Agencies and regional partners expect that the benefits derived from this expanded project, along with the other projects identified, but evaluated with very conservative metrics at the time by the 2012 expert panel for this population, will contribute to meet or exceed the 2018 Table 5 HQI when more information is available for evaluation by the 2015 panel."*			21.50
				Screens addressed	3					3.00
		Complexity	6.1 Bed & Channel Form	Instream miles improved						
			6.2 Instream Structural Complexity							
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		2				2.00
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	7	6				13.40
			5.2 Floodplain Condition	Riparian acres protected	1.5					1.50
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved		2				2.00
			8.2 Oxygen	Stream miles protected*	0.9					0.90
Snake River Spring/Summer Chinook	**Yankee Fork+**	Flow	9.2 Decreased Water Quantity	Acre-feet protected						
				cfs protected						
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed						
			2.3 Mechanical Injury	Access miles improved						
				Screens addressed						
		Complexity	6.1 Bed & Channel Form	Instream miles improved	0.5	6.1	7	13.1	115	13.60
			6.2 Instream Structural Complexity							
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved						
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved		29		29		29.20
			5.2 Floodplain Condition	Riparian acres protected						
			7.2 Increased Sediment Quantity	Wetland acres improved		4.8		4.8		4.80
			8.1 Temperature	Road miles improved						

Table 3. FCRPS BiOp RPA 34 and 35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. Data sources: RPAs 34 & 35 total metrics completed 2007-2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; metrics associated with 2013-2018 Expert Panel Actions per FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and additional metrics associated with 2013-2018 supplemental actions per FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35; *indicates metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists; ^indicates metrics listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists; No Data indicates metrics for which percent increase could not be calculated (i.e., new supplemental action metrics without equivalent metrics identified through the 2012 expert panel process); gray hatched cells indicate populations without supplemental actions].

ESU/DPS	Population	Metric Category	Limiting Factors to Be Addressed by 2013-2018 Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metrics Associated with 2013-2018 Expert Panel Actions	Additional Metrics Associated with 2013-2018 Supplemental Actions	Total Metrics Associated with 2013-2018 Expert Panel Actions + Supplemental Actions *(Sum of Columns G & H)*	Percent Increase in 2013-2018 Metrics due to Supplemental Actions	RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018) *(Sum of Columns F, G, & H)*
Upper Columbia Spring Chinook	**Entiat River+**	Flow	9.2 Decreased Water Quantity	Acre-feet protected						
				cfs protected	0.3					0.30
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	2	3		3		5.00
			2.3 Mechanical Injury	Access miles improved	61	3.5		3.5		64.50
				Screens addressed	9	8		8		17.00
		Complexity	6.1 Bed & Channel Form	Instream miles improved	3.7		12.5	12.5	No Data	16.20
			6.2 Instream Structural Complexity	# of structures addressed^			100	100	No Data	100.00
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved						
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	4.11					4.11
			5.2 Floodplain Condition	Riparian acres protected	2.9					2.90
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved						
			8.2 Oxygen	Stream miles improved*	1.9					1.90
Snake River Summer Steelhead	**Lochsa River+**	Flow	9.2 Decreased Water Quantity	Acre-feet protected						
				cfs protected						
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	7	13	31	44	238	51.00
			2.3 Mechanical Injury	Access miles improved	14.3	56.5	12	68.5	21	82.80
				Screens addressed						
		Complexity	6.1 Bed & Channel Form 6.2 Instream Structural Complexity	Instream miles improved						
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved						
			4.2 LWD Recruitment	Riparian miles protected		75		75		75.00
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	8.5	1,549	4000	5,549	258	5,557.50
			5.2 Floodplain Condition	Riparian acres protected						
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved	14.5	268.3	385	653.3	143	667.80
			8.2 Oxygen	Stream miles improved*	56.1					56.10

Table 3. FCRPS BiOp RPA 34 and 35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. Data sources: RPAs 34 & 35 total metrics completed 2007-2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; metrics associated with 2013-2018 Expert Panel Actions per FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and additional metrics associated with 2013-2018 supplemental actions per FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35; *indicates metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists; ^indicates metrics listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists; No Data indicates metrics for which percent increase could not be calculated (i.e., new supplemental action metrics without equivalent metrics identified through the 2012 expert panel process); gray hatched cells indicate populations without supplemental actions].

ESU/DPS	Population	Metric Category	Limiting Factors to Be Addressed by 2013-2018 Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metrics Associated with 2013-2018 Expert Panel Actions	Additional Metrics Associated with 2013-2018 Supplemental Actions	Total Metrics Associated with 2013-2018 Expert Panel Actions + Supplemental Actions *(Sum of Columns G & H)*	Percent Increase in 2013-2018 Metrics due to Supplemental Actions	RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018) *(Sum of Columns F, G, & H)*
Snake River Summer Steelhead	**South Fork Clearwater River+**	Flow	9.2 Decreased Water Quantity	Acre-feet protected						
				cfs protected						
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	11	23	3	26	13	37.00
			2.3 Mechanical Injury	Access miles improved	30.5	71.7	150	221.7	209	252.20
				Screens addressed						
		Complexity	6.1 Bed & Channel Form	Instream miles improved	3.8	8.1	0.25	8.35	3	12.15
			6.2 Instream Structural Complexity	# of structures addressed^			35	35	No Data	35.00
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		15		15		15.00
			4.2 LWD Recruitment	Riparian miles protected			0.34	0.34	No Data	0.34
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	146.7	277		277		423.20
			5.2 Floodplain Condition	Riparian acres protected	333					333.00
			7.2 Increased Sediment Quantity	Wetland acres improved		38	10.6	48.6	28	48.60
			8.1 Temperature	Road miles improved		179.6	63	242.6	35	242.60
			8.2 Oxygen	Stream miles protected*	2.5					2.50
			8.4 Turbidity	Stream miles improved*	19					19.00
Snake River Spring/Summer Chinook	Pahsimeroi River	Flow	9.2 Decreased Water Quantity	Acre-feet protected	1553.1					
				cfs protected	36.7	14				50.70
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	13	17				30.00
			2.3 Mechanical Injury	Access miles improved	20	73.4				93.40
				Screens addressed	4	5				9.00
		Complexity	6.1 Bed & Channel Form	Instream miles improved		17.8				17.80
			6.2 Instream Structural Complexity	# of structures addressed^						
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		9				9.00
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	7.9					7.90
			5.2 Floodplain Condition	Riparian acres protected	14.6					14.60
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved						
			8.2 Oxygen	Stream miles protected*	8.1					8.10
			8.4 Turbidity	Stream miles improved*	4.2					4.20

Table 3. FCRPS BiOp RPA 34 and 35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. Data sources: RPAs 34 & 35 total metrics completed 2007-2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; metrics associated with 2013-2018 Expert Panel Actions per FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and additional metrics associated with 2013-2018 supplemental actions per FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions. [**Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35; *indicates metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists; ^indicates metrics listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists; No Data indicates metrics for which percent increase could not be calculated (i.e., new supplemental action metrics without equivalent metrics identified through the 2012 expert panel process); gray hatched cells indicate populations without supplemental actions].

ESU/DPS	Population	Metric Category	Limiting Factors to Be Addressed by 2013-2018 Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metrics Associated with 2013-2018 Expert Panel Actions	Additional Metrics Associated with 2013-2018 Supplemental Actions	Total Metrics Associated with 2013-2018 Expert Panel Actions + Supplemental Actions *(Sum of Columns G & H)*	Percent Increase in 2013-2018 Metrics due to Supplemental Actions	RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018) *(Sum of Columns F, G, & H)*
Upper Columbia Summer Steelhead	**Methow River**	Flow	9.2 Decreased Water Quantity	Acre-feet protected	973.4	7,351				8,324.40
				cfs protected	101	14				115.00
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	5	8				13.00
			2.3 Mechanical Injury	Access miles improved	95.6	42				137.60
				Screens addressed	4	7				11.00
		Complexity	6.1 Bed & Channel Form	Instream miles improved	7.2	23.2				30.40
			6.2 Instream Structural Complexity	# of structures addressed^						
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		4.6				4.60
			4.2 LWD Recruitment	Riparian miles protected	362.9					362.90
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	42.1	153				194.80
			5.2 Floodplain Condition	Riparian acres protected		0.3				
			7.2 Increased Sediment Quantity	Wetland acres improved		167.9				167.90
			8.1 Temperature	Road miles improved						
			8.2 Oxygen	Stream miles protected*	9.9					9.90
			8.4 Turbidity	Stream miles improved*	5.7					5.70
Upper Columbia Summer Steelhead	**Okanogan River**	Flow	9.2 Decreased Water Quantity	Acre-feet protected	2584.9	4,630				7,214.90
				cfs protected	208.8	7.5				216.30
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	20	3				23.00
			2.3 Mechanical Injury	Access miles improved	43.1	26.6				69.70
				Screens addressed	1	55				56.00
		Complexity	6.1 Bed & Channel Form	Instream miles improved	4.6	2.4				7.00
			6.2 Instream Structural Complexity	# of structures addressed^						
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved		4.6				4.60
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	113.1	0.4				113.50
			5.2 Floodplain Condition	Riparian acres protected	169.6					169.60
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved		5				5.00
			8.2 Oxygen	Stream miles protected*	4					4.00
			8.4 Turbidity	Stream miles improved*	9					9.00

Table 3. FCRPS BiOp RPA 34 and 35 2007-2012 completed and RPA 35 2013-2018 planned tributary habitat metrics for the seven supplemental action and additional four non-hydro benefit spring/summer Chinook and summer steelhead populations. Data sources: RPAs 34 & 35 total metrics completed 2007-2012 per FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; metrics associated with 2013-2018 Expert Panel Actions per FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and additional metrics associated with 2013-2018 supplemental actions per FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions. **[Bold** entries indicate priority populations; + indicates 2012-2018 supplemental action populations per 2013 CE, Section 2, Table 35; *indicates metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists; ^indicates metrics listed in the 2014-2018 IP Appendix B project list, but not the 2013 CE &/or 2014-2018 IP Appendix A project lists; No Data indicates metrics for which percent increase could not be calculated (i.e., new supplemental action metrics without equivalent metrics identified through the 2012 expert panel process); gray hatched cells indicate populations without supplemental actions].

ESU/DPS	Population	Metric Category	Limiting Factors to Be Addressed by 2013-2018 Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metrics Associated with 2013-2018 Expert Panel Actions	Additional Metrics Associated with 2013-2018 Supplemental Actions	Total Metrics Associated with 2013-2018 Expert Panel Actions + Supplemental Actions *(Sum of Columns G & H)*	Percent Increase in 2013-2018 Metrics due to Supplemental Actions	RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018) *(Sum of Columns F, G, & H)*
Upper Columbia Summer Steelhead	**Wenatchee River**	Flow	9.2 Decreased Water Quantity	Acre-feet protected						
				cfs protected	1.2	15				16.20
		Passage Entrainment	1.1 Anthropogenic Barriers	Barriers addressed	29	2				31.00
			2.3 Mechanical Injury	Access miles improved	24.9	26.5				51.40
				Screens addressed	5					5.00
		Complexity	6.1 Bed & Channel Form	Instream miles improved	1.68	20.1				21.78
			6.2 Instream Structural Complexity	# of structures addressed^						
		WQ/Riparian	4.1 Riparian Condition	Riparian miles improved						
			4.2 LWD Recruitment	Riparian miles protected						
			5.1 Side Channel & Wetland Conditions	Riparian acres improved	6.2	23.9				30.10
			5.2 Floodplain Condition	Riparian acres protected						
			7.2 Increased Sediment Quantity	Wetland acres improved						
			8.1 Temperature	Road miles improved						
			8.2 Oxygen	Stream miles protected*						
			8.4 Turbidity	Stream miles improved*	1					1.00

Table 4a. FCRPS BiOp RPA 35, Table 5 Habitat Quality Improvements (HQIs) achieved from 2007-2012, projected for 2012-2018, and associated tributary habitat metrics for the Catherine Creek spring/summer Chinook priority population. [Data sources: FCRPS Comprehensive Evaluation, Section 2, Table 35; FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions; **blue** entries indicate ODFW calculations; * entries indicate metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists].

		From RPA Action 35, Table 5		Results from Expert Panel Evaluations			
ESU	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions	Habitat Quality Improvement Achieved through 2009	Percentage of RPA Action 35 Table 5, 2009 Habitat Quality Improvement Achieved	Habitat Quality Improvement Achieved through 2011	Percentage of RPA Action 35 Table 5, 2018 Habitat Quality Improvement Achieved through 2011
Snake River Spring/Summer Chinook	Catherine Creek	4	23	3	**75**	5	**22**

Table 4b. FCRPS BiOp RPA 35, Table 5 Habitat Quality Improvements (HQIs) achieved from 2007-2012, projected for 2012-2018, and associated tributary habitat metrics for the Catherine Creek spring/summer Chinook priority population. [Data sources: FCRPS Comprehensive Evaluation, Section 2, Table 35; FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions; **blue** entries indicate ODFW calculations; * entries indicate metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists].

Results from Expert Panel Evaluations cont

Habitat Treatment Metric Category	Limiting Factors to Be Addressed by 2013-2018 Habitat Actions	Treatment Metrics	RPAs 34 & 35 Total Metrics Completed 2007-2012	Metric Estimates Associated with 2013-2018 Expert Panel Actions	Habitat Quality Improvement Achieved through 2011 + 2012-2018 Estimates	Metric Estimates Associated with 2013-2018 Supplemental Actions
Flow	9.2 Decreased Water Quantity	Acre-feet protected	381.2	3,230		
		cfs protected	1.7	3		3
Passage Entrainment	1.1 Anthropogenic Barriers 2.3 Mechanical Injury	Barriers addressed	12	14		1
		Access miles improved	126.8	30.8		
		Screens addressed		1		
Complexity	6.1 Bed & Channel Form 6.2 Instream Structural Complexity	Instream miles improved	20.8	19.2		12.45
WQ/Riparian	4.1 Riparian Condition 4.2 LWD Recruitment 5.1 Side Channel & Wetland Conditions 5.2 Floodplain Condition 7.2 Increased Sediment Quantity 8.1 Temperature 8.2 Oxygen 8.4 Turbidity	Riparian miles improved		1.5	11	
		Riparian miles protected		1		
		Riparian acres improved	77.2	1,520		
		Riparian acres protected	53			
		Wetland acres improved		98		
		Road miles improved		22		
		Stream miles protected*	10.6			
		Stream miles improved*	22.3			

Table 4c. FCRPS BiOp RPA 35, Table 5 Habitat Quality Improvements (HQIs) achieved from 2007-2012, projected for 2012-2018, and associated tributary habitat metrics for the Catherine Creek spring/summer Chinook priority population. [Data sources: FCRPS Comprehensive Evaluation, Section 2, Table 35; FCRPS 2013 Comprehensive Evaluation, Section 3, Attachment 2-Table 1; FCRPS 2014-2018 Implementation Plan, Appendix A Project Lists; and FCRPS 2014-2018 Implementation Plan, Appendix B, Table B-1 Tributary Habitat Supplemental Actions; **blue** entries indicate ODFW calculations; * entries indicate metrics listed in the 2013 CE, but not the 2014-2018 IP Appendix A project lists].

Including Menu of Supplemental Projects		Percentage at or above 2018 Table 5 Habitat Quality Improvement			
RPAs 34 & 45 Total Metrics Completed (2007-2012) & Planned (2013-2018)	Habitat Quality Improvement Achieved through 2011 + 2012-2018 Estimates	Percentage of 2018 Habitat Quality Improvement through 2011 (based on Expert Panel Evaluations)	Projected Percentage of 2018 Habitat Quality Improvement Based on Expert Panel Identified Projects through 2018	Projected Percentage of 2018 Habitat Quality Improvement Based on Full Menu of Identified Projects Available through 2018	Percent Increase in Projected Percentage of 2018 Habitat Quality Improvement Estimates (Expert Panel Estimate versus Expert Panel + Supplemental Projects Estimate)
3611.2	15	22	**48**	65	**36**
7.7					
27					
157.6					
1					
52.45					
1.5					
1					
1597.2					
53					
98					
22					
10.6					
22.3					

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Coding: {Administrative Record Numbers are enclosed in brackets like these.} {} means we have not found an Administrative Record Number.

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