Science, Service, Stewardship

5-Year Review: Summary & Evaluation of **Snake River Sockeye** **Snake River Spring-Summer Chinook** **Snake River Fall-Run Chinook** **Snake River Basin Steelhead**

National Marine Fisheries Service
Northwest Region
Portland, OR

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5-Year Review: Snake River Species

Species Reviewed	Evolutionarily Significant Unit or Distinct Population Segment
Sockeye Salmon (*Oncorhynchus nerka*)	*Snake River Sockeye*
Chinook Salmon (*O. tshawytscha*)	*Snake River Spring/Summer Chinook* *Snake River Fall-run Chinook*
Steelhead (*O. mykiss*)	*Snake River basin Steelhead*

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1 ▪ General Information

1.1 Introduction

Many West Coast salmon and steelhead (Oncorhynchus spp.) stocks have declined substantially from their historic numbers and now are at a fraction of their historical abundance. There are several factors that contribute to these declines, including: overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices. These factors collectively led to the National Marine Fisheries Service's (NMFS) listing of 28 salmon and steelhead stocks in California, Idaho, Oregon, and Washington under the Federal Endangered Species Act (ESA).

The ESA, under section 4(c)(2), directs the Secretary of Commerce to review the listing classification of threatened and endangered species at least once every five years. After completing this review, the Secretary must determine if any species should be: (1) removed from the list; (2) have its status changed from threatened to endangered; or (3) have its status changed from endangered to threatened. The most recent listing determinations for most salmon and steelhead occurred in 2005 and 2006. This document describes the results of the agency's five-year review of the ESA-listed salmonid species in the Snake River (SR) basin. These include: SR sockeye salmon, SR spring/summer Chinook salmon, SR fall-run Chinook salmon, and SR basin steelhead.

1.1.1 Background on listing determinations

The ESA defines species to include subspecies and distinct population segments (DPS) of vertebrate species. A species may be listed as threatened or endangered. To identify distinct population segments of salmon species we apply the "Policy on Applying the Definition of Species under the ESA to Pacific Salmon" (56 FR 58612). Under this policy we identify population groups that are "evolutionarily significant units" (ESU) within their species. We consider a group of populations to be an ESU if it is substantially reproductively isolated from other populations, and represents an important component in the evolutionary legacy of the biological species. We consider an ESU as constituting a DPS and therefore a "species" under the ESA.

To identify DPSs of steelhead, we apply the joint U.S. Fish and Wildlife Service-National Marine Fisheries Service DPS policy (61 FR 4722) rather than the ESU policy. Under this policy, a DPS of steelhead must be discrete from other populations, and it must be significant to its taxon.

Artificial propagation programs (hatcheries) are common throughout the range of ESA-listed West Coast salmon and steelhead. Prior to 2005, our policy was to include in the listed ESU or DPS only those hatchery fish deemed "essential for conservation" of the species. We revised that approach in response to a court decision and on June 28, 2005, announced a final policy

addressing the role of artificially propagated Pacific salmon and steelhead in listing determinations under the ESA (70 FR 37204) (hatchery listing policy). This policy establishes criteria for including hatchery stocks in ESUs and DPSs. In addition, it (1) provides direction for considering hatchery fish in extinction risk assessments of ESUs and DPSs; (2) requires that hatchery fish determined to be part of an ESU or DPS be included in any listing of the ESU or DPS; (3) affirms our commitment to conserving natural salmon and steelhead populations and the ecosystems upon which they depend; and (4) affirms our commitment to fulfilling trust and treaty obligations with regard to the harvest of some Pacific salmon and steelhead populations, consistent with the conservation and recovery of listed salmon ESUs and steelhead DPSs.

To determine whether a hatchery program is part of an ESU or DPS, and therefore must be included in the listing, we consider the origins of the hatchery stock, where the hatchery fish are released, and the extent to which the hatchery stock has diverged genetically from the donor stock. We include within the ESU or DPS (and therefore within the listing) hatchery fish that are derived from the population in the area where they are released, and that are no more than moderately diverged from the local population.

Because the new hatchery listing policy changed the way we considered hatchery fish in ESA listing determinations, we completed new status reviews and ESA listing determinations for West Coast salmon ESUs and steelhead DPSs. On June 28, 2005, we issued final listing determinations for 16 ESUs of Pacific salmon (70 FR 37160). On January 5, 2006 we issued final listing determinations for 10 DPSs of steelhead (71 FR 834).

1.2 Methodology used to complete the review

On March 18, 2010, we announced the initiation of five-year reviews for 16 ESUs of salmon and 10 DPSs of steelhead in Oregon, California, Idaho, and Washington (75 FR 13082). We requested that the public submit new information on these species that has become available since our listing determinations in 2005 and 2006. In response to our request, we received information from Federal and state agencies, Native American Tribes, conservation groups, fishing groups, and individuals. We considered this information, as well as information routinely collected by our agency, to complete these five year reviews.

To complete the reviews, we first asked scientists from our Northwest Fisheries Science Center to collect and analyze new information about ESU and DPS viability. To evaluate viability, our scientists used the Viable Salmonid Population concept developed by McElhany et al. (2000). The VSP concept evaluates four criteria – abundance, productivity, spatial structure, and diversity – to assess species viability. Through the application of this concept, the Science Center considered new information on the four salmon and steelhead population viability criteria. They also considered new information on ESU and DPS boundaries. At the end of this process, the science teams prepared reports detailing the results of their analyses (Ford et al. 2010).

To further inform the reviews, we also asked salmon management biologists from our Northwest Region familiar with hatchery programs to consider new information available since the previous

listing determinations. Among other things, they considered hatchery programs that have ended, new hatchery programs that have started changes in the operation of existing programs, and scientific data relevant to the degree of divergence of hatchery fish from naturally spawning fish in the same area. They produced a report (Jones et al. 2011) describing their findings. Finally, we consulted biologists and other salmon management specialists from the Northwest Region who are familiar with hatchery programs, habitat conditions, hydropower operations, and harvest management. In a series of structured meetings, by geographic area, these biologists identified relevant information and provided their insights on the degree to which circumstances have changed for each listed entity.

In preparing this report, we considered all relevant information, including the work of the Northwest Fisheries Science Center (Ford et al. 2010;); the report of the regional biologists regarding hatchery programs (Jones et al. 2011); recovery plans for the species in question; technical reports prepared in support of recovery plans for the species in question; the listing record (including designation of critical habitat and adoption of protective regulations); recent biological opinions issued for ESA-listed Snake River basin salmon and steelhead; information submitted by the public and other government agencies; and the information and views provided by the geographically based management teams. The present report describes the agency's findings based on all of the information considered.

1.3 Background – Summary of Previous Reviews, Statutory and Regulatory Actions, and Recovery Planning

1.3.1 Federal Register Notice announcing initiation of this review

75 FR 13082; March 18, 2010

1.3.2 Listing history

Beginning in 1991, NMFS began listing salmonid species in the Snake River basin under the ESA. Over the next several years, four species of salmonids in this area were listed as threatened or endangered (Table 1).

Table 1. Summary of the listing history under the Endangered Species Act for ESUs and DPS in the Snake River basin.

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)
Sockeye Salmon (*O. nerka*)	Snake River Sockeye Salmon	**FR Notice:** 56 FR 58619 **Date:** 11/20/1991 **Classification:** Endangered	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005 **Classification:** Endangered
Chinook Salmon (*O. tshawytscha*)	Snake River Spring/ Summer Chinook salmon	**FR Notice:** 57 FR 34639 **Date:** 4/22/1992 **Classification:** Threatened	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005 **Classification:** Threatened
Chinook Salmon (*O. tshawytscha*)	Snake River Fall-Run Chinook Salmon	**FR Notice:** 57 FR 14653 **Date:** 4/22/1992 **Classification:** Threatened	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005 **Classification:** Threatened
Steelhead (*O. mykiss*)	Snake River Basin Steelhead	**FR Notice:** 62 FR 43937 **Date:** 8/18/1997 **Classification:** Threatened	**FR Notice:** 71 FR 834 **Date:** 1/5/2006 **Classification:** Threatened

1.3.3 Associated rulemakings

The ESA requires NMFS to designate critical habitat, to the maximum extent prudent and determinable, for species it lists under the ESA. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time of listing if the agency determines that the area itself is essential for conservation. We designated critical habitat for Snake River sockeye salmon and fall-run Chinook salmon in 1993. Critical habitat was designated for Snake River spring/summer Chinook salmon and steelhead in 1999 and 2005, respectively.

Section 9 of the ESA prohibits the take of species listed as endangered. The ESA defines take to mean harass, harm, pursue, hunt, shoot, wound, trap, capture, or collect, or attempt to engage in any such conduct. For threatened species, the ESA does not automatically prohibit take, but instead authorizes the agency to adopt regulations it deems necessary and advisable for species conservation including regulations that prohibit take (ESA section 4(d)). For threatened salmonids, NMFS has adopted 4(d) regulations that prohibit take except in specific circumstances. In 2000 and again in 2005, we applied 4(d) protective regulations to the three Snake River species listed as threatened.

Table 2. Summary of rulemaking for 4(d) protective regulations and critical habitat for ESUs and DPS in the Snake River basin.

Salmonid Species	ESU/DPS Name	4(d) Protective Regulations	Critical Habitat Designations
Sockeye Salmon (*O. nerka*)	Snake River Sockeye Salmon	ESA section 9 prohibitions apply	**FR Notice:** 58 FR 68543 **Date:** 12/28/1993
Chinook Salmon (*O. tshawytscha*)	Snake River Spring/ Summer Chinook Salmon	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005	**FR Notice:** 64 FR 57399 **Date:** 10/25/1999
Chinook Salmon (*O. tshawytscha*)	Snake River Fall-Run Chinook Salmon	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005	**FR Notice:** 58 FR 68543 **Date:** 12/28/1993
Steelhead (*O. mykiss*)	Snake River Basin Steelhead	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005	**FR Notice:** 70 FR 52630 **Date:** 9/2/2005

1.3.4 Review History

Table 3 lists the numerous scientific assessments of the status of the listed salmon and steelhead in the Snake River basin. These assessments include status reviews conducted by our Northwest Fisheries Science Center and technical reports prepared in support of recovery planning for these species.

Table 3. Summary of previous scientific assessments for the ESUs and DPS in the Snake River basin.

Salmonid Species	ESU/DPS Name	Document Citation
Sockeye Salmon (*O. nerka*)	Snake River Sockeye Salmon	ICTRT 2007 Good et al. 2005 McClure et al. 2005 ICTRT 2003 NMFS 1991a
Chinook Salmon (*O. tshawytscha*)	Snake River Spring/ Summer Chinook Salmon	ICTRT 2007 ICTRT and Zabel 2007 Good et al. 2005 McClure et al. 2005 ICTRT 2003 NMFS 1998 NMFS 1991b
Chinook Salmon (*O. tshawytscha*)	Snake River Fall-Run Chinook Salmon	ICTRT 2007 ICTRT and Zabel 2007 Good et al. 2005 McClure et al. 2005 ICTRT 2003 NMFS 1999 NMFS 1991c
Steelhead (*O. mykiss*)	Snake River Basin Steelhead	ICTRT 2007 ICTRT and Zabel 2007 Good et al. 2005 McClure et al. 2005 ICTRT 2003 NMFS 1997 NMFS 1996

1.3.5 Species' Recovery Priority Number at Start of 5-year Review Process

On June 15, 1990, NMFS issued guidelines (55 FR 24296) for assigning listing and recovery priorities. We assess three criteria to determine a species' priority for recovery plan development, implementation, and resource allocation: (1) magnitude of threat; (2) recovery potential; and (3) existing conflict with activities such as construction and development. Table 4 lists the recovery priority numbers for the subject species, as reported in the 2006-2008 Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species (available at: http://www.nmfs.noaa.gov/pr/pdfs/laws/esabiennial2008.pdf).

1.3.6 Recovery Plan or Outline

Table 4. Recovery Priority Number and Endangered Species Act Recovery Plans for the ESUs and DPSs in the Snake River basin.

Salmonid Species	ESU/DPS Name	Recovery Priority Number	Recovery Plans/Outline
Sockeye Salmon (*O. nerka*)	Snake River Sockeye Salmon	3	Under Development
Chinook Salmon (*O. tshawytscha*)	Snake River Spring/ Summer Chinook Salmon	1	Under Development
Chinook Salmon (*O. tshawytscha*)	Snake River Fall-Run Chinook Salmon	1	Under Development
Steelhead (*O. mykiss*)	Snake River Basin Steelhead	1	Under Development

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2 · Review Analysis

In this section we review new information to determine whether species' delineations remain appropriate.

2.1 Delineation of Species under the Endangered Species Act

Is the species under review a vertebrate?

ESU/DPS Name	YES	NO
Snake River Sockeye Salmon	X	
Snake River Spring/Summer Chinook Salmon	X	
Snake River Fall-Run Chinook Salmon	X	
Snake River Basin Steelhead	X	

Is the species under review listed as an ESU/DPS?

ESU/DPS Name	YES	NO
Snake River Sockeye Salmon	X	
Snake River Spring/Summer Chinook Salmon	X	
Snake River Fall-Run Chinook Salmon	X	
Snake River Basin Steelhead	X	

Was the ESU/DPS listed prior to 1996?

ESU/DPS Name	YES	NO	Date Listed if Prior to 1996
Snake River Sockeye Salmon	X		11/20/1991
Snake River Spring/Summer Chinook Salmon	X		04/22/1992
Snake River Fall-Run Chinook Salmon	X		04/22/1992
Snake River Basin Steelhead		X	N/A

Prior to this 5-year review, was the ESU/DPS classification reviewed to ensure it meets the 1996 DPS policy standards?

Not Applicable; NMFS applied the ESU policy to Snake River salmon. Snake River basin steelhead were listed as a DPS after 1996.

2.1.1 Summary of relevant new information regarding the delineation of the Snake River basin ESUs/DPSs

ESU/DPS Boundaries

This section provides a summary of information presented in Ford et al. 2010: Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Northwest.

The Northwest Fisheries Science Center team found no new information since the last status review that would justify a change in boundaries of the SR sockeye salmon ESU, SR spring/summer Chinook salmon ESU, SR fall-run Chinook salmon ESU, or the SR basin steelhead DPS (Ford et al. 2010).

Membership of Hatchery Programs

In preparing this report, our management biologists reviewed the available information regarding hatchery membership of these ESUs and DPS (Jones et al. 2011). They considered changes in hatchery programs that occurred since the last status review (e.g., some have been terminated while others are new) and made recommendations about the inclusion or exclusion of specific programs. They also noted any errors and omissions in the existing descriptions of hatchery population membership. NMFS intends to address any needed changes and corrections via separate rulemaking subsequent to the completion of these five-year status reviews.

Currently, the SR sockeye ESU includes populations of anadromous sockeye salmon in the Snake River basin, Idaho (extant populations occur only in the Stanley Basin) (56 FR 58619; November 20, 1991), as well as residual sockeye salmon in Redfish Lake, Idaho, and one captive propagation hatchery program. Artificially propagated sockeye salmon from the Redfish Lake Captive Propagation program are considered part of this ESU. In 1993 NMFS determined that the residual population of SR sockeye that exists in Redfish Lake is substantially reproductively isolated from kokanee (i.e., non-anadromous populations *of O. nerka* that become resident in lake environments over long periods of time), represents an important component in the evolutionary legacy of the biological species, and thus was included in the SR sockeye ESU (70 FR 37160). The SR sockeye salmon hatchery program has not changed substantially from the previous ESA status review. Jones et al. (2011) did not recommend further review of this program.

The SR fall-run Chinook ESU includes all naturally spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins (57 FR 14653, April 22, 1992; 57 FR 23458, June 3, 1992). Four artificial propagation programs are considered to be part of the ESU: the Lyons Ferry Hatchery, Fall Chinook Acclimation Ponds

Program, Nez Perce Tribal Hatchery, and Oxbow Hatchery fall-run Chinook hatchery programs (70 FR 37160).

Although the SR fall-run Chinook salmon hatchery programs have not changed substantially from the previous ESA status review, Jones et al. (2011) recommended monitoring these programs. Ongoing use of composite broodstock for all programs and low levels of natural-origin fish incorporated into the broodstock may lead to divergence from the listed natural-origin population.

The SR spring/summer Chinook salmon ESU includes all naturally spawned populations of spring/summer Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (57 FR 23458; June 3, 1992). Fifteen artificial propagation programs are also considered to be part of the ESU: the Tucannon River conventional Hatchery, Tucannon River Captive Broodstock Program, Lostine River, Catherine Creek, Lookingglass Hatchery Reintroduction Program (Catherine Creek stock), Upper Grande Ronde, Imnaha River, Big Sheep Creek, McCall Hatchery, Johnson Creek Artificial Propagation Enhancement, Lemhi River Captive Rearing Experiment, Pahsimeroi Hatchery, East Fork Captive Rearing Experiment, West Fork Yankee Fork Captive Rearing Experiment, and the Sawtooth Hatchery spring/summer-run Chinook hatchery programs. We have determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (70 FR 37160).

Jones et al. (2011) identified several SR spring/summer Chinook salmon hatchery programs that have been revised or may warrant further review. Three hatchery programs in the Salmon River basin (the Lemhi River, East Fork Salmon River, and West Fork Yankee Fork River captive rearing experiments) were terminated in 2009 and should be removed from the ESU. Two new spring/summer Chinook salmon programs (Yankee Fork and Dollar Creek) in the upper Salmon River should be considered for inclusion in the ESU because they were initiated with currently listed stocks and the propagated fish are being released within-ESU boundaries.

In addition, Jones et al. (2011) recommended further review of two existing programs in the SR spring/summer Chinook salmon ESU. The Imnaha River hatchery program warrants further review because of shifts in age structure and run timing, combined with decreasing natural origin contribution in both broodstock and natural spawners. The Big Sheep Creek hatchery program also warrants further review because it is composed of the Imnaha stock and program goals remain undefined and the program has unknown impacts on the natural population in this watershed.

The SR basin steelhead DPS includes all naturally spawned populations of steelhead in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho (62 FR 43937; August 18, 1997). Six artificial propagation programs are also considered part of the DPS: the Tucannon River, Dworshak NFH, Lolo Creek, North Fork Clearwater, East Fork Salmon River,

and the Little Sheep Creek/Imnaha River Hatchery steelhead hatchery programs (71 FR 834; January 5, 2006).

Jones et al. (2011) identified several SR basin steelhead hatchery programs that have been revised or may warrant further review since the previous ESA status review. Jones et al. (2011) recommended that three new programs (Squaw Creek B-run, Streamside Incubator Project, and Yankee Fork) not be included in the SR basin steelhead DPS. The Streamside Incubator Project and Yankee Fork were established using stocks that are not part of this DPS. The Squaw Creek B-run program introduces Clearwater B-run steelhead into the Salmon River basin where they are not native. Jones et al. (2011) also recommended further review of four existing programs in the SR basin steelhead DPS. Three existing hatchery programs warrant further review because of practices where no natural-origin fish are being used for broodstock and these are: the Dworshak National Fish Hatchery program, Lolo Creek on the Clearwater River, and the North Fork Clearwater hatchery program. Additionally, the Little Sheep Creek/Imnaha River hatchery warrants further review because of the potential for divergence based on decreasing natural-origin influence and unknown impact on the natural-origin population. No current Snake River basin steelhead hatchery programs have been terminated since the time of the last status review.

2.2 Recovery Criteria

The ESA requires that NMFS develop recovery plans for each listed species. Recovery plans must contain, to the maximum extent practicable, objective measureable criteria for delisting the species, site-specific management actions necessary to recover the species, and time and cost estimates for implementing the recovery plan.

2.2.1 Do the species have final, approved recovery plans containing objective, measurable criteria?

ESU/DPS Name	YES	NO
Snake River Sockeye Salmon		X
Snake River Spring/Summer Chinook Salmon		X
Snake River Fall-Run Chinook Salmon		X
Snake River Basin Steelhead		X

2.2.2 Adequacy of recovery criteria

Based on new information considered during this review, are the recovery criteria still appropriate?*

ESU/DPS Name	YES	NO
Snake River Sockeye Salmon	X	
Snake River Spring/Summer Chinook Salmon	X	
Snake River Fall-Run Chinook Salmon	X	
Snake River Basin Steelhead	X	

* The recovery criteria reflect the best available information, but are recommendations only at this point, as they have not yet been adopted in a final recovery plan.

Are all of the listing factors that are relevant to the species addressed in the recovery criteria?

ESU/DPS Name	YES	NO
Snake River Sockeye Salmon	N/A	N/A
Snake River Spring/Summer Chinook Salmon	N/A	N/A
Snake River Fall-run Chinook Salmon	N/A	N/A
Snake River Basin Steelhead	N/A	N/A

2.2.3 List the recovery criteria as they appear in the recovery plan

NMFS is currently writing a recovery plan for the four ESA-listed Snake River salmon and steelhead species addressed in this five-year status review; therefore, final or interim recovery criteria are not currently available. We have initiated recovery planning for the Snake River listed species based upon three "management unit (MU) plans" – Idaho, northeast Oregon and southeast Washington – encompassing the Snake River drainage. While each of these MU plans will meet ESA requirements and will use consistent scientific principles, each MU plan will be unique based on local initiatives and conditions. An ESU/DPS-level Snake River recovery plan will "roll-up" the information from the MU plans and provide additional ESA required information needed for a species-level recovery plan.

For the purposes of reproduction, salmon and steelhead typically exhibit a metapopulation structure (Schtickzelle and Quinn 2007, McElhany et al. 2000). Rather than interbreeding as one large aggregation, ESUs and DPSs function as a group of demographically independent populations separated by areas of unsuitable spawning habitat. For conservation and management purposes, it is important to identify the independent populations that make up an ESU or DPS. For the purposes of recovery planning and development of recovery criteria, the

Interior Columbia Technical Recovery Team (ICTRT) identified independent populations for each SR ESA-listed species, and grouped them together into genetically similar major population groups (MPGs) (ICTRT 2003). The SR spring/summer Chinook salmon ESU is comprised of five MPGs: Lower Snake River, Grande Ronde/Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River. The SR fall-run Chinook salmon ESU has one MPG: the Snake River MPG. One population (the Lower Mainstem population) in the MPG is extant and the two other populations (located above Hells Canyon Dam) are extirpated. The SR sockeye ESU has one extant MPG. The SR basin steelhead DPS is comprised of five extant MPGs: Clearwater River, Grande Ronde River, Imnaha River, Lower Snake River, and the Salmon River. The SR basin steelhead DPS also includes the Hells Canyon Tributaries MPG but does not contain an extant population and therefore is not expected to contribute to recovery of the DPS.

The ICTRT also developed specific biological viability criteria for application at the ESU/DPS, MPG, and independent population scales (ICTRT 2007). The viability criteria are based on the VSP concept (McElhaney et al. 2000). The ICTRT report identified population-specific biological viability criteria for each of the individual populations within the MPGs for each ESU and DPS. These criteria are integrated to develop a total population viability rating. The population viability ratings, in order of increasing risk, are highly viable, viable, moderate risk and high risk. A further bifurcation occurs at the moderate risk rating. Populations rated at moderate risk are candidates for achieving a "maintained" status. Additional criteria to be identified in the Recovery Plan must be met before a population at moderate risk can be considered "maintained." Populations that do not meet these additional criteria would remain rated at moderate risk and would generally not contribute to viability at the MPG level.

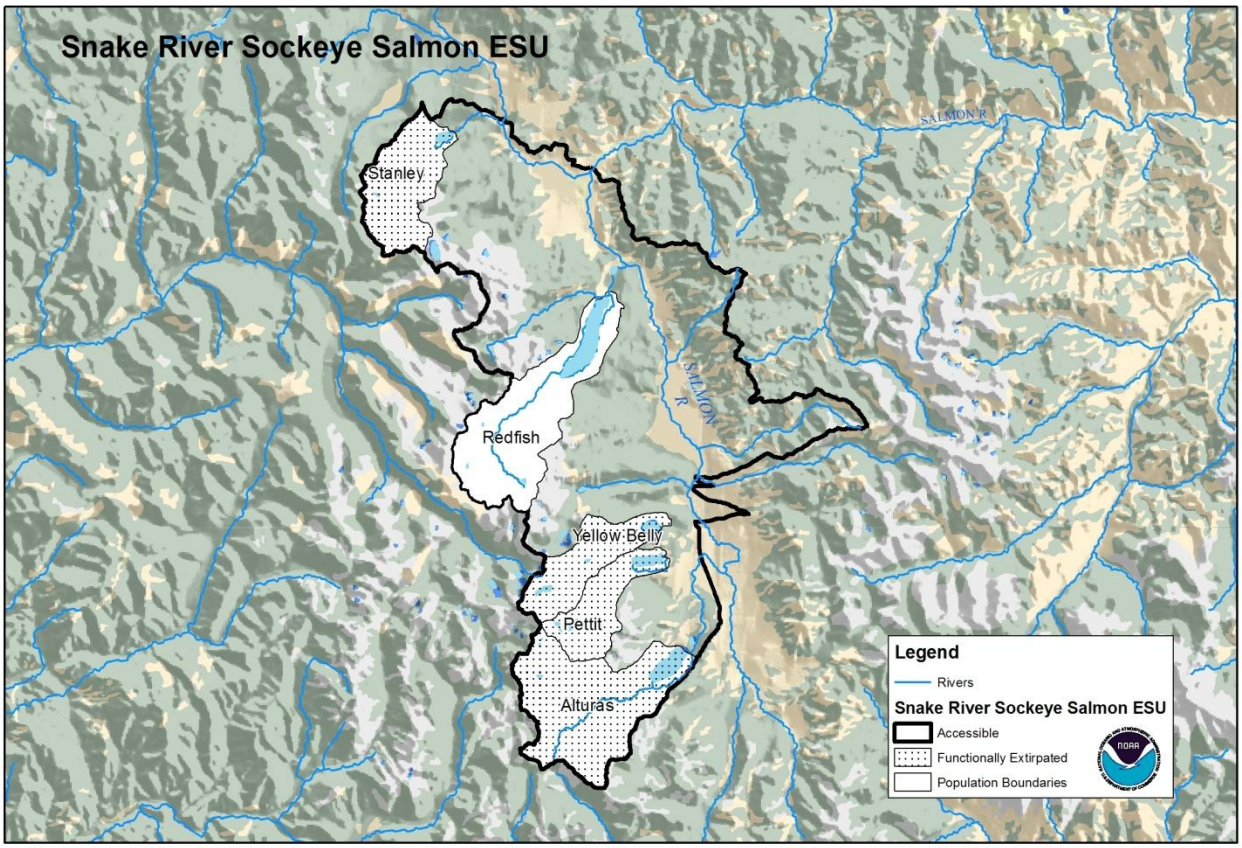
Recovery strategies outlined in the ICTRT viability criteria report (ICTRT 2007) are targeted to achieve, at a minimum, the ICTRT's biological viability criteria for each major population grouping. Accordingly, the criteria are designed "[t]o have all major population groups at viable (low risk) status with representation of all the major life history strategies present historically, and with the abundance, productivity, spatial structure and diversity attributes required for long-term persistence." The Snake River recovery plan will recognize that, at the MPG level, there may be several alternative combinations of populations that could satisfy the ICTRT viability criteria. Each of the MU plans will identify specific combinations that are the most likely to achieve viability for each of the major population groups (Ford et al. 2010).

The ICTRT recommends that each extant MPG should include viable populations totaling at least half of the populations historically present, with all major life-history groups represented. In addition, the viable populations within an MPG should include proportional representation of the large and very large populations that were present historically. Within any particular MPG, there may be several alternative combinations of populations that could satisfy the ICTRT criteria. The ICTRT identified example scenarios described below that would satisfy the criteria for all extant MPGs (ICTRT 2007). In each case the remaining populations in an MPG should be at or above maintained status.

The following ICTRT recommended MPG-level scenarios are consistent with the ICTRT biological criteria for each ESU/DPS and will be used to develop proposed recovery strategies for each ESA-listed SR salmon and steelhead species in the draft Snake River recovery plan. The recovery scenarios presented below are not final and may be modified prior to notification for public review and comment in the proposed Snake River recovery plan currently being developed by NMFS.

SR Sockeye Salmon

Figure 1. Snake River Sockeye Salmon ESU population structure[1]



[1] The map above generally shows the accessible and historically accessible areas for the SR sockeye salmon. The area displayed is consistent with the regulatory description of the boundaries of the SR sockeye salmon found at 50 CFR17.11, 223.102, and 224.102. Actions outside the boundaries shown can affect this ESU. Therefore, these boundaries do not delimit the entire area that could warrant consideration in recovery planning or determining if an action may affect this ESU for the purposes of the ESA.

SR Sockeye

There are five populations in this ESU (Figure 1). However, four historical populations are extirpated (Alturas Lake, Pettit Lake, Yellowbelly Lake and Stanley Lake). Therefore, the single extant historical population of SR sockeye salmon is currently restricted to Redfish Lake in the Sawtooth Valley. At the time of listing in 1991, the only confirmed population that belonged to this ESU was the beach-spawning population of sockeye from Redfish Lake. Historical records indicate that sockeye once occurred in several other lakes in the Stanley Basin,[2] but no adults were observed in these lakes for many decades and once residual sockeye salmon were observed, their relationship to the Redfish Lake population was uncertain (McClure et al. 2005). Since listing, progeny of Redfish Lake sockeye have been outplanted to Pettit and Alturas lakes within the Sawtooth Valley.

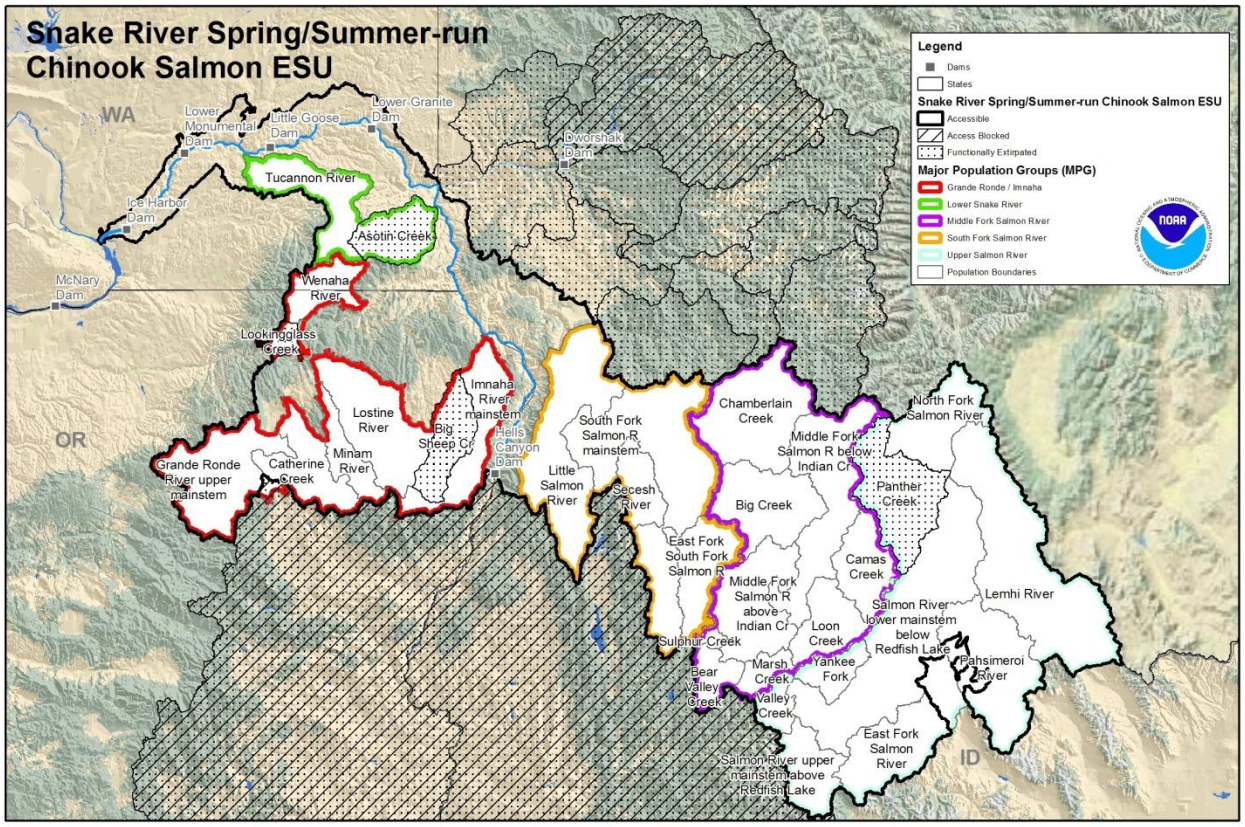
The Stanley Basin and Sawtooth Valley lakes are relatively small compared to other lake systems that historically supported sockeye production in the Columbia basin. Stanley Lake is assigned to the smallest size category, along with Pettit and Yellowbelly Lakes. Redfish Lake and Alturas Lake fall into the next size category – intermediate. The average abundance targets recommended by the Snake River Recovery Team (Bevan et al. 1994) were incorporated as minimum abundance thresholds into a sockeye viability curve. It was generated using historical age structure estimates from Redfish Lake sampling in the 1950s-1960s, and year-to-year variations in brood-year replacement rates generated from abundance series for Lake Wenatchee sockeye. The minimum spawning abundance threshold is set at 1,000 for the Redfish and Alturas Lake populations (intermediate category), and at 500 for populations in the smallest historical size category (e.g., Alturas and Pettit Lakes). The ICTRT recommended that long-term recovery objectives should include restoring at least three of the lake populations in the ESU to viable or highly viable status.

[2] In fact, the only historically occupied lake in the Stanley Basin is Stanley Lake which is not occupied at this time.

SR Spring/Summer Chinook Salmon

This ESU has five MPGs with 28 extant populations (Figure 2).

Figure 2. Snake River Spring/Summer-run Chinook Salmon ESU population structure[3]



Lower Snake River MPG

This MPG contained two populations historically; Asotin Creek is identified as extirpated. The ICTRT criteria call for both populations to be restored to viable status. The ICTRT recommended that recovery planners should give priority to restoring the Tucannon River to highly viable status, and deferring an evaluation of the potential for reintroducing production in Asotin Creek as recovery planning progresses.

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[3] The map above generally shows the accessible and historically accessible areas for the SR sping/summer Chinook salmon. The area displayed is consistent with the regulatory description of the boundaries of the SR spring/summer Chinook salmon found at 50 CFR17.11, 223.102, and 224.102. Actions outside the boundaries shown can affect this ESU. Therefore, these boundaries do not delimit the entire area that could warrant consideration in recovery planning or determining if an action may affect this ESU for the purposes of the ESA.

Grande Ronde/Imnaha MPG

This MPG has eight historical populations (two identified as extirpated – Big Sheep Creek and Lookingglass Creek). The ICTRT criteria call for a minimum of four populations to be at viable or highly viable status. The potential scenario identified by the ICTRT would include viable populations in the Imnaha River (representing important run-timing diversity), the Lostine/Wallowa River (representing a large size population) and at least one from each of the following pairs: Catherine Creek or Upper Grande Ronde (representing large size populations); and Minam River or Wenaha River.

South Fork Salmon River MPG

Four populations comprise this MPG, with two classified as large-size and two as intermediate-size. The South Fork Salmon River drainage contains three of the populations; the fourth lies outside of the drainage. At least two of the populations (one intermediate and one large) must be at viable status for the MPG to be considered viable, and one of these two must be highly viable. One population in the MPG (Little Salmon River) is a spring/summer run type and the remaining three are the summer-only run type. The ICTRT MPG–level viability criteria require that the Little Salmon River population be viable for the MPG to be considered viable. The ICTRT recommends that the populations in the South Fork drainages be given priority relative to meeting MPG viability objectives because of the relatively small size and the high level of potential hatchery integration for the Little Salmon River population. The viability for this MPG relies on the production of summer-run type populations with the South Fork Salmon River drainage, rather than the inclusion of a minor amount of spring-run type production from outside the main drainage. Therefore, a recovery scenario for this MPG should not emphasize the life-history strategy requirement of MPG viability. Rather, this recovery scenario should emphasize the need to achieve viable status for the Secesh River population which has no supplementation and will satisfy the intermediate-size requirement for MPG viability. The South Fork Salmon River population is the initial choice to meet requirement of a large population.

Middle Fork Salmon River MPG

The ICTRT criteria call for at least five of the nine populations in this MPG to be rated as viable, with at least one demonstrating highly viable status. When all six MPG-level viability criteria are considered, there are 45 possible scenarios in which five populations, selected from the nine, could achieve MPG viability. The Big Creek population must be viable in any scenario because of its unique historic intrinsic potential in the MPG. It is the only population that meets the ICTRT large size category, and is one of two populations that include both spring- and summer-run fish. At least two of the three intermediate size populations (Chamberlain Creek, Middle Fork Salmon River above Indian Creek, and Bear Valley Creek) must be included among the minimum of five viable populations. In order to satisfy the intermediate-size population requirement, a viable status is targeted for the Chamberlain Creek and Bear Valley Creek populations. This is based on management opportunity and historic production potential. Two other populations must be viable to meet the minimum requirement of five viable populations.

The choices include Middle Fork Salmon River below Indian Creek, Camas Creek, Loon Creek, Middle Fork Salmon River above Indian Creek, Sulphur Creek and Marsh Creek. The Loon Creek and Marsh Creek populations are targeted for desired viable status, because of their geographic distribution in the MPG and historic intrinsic production potential.

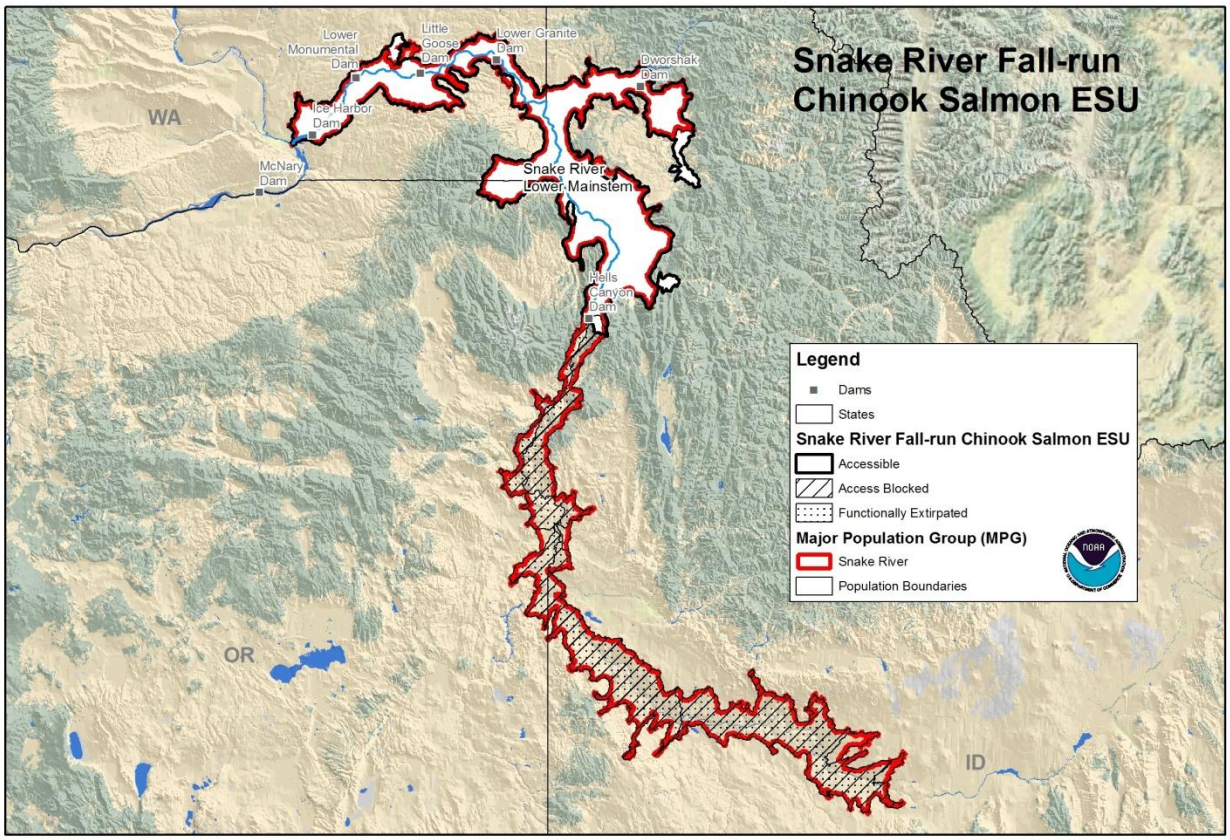
Upper Salmon River MPG

This MPG included nine historical populations, one of which (Panther Creek) is considered functionally extirpated. The ICTRT criteria recommend that only three of the five very large and large populations be included. However, because the single intermediate size population (Panther Creek) is extirpated, an additional population from one of the larger size categories must be substituted for the intermediate population in the scenario. The Pahsimeroi River population must be viable because of its unique life-history strategy (it is the only summer-run population) in the MPG. The Pahsimeroi is classified as a large size population. Therefore, at least three of the other four very large and large populations (Lemhi River, Salmon River Lower Mainstem below Redfish Lake Creek, East Fork Salmon River, and Salmon River Upper Mainstem above Redfish Lake Creek) must be included in the minimum set of five viable populations. Based on spatial distribution, management opportunity, and historical production potential in the MPG, the Lemhi River and Salmon River Upper Mainstem population need to be viable to satisfy the criterion for proportional representation of size class. The East Fork Salmon River population is an initial choice to achieve viable status. Finally, Valley Creek is an initial choice to round out the population selections.

SR Fall-run Chinook Salmon

This ESU has one MPG with one extant population (Figure 3)

Figure 3. Snake River Fall-run Chinook Salmon ESU population structure[4]



Snake River Fall Chinook MPG

SR fall-run Chinook salmon are currently restricted to one extant population, the Lower Mainstem Snake River population, which occupies approximately 15 percent of the historical range of this ESU. The ICTRT considers the SR fall-run Chinook salmon ESU to consist of one MPG, with three historical populations (only one of which is extant). The two upstream populations (above the Hells Canyon hydropower complex), Marsing Reach and Salmon Falls, are extirpated. The extant Lower Mainstem population (below the Hells Canyon hydropower

[4] The map above generally shows the accessible to the SR fall-run Chinook salmon ESU. Areas historically accessible above Hells Canyon Dam are not fully displayed. The area displayed is consistent with the regulatory description of the boundaries of the SR fall-run Chinook salmon found at 50 CFR17.11, 223.102, and 224.102. Actions outside the boundaries shown can affect this ESU. Therefore, these boundaries do not delimit the entire area that could warrant consideration in recovery planning or determining if an action may affect this ESU for the purposes of the ESA.

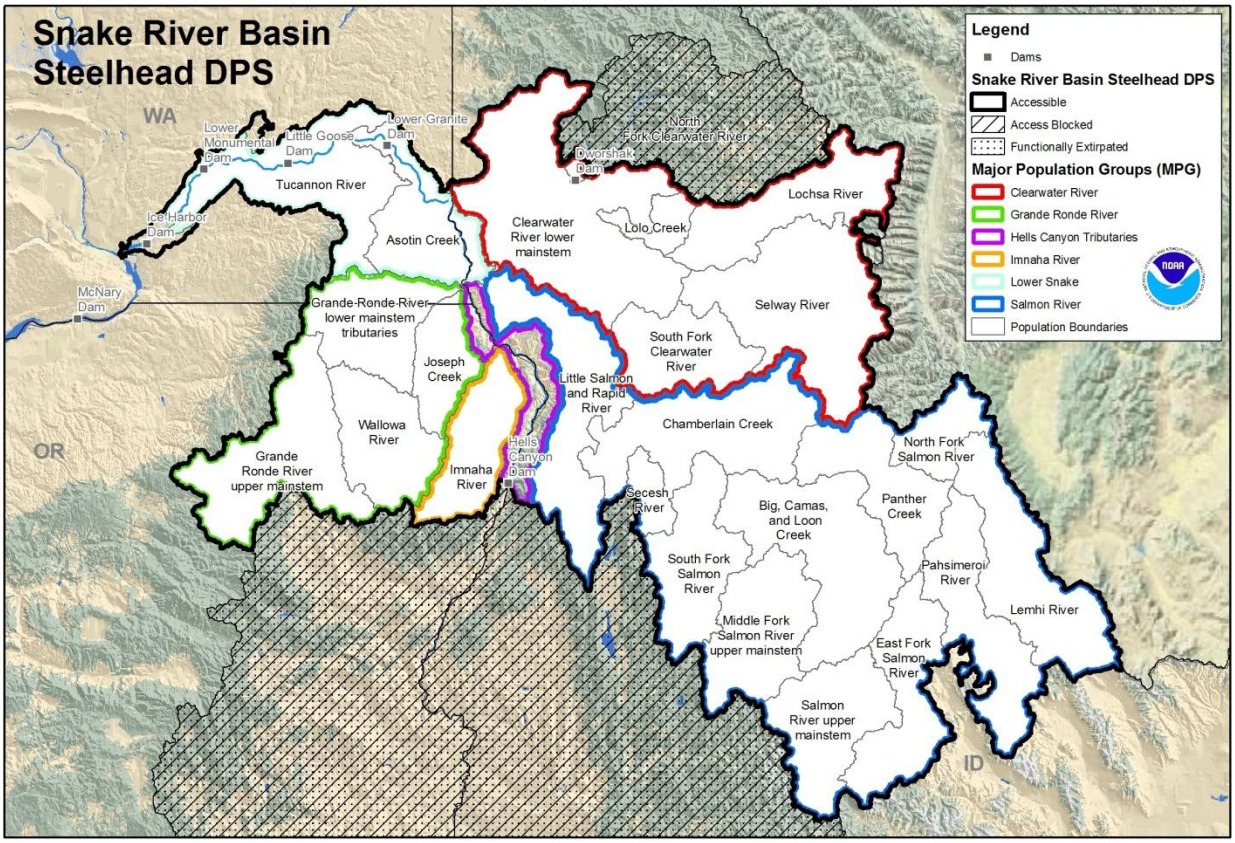
complex) is currently rated at moderate risk relative to ICTRT criteria. The ICTRT concluded that the single MPG must be at low risk (highly viable) for the ESU to be considered viable (ICTRT 2007). This would require the re-establishment of at least one other population to meet the minimum viability criteria established by the ICTRT for ESUs with a single MPG. The ICTRT recognized the difficulty of re-establishing fall-run Chinook salmon populations and suggested initial recovery efforts emphasize improving the viability of the extant population, while creating the potential for re-establishment of an additional population (ICTRT 2007).

The Lower mainstem population would be considered at low risk if the combination of abundance and productivity (geometric mean spawner to spawner ratios for parent escapements less than 2,000 spawners – 75 percent of the minimum abundance threshold of 3,000) exceeds a viability curve generated by simulation modeling that incorporates observed year-to-year variability in return rates. In any case, the ICTRT criteria for low viability risk stipulate that the 10-year geometric mean natural origin escapement should exceed 3,000, with a minimum of 2,500 natural origin spawners in the mainstem Snake River major spawning areas. Achieving a very low risk rating for abundance and productivity requires exceeding the same natural-origin abundance threshold combined with a productivity estimate of 1.5 or higher. The ICTRT described five major spawning areas within the Lower Mainstem population – three mainstem reaches (Salmon River confluence to Hells Canyon Dam site, Lower Granite Dam to the Salmon river confluence, and the mainstem off of and including the lower Tucannon River), and two tributary mainstems (lower Grande Ronde River and the Clearwater River). In addition the ICTRT defined smaller spawning reaches in the Imnaha River and the Salmon River as minor spawning areas.

SR Basin Steelhead

This DPS has six MPGs (5 extant and one – Hells Canyon – with no associated independent populations) with 24 extant populations (Figure 4). This DPS consists of A-run steelhead which are primarily return to spawning areas beginning in the summer and the larger-sized B-run steelhead which begin the migration in the fall.

Figure 4. Snake River basin Steelhead DPS population structure[5]



[5] The map above generally shows the accessible and historically accessible areas for the SR basin steelhead. The area displayed is consistent with the regulatory description of the boundaries of the SR basin steelhead found at 50 CFR17.11, 223.102, and 224.102. Actions outside the boundaries shown can affect this DPS. Therefore, these boundaries do not delimit the entire area that could warrant consideration in recovery planning or determining if an action may affect this DPS for the purposes of the ESA.

Clearwater River MPG

This MPG includes five extant and one extirpated (North Fork Clearwater River) populations. Three populations must meet viability criteria, one of which must meet the criteria for high viability. There are three populations that must achieve viable status, including the Clearwater lower mainstem (the only A-run life history type), Lolo Creek (the only A/B-run life-history type) and South Fork Clearwater (the only intermediate-size population). Additionally, either the Lochsa River or Selway River population must be viable for the MPG to be considered viable—since the ICTRT criteria require at least two of the three large-size populations to be viable. Because the predominant historic production was from fish of B-run type life-history strategy and the entire North Fork Clearwater drainage is blocked to that type of production, the recovery planning objective in this MPG is to achieve viable status for the Lochsa River population. The Lochsa River population was selected because of greater ability to assess status using current monitoring programs. Those four populations that currently occupy historical habitat must be rated as viable for the MPG to be considered viable. All the remaining extant populations should be at a 'maintained' status.

Grande Ronde River MPG

Two of the four populations must achieve viable status to meet the ICTRT criteria for this MPG. In addition, at least one of these populations must be rated as highly viable. The ICTRT example scenario includes the Upper Grande Ronde River (large-size population), and either Joseph Creek (currently low risk status) or the Lower Grande Ronde River be at viable status for the MPG to be rated viable.

Hells Canyon Tributaries MPG

This MPG historically contained three independent populations. However, all three of these populations were above Hells Canyon Dam (Powder River, Burnt River and Weiser River) and are now extirpated. A small number of steelhead occupy some tributaries below Hells Canyon Dam, however none of these tributaries (nor all combined) appear to be large enough to support an independent population. Based on the extirpated status of populations in the MPG it is not expected to contribute to recovery of the DPS.

Imnaha River MPG

This MPG contains one population. The Imnaha River population should meet highly viable status for this MPG to be rated as viable under the basic ICTRT criteria.

Lower Snake MPG

The Lower Snake MPG contains two populations. The ICTRT recommends that both populations (Tucannon River and Asotin Creek) be restored to viable status, with at least one meeting the criteria for highly viable.

Salmon River MPG

This relatively large MPG includes 12 extant populations. Two populations are characterized as large-size, ten are intermediate-size, and two are basic-size populations. The ICTRT recommends a minimum of six populations, at least four of which are intermediate-size and one large-size, be at viable status for the MPG to be viable. At least one of the minimum six populations must be highly viable. The initial recovery planning objective targets the South Fork Salmon River, Secesh River, Chamberlain Creek, and Upper Middle fork Salmon River populations to achieve viable status for the MPG. The South Fork Salmon River population was selected because of its genetic distinctiveness, historic B-run production potential, and lack of hatchery influence or effects. The Chamberlain Creek population (which includes fish spawning in French, Sheep, Crooked, Bargamin, and Sabe Creeks, the Wind River and Chamberlain Creek) was delineated on the basis of life history and basin topography. All streams in this population are classified as supporting A-run steelhead. The Chamberlain Creek population was selected to represent wild A-run steelhead life-history strategy in the MPG. The Secesh River population, which includes the mainstem Secesh and its tributaries, is identified in the recovery planning objective because of its genetic distinctiveness, historic B-run production potential and lack of hatchery influence or effects. The Upper Middle Fork Salmon River population was selected because of its lack of hatchery influence and geographic separation from the previous three populations. At least two of the remaining populations must be rated viable for the Salmon River MPG to be rated viable.

2.3 Updated Information and Current Species' Status

In addition to recommending recovery criteria, the ICTRT also assessed the current status of each population of the listed salmonid ESUs and DPS within the Snake River basin. Each population was rated against the biological criteria recommended by the ICTRT and assigned a current viability rating. The information below is based on these analyses and is summarized from *Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Northwest* (Ford et al. 2010).

2.3.1 Analysis of Viable Salmonid Population (VSP) Criteria (including discussion of whether recovery criteria have been met)

SR Sockeye Salmon

Abundance and Productivity

The average abundance targets recommended by the Snake River Recovery Team (Bevan et al. 1994) were incorporated as minimum abundance thresholds into a sockeye viability curve. It was generated using historical age structure estimates from Redfish Lake sampling in the 1950s-1960s, and year-to-year variations in brood-year replacement rates generated from abundance series for Lake Wenatchee sockeye. The minimum spawning abundance threshold is set at 1,000 for the Redfish and Alturas Lake populations (intermediate category), and at 500 for populations

in the smallest historical size category (e.g., Alturas and Petit Lakes). The ICTRT recommended that long-term recovery objectives include restoring at least three of the lake populations in the ESU to viable or highly viable status. Adult returns in 2008 and 2009 were the highest since the current captive brood-based program began, with a total of 650 and 809 adults returning to the Sawtooth Hatchery weir.

Spatial Structure and Diversity

Ford et al. (2010) did not provide any updated information on the spatial structure/diversity metric for Snake River sockeye. It is unlikely that these metrics have changed since the last status review.

ESU Summary

The sockeye captive broodstock program has met its initial objectives by preventing the extinction of the ESU in the short term and preventing any further loss of genetic diversity. In recent years, the numbers of returning adults have exceeded those needed for broodstock collection. Therefore, the program has initiated efforts to evaluate alternative supplementation strategies in support of re-establishing natural production of anadromous sockeye. These include releasing adults to spawn naturally, planting boxes with eyed-eggs for incubation and early rearing, and releasing hatchery-reared smolts for volitional emigration from the Sawtooth Valley lakes. Limnological studies are being conducted to determine production potentials in three of the Sawtooth Valley lakes that are candidates for sockeye restoration. The Corps of Engineers was able to initiate studies of survival of marked SR sockeye smolts through the mainstem Federal Columbia River Power System (FCRPS) in 2010. Prior to this the survival of unlisted sockeye from the Upper Columbia ESU through the lower Columbia reach has been extrapolated to the Snake River to estimate the relative effectiveness of in-river improvements (e.g., surface bypass) versus transport operations in supporting efforts to increase the viability of the ESU. Although the captive brood program has been successful in providing substantial numbers of hatchery sockeye for supplementation efforts, re-establishing sustainable natural production will require substantial increases in survival rates across all life-history stages. The increased abundance of hatchery reared SR sockeye reduces the risk of immediate extinction, but levels of naturally produced sockeye returns remain extremely low.

Although the status of the SR sockeye salmon ESU appears to be improving, this ESU remains at a high risk of extinction. Recent returns are still a fraction of historic abundance and substantial increases in survival rates across all life-history stages must occur in order to re-establish sustainable natural production. The new information considered does not indicate a change in the biological risk category since the time of the last status review (Ford et al 2010).

SR Spring/Summer Chinook Salmon

The overall viability ratings for all populations in the SR spring/summer Chinook salmon ESU remain at high risk after the addition of more recent year abundance and productivity data. Under the approach recommended by the ICTRT, the overall rating for an ESU depends on population-level ratings nested by MPG. The following brief summaries describe the current status of populations within each of the extant MPGs in the ESU, contrasting the current ratings with assessments previously done by the ICTRT using data through the 2008 return year.

Abundance and Productivity

Lower Snake River MPG

Abundance and productivity remain the major concern for the Tucannon River population. Natural spawning abundance (10-year geometric mean) has increased but remains well below the minimum abundance threshold for the single extant population in this MPG. Poor natural productivity continues to be a major concern.

Grande Ronde/Imnaha MPG

The Wenaha River, Lostine/Wallowa River and Minam River populations showed substantial increases in natural abundance relative to the previous ICTRT review, although each remains below their respective minimum abundance thresholds. The Catherine Creek and Upper Grande Ronde populations each remain in a critically depressed state. Geometric mean productivity estimates remain relatively low for all populations in the MPG.

South Fork Salmon River MPG

Natural spawning abundance (10-year geometric mean) estimates increased for the three populations with available data series. Productivity estimates for these populations are generally higher than estimates for populations in other MPGs within the ESU. Viability ratings based on the combined estimates of abundance and productivity remain at high risk, although the survival/capacity gaps relative to moderate and low risk viability curves are smaller than for other ESU populations.

Middle Fork Salmon River MPG

Natural-origin abundance and productivity remains extremely low for populations within this MPG. As in the previous ICTRT assessment, abundance and productivity estimates for Bear Valley Creek and Chamberlain Creek (limited data series) are the closest to meeting viability minimums among populations in the MPG.

Upper Salmon River MPG

Abundance and productivity estimates for most populations within this MPG remain at very low levels relative to viability objectives. The Upper Salmon Mainstem has the highest relative abundance and productivity combination of populations within the MPG.

Spatial Structure and Diversity

Lower Snake River MPG

The integrated spatial structure/diversity risk rating for the Lower Snake River MPG is moderate.

Grande Ronde/Imnaha MPG

The Upper Grande Ronde population is rated at high risk for spatial structure and diversity while the remaining populations are rated at moderate.

South Fork Salmon River MPG

Spatial structure/diversity risks are currently rated moderate for the South Fork Mainstem population (relatively high proportion of hatchery spawners) and low for the Secesh River and East Fork South Fork populations.

Middle Fork Salmon River MPG

Spatial structure/diversity risk ratings for Middle Fork Salmon River MPG populations are generally moderate. This primarily is driven by moderate ratings for genetic structure assigned by the ICTRT because of uncertainty arising from the lack of direct genetic samples from within the component populations.

Upper Salmon River MPG

Spatial structure/diversity risk ratings vary considerably across the Upper Salmon River MPG. Four of the eight populations are rated at low or moderate risk for overall spatial structure and diversity and could achieve viable status with improvements in average abundance/productivity. The high spatial structure/diversity risk rating for the Lemhi population is driven by a substantial loss of access to tributary spawning/rearing habitats and the associated reduction in life-history diversity. High risk ratings for Pahsimeroi River, East Fork Salmon River, and Yankee Fork Salmon River are driven by a combination of habitat loss and diversity concerns related to low natural abundance combined with chronically high proportions of hatchery spawners in natural areas.

ESU Summary

Population-level status ratings remain at high risk across all MPGs in the ESU. Although recent natural spawning abundance has increased, all populations remain below minimum natural-origin abundance thresholds. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU. The ability of populations to be self sustaining through normal periods of relatively low ocean survival remains uncertain. Factors cited by the 2005 Biological Review Team (Good et al. 2005) remain concerns or key uncertainties for several populations.

As a result of the current high risk facing this ESU's component populations, the SR spring/summer Chinook salmon MPGs do not meet the ICTRT viability criteria for the ESU (i.e., all five MPGs should be viable for the ESU to be viable). Therefore, the ESU is not currently considered to be viable. Overall, there is no new information to indicate an improvement in the biological risk category since the time of the last status review. There is also no new information to indicate that this ESU's extinction risk has increased considerably in the past five years. This ESU remains well distributed over 28 extant populations in three states. Total ESU abundance is depressed but not at critically low levels. Some populations have experienced increased abundance in the last five years. New information considered during this review confirms that this DPS remains at moderate risk of extinction.

SR Fall-run Chinook Salmon

Abundance and Productivity

The current estimate (1999-2008 10-year geometric mean) of natural-origin spawning abundance of the SR fall-run Chinook salmon ESU is just over 2,200 adults. The ICTRT recommends calculating population productivity (expected spawner-to-spawner return rate at low to moderate parent escapements) using the 20 most recent brood years. Previous status reviews for SR fall-run Chinook salmon included estimates based on a more recent time series to account for potential major, but un-quantified, changes in downstream passage conditions (enhanced flows and transport regimes) initiated in 1990. The updated productivity based on the 1990 to present series was 1.28. The estimate for the longer series (1983-2003) brood years was 1.07. When the current natural spawning escapement estimate of 2,200 is combined with either of the productivity estimates, the result is a "moderate" risk rating for the ESU with respect to both abundance and productivity. However, we note that there is considerable uncertainty in both the abundance and productivity estimates due to the inability to discriminate between hatchery and naturally produced fish.

Spatial Structure and Diversity

The addition of two years of spawner distribution and hatchery composition data does not alter the conclusions reached in the ICTRT report regarding spatial structure and diversity ratings. It states, "The Lower SR fall Chinook salmon population was rated at low risk for Goal A (allowing natural rates and levels of spatially mediated processes) and moderate risk for Goal B (maintaining natural levels of variation) resulting in an overall spatial structure and diversity rating of moderate risk. The moderate risk rating was driven by changes in major life history patterns, shifts in phenotypic traits and high levels of genetic homogeneity in samples from natural-origin returns. More significant is that hatchery fish comprise more than 75 percent of the natural spawning population. Over the long term this condition will increase the likelihood that diversity of the natural population will be altered in ways that lower its likelihood of persistence. In addition, the substantial selective pressure imposed by current hydropower operations and cumulative harvest impacts would also lead to a moderate rating."

Scale samples from natural origin SR fall–run Chinook salmon taken at Lower Granite Dam continue to indicate that approximately half of the returns overwintered in fresh water. The majority of these fish are likely from the Clearwater River.

ESU Summary

SR fall-run Chinook salmon abundance has increased substantially since they were listed. The pattern for population productivity is less certain because of imprecision in the underlying data and the lack of metric standardization for the effects of density dependence on recruitment performance. In light of this evidence, the population remains at a moderate risk of going extinct (probability between 5 percent and 25 percent in 100 years). The extant population of SR fall-run Chinook salmon is the only one remaining from an ESU that historically included two large mainstem populations upstream of the current location of the Hells Canyon Dam complex. The recent increases in natural origin abundance are encouraging. However, hatchery-origin spawner proportions have increased dramatically in recent years – on average, 78 percent of the estimated adult spawners have been hatchery origin over the most recent brood cycle.

Given the combination of current ratings for abundance/productivity and spatial structure/diversity summarized above, the SR fall-run Chinook salmon ESU is rated at moderate risk relative to ICTRT criteria. There is a high level of uncertainty associated with the overall rating for this population, primarily driven by uncertainties regarding current average natural-origin abundance and productivity levels. It is difficult to separate variations in ocean survival from potential changes in hydropower impacts without comparative measures of juvenile passage survivals under current operations or a representative measure of ocean survival rates. Overall, the new information considered indicates an improvement in ESU abundance. However, uncertainty about population productivity and the large proportion of hatchery-origin returns indicate that the biological risk category has not changed since the last status review.

SR Basin Steelhead

Only two of the 24 extant populations of SR steelhead have estimates of population specific spawning abundance. Adult abundance data series are limited to aggregate estimates at Lower Granite Dam (total, A-run and B-run), estimates for two Grande Ronde populations (Joseph Creek and Upper Grande Ronde River), and index area or weir counts for subsections of several other populations. The ICTRT used aggregate estimates of abundance at Lower Granite Dam, along with juvenile indices of abundance available for some areas, to infer abundance and productivity ratings for populations without specific adult abundance time series (Ford et al. 2010). Both populations with specific spawning abundance data series are in the Grande Ronde River MPG. The overall viability rating for the Joseph Creek population remained as highly viable after updating the analysis to include returns through the 2009 spawning year. The increase in natural-origin abundance for the other population with a data series, the Upper Grande Ronde River, was not sufficient to change the abundance/productivity criteria rating from moderate risk.

The ICTRT identified collecting population-specific estimates of annual abundance and obtaining information on the relative distribution of hatchery spawners at the population level as the main priorities for this DPS (ICTRT 2007). Two projects have been initiated to gain more specific data on the distribution of spawners among populations or geographic aggregations of populations. In addition, adult PIT-tag arrays are being installed in the lower sections of several watersheds, allowing for mark-recapture based estimates for some population aggregates.

The overall viability ratings for populations in the SR steelhead DPS range from moderate to high risk. Under the approach recommended by the ICTRT, the overall rating for a DPS depends on population-level ratings organized by MPG within that DPS. The following summaries describe the current status of populations within each of the extant MPGs in the SR basin steelhead DPS.

Abundance and Productivity

Clearwater MPG

There is insufficient data on natural spawning abundance to determine productivity for the five populations in this MPG. The overall abundance and productivity risk rating therefore was identified as high for all populations, except for the Lower Mainstem Clearwater River which was identified as moderate.

Grande Ronde River MPG

Population-level abundance data series are available for two populations within this DPS (Joseph Creek and Upper Grande Ronde River). However, estimates of recent natural spawner abundance are now also available for the other two populations: Lower Grande Ronde and Wallowa. The most recent estimates of mean abundance of wild fish for these populations are values that exceed the Minimum Abundance Thresholds established by the ICTRT, with the exception of the value for the Upper Grande Ronde population, which is 0.80 of the Minimum Abundance Threshold. Hatchery strays are rare in all populations, comprising less than 5 percent of the spawners in all cases. However, additional information is needed to confirm these low levels for the Wallowa and Lower Grande Ronde populations.

Longer term trend estimates for the Upper Grand Rode River and Joseph Creek populations differ slightly. Both series begin with estimates from the early 1970s and extend through 2009. The average trend over the full time period was negative 1 to 5 percent per year for the Upper Grande Ronde and a positive 1 to 4 percent per year for Joseph Creek across the range of long-term trend metrics.

After updating the analysis to include returns through the 2009 spawning year, the rating for the Joseph Creek population’s overall viability rating remained Highly Viable. The increase in natural-origin abundance for the Upper Grande Ronde River was not sufficient to change the abundance/productivity criteria rating from moderate risk.

Imnaha River MPG

The Imnaha River population is the only population within the Imnaha River MPG. This steelhead population is extant and exhibits a summer-run life history. The ICTRT (2007) found that abundance trends for this population could not be determined because no data or expansion method exists to create whole-population estimates. The only long-term estimates for the population are estimates for abundance and productivity within a six-mile section of Camp Creek, which represents a small portion of the overall spawning area. The ICTRT rated the Imnaha River population at moderate risk for abundance and productivity based on the uncertainty in abundance. Although the incidence of hatchery fish mixing with the natural population is believed to be low (less than 10 percent of the spawners), information needs to be collected to confirm this.

Lower Snake MPG

The ICTRT does not have data available to determine natural spawning abundance and productivity estimates for the Tucannon River and Asotin Creek summer steelhead populations that make up this MPG. Consequently, the ICTRT considers these populations at high risk due to that uncertainty. The Snake River Salmon Recovery Board indicates that the Asotin Creek population core area (within Asotin Creek subbasin) has had escapements exceeding 500 spawners in 2000 and 2005. Although promising, these estimates are of insufficient duration to demonstrate with certainty that the population is functioning above the minimum threshold.

Salmon River MPG

There are 12 populations in the Salmon River MPG. All populations are identified as having insufficient abundance and productivity data.

Spatial Structure and Diversity

Clearwater MPG

Spatial structure and diversity risks currently are rated low for the Lower Mainstem Clearwater, Selway River, and the Lochsa River. The South Fork Clearwater River and Lolo Creek have moderate risk ratings for spatial structure and diversity.

Upper Grande Ronde MPG

Spatial structure and diversity risks currently are rated as low for Joseph Creek and the Wallowa River. The Lower Grande Ronde River and the Upper Grande Ronde River have moderate risk ratings for spatial structure and diversity.

Imnaha River MPG

The combined spatial structure and diversity rating for the Imnaha River steelhead population is moderate risk. Current spawner distribution mirrors the historic distribution. Spawning is

distributed broadly throughout the population area, from lower elevation river tributaries to high elevation stream in the Wallowa Mountains.

Lower Snake River MPG

Spatial structure and diversity risks currently are rated moderate for the two populations in the MPG: the Tucannon River and Asotin Creek.

Salmon River MPG

Spatial structure/diversity risks currently are rated low for the South Fork Salmon River, Secesh River, Chamberlain Creek, Lower Middle Fork and Upper Middle Fork Salmon River populations; and moderate for the North Fork Salmon River, Little Salmon River, Lemhi River, Upper Mainstem Salmon River and East Fork Salmon River and Pahsimeroi River populations. Panther Creek is rated as high risk for spatial structure and diversity.

Updated Risk Summary

The level of natural production in the two populations with long-term data series and the Asotin Creek index reaches is encouraging, but the status of most populations in this DPS remains highly uncertain. Population-level natural origin abundance and productivity inferred from aggregate data and juvenile indices indicate that many populations are likely below the minimum levels defined by the ICTRT viability criteria. Uncertainty remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites. There is little evidence demonstrating a change in DPS viability since the previous status review.

Clearwater MPG

Four of the populations in the Clearwater MPG have an overall viability rating of high risk (South Fork Clearwater, Lolo Creek, Selway River and Lochsa River). The Lower Mainstem Clearwater River has an uncertain overall viability rating of maintained. Therefore, due to these population viability ratings, the Clearwater MPG is not viable.

Grande Ronde River MPG

The Joseph Creek steelhead population has an overall viability rating of highly viable because of the abundance productivity rating of very low risk and the spatial structure and diversity rating of low risk. The Lower Grande Ronde River population does not have an overall viability rating because there is no population-specific abundance and productivity data. The Wallowa River population has an overall viability rating of high risk, though there is uncertainty associated with this rating. The Upper Grande Ronde population is rated as maintained. The ICTRT criteria recommend that a minimum of two populations achieve at least viable status for the MPG to be viable. Further, to meet the MPG viability criteria, one large and one intermediate population must meet or exceed population-level criteria; and one population in the MPG must meet highly viable criteria. Therefore, due to the population viability ratings, the Grande Ronde River MPG is not viable.

Imnaha River MPG

The Imnaha River MPG contains only one population. This population must be rated highly viable for the MPG to be considered viable according to ICTRT criteria. The ICTRT rated the Imnaha River population at moderate risk for abundance and productivity based on the uncertainty in abundance. Current data that is available for other VSP parameters, however, indicate that the population meets the criteria for a maintained population. However, this does not meet the criteria for a viable MPG because the population needs to be highly viable for the MPG to be viable. Therefore, the Imnaha MPG is not viable.

Lower Snake MPG

For the two populations in the Lower Snake MPG, the Tucannon River has an overall viability rating of high risk and the Asotin Creek population has uncertain viability rating of maintained using the ICTRT criteria. Based on these ratings, the Lower Snake MPG is not viable.

Salmon River MPG

Six of the 12 populations in this MPG have an overall viability rating of high risk (South Fork Salmon River, Secesh River, Chamberlain Creek, Lower Middle Fork Salmon River, Upper Middle Fork Salmon River, and Panther Creek). The remaining six populations are rated at maintained status (Little Salmon River, North Fork Salmon River, Lemhi River, Pahsimeroi River, East Fork Salmon River and Upper Mainstem Salmon River). Based on these ratings, the Lower Snake MPG is not viable.

DPS Summary

The viability ratings of the component populations in the Snake River steelhead DPS do not currently meet the ICTRT viability criteria for the DPS – the five MPGs should be at viable status for the DPS to be viable. Due to the high risk population ratings, uncertainty about the viability status of many populations, and overall lack of population data, none of the MPGs are considered to be viable. Therefore, the DPS is not currently considered to be viable.

There is little evidence for substantial change in DPS viability relative to the previous status review. Although direct biological performance measures for this DPS indicate little realized progress to date toward meeting its recovery criteria, there is no new information to indicate that its extinction risk has increased significantly. The DPS remains well distributed throughout its current range in the Snake River basin and at least some populations are considered to be viable. Overall, the new information considered does not indicate a change in the biological risk category since the time of the last status review. This DPS remains at moderate risk of extinction.

2.3.2 Five-Factor Analysis

Section 4(a)(1)(b) of the ESA directs us to determine whether any species is threatened or endangered because of any of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence. Section 4(b)(1)(A) requires us to make listing determinations after conducting a review of the status of the species and taking into account efforts to protect such species. Below we discuss new information relating to each of the five factors as well as efforts being made to protect the species.

Present or threatened destruction, modification or curtailment of its habitat or range

Significant habitat restoration and protection actions at the Federal, state, and local levels have been implemented to improve degraded habitat conditions and restore fish passage. While these efforts have been substantial and are expected to benefit the survival and productivity of the targeted populations, we do not yet have evidence demonstrating that improvements in habitat conditions have led to improvements in population viability. Ongoing improvements in the monitoring, evaluation, and reporting of habitat metrics and fish population response will allow us to document the effectiveness of habitat restoration actions and progress toward the viability criteria for these ESUs and DPS in the future. Generally, it takes one to five decades to demonstrate such increases in viability. Below, we briefly summarize several noteworthy restoration and protection actions that have been implemented since the last review. We also note areas where concerns about these ESUs' and DPS's habitat condition remain

Implementation of the FCRPS Biological Opinion (FCRPS Opinion) (NMFS 2008a; NMFS 2010) is providing a number of actions that will result in survival improvements: reduced duration of outmigration to the estuary, improved juvenile survival and condition, and increased access to habitats. Some of the milestones are discussed below.

Improvements in operations and fish passage at hydropower facilities and dams

Since 2006, surface passage routes (spillway weirs) for juvenile migrants have been installed at Little Goose Dam (2009), Lower Monumental Dam (2007), McNary Dam (two weirs in 2007), and John Day Dam (two weirs in 2008). A spillway wall was installed at The Dalles Dam in 2010 to improve juvenile egress conditions (and survival) downstream of the dam.

Previously installed surface passage routes continue to operate along with voluntary spill at Lower Granite (2003) and Ice Harbor (2005) on the Snake River and at Bonneville Dam (corner collector at Powerhouse 2 in 2004). Voluntary spill for juvenile SR fall-run Chinook passage has also continued at the Snake River dams since 2006.

Studies to assess whether or not specified juvenile dam survival performance standards are being achieved at each dam continue. The results of these tests will determine if additional measures are needed at these projects.

Additional measures to enhance conditions in the Snake River migration corridor also continue. Cool water continues to be released from Dworshak Dam on the North Fork Clearwater River between July and September to reduce temperatures for migrating adults and juvenile SR fall-run Chinook salmon. Also, the U.S. Bureau of Reclamation and Idaho Power Company continue to release water to augment flows during the summer migration period. Lastly, Idaho Power Company's Hells Canyon Complex is operated to maintain stable spawning flows for SR fall-run Chinook salmon and ensure that dam operations do not dewater SR fall-run Chinook salmon redds.

The 2010 FCRPS Supplemental Biological Opinion also continues efforts to assess hydropower critical uncertainties and future management decisions. Some examples include the continuation of transport survival studies to assess seasonal trends in smolt to adult returns; installation of adult PIT tag detectors at The Dalles Dam (or John Day Dam) to better assess adult losses in the lower Columbia River; and efforts to evaluate the differential survival of Upper Columbia/Snake River stocks.

Management of Tributary Habitat

Numerous habitat projects have been completed since the previous status review. Recovery projects throughout the Snake River basin include: (1) improved fish passage and increased access to high quality habitat; (2) riparian vegetation restoration through fencing and planning; (3) instream habitat improvements; (4) screening of irrigation diversions; and (5) land acquisitions to protect existing high-quality habitat. Most of these projects were accomplished with cooperation and/or funding from: the Washington Salmon Recovery Funding Board (for projects in the SE Washington), NMFS' Pacific Coastal Salmon Recovery Fund for projects in all three states, Habitat Conservation Plans, Bonneville Power Administration, Army Corps of Engineers, U.S. Forest Service, U.S. Bureau of Land Management, Bureau of Reclamation, the Oregon Watershed Enhancement Board for projects in Northeast Oregon, local Soil and Water Conservation Districts in all three states, and other Federal, State, and local landowners. Some of these key habitat improvements that have been implemented since the previous status review include:

- Restoration of stream flows and passage improvements in the upper Salmon River;
- Designation of fish as a beneficial use for water allocations in Idaho;
- Development and implementation of Snake River Management Unit plans and proposed recovery actions:
- U.S. Natural Resource Conservation Service – Implementation of Wildlife Habitat Incentives Program (WHIP) and Environmental Quality Incentives Program (EQIP) projects in Idaho.

- U.S. Forest Service and Bureau of Land Management –PACFISH /INFISH Biological Opinion improvements in watershed management and annual monitoring of progress.
- Habitat Conservation Plans – developed in Plum Creek, Upper Snake, and Lemhi River basins.
- Development of the Northeast Oregon Snake River Management Unit Draft Recovery Plan, including identification of priority limiting factors and proposed recovery actions used by partners implementing tributary habitat restoration projects.
- Implementation of FCRPS Reasonable and Prudent Actions by the FCRPS Action Agencies, including analyses identifying priority areas and actions.
- Negotiation and implementation of the Columbia basin Fish Accords providing funding for tribal restoration and recovery actions.
- Continuation of the BPA-funded Columbia basin Water Transaction Program to increase stream flow in rivers and streams.
- Continued implementation of fish screening programs for water transfer sites.

Federal Land Management

Federal land managers have taken a number of measures to protect and restore habitat throughout the Snake River basin. According to the Forest Service and Bureau of Land Management, habitat improvement and benefits have been demonstrated on Federal lands through the implementation of PACFISH (USDA and USDI 1994), the Aquatic Habitat Restoration Activities Biological Opinion (ARBO), and other management efforts.

Monitoring results from the PACFISH Biological Opinion Monitoring Program (PIBO) provided by the Forest Service indicate that, throughout the Snake River basin, some trends in stream habitat attributes (large woody debris, streambank characteristics, etc.) are positive, some are negative, and others have no trend (Al-Chokhachy et al. 2010a).

Additional information from the PIBO monitoring program indicates that unmanaged or reference reaches (streams in watersheds with little to no impact from road building, grazing, timber harvest, and mining) on Federal lands in the Interior Columbia basin (including the Snake River basin) are in better condition than managed streams (Al-Chokhachy et al. 2010b). In particular, managed watersheds with high road densities or livestock grazing tend to have stream reaches with worse habitat condition than streams in reference watersheds. When roads and grazing both occur in the same watershed, the presence of grazing has an additional significant negative effect on the relationship between road density and the condition of stream habitat (Al-Chokhachy et al. 2010b). These results indicate that legacy effects of historic management still are manifest in the current condition of streams on Federal lands in the Interior Columbia basin and ongoing management may still be affecting stream recovery rates. Forest Service researchers have conclude that the observed differences in average stream condition between reference and

managed watersheds may indicate that recent management regulations (e.g, PACFISH) in combination with the legacy of previous management actions may not be sufficient to improve the status of streams within managed watersheds, particularly over relatively short time periods (10-20 years) (Al-Chokhachy et al. 2010b).

Significant progress in livestock grazing management on Federal lands has been made in the last 15 years, but the results of Al-Chohachy et al. (2010b) indicate that further refinements to grazing management may be necessary in certain areas. In addition to these refinements, it is also essential to carry out adequate monitoring for livestock grazing. Without monitoring data, it will not be possible to tell if future refinements to grazing management are actually being carried out.

The Federal land managers are implementing several programs designed to restore the health of watersheds and improve aquatic habitat. The Forest Service's Legacy Road restoration program and identification of a minimum road system through implementation of Subpart A of the Travel Management Rule may help reduce the aquatic impacts of the transportation system. The Federal land managers have also developed aquatic restoration strategies. The Aquatic Restoration Strategy (Forest Service) and the 2015 Aquatic Strategy Plan (BLM) emphasize cooperative whole watershed-scale restoration. The actual realized benefits of these programs will depend on funding and the effectiveness of implementation.

Due to the vast acreage of Federal land throughout the range of salmon and steelhead in the Snake River basin, conservation of these ESUs' and DPS's habitat on Federal land is a recovery priority. However, there is uncertainty over the future conservation of salmon and steelhead on Federal lands in the Snake River basin. The level of protection afforded to these ESUs' and DPS's habitat will be determined by land management plans currently under development by the Forest Service and BLM. In August 2008, the Deputy Regional Directors for the Forest Service, BLM, NMFS, U.S. Fish and Wildlife Service, and Environmental Protection Agency developed "A Framework for Incorporating the Aquatic and Riparian Component of the Interior Columbia basin Strategy into Bureau of Land Management and Forest Service Plan Revisions." The framework identifies six components to be included in the plan revisions: riparian management areas; protection of population strongholds; identification of restoration priorities; multi-scale analysis; development of management direction to identify desired outcomes of future conditions; and monitoring/adaptive management. The manner in which these components are implemented and integrated with the recovery plan will help determine the extent to which federal land management will contribute to recovery.

The inclusion of a comprehensive effectiveness monitoring program such as PIBO is an essential component of any future aquatic conservation strategy. Effectiveness monitoring data from a large-scale program such as PIBO allows managers to determine if current practices are allowing for the attainment of aquatic and riparian management objectives. It also allows managers to incorporate the additive effects of multiple land management activities when prescribing future management standards that will prevent further degradation of streams and begin to restore physical habitat (Al-Chokhachy et al. 2010b).

Significant opportunities exist for recovery and/or conservation actions on Federal lands as part of the ESA section 7(a)(1) responsibilities. NMFS will continue to work with the Forest Service and BLM to identify opportunities for restoration actions on Federal lands. We will also work with these agencies, to the degree possible, to provide funding and technical assistance for projects that benefit the salmon and steelhead in the Snake River basin. Initiation and completion of consultation by Forest Service and BLM on all actions where consultation is required is also a conservation priority.

Non-Federal Land Tributary Management

Concern remains regarding mainstem flow management, particularly within the Grande Ronde, Lemhi, Pahsimeroi and upper Salmon River basins. In addition, smaller basins are impacted by diversion projects such as Sweetwater Creek a tributary to Lapwai Creek in the lower Clearwater basin. The Potlatch River, also a tributary to the lower Clearwater River, has numerous small diversions that cumulatively contribute to low-flow summer problems. Late-season tributary flow management remains a concern in certain areas throughout the range of these species. Some reaches of small- and mid-sized tributaries providing key rearing habitat are often dry during the summer due to an over allocation of surface water for irrigation purposes.

Completion of the MU and ESU/DPS-level recovery plans and ongoing implementation of recovery actions is a high priority in order to comprehensively identify and prioritize recovery actions, implement projects and establish needed research and monitoring to track implementation of habitat related recovery actions and assess action effectiveness. Recovery actions that focus on habitat improvements are anticipated to result in the greatest benefit to the Snake River salmon and steelhead populations. Actions that address the viability factors contributing to moderate to high abundance/productivity and/or spatial structure/diversity risk status in the Snake River populations should be given a priority for implementation.

Non-Federal actions throughout the Snake River basin have resulted in continued urbanization pressures, increased stormwater inputs, additional pesticide and herbicide applications, bank hardening and stabilization, and increased surface and groundwater withdrawals. These types of impacts are likely to further degrade habitat conditions. The net impact of such degradation in the context of considerable habitat restoration efforts being implemented is not currently known. Monitoring and evaluation are needed to assess the net impacts of habitat restoration and degradation to large-scale habitat conditions and to the viability of the ESUs/DPS are not available. ESU and DPS habitat research, monitoring and evaluation actions will be identified in the proposed Snake River recovery plan.

Habitat Factor Conclusion

New information that has become available since the last status review, indicates that there have been some improvements in freshwater and estuary habitat conditions due to restoration and additional habitat protection. We therefore conclude that the risk to the species' persistence because of habitat destruction or modification has improved slightly since the last status review. However, habitat concerns remain throughout the Snake River basin particularly in regards to water quality, water quantity, and riparian condition. There are numerous opportunities for habitat restoration or protection throughout the basin. It is likely that many additional habitat protection or restoration actions will be necessary to bring listed salmon and steelhead in the Snake River basin to viable status.

Overutilization for commercial, recreational, scientific, or educational purposes

Research and Monitoring

Although the absolute quantity of take authorized for scientific research and monitoring has been relatively low, take authorizations have greatly increased over the past five years. Our records of take authorization under ESA sections 10(a)(1)(A) and 4(d) for salmon and steelhead in the Snake River basin reveal a steady increase in requests for take for the purposes of scientific research. We expect additional increases in take requests in the foreseeable future with implementation of the 2010 FCRPS Supplemental Biological Opinion., Hatchery Genetic Management Plans, and species status monitoring. Handling impacts (e.g., electroshocking, tagging, marking) need to be better quantified (i.e., direct mortality, delayed mortality and sub-lethal effects) and it will be necessary to prioritize the Research Monitoring and Evaluation tasks before they can be implemented fully.

Given the greater demand for take under various research and monitoring schemes, it is likely that these activities are having a larger (and continuously increasing) impact since the last ESA status review.

Harvest

Harvest changes in fisheries management since the previous status review include adoption of the May 2008 U.S. v. OR Management Agreement (2008-2017) which will, on average, reduce impacts of freshwater fisheries to all Snake River ESUs/DPS (NMFS 2008b). Additionally, implementation of harvest rates based on run size for all U.S. fisheries is predicted to improve management for Snake River salmon and steelhead.

Ongoing tributary fisheries management discussions are working toward abundance-based sliding-scale harvest rates for SR spring/summer Chinook salmon. More fisheries data would help to verify existing scientific information on catch and release mortality in recreational fisheries.

New information available since the last ESA status review indicates harvest impacts have decreased slightly, but research impacts have increased. Impacts from these sources of mortality are not considered to be major limiting factors for these ESUs and DPS. We conclude that the risk to the species' persistence because of overutilization remains essentially unchanged since the last status review

Disease or predation

Although actions to reduce avian predation in the Columbia Basin have been ongoing with implementation of the FCRPS Biological Opinion, high levels of avian predation continue to significantly affect the Snake River salmon ESUs and Snake River basin steelhead DPS. A Columbia basin-wide assessment of avian predation on juvenile salmonids indicates that the most significant impacts to smolt survival occur in the Columbia River estuary (Collis et al. 2009). The combined consumption of juvenile salmonids by Caspian terns and double-crested cormorants nesting on East Sand Island was estimated to be between 7 and 16 million smolts annually. This represents approximately 10 percent of all the salmonid smolts that survive to the estuary in an average year. Estimated smolt losses to piscivorous colonial waterbirds that nest in the Columbia River estuary are more than an order of magnitude greater than those observed on the mid-Columbia River.

Predation remains a concern due to a general increase in pinniped populations along the West Coast. California sea lion populations are growing rapidly, and there is potential that these predators could reduce the abundance of several salmon and steelhead ESUs/DPSs. The available information clearly indicates that adult salmon contribute substantially to the diets of pinnipeds in the lower Columbia River and estuary, especially in the spring, late-summer, and fall seasons when Chinook salmon are most abundant (Scordino 2010). The effect of marine mammals on the productivity and abundance of Columbia River basin ESA-listed salmon and steelhead populations has not been quantitatively assessed. The absolute number of animals preying upon salmon and steelhead throughout the lower Columbia River and estuary is not known, the duration of time that they are present is uncertain, and the portion of their diet that is made up of listed species is unknown. We do have information to indicate that Steller sea lion abundance is increasing in the lower Columbia River and that predation by California sea lions at Bonneville Dam continues to increase (NMFS 2011).

A sport fishing reward program was implemented in 1990 to reduce the numbers of Northern pikeminnow in the Columbia basin (NMFS 2010). The program continues to meet expected targets, which may reduce predation on smolts in the mainstem Columbia River.

Non- indigenous fishes affect salmon and their ecosystems through many mechanisms. A number of studies have concluded that many established non-indigenous species (in addition to smallmouth bass, channel catfish, and American shad) pose a threat to the recovery of ESA-listed Pacific salmon. Threats are not restricted to direct predation; non-indigenous species compete directly and indirectly for resources, significantly altering food webs and trophic structure, and potentially altering evolutionary trajectories (Sanderson et al. 2009; NMFS 2010).

Disease rates over the past five years are believed to be consistent with the previous review period. Climate change impacts such as increasing temperature may increase susceptibility to diseases. Recent reports indicate the spread of a new strain of infectious haematopoietic necrosis virus along the Pacific coast that may increase disease-related concerns for Snake River salmon and steelhead in the future.

New information available since the last status review indicates there is an increase in the level of avian and pinniped predation on Snake River salmon and steelhead. At this time we do not have information available that would allow us to quantify the change in extinction risk due to predation. We therefore conclude that the risk to the species' persistence because of predation has increased by an unquantified amount since the last status review.

Inadequacy of existing regulatory mechanisms

New information available since the last status review indicates that the adequacy of some regulatory mechanisms has improved. For example:

- Revised harvest practices according to abundance-based sliding scale rates identified in 2008 U.S. v OR Agreement.
- Settlement of Snake River water rights and water rights claims through the State of Idaho's Snake River basin Adjudication process.
- The EPA has approved a Total Maximum Daily Load for the Lower Grande Ronde in 2010 for temperature and bacteria.
- Washington State Use-based (e.g., aquatic life use) Surface Water Quality Standards, Washington Administrative Code (WAC) 173-201A. The 2003 standards were amended in 2006 to provide additional spawning and incubation temperature criteria for salmon, trout, and char. The standards include an Antidegradation Policy, which was approved by Environmental Protection Agency (EPA) in May 2007. The EPA approved the Washington State's 2008 Water Quality Assessment 305(b) report and 303(d) list in January 2009. Washington's 2010 water quality report is scheduled for submission to EPA in the fall of 2011.
- Washington Shoreline Management Act, Ch. 90.58 RCW (SMA). In 1971 the Washington State Legislature passed the Washington Shoreline Management Act, adopted by public referendum in 1972. The purpose of the Act is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines" by requiring every county and many cities to develop a Shoreline Master Plan to govern development in shoreline areas, including all wetlands, river deltas, and riparian areas associated with rivers, streams and lakes. County and city shoreline master programs were originally adopted i the 1970's under Washington Administrative Code, Ch. 173-26. The Washington Department of Ecology promulgated more protective shoreline requirements in 2003. All counties in Washington State, and the cities within those counties, are subject to these requirements and are updating their shoreline master programs pursuant to the

update schedule specified in RCW 90.58.080. The statute requires shoreline master programs to be updated in Asotin, Garfield, Columbia, and Whitman counties by December 1, 2014.

- Washington Growth Management Act, Revised Code of Washington Ch. 36.70A (GMA) and Critical Areas Ordinance (CAO). As with the SMA, GMA also has an update process for city and county critical areas ordinances. Most critical areas ordinances were originally adopted following GMA's enactment in 1990/1991. While CAO are typically amended more often than shoreline master programs, GMA's update schedule for Eastern Washington counties started in December 2005, 2006, or 2007 (depending on the county).

At the same time, there are a number of concerns regarding existing regulatory mechanisms, including:

- Lack of documentation or analysis on the effectiveness of land-use regulatory mechanisms and land-use management programs.
- Revised land-use regulations to allow development on rural lands (Adoption of Measure 37, with modification by Measure 49, in Oregon).
- Water rights allocation and administration issues in Oregon and Idaho.
- Continued implementation of management actions in some areas which impact riparian areas.
- Completed TMDLs in Oregon currently lack implementation and documented impacts or improvements.
- Increased mining and mineral extraction activities in Idaho and eastern Oregon.

We conclude that the risk to the species' persistence because of the adequacy of existing regulatory mechanisms has decreased slightly, based on the improvements noted above. However, many ongoing threats to salmon and steelhead habitat could be ameliorated by strengthening existing regulatory mechanisms.

Other natural or manmade factors affecting its continued existence

Climate Change

Current research by Mote and Salathé (2010), and other members of the University of Washington Climate Impacts Group is providing insights to potential future climate change impacts for the Pacific Northwest region. Although the values or severity of these changes may be uncertain, and their biological impacts on salmonids have yet to be demonstrated, there is general scientific agreement regarding the impacts already evident in the last 40 years of climatological data and expected trends.

Expected climate change impacts for freshwater conditions and salmon and steelhead populations include:

- Increase in water temperatures.
- Decreases in snow pack causing a shift of peak flows from summer to spring, and a decrease in summer flows. Shifts in the timing of peak flows will likely result in changes in outmigration timing, changes in survival, changes in distribution, and changes in the availability of spawning and rearing habitats.
- Peak flows will be flashier, likely resulting in channel scouring and increased risk of sedimentation.
- Likely increase in winter flooding events.
- Under future climate scenarios, higher elevation areas will likely continue to provide habitat conditions within the biological tolerances of salmonids. However, lower and transitional areas will experience increasing temperatures reducing the available spawning and rearing habitats, altering distribution, and diminishing survival of fish migrating up to and from the higher elevation spawning areas.
- Life history strategies may be altered (e.g., adoption of sub-yearling life history strategies by Snake River spring/summer Chinook populations).

Expected climate change impacts to ocean conditions include:

- Increasing ocean acidification, although uncertainty remains about the effects on marine food webs and salmonid survival in the ocean.
- Ocean temperatures will increase resulting in changes in the distribution and abundance of warm and cold-water species. There is uncertainty about the effects on marine food webs and ocean survival of salmonids.
- Likely changes to a variety of processes such as the pattern and cycle of the Pacific Decadal Oscillation and the intensity and patterns of upwelling.

The certainty in modeled climate change impacts has increased as has our understanding of likely impacts of these changes on salmonid populations. While climate change impacts remain a recovery concern over the long term, it is unlikely climate change impacts have changed substantially in the few years since the last review.

Hatchery Effects

Hatchery programs can help preserve genetic resources, increase spatial distribution, and provide a short-term demographic benefit in abundance in low return years. However, artificial propagation also poses risks to natural productivity and diversity. The magnitude and type of the risk is dependent on the status of affected populations and on specific practices in the hatchery program.

Hatchery practices evolved as the status of natural populations changed and new plans are now under development for every hatchery program in the Snake River basin. For example, many captive programs initiated during the 1990s to conserve SR spring/summer Chinook salmon genetic resources have been terminated after the status of these fish improved. Sockeye extirpation and further loss of genetic diversity have been averted, largely due to the hatchery, and the program is now adjusting to promote increased population structure, spatial structure and recovery of the ESU. In addition, a comprehensive assessment of hatchery benefits and risks is now underway across the Snake River basin. The assessment is expected to result in operational refinements and changes that benefit listed species and satisfy mitigation requirements.

SR spring/summer Chinook salmon hatchery program production levels remain stable since last review. Three small-scale captive programs producing SR spring/summer Chinook salmon (Lemhi River, East Fork Salmon River, and West Fork Yankee Fork) were terminated.

SR fall-run Chinook salmon hatchery production has increased and so have adult returns (particularly hatchery-origin returns). The abundance of natural-origin adult returns has been stable, or declining slightly, in six of the past seven years and we still have no direct measure of natural-origin population productivity. Concern remains regarding the potential risks of poor integration (the proportion of hatchery broodstook comprised of natural-origin fish remains low) and regarding the effects on natural population productivity from increasing levels of hatchery-origin fish on the spawning grounds.

Steelhead programs in the Snake River basin are under ESA review and one important issue is determining where and to what extent unaccounted for hatchery steelhead are interacting with depressed listed populations, particularly those in Idaho. Releases of SR spring/summer Chinook salmon and steelhead within the spawning and rearing areas of the SR sockeye salmon ESU have remained flat since 2005.

New information available since the last status review indicates that there have not been significant changes to these factors or in our knowledge of the extent to which they present risks to the persistence of the Snake River salmon and steelhead.

Efforts being made to Protect the Species

When considering whether to list a species as threatened or endangered, section 4(b)(1)(A) of the ESA requires that NMFS take into account any efforts being made to protect that species. Throughout the range of salmon ESUs and steelhead DPSs, there are numerous Federal, state, tribal and local programs that protect anadromous fish and their habitat. The proposed listing determinations for West Coast salmon and steelhead (69 FR 33102) reviewed these programs in detail.

In the final listing determinations for salmon (70 FR 37160) and steelhead (71 FR 834), we noted that while many of the ongoing protective efforts are likely to promote the conservation of listed salmonids, most efforts are relatively recent, have yet to demonstrate their effectiveness, and for the most part do not address conservation needs at scales sufficient to conserve entire ESUs or DPSs. Therefore, we concluded that existing protective efforts did not preclude listing several ESUs of salmon and several DPSs of steelhead.

In our above five factor analysis, we note the many habitat, hydropower, hatchery, and harvest improvements that occurred in the past five years. We currently are working with our Federal, state, and tribal co-managers to develop monitoring programs, databases, and analytical tools to assist us in tracking, monitoring, and assessing the effectiveness of these improvements.

2.4 Synthesis

The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range. Under ESA section 4(c)(2), we must review the listing classification of all listed species at least once every five years. While conducting these reviews, we apply the provisions of ESA section 4(a)(1 and NMFS' implementing regulations at 50 CFR part 424.

To determine if a reclassification is warranted, we review the status of the species and evaluate the five factors, as identified in ESA section 4(a)(1): (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; and (5) other natural or man-made factors affecting a species' continued existence. We then make a determination based solely on the best available scientific and commercial information, taking into account efforts by states and foreign governments to protect the species.

The updated status reviews completed by our Northwest Fisheries Science Center indicates that while there have been improvements in the viability ratings for some of the component populations, none of the Snake River ESUs and DPS are currently meeting the viability criteria recommended by the ICTRT. Several more populations within each ESU and DPS will need improved viability ratings in order to meet the viability criteria. While little improvement in ESU

and DPS viability has been observed over the last five years, there is also no new information to indicate that the extinction risk has increased. The Science Center concluded, after reviewing the available new information, that the biological risk category for the SR sockeye salmon, SR spring/summer Chinook salmon, SR fall-run Chinook salmon, and SR basin steelhead has not changed since the time of the last status reviews.

Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the Snake River salmon and steelhead's persistence has not changed significantly since our final listing determinations in 2005 and 2006. Improvements have been made to the operation of the FCRPS and numerous habitat restoration projects have been completed in many Snake River tributaries. Harvest rates remain relatively low and stable. The protection afforded by some regulatory mechanisms, such as revised harvest practices identified in the 2008 U.S. v OR Agreement, has increased. Conversely, habitat problems are still common throughout the basin and many more habitat improvements are likely needed to achieve viability, particularly for SR spring/summer Chinook salmon and SR basin steelhead. Many existing regulatory mechanisms could be improved to better protect salmon and steelhead habitat. In addition, predation from an increase in pinniped populations and significant avian impacts remain a concern, as do the impacts that climate change poses to long-term recovery.

After considering the biological viability of the listed Snake River salmon and steelhead and the current status of the ESA section 4(a)(1) factors, we conclude that the status of these ESUs and DPS has not improved significantly since they was listed in 2005 and 2006. However, the implementation of sound management actions in each "H"—hydropower, habitat, hatcheries, and harvest—are essential to the recovery of these ESUs and DPS and must continue. Establishing additional populations of SR sockeye salmon and SR fall-run Chinook salmon is also a conservation priority. The biological benefits of habitat restoration and protection efforts, in particular, have yet to be fully expressed and will likely take decades to result in measurable improvements to population viability. By continuing to implement actions that address the factors limiting population survival and monitoring the effects of the action over time, we will ensure that restoration efforts meet the biological needs of each population and, in turn, contribute to the recovery of these ESUs and DPS. After completion, the Snake River Recovery Plan will be the primary guide for identifying future actions to target and address salmon and steelhead limiting factors and threats. Over the next five years, it will be important continue to implement these actions and monitor our progress.

2.4.1 ESU/DPS Delineation and Hatchery Membership

The Northwest Fisheries Science Center's review (Ford et al. 2010) found that no new information has become available that would justify a change in boundaries of the Snake River ESUs and DPS.

The Northwest Regional Office's review of new information to inform the ESU/DPS membership status of various hatchery programs (Jones et al. 2011) noted the following changes since the last status evaluation:

- The SR sockeye captive hatchery program has not changed substantially from the previous ESA status review. Further review of this program was not recommended.
- Several SR spring/summer Chinook salmon hatchery programs have been revised or may warrant further review since the previous ESA status review. The Lemhi River, East Fork Salmon River, West Fork Yankee Fork River captive rearing experiments were terminated in 2009. New hatchery programs established include the Yankee Fork and Dollar Creek in the Upper Salmon River. The Imnaha River hatchery program and the Big Sheep Creek program warrant further review because of low numbers of natural-origin fish and a high percentage of hatchery spawners leading to divergence in age structure and run timing.
- The SR fall-run Chinook salmon hatchery programs have not changed substantially from the previous ESA status review. However further review of these programs was recommended.
- For the SR basin steelhead DPS, Jones et al. (2011) recommended that three new programs (Squaw Creek B-run, Streamside Incubator Project, and Yankee Fork) should not be included in the DPS, and also recommended further review for four existing programs in the SR basin steelhead DPS. Three hatchery programs warrant further review because of practices where no natural-origin fish are being used for broodstock, these include: Dworshak National Fish Hatchery program, Lolo Creek on the Clearwater River, and the North Fork Clearwater hatchery program. Additionally, the Little Sheep Creek/Imnaha hatchery warrants further review because of the potential for divergence based on decreasing natural-origin influence and unknown impact on the natural-origin population.

2.4.2 ESU/DPS Viability and Statutory Listing Factors

- The Northwest Fisheries Science Center's review of updated information does not indicate a change in the biological rick category for any of the Snake River ESUs or DPS since the time of the last status review.
- Our review of new information for each of the statutory listing factors indicates that while some impacts have decreased and some have increased, the overall level of concern remains the same.

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3 · Results

3.1 Classification

Listing status:

Based on the information identified above, we determine that:

- The SR sockeye salmon ESU should remain listed as endangered.
- The SR spring/summer Chinook salmon ESU should remain listed as threatened.
- The SR fall-run Chinook salmon ESU should remain listed as threatened.
- The SR basin steelhead DPS should remain listed as threatened.

ESU/DPS delineation

No change is appropriate for ESU or DPS delineations.

Hatchery membership

- SR sockeye salmon hatchery programs: No Change.
- SR spring/summer Chinook salmon hatchery programs:
    - The Lemhi River, East Fork Salmon River, and West Fork Yankee Fork captive rearing experiments have all been terminated and should be removed from the ESU.
    - Two new spring/summer Chinook salmon programs (Yankee Fork and Dollar Creek) should be considered for inclusion in the ESU.
    - Two existing programs (Imnaha River and Big Sheep Creek) are included in the ESU, but warrant further review because of the potential divergence from natural-origin populations.
- The SR fall-run Chinook salmon hatchery programs have not changed substantially from the previous ESA status review. However, further review of these programs was recommended.
- SR basin steelhead hatchery programs:
    - Three new steelhead programs (Streamside Incubator Project, Yankee Fork, and Squaw Creek B-run) are not recommended for inclusion in the DPS.
    - Four existing hatchery programs warrant further review: (1) Dworshak National Fish Hatchery; (2) Lolo Creek Hatchery – Clearwater River; (3) North Fork Clearwater Hatchery; and (4) Little Sheep Creek/Imnaha River Hatchery.

- No current SR basin steelhead hatchery programs have been terminated since the time of the last status review.

3.2 New Recovery Priority Number

There are no changes in the recovery priority number listed in Table 4 for either the Snake River ESUs or the Snake River basin steelhead DPS.

4 · Recommendations for Future Actions

In our review of the listing factors we identified several actions that are critical to improving the status of Snake River ESUs and DPS. Completion, adoption and implementation of a Snake River Recovery Plan for the four ESA-listed Snake River salmon and steelhead species, implementation of the 2008 Harvest Biological Opinion, implementation of the new U.S. v. OR Agreement, implementation the 2010 FCRPS Biological Opinion, and the completion of the ESA consultations on the hatchery programs in the Snake River ESUs and DPS are the most important actions to be taken over the next 5 years. Improved coordination and cooperation of Federal, state, tribal and local partners is critical to the successful implementation of these plans and agreements. Efforts to improve flow management and habitat conditions by Federal agencies (specifically – the Bureau of Reclamation [Grande Ronde watershed], US Army Corps of Engineers, US Forest Service, and the Bureau of Land Management) represent the greatest opportunities to advance recovery for the Snake River salmon ESUs and steelhead DPS and should be aggressively pursued.

Additional actions recommended to be implemented are as follows:

Implement Research Monitoring and Evaluation (RM&E) actions to address critical uncertainties:

- Smolt migration timing and mortality rates through the lower Snake and Columbia Rivers
- Investigate factors that could contribute to latent mortality of fish passing through the hydro system.
- Implement RM&E actions identified in NMFS' 2010 FCRPS Biological Opinion.
- Improve estimates of RM&E handling (electrofishing, weirs, catch and release, tagging, marking, trapping, and sorting) impacts
- Identify the contributing factors for lower or greater reproductive success rates for hatchery fish
- Implement actions to provide a direct measure of SR fall-run Chinook salmon natural population productivity and implement further actions to measure effects, positive and negative, of high levels of hatchery-origin spawners on natural population of SR fall-run Chinook salmon productivity and survival.
- Implement climate change research to address uncertainties with regard to biological impacts, with a focus on the Snake basin
- Investigate climate change impacts with regard to ocean conditions and impacts to Snake River ESUs and DPS

- Investigate factors influencing the adoption of alternative life history patterns and how these changes might contribute to the productivity and abundance of the affected populations.

Additional habitat actions recommended to be implemented are as follows:

- Continue to focus and prioritize recovery actions on limiting factors
- Continue to implement and sustain current habitat efforts (permits, enforcement, restoration, and protection) through the economic downturn.
- Implement TMDLs and Snake River basin Adjudication.
- Complete the Bureau of Reclamation Tributary Assessment on middle and lower Catherine Creek in the Grand Ronde watershed in northeast Oregon.

Additional hatchery actions recommended to be implemented are as follows:

- Evaluate the impacts of other hatchery species releases (both anadromous and resident)
- Implement relative reproductive success studies and evaluate spawner effectiveness of hatchery fish
- Investigate demographic risk versus conservation benefit regarding evaluation of sliding scale hatchery management
- Implement sockeye hatchery management and identify next steps in Recovery Plan
- Continue the captive broodstock program for Snake River sockeye salmon to build genetic resources while continuing to implement alternative release strategies such as planting eyed-egg incubation boxes, releasing smolts for volitional emigration and releasing adults for volitional spawning.

Additional harvest actions recommended to be implemented are as follows:

- Conduct pit tag detection for all harvested fish to better understand the sources of losses in conversion rates and improve the sophistication in harvest management.
- Improve estimates of harvest catch and release impacts.

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National Marine Fisheries Service
5-Year Review

Snake River Sockeye Salmon
Snake River Spring/Summer Chinook Salmon
Snake River Fall-run Chinook Salmon
Snake River Basin Steelhead

Conclusion:

Based on the information identified above, we conclude:

- The Snake River Sockeye salmon ESU should remain listed as endangered.
- The Snake River Spring/Summer Chinook salmon ESU should remain listed as threatened.
- The Snake River Fall-run Chinook salmon ESU should remain listed as threatened.
- The Snake River basin steelhead DPS should remain listed as threatened.

REGIONAL OFFICE APPROVAL

Northwest Regional Administrator, NOAA Fisheries

Approve: Date: *July 26, 2011*