Science, Service, Stewardship

5-Year Review:
Summary & Evaluation of
Upper Columbia River Steelhead
Upper Columbia River
Spring-run Chinook

National Marine Fisheries Service
Northwest Region
Portland, OR

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5-Year Review: Upper Columbia River Species

Species Reviewed	Evolutionarily Significant Unit or Distinct Population Segment
Chinook Salmon (*Oncorhynchus tshawytscha*)	*Upper Columbia River Spring-run Chinook*
Steelhead (*O. mykiss*)	*Upper Columbia River Steelhead*

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1 ▪ General Information

1.1 Introduction

Many West Coast salmon and steelhead (Oncorhynchus sp.) 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 5-year status review for ESA-listed Upper Columbia River (UCR) salmon and steelhead species. These include: UCR Spring-run Chinook salmon and UCR steelhead.

1.1.1 Background on salmonid 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 a 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 (VSP) 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 salmon management biologists 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 UCR steelhead and Spring-run Chinook salmon; 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

In 1997, NMFS began listing UCR salmonid species under the ESA. By 1999, NMFS listed two species in this area as endangered, and later reclassified one as threatened (Table 1).

Table 1. Summary of the listing history under the Endangered Species Act for the Upper Columbia River salmonids.

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)
Chinook Salmon (*O. tshawytscha*)	Upper Columbia River Spring-run Chinook Salmon	**FR Notice:** 64 FR 14308 **Date:** 3/24/1999 **Classification:** Endangered	**FR Notice:** 70 FR 37160 **Date:** 6/28/2005 **Classification:** Endangered
Steelhead (*O. mykiss*)	Upper Columbia River Steelhead	**FR Notice:** 63 FR 43937 **Date:** 8/18/1997 **Classification:** Endangered	**FR Notice:** 71 FR 834 **Date:** 1/5/2006 **Re-classification:** Threatened **FR Notice:** Legal Challenge **Date:** 1/13/2007 **Re-classification:** Endangered **FR Notice:** 74 FR 42605 **Date:** 8/24/2009 **Re-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 both UCR Spring-run Chinook salmon and UCR steelhead in 2005.

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. On January 5, 2006, we applied the 4(d) regulations to UCR steelhead (71 FR 834).

Table 2. Summary of rulemaking for 4(d) protective regulations and critical habitat for salmon and steelhead in the Upper Columbia River.

Salmonid Species	ESU/DPS Name	4(d) Protective Regulations	Critical Habitat Designations
Chinook Salmon (*O. tshawytscha*)	Upper Columbia River Spring-run Chinook Salmon	ESA section 9 applies	**FR Notice:** 70 FR 52630 **Date:** 9/2/2005
Steelhead (*O. mykiss*)	Upper Columbia River Steelhead	**FR Notice:** 71 FR 5178 **Date:** 2/1/2006	**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 UCR Spring-run Chinook salmon and UCR steelhead DPS. 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 UCR salmon and steelhead.

Salmonid Species	ESU/DPS Name	Document Citation
Chinook Salmon (*O. tshawytscha)*	Upper Columbia River Spring-run Chinook Salmon	ICTRT 2007a ICTRT 2007b ICTRT and Zabel 2007 Good et al. 2005 McClure et al. 2005 ICTRT 2003 NMFS 1999 NMFS 1998a NMFS 1998b
Steelhead (*O. mykiss*)	Upper Columbia River Steelhead	ICTRT 2007a ICTRT 2007b 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 Plan for UCR Spring-run Chinook salmon and UCR steelhead.

Salmonid Species	ESU/DPS Name	Recovery Priority Number	Recovery Plan/Outline
Chinook Salmon (*O. tshawytscha*)	Upper Columbia River Spring-run Chinook Salmon	**1**	**Title:** Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan **Date:** 10/9/2007 Available at: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Upper-Col-Plan.cfm **Type:** Final **FR Notice:** 72 FR 57303
Steelhead (*O. mykiss*)	Upper Columbia River Steelhead	**1**	**Title:** Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan Available at: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Upper-Col-Plan.cfm **Date:** 10/9/2007 **Type:** Final **FR Notice:** 72 FR 57303

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2 · Review Analysis

In this section we review new information to determine whether the UCR 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
Upper Columbia River Spring-run Chinook Salmon	X	
Upper Columbia River Steelhead	X	

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

ESU/DPS Name	YES	NO
Upper Columbia River Spring-run Chinook Salmon	X	
Upper Columbia River Steelhead	X	

Was the ESU/DPS listed prior to 1996?

ESU/DPS Name	YES	NO	Date Listed if Prior to 1996
Upper Columbia River Spring-run Chinook Salmon		X	n/a
Upper Columbia River Steelhead		X	n/a

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

Not Applicable

2.1.1 Summary of relevant new information regarding the delineation of the UCR Spring-run Chinook salmon ESU and the UCR steelhead DPS

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.

We found no new information that would justify a change in the boundaries of the UCR spring-run Chinook salmon ESU or the UCR 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 this ESU 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.

They also identified five programs that are trending toward divergence from the ESU/DPS and need further evaluation before recommending for inclusion or removal from the ESU/DPS.

UCR Spring-run Chinook salmon

The UCR Spring-run Chinook ESU includes all naturally spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River (64 FR 14208: March 24, 1999). Six artificial propagations are considered to be part of the ESU: The Twisp River, Chewuch River, Methow Composite, Winthrop NFH, Chiwawa River, and White River spring-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).

We determined that the Spring-run Chinook salmon hatchery program at the Entiat National Fish Hatchery (not considered part of the ESU) was a threat to the ESU, and therefore discontinued the program in 2007. The last adult from the program returned to the Entiat River in 2010. In the Methow River, there are two hatchery programs that are considered to be part of the ESU. The Winthrop National Fish Hatchery, operated by the US Fish and Wildlife Service, and the Methow Fish Hatchery (Methow Composite), operated by the WDFW, both rely on a high percentage of hatchery-origin fish for broodstock in addition to using a composite stock of natural spawners (i.e., a combination of Methow and Chewuch River fish). These practices genetically homogenize Methow River Spring-run Chinook salmon, breaking down genetic

differentiation and posing a continued risk to population diversity and productivity. Continued implementation of existing broodstock practices may result in a level of divergence that warrants reconsideration of ESU-membership for both Methow River Spring-run Chinook salmon hatchery programs. Jones et al. (2011) recommended further review of these programs.

UCR Steelhead

The UCR steelhead DPS includes all naturally spawned populations of steelhead in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border (62 FR 43937); August 18, 1997). Six artificial propagation programs are considered part of the DPS: the Wenatchee River, Wells Hatchery in the Methow and Okanogan rivers, Winthrop NFH, Omak Creek, and the Ringold steelhead 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 DPS (71 FR 834).

The Winthrop NFH, Wells Hatchery, and Ringold Hatchery (located in the lower portion of the Upper Columbia River) programs continue to use composite Methow and Okanogan natural-origin and hatchery-origin steelhead for broodstock. Only a portion of the Winthrop NFH program uses all natural-origin Methow River steelhead in the broodstock. If the Winthrop NFH, Wells Hatchery, and Ringold Hatchery program continue to use composite Methow and Okanogan natural-origin and hatchery-origin steelhead for broodstock, divergence would be expected, and membership in the DPS may warrant reconsideration. Jones et al. (2011) recommended further review of these programs.

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
Upper Columbia River Spring-run Chinook Salmon	X	
Upper Columbia River 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
Upper Columbia River Spring-run Chinook Salmon	X	
Upper Columbia River Steelhead	X	

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

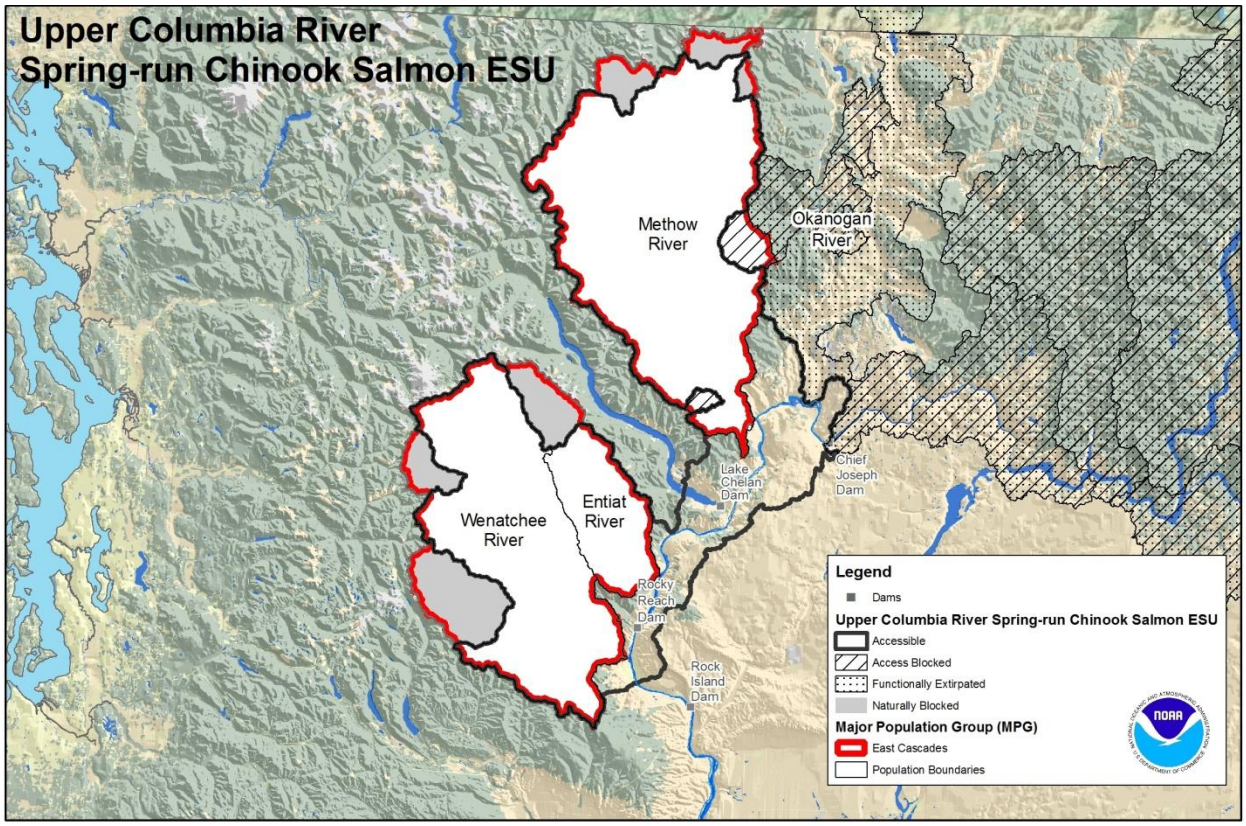
ESU/DPS Name	YES	NO
Upper Columbia River Spring-run Chinook Salmon	X	
Upper Columbia River Steelhead	X	

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

For the purposes of reproduction, salmon ESUs and steelhead DPSs typically display 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 largely 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 recovery planning and development of recovery criteria, the Interior Columbia Technical Recovery Team (ICTRT) identified independent populations within the UCR spring-run Chinook salmon ESU and the UCR steelhead DPS, and grouped them into genetically similar major population groups (MPGs) (ICTRT 2003). Within the UCR Spring-run

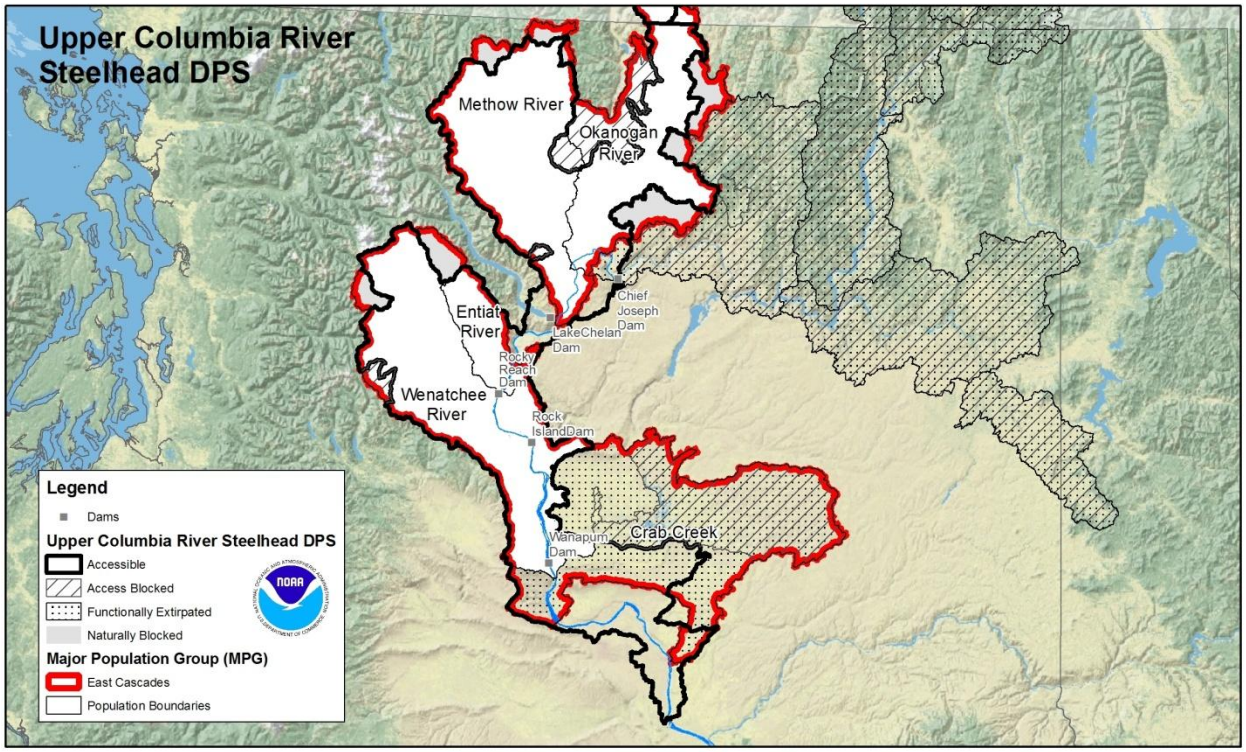
Chinook salmon ESU, there are four independent populations (three extant and one extinct) and all belong to one genetically similar MPG (Figure 1). Similarly, within the UCR steelhead DPS, there are four independent extant populations belonging to one genetically similar MPG (Figure 2).

Figure 1. UCR Spring-run Chinook salmon population structure[1]



[1] The maps in Figures 1 and 2 generally show the accessible and historically accessible areas for the UCR Spring-run Chinook salmon ESU and the UCR steelhead DPS. The areas displayed are consistent with the regulatory description of the boundaries of the UCR Spring-run Chinook salmon and UCR steelhead DPS found at 50 CFR17.11, 223.102, and 224.102. Actions outside the boundaries shown can affect this ESU/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 ESU/DPS for the purposes of the ESA.

Figure 2. UCR steelhead population structure



The ICTRT (2007b) also developed specific biological viability criteria based on the VSP concept (McElhany et al. 2000) at the population, MPG, and ESU/DPS levels. At the population level, the ICTRT recommended specific biological criteria based on the four viability components of VSP—abundance/productivity and spatial structure/diversity. These criteria are integrated to develop a total population viability rating. The population viability ratings, in order of descending risk, are highly viable, viable, moderate risk and high risk.

In 2007, NMFS issued a final recovery plan (Plan) for the UCR Spring-run Chinook salmon ESU and the UCR steelhead DPS, which adopted the ICTRT 2007 viability goals as biological delisting criteria (UCSRB 2007). The recovery strategies outlined in the Plan are targeted to achieve, at a minimum, the biological criteria for each ESU/DPS.

UCR Spring-run Chinook Salmon Biological Recovery Criteria

Criterion 1: The 12-year geometric mean for abundance and productivity of naturally produced Spring-run Chinook salmon within the Wenatchee, Entiat, and Methow populations must reach a level that would have no more than a 5 percent extinction-risk (viability) over a 100-year period.

Criterion 2: At a minimum, the UCR Spring-run Chinook salmon ESU will maintain at least 4,500 naturally produced spawners and a spawner:spawner ratio greater than 1.0 distributed among the three populations.

Criterion 3, 4, and 5: The Recovery Plan identifies specific spatial structure and diversity metrics designed to restore the distribution of naturally produced UCR Spring-run Chinook salmon to previously occupied areas (where practical) and allow natural patterns of genetic and phenotypic diversity to be expressed.

UCR Steelhead Biological Recovery Criteria

Criterion 1: The 12-year geometric mean for abundance and productivity of naturally produced steelhead within the Wenatchee, Entiat, Methow, and Okanogan populations must reach a level that would have no more than a 5 percent extinction-risk (viability) over a 100-year period.

Criterion 2: At a minimum, the UCR steelhead DPS will maintain at least 3,000 spawners and a spawner:spawner ratio greater than 1.0 distributed among the four populations.

Criterion 3, 4, and 5: The Recovery Plan identifies specific spatial structure and diversity metrics designed to restore the distribution of naturally produced UCR steelhead to previously occupied areas (where practical) and allows natural patterns of genetic and phenotypic diversity to be expressed.

2.3 Updated Information and Current Species' Status

In addition to recommending recovery criteria, the ICTRT also assessed the current status of each population ESU/DPS (ICTRT 2007b). Each population was rated against the biological criteria identified in the recovery plan and assigned a current viability rating.

2.3.1 Analysis of Viable Salmonid Population (VSP) Criteria

UCR Spring-run Chinook Salmon ESU

Abundance & Productivity

Total spawning abundance, including both natural-origin and hatchery fish, has increased relative to the levels reported in the previous review. The geometric mean abundances of both natural-origin and hatchery spawners are higher for each population relative to the previous ESA status review and to the levels just prior to listing. The relative increase in hatchery-origin spawners in the Wenatchee and Methow River populations is disproportionately high, reflecting the large increase in releases from the directed supplementation programs in those two drainages.

The short term indices of population growth rate depict an upward trend in natural-origin returns since 1995 at a higher average rate than during the period leading up to the previous ESA status review (Ford et al. 2010). However, estimated population growth rates, assuming that hatchery-origin spawners and natural-origin spawners are contributing to natural production at the same rate, are below replacement for all three populations in this ESU. Possible contributing factors would include density dependent effects, differences in spawning distribution relative to habitat

quality, and reduced fitness of hatchery-origin spawners. Overall abundance and productivity remains at High risk for each of the three extant populations in this MPG/ESU.

Spatial Structure & Diversity

Despite modest improvements in the distribution of fish within their historical range through replacement of culverts and removal of other passage barriers, the composite spatial structure/diversity metric for all three extant populations in this MPG/ESU remained the same, primarily because of the diversity component driven by chronically high proportions of hatchery-origin spawners in natural spawning areas and lack of genetic diversity among the natural-origin spawners (ICTRT 2008).

Updated Risk Summary

Overall abundance and productivity remains at high risk of extinction for each of the three extant populations in this MPG/ESU. The 10-year geometric mean abundance of adult natural-origin spawners has increased for each population relative to the levels for the 1981-2003 series, but the estimates remain below the corresponding thresholds identified by the ICTRT. Estimated productivity (spawner-to-spawner return rate at low to moderate escapements) was, on average, lower over the years 1987-2009 than for the previous 1981-2003 period. The combinations of current abundance and productivity for each population result in a high risk rating relative to the ICTRT viability curves.

The composite spatial structure/diversity (SS/D) risks for all three of the extant populations in this MPG/ESU are at high risk of extinction. The spatial structure component of the SS/D metric is at a low risk rating for the Wenatchee River and Methow River populations and at moderate risk rating for the Entiat River population. All three of the extant populations in this single MPG/ESU are at high risk of extinction for the diversity metric. Chronically high proportions of hatchery-origin spawners in natural spawning areas and lack of genetic diversity among the natural-origin spawners (ICTRT 2008) drive this diversity risk factor.

Based on the combined ratings for abundance/productivity and spatial structure/diversity, all three extant populations of UCR Spring-run Chinook salmon remain at an overall high risk of extinction.

ESU Summary

Although there has been an increase of abundance for all three UCR Spring-run Chinook salmon populations, overall productivity has decreased and the ESU remains at a high risk of extinction. Since the ESU-level recovery criteria require that all the extant populations within this single MPG be rated as viable for the ESU to be viable, more progress must be made before the UCR Spring-run Chinook salmon ESU can be considered recovered.

Several factors cited in the previous status review (Good et al. 2005) remain concerns or key uncertainties for all three extant populations. Increases in natural-origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging. However, average productivity levels remain extremely low. Large-scale directed supplementation programs are underway in the Wenatchee and Methow populations. These programs are intended to mitigate short-term demographic risks while actions to improve natural productivity and capacity are implemented. While these programs may provide short-term demographic benefits, there are significant uncertainties regarding the long-term risks of relying on high levels of hatchery influx to maintain natural populations.

Overall, the new information considered does not indicate a change in the biological risk category since the time of the last status review. The viability of the UCR Spring-run Chinook salmon ESU has likely improved somewhat, however the ESU remains at a moderate-to-high risk of extinction - none of the populations meet the ICTRT's 2007 biological recovery criteria (ICTRT 2007b).

UCR Steelhead DPS

Abundance & Productivity

The most recent estimates (five year geometric mean) of total and natural-origin spawner abundance are higher for all four independent populations of the DPS, and for the Priest Rapids Dam aggregate run, since the last status review. Annual returns since 2005 were all above the population-specific ranges reported in the previous review. In spite of the recent increases however, natural-origin returns remain well below target levels.

Hatchery-origin returns continue to constitute a high fraction of total spawners in natural spawning areas for this DPS. Estimates of natural-origin spawner abundance are higher for the most recent five year cycle. Current patterns in the proportion of natural-origin spawners among populations are similar to that reported in the previous status review. The proportions of natural-origin spawners are highest in the Wenatchee River, and remain at extremely low levels in the Methow and Okanogan Rivers.

Spatial Structure & Diversity

Although modest improvements in the distribution of fish within their historical range have been achieved through replacement of culverts and removal of other passage barriers, the spatial structure and diversity metrics have not changed since the completion of the 2008 ICTRT status assessments. The proportions of hatchery-origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations, and continue to be a major concern.

Updated Risk Summary

All four populations of the UCR steelhead DPS remain at high risk of extinction since the last status review. The most recent estimates of natural-origin abundance (10-year geometric mean) and natural-origin productivity are at low to moderate parent abundance and remain well below the ICTRT-defined viability curve minimum for the DPS. Spawning escapements into natural areas, especially for the Methow and Okanogan populations, continue to show a high proportion of hatchery-origin fish. Productivity, assuming that the hatchery-origin and natural-origin spawners are contributing to natural production at the same effectiveness, is below replacement for all four populations (even at low to moderate spawning levels). Geometric mean natural-origin abundance and productivity estimates since the previous status review are the highest for the Wenatchee River population that contains the lowest relative proportion of hatchery spawners.

DPS Summary

Although there has been an increase in abundance and productivity for all four UCR steelhead populations, the improvement has been minor, and none of the populations meet the recovery criteria established in the UCR Recovery Plan. Since the DPS-level recovery criteria require that all four populations be viable, more progress must be made before the UCR steelhead can be considered recovered.

Several factors cited in the previous status review (Good et al. 2005) remain concerns or key uncertainties. UCR steelhead populations have increased in natural-origin abundance in recent years, but productivity levels continue to remain low. The proportion of hatchery-origin returns in natural spawning areas remains extremely high across the DPS, especially in the Methow and Okanogan River populations. Recent improvements in natural returns, although modest, are most likely the result of several years of relatively good ‘natural’ ocean and tributary habitat survival conditions.

Overall, the new information considered does not indicate a change in the biological risk category since the time of the last status review. Direct biological performance measures for this DPS indicate modest progress to date toward meeting viability criteria. New information considered during this review confirms that all populations within this DPS are at high risk and the DPS, as a whole, is not viable.

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. The effectiveness of habitat restoration actions and progress toward meeting the viability criteria will be monitored and evaluated with the aid of new reporting techniques. Generally, it takes one to five decades to demonstrate such increases in viability. Below, we summarize several noteworthy restoration and protection actions implemented since the last review. We also note areas where concerns about this DPS' habitat condition remain.

The implementation of the Federal Columbia River Power System (FCRPS) Biological Opinion (Opinion) (NMFS 2008a; NMFS 2010) has provided a number of actions that will result in survival improvements, reduced duration of outmigration to the estuary, improvements in juvenile survival and condition, and increased access to habitats. Some of the major milestones include the following:

Improvements in Operations and Fish Passage at Hydropower Facilities and Dams

Implementation of the FCRPS Opinion (NMFS 2008a; NMFS 2010) provides a number of new actions and continuation of existing programs that have and will likely continue to increase passage survival through the Columbia River passage corridor. In addition to increasing direct survival at the dams and through the project reservoirs, these actions reduce the duration of juvenile salmonid outmigration to the estuary, and increase access to habitat for adult migrants.

Since 2006, direct survival for juvenile salmonid outmigration in the Columbia River has likely increased because of the installation or improvement of juvenile passage structures at The Dalles Dam (spillway wall installed in 2010), John Day Dam (two surface passage weirs installed in 2008), McNary Dam (surface passage routes and spillway weirs installed in 2007), Priest Rapids Dam (surface bypass prototype evaluated and design improvements from 2007-2010), and Wanapum Dam (surface bypass installed in 2008). Juvenile passage facilities continue to

perform well at Rocky Reach Dam (surface collector installed in 2003), Rock Island Dam (array of notched surface spill gates), Wells Dam (surface collector) and Bonneville Dam (corner surface collector installed in 2004). Mainstem dam juvenile passage facilities have been evaluated for passage survival and behavioral response, and testing continues. Survival and behavioral testing subsequently inform modifications to passage facility design and project operations, based on lessons learned and adaptive management.

By 2001, juvenile project survival standard (93 percent survival for dam and reservoir passage) for juvenile UCR Spring-run Chinook salmon and juvenile UCR steelhead was only achieved at one of the five Middle Columbia PUD dams. As of 2010, four PUD hydroelectric projects achieved Spring Chinook salmon survival standards and the fifth project is within a percentage point. Four of the five PUD dams now have a permanent juvenile passage facility, and construction at the fifth dam is planned for 2011-2012. UCR steelhead survival performance standards are achieved at all PUD dams, but unresolved reservoir mortality issues have not allowed achievement of project survival standards at two of the five projects. Tests to identify reservoir mortality mechanisms are planned for 2011. Other recent hydroelectric project improvements include the construction of a new trap and handling facility at Priest Rapids Dam; ongoing installation of new turbines at Wanapum Dam; installation of PIT tag detection arrays in the Rocky Reach Dam juvenile bypass facility; improvements to Northern Pikeminnow removal programs; and enhanced avian predator deterrent programs (hazing and wire arrays).

Future improvements are anticipated as the FCRPS Opinion (NMFS 2008a; NMFS 2010) is implemented further. Some of the future improvements include adult PIT tag detectors at The Dalles Dam or John Day Dam; enhanced estuarine detection of PIT tagged adults; and development and evaluation of PIT tag detection at project spillways. These technological enhancements will increase the ability to detect and correct salmonid passage issues throughout the Columbia River Basin. Plans to study reservoir mortality are underway.

Management of Tributary Habitat

Since the last status review, numerous habitat improvement projects have been completed. Recovery projects throughout the range of the UCR Spring-run Chinook salmon ESU and the UCR steelhead DPS included: (1) improved fish passage and increased access to high quality habitat; (2) riparian vegetation restoration through fencing and planting; (3) reestablishment of off channel habitat; (4) significant flow improvements in several important tributary stream reaches; and (5) land protection through funds from Middle Columbia Habitat Conservation Plans, Grant County PUD, Washington Salmon Recovery Funding Board, Bonneville Power Administration, and the Pacific Coast Salmon Recovery Fund.

In Nason Creek, two restored oxbows now connect over one mile of habitat, thereby increasing habitat diversity and off-channel rearing and over-wintering habitat for salmon and steelhead. Additional off-channel areas have been created or enhanced throughout the Wenatchee watershed from Leavenworth downstream. Replacement of eighteen culverts in Chumstick

Creek provides year-round passage to all life stages of fish. Improved management at Leavenworth National Fish Hatchery enables steelhead to access roughly two additional miles of good quality habitat. In the Methow River Basin, the Forest Service has improved habitat conditions by fencing riparian areas where grazing occurs, replacing culverts in the Twisp watershed, and performing a minimum roads analysis in the Chewuch Watershed to help guide their road system. While these projects will likely improve salmonid rearing conditions and survival, habitat responses have yet to be adequately monitored. It is also important to note that habitat projects usually require more than five years to improve habitat conditions. Instream flows have been significantly improved in the Chewuch River, Twisp River, Beaver Creek and other tributaries as a result of publicly funded water conservation projects and court action. In the Okanogan Basin, fish passage and instream flows have been improved in several tributaries as well as in the mainstem Okanagon. Passage projects in the Okanogan are particularly important for steelhead in that portion of the mainstem within the U.S. where it is too warm to support year-round rearing.

Despite significant efforts to improve habitat conditions, much of the habitat in the range of UCR Spring-run Chinook salmon and UCR steelhead remains degraded. Restoring habitat to historic conditions may not be needed to attain viability, but considerable improvement is needed to restore habitat to levels that will support viable populations of both UCR steelhead and Spring-run Chinook salmon. In particular, the poor status of the habitat is a major obstacle to achieving UCR Spring-run Chinook salmon ESU and steelhead DPS viability. There are significant opportunities to improve habitat conditions in the Methow, Entiat, and Wenatchee basins. For example, in the Methow basin, sediment levels in the Chewuch River are very high. Yet, land managers have made little progress in reducing road densities and treating other sediment sources. Additional opportunities for habitat improvement include increasing flows in the lower eight miles of the Chewuch River and removing problematic irrigation push-up dams on the Twisp and Methow rivers.

The mainstems of the Wenatchee, Entiat, and Methow rivers and key reaches of larger tributaries of each are nearly devoid of large woody debris. State and Federal highway departments, railroad rights-of-way and power line corridors severely limit the expression of normative floodplain function and the extent of the channel migration zone of the Wenatchee River, Nason Creek, and Peshastin Creek. Residential development has severely limited channel migration in the Methow below the Lost River, and future residential development presents a substantial threat to normative habitat forming processes. In the dynamic reaches of the upper Methow, bank armoring at a single location can cause negative changes in habitat conditions for great distances both up and downstream. For this reason, much of the money available for habitat restoration in the Methow Basin has instead been dedicated to preventing the problems that would otherwise result from the type of residential development typically permitted there.

Federal and Non-Federal actions, including agriculture, urbanization, and development throughout the UCR basin have likely resulted in stormwater inputs, pesticide and herbicide contamination, bank hardening and stabilization, overwater structures, and low stream flow. In

addition, the frequency of large fires and increases in disease and insect outbreaks also add uncertainty to the future condition of large areas of forested lands and their ability to maintain conditions suitable for anadromous fish. These types of impacts may further degrade habitat conditions. The net impact of such degradation in the context of considerable habitat restoration efforts is unknown.

Federal Land Management

Federal land managers have taken a number of measures to protect and restore habitat throughout the UCR 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 the Northwest Forest Plan (FEMAT 1993), 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, within the range of the UCR steelhead and UCR Spring-run Chinook salmon, 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). One notable improvement is an increase in the average number of large woody debris placed in streams across the range of the UCR steelhead DPS (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 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 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 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-Chokhachy 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 UCR steelhead and Spring-run Chinook salmon, conservation of this DPS'/ESU's habitat on Federal land is a recovery priority. However, there is uncertainty over the future conservation of UCR steelhead and UCR Spring-run Chinook salmon on Federal lands. The level of protection afforded to these species and their 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.

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 and to the degree possible, to provide funding and technical assistance for projects that benefit the UCR steelhead and Spring-run Chinook salmon.

New information available since the last status review indicates that many restoration and protection actions have been implemented in freshwater and estuary habitat but does not reveal overall trends in habitat quality, quantity, and function. In addition, we remain concerned with habitat conditions throughout the range of the UCR steelhead DPS and Spring-run Chinook

salmon ESU, particularly in regards to water quality, water quantity, riparian condition, and floodplain function. We therefore conclude that the risk to the species' persistence because of habitat destruction or modification has not changed since the last status review.

Overutilization for commercial, recreational, scientific, or educational purposes

Harvest

New terminal fisheries targeted at hatchery-origin fish in the Hanford Reach and surrounding tributaries reduce hatchery surplus returns and minimize impact to natural-origin fish. The May 2008 U.S. v. Oregon Management Agreement (2008-2017) will, on average, reduce impacts of fisheries on the UCR Spring-run Chinook salmon ESU and UCR steelhead DPS (NMFS 2008b).

UCR Spring-run Chinook salmon migrate offshore in marine waters where impacts from ocean salmon fisheries are too low to be quantified. The only significant harvest occurs in the mainstem Columbia River in tribal and non-tribal fisheries directed at hatchery Spring-run Chinook salmon. Exploitation rates have increased in recent years but still remain relatively low, generally below 10 percent. The increase of exploitation rates are a result of record returns of hatchery Spring-run Chinook salmon to the Columbia River basin.

For UCR steelhead, total exploitation rates have been stable at around 5 percent. The majority of impacts on the summer run occur in tribal gillnet and dip net fisheries targeting the Spring-run Chinook salmon.

Research and Monitoring

Although the absolute quantity of take authorized for scientific research and monitoring has been relatively low, our records of take authorization under ESA sections 10(a)(1)(A) and 4(d) for the UCR species reveal a steady increase in requests for take. We expect additional increases in take requests in the foreseeable future with implementation of the 2010 FCRPS Supplemental Biological Opinion. This Opinion integrates the 2008 reasonable and prudent alternative and the Adaptive Management Implementation Plan (FCRPS Biological Opinion) and Hatchery Genetic Management Plans (HGMPs). Handling impacts (e.g., direct mortality, delayed mortality, and sub-lethal effects) from research and monitoring activities (e.g., electroshocking, tagging, and marking) need to be better quantified.

New information available since the last status review indicates harvest impacts have decreased somewhat, but research impacts have increased. We conclude that the absolute degree of change in either direction from these factors has not changed substantially 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 UCR Spring-run Chinook salmon ESU and 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.

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 substantially 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. 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 may increase disease related concerns for UCR Spring-run Chinook salmon and UCR 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 UCR steelhead and UCR Spring-run Chinook salmon. 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

Various Federal, state, county and tribal regulatory mechanisms are in place to reduce habitat loss and degradation caused by human use and development. New information available since the last status review indicates that the adequacy of a number of regulatory mechanisms has improved. Examples include:

- 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 of 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 (SMP) to govern development in shoreline areas, including all wetlands, river deltas, and riparian areas associated with rivers, streams and lakes. The Douglas County shoreline master program update was approved by the state on August 27, 2009. Chelan and Okanogan Counties are in the process of updating their Shoreline master programs.

- 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, or 2006, or 2007 (depending on the county).

- Instream Flows: On December 11, 2007, amendments to Chapter 173-545 WAC (the Instream Resources Protection Program for the Wenatchee River Basin, WRIA 45) were adopted. The existing water management rule (adopted in 1983) was amended to guide water use planning and decision-making for future human domestic needs while maintaining enough water in streams to protect important fish species and existing water rights. The rule amendments were recommended by the Wenatchee Watershed Planning Unit. Specifically, the rule amendments:
    - Revise existing instream flow levels,
    - Establish a reservation of water for future use, and
    - Set maximum allocations above the instream flows for the Wenatchee River and its tributaries.

However, despite improvement in the adequacy of regulatory mechanisms within the UCR ESU/DPS, there remain a number of concerns regarding existing regulatory mechanisms, including:

- Lack of documentation or analysis of the effectiveness of land-use regulatory mechanisms and land-use management plans;
- Contradictory policies and/or implementation of regulations by Federal agencies. For example, one agency may take actions to improve riparian vegetation and instream habitat in one area while a short distance away another Federal authority requires removal of vegetation and instream structures;
- Lack of reporting and enforcement for some regulatory programs;

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 UCR 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 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.

Expected climate change impacts to ocean conditions include:

- Increasing ocean acidification (although there is uncertainty about the downstream 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.

Over the past 40 years climate change has degraded environmental conditions for Pacific Northwest salmon and steelhead. 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 unknown whether climate change impacts have changed in the few years since the last review.

Hatchery Effects

Hatchery programs can provide short-term demographic benefits, such as increases in abundance during periods of low natural abundance. They also can help preserve genetic resources until limiting factors can be addressed. However, the long-term use of artificial propagation may pose risks to natural productivity and diversity. The magnitude and type of the risk depends on the status of affected populations and on specific practices in the hatchery program.

UCR Spring-run Chinook Salmon

Implementation of reforms and changes in hatchery management has occurred since the last status review, although the benefits have not yet been fully realized and documented. Improvements include the following to reduce the diversity risks to the ESU:

- Discontinuing the Entiat National Fish Hatchery (NFH) Spring-run Chinook salmon program;
- Phasing out the non-ESU Carson stock of the Methow River hatchery programs;
- Proposed hatchery reforms for the Wenatchee River programs (e.g., limiting hatchery fish on the spawning grounds based on the abundance of natural-origin returns;
- Increasing genetic resources in the White River to reduce risks to diversity and productivity for the Wenatchee Spring-run Chinook salmon population; and,
- Removing differentially marked Leavenworth hatchery fish at Tumwater Dam before escaping upstream to spawn in order to reduce the risk of naturally spawning Leavenworth NFH hatchery strays that originate from outside the ESU to the Wenatchee population.

New information available since the last status review indicates that although hatchery management has become less of a risk factor to the Wenatchee and Entiat River Spring-run salmon populations, hatchery practices in the Methow Basin have not changed the risk to diversity for the Methow River population. We conclude on balance, that the extent to which hatchery effects continue to present risks to the persistence of the UCR Spring-run Chinook salmon ESU remains unchanged.

UCR Steelhead

We anticipate that proposed hatchery reforms will likely reduce risks to diversity for the Wenatchee River steelhead population. There is no steelhead hatchery program in the Entiat River. However, new information since the last status review indicates that hatchery practices in the Methow River are posing an increased risk to population diversity and productivity.

Hatchery practices for the Wells Hatchery, Omak Creek Hatchery, and Ringold Hatchery are trending toward divergence from the local natural populations in the DPS. These programs continue to use composite Methow River and Okanogan River steelhead for broodstock and incorporate a low percentage of natural-origin fish for broodstock. These programs also are

responsible for excessive levels of natural spawning by hatchery fish which poses risks to population diversity, productivity, and abundance (risks to abundance result primarily from competition and predation affects on natural fish). On average, hatchery fish comprise at least 85 percent of the natural spawners in the Methow River and are likely to result in decreased viability of the UCR steelhead DPS unless the above noted concerns are addressed.

New information since the last status review indicates that there have not been significant changes to these factors, and that these factors continue to present risks to the persistence of the UCR steelhead DPS.

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 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 five factor-analysis above, 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 risk 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 the viability ratings for all populations of UCR Spring-run Chinook salmon and UCR steelhead remain at high risk and do not meet the recovery criteria. Neither the UCR Spring-run Chinook salmon ESU or UCR steelhead DPS are viable, and, there is no new information to indicate that the extinction risk has changed for either UCR ESU/DPS. The Science Center concluded, after reviewing the available new information, that the biological risk category for the UCR Spring-run Chinook salmon ESU and the UCR steelhead DPS has not changed since the time of the last status review.

Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the persistence of the Spring-run Chinook salmon ESU and steelhead DPS has not changed significantly since our final 2005 ESU and 2006 DPS listing determinations. Improvements have been made in operations and fish passage at tributary dams and at the FCRPS dams, and numerous habitat restoration projects have been completed in many Upper Columbia River tributaries. Conversely, habitat problems are still common throughout the region and many more habitat improvements are likely needed to achieve viability. Harvest rates remain relatively low and stable for both species. Changes in hatchery management are needed for both species to reduce the number of hatchery-origin fish used as broodstock and to reduce the number of hatchery fish allowed to spawn naturally. The protection afforded by some regulatory mechanisms, such as implementation of TMDLs, has increased, although existing regulatory mechanisms could be improved to better protect UCR steelhead and Spring-run Chinook salmon 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 Upper Columbia River ESU/DPS and the current status of their ESA section 4(a)(1) factors, we conclude that the status of the UCR Spring-run Chinook salmon ESU and steelhead DPS has not improved significantly since the final listing determinations in 2005 and 2006, respectively. The implementation of sound management actions in hydropower, habitat, hatcheries, and harvest are essential to the recovery of the Upper Columbia River ESU/DPS and must continue. The biological benefits of habitat restoration and protection efforts, in particular habitat restoration, have yet to be fully expressed and will likely take another five to 20 years 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 species. The UCR Recovery Plan is the primary guide for identifying future actions to target and address UCR Spring-run Chinook salmon and UCR 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 Upper Columbia River ESU and 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 Upper Columbia River ESU 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) found that the UCR steelhead and Spring-run Chinook salmon hatchery programs have not changed substantially from the previous 2005 ESA status review. However, trends in current hatchery management, if continued, could lead to future changes in ESU and DPS memberships (Jones et al. 2011).

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 risk category for either UCR species since the time of the last status review (Ford et al. 2010).
- Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the UCR salmon and steelhead's persistence has not changed significantly since our 2005 final listing determination for the Spring-run Chinook salmon ESU, and our 2006 final listing determination for the steelhead DPS.

3 · Results

3.1 Classification

Listing status:

Based on the information identified above, we determine that no reclassification for either the UCR steelhead DPS or the UCR Spring-run Chinook salmon ESU is appropriate, and therefore the UCR steelhead DPS should remain listed as threatened, and the UCR Spring-run Chinook salmon ESU should remain listed as endangered.

Hatchery membership:

The UCR steelhead and spring-run Chinook salmon hatchery programs have not changed substantially from the previous ESA status review. Therefore, we do not recommend any changes in hatchery membership for either the UCR steelhead DPS or UCR Spring-run Chinook salmon ESU.

Five hatchery programs that are part of the listed ESUs/DPS are trending toward divergence from the listed ESUs/DPS and should be reviewed in the future to determine if they should remain part of the ESUs/DPS.

Hatchery programs needing further review:

- The Winthrop NFH Spring-run Chinook Program (Methow Composite Stock)
- The Methow Composite Program (Spring-run Chinook salmon)(at Methow River)
- The Wells Hatchery summer steelhead program (Methow River program)
- The Wells Hatchery summer steelhead program (Okanogan River program)
- The Ringold Hatchery summer steelhead program (summer steelhead from Wells Hatchery)
- Winthrop NFH summer steelhead program (Methow River)

3.2 New Recovery Priority Number

There are no changes in the recovery priority number listed in Table 4 for either the UCR Spring-run Chinook salmon ESU or the UCR steelhead DPS.

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4 · Recommendations for Future Actions

In our review of the listing factors we identified several actions critical to improving the status of the UCR steelhead DPS and the Spring-run Chinook salmon ESU. The most important actions to be taken over the next 5 years include implementation of the high priority strategies and actions identified in the 2007 UCR Recovery Plan, the 2008 Harvest Biological Opinion, the 2010 FCRPS Biological Opinion, and the completion of ESA consultations on the hatchery programs in the UCR steelhead DPS and Spring-run Chinook salmon ESU. We are currently in the process of identifying actions that address the factors contributing to the existing high risk rating for each population, since such actions have the greatest potential to improve VSP parameters at both the MPG and ESU/DPS levels.

We are directing our efforts at populations that need viability improvement according to ESU/DPS-, MPG-, and population-level recovery criteria, the best available scientific information concerning ESU/DPS status, the role of the independent populations in meeting ESU/DPS and MPG viability, limiting factors and threats, and the likelihood of action effectiveness to guide our recommendations for future actions. NMFS is coordinating with the Federal, state, tribal, and local implementing entities during this prioritization process to ensure that risk factors and actions identified in the recovery plan, and the actions identified in the Harvest Biological Opinion, the FCRPS Biological Opinion, and the ESA consultations on hatchery programs are addressed.

Additional recommended actions include:

- Fisheries co-managers further evaluating the impacts of other hatchery releases (both anadromous and resident) on Spring-run Chinook salmon and steelhead.
- Federal and private dam operators further investigating causes of adult losses between hydro facilities by reach (particularly the Columbia River Estuary to Bonneville Dam; Bonneville Dam to McNary Dam; and, McNary Dam to Wells Dam).
- State and Tribal fisheries co-managers using pit tag detection on all harvested fish to better understand the sources of losses in conversion rates and improve the sophistication in harvest management.
- Federal and state management agencies estimating sea lion population (and predation rates on salmonids) in the Lower Columbia River.
- Fisheries co-managers improving estimates of catch and release harvest impacts.
- Federal, state, tribal and private entities improving estimates of research, monitoring, and evaluation handling (electrofishing, weirs, catch and release, tagging, marking, trapping, sorting) impacts.

- Federal, state, tribal and private entities identifying contributing factors for lower or greater hatchery fish reproductive success.
- Federal, state, tribal and private entities continuing focus and prioritization of recovery actions on limiting factors.
- Federal, state, tribal and private entities implementing Research Monitoring and Evaluation (RME) actions to address critical uncertainties

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5-Year Review

Upper Columbia River Spring-run Chinook Salmon
Upper Columbia River Steelhead

Conclusion:

Based on the information identified above, we conclude:

- The Upper Columbia River Spring-run Chinook salmon ESU should remain listed as endangered.
- The Upper Columbia River steelhead DPS should remain listed as threatened.

REGIONAL OFFICE APPROVAL

Northwest Regional Administrator, NOAA Fisheries

Approve:  Date: *July 26, 2011*