

# 5-Year Review: Summary & Evaluation of **Ozette Lake Sockeye**

National Marine Fisheries Service  
Northwest Region  
Portland, OR



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## 5-Year Review: Ozette Lake Species

Species Reviewed	Evolutionarily Significant Unit
<b>Sockeye Salmon</b> ( <i>Oncorhynchus nerka</i> )	Ozette Lake Sockeye

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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 review for ESA-listed Ozette Lake sockeye salmon.

### 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.

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 the ESU or DPS be included in any listing of an 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 including the Ozette Lake sockeye salmon ESU (70 FR 37160).

## **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, the implementation of new hatchery programs, 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); 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 1999, NMFS listed the Ozette Lake sockeye ESU under the ESA and classified it as a threatened species (Table 1). In 2005, hatchery-origin sockeye from the Umbrella Creek and Big River Hatchery programs were determined to be part of the ESU and listed with natural-origin sockeye as protected under the ESA (70 FR 37160).

**Table 1. Summary of the listing history under the Endangered Species Act for the Ozette Lake sockeye salmon ESU**

<b>Salmonid Species</b>	<b>ESU Name</b>	<b>Original Listing</b>	<b>Revised Listing(s)</b>
<b>Sockeye Salmon</b> ( <i>Oncorhynchus nerka</i> )	Ozette Lake Sockeye Salmon	<b>FR notice:</b> 64 FR 14528 <b>Date listed:</b> 3/25/1999 <b>Classification:</b> Threatened	<b>FR notice:</b> 70 FR 37160 <b>Date:</b> 6/28/2005 <b>Re-classification:</b> 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 Ozette Lake sockeye salmon in 2005 (70 FR 52630, September 2, 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. In 2000 and again in 2005, we applied 4(d) protective regulations to the Ozette Lake sockeye salmon ESU (70 FR 37160, June 28, 2005).

**Table 2. Summary of rulemaking for 4(d) protective regulations and critical habitat for Ozette Lake Sockeye Salmon.**

Salmonid Species	ESU Name	4(d) Protective Regulations	Critical Habitat Designations
<b>Sockeye Salmon</b> ( <i>Oncorhynchus nerka</i> )	Ozette Lake sockeye Salmon	<b>FR notice:</b> 70 FR 37160 <b>Date:</b> 6/28/2005	<b>FR notice:</b> 70 FR 52630 <b>Date:</b> 9/2/2005

### 1.3.4 Review History

Table 3 lists the scientific assessments of the status of the Ozette Lake sockeye salmon ESU. These assessments include status reviews conducted by our Northwest Fisheries Science Center and technical reports prepared in support of recovery planning for this ESU.

**Table 3. Summary of previous scientific assessments for the Ozette Lake Sockeye Salmon ESU.**

Salmonid Species	ESU Name	Document Citation
<b>Sockeye Salmon</b> ( <i>Oncorhynchus nerka</i> )	Ozette Lake Sockeye Salmon	Currens et al. 2009 Rawson et al. 2009 Good et al. 2005 PSTRT and SSSG 2003 NMFS 1998 NMFS 1997

### 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 Ozette Lake sockeye salmon ESU.**

Salmonid Species	ESU Name	Recovery Priority Number	Recovery Plans/Outline
<b>Sockeye Salmon</b> ( <i>Oncorhynchus nerka</i> )	Ozette Lake Sockeye Salmon	1	<p><b>Title:</b> Recovery Plan For Lake Ozette Sockeye Salmon (<i>Oncorhynchus nerka</i>)</p> <p>Available at:  <a href="http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/Lake-Ozette-Plan.cfm">http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/Lake-Ozette-Plan.cfm</a></p> <p><b>Date:</b> 5/29/2009</p> <p><b>Type:</b> Final</p> <p><b>FR Notice:</b> 74 FR 25706</p>

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## 2 - Review Analysis

In this section, we review new information to determine whether the Ozette Lake sockeye salmon ESU's delineation remains appropriate.

### 2.1 Delineation of species under the Endangered Species Act

Is the species under review a vertebrate?

ESU Name	YES	NO
Ozette Lake Sockeye Salmon	X	

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

ESU Name	YES	NO
Ozette Lake Sockeye Salmon	X	

Was the DPS listed prior to 1996?

ESU Name	YES	NO	Date Listed if Prior to 1996
Ozette Lake Sockeye Salmon		X	n/a

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

Not Applicable

#### 2.1.1 Summary of relevant new information regarding delineation of Ozette Lake sockeye salmon ESU

##### ESU/DPS Boundaries

The Northwest Fisheries Science Center's review found that no new information has become available that would potentially justify a change in boundaries of the Ozette Lake Sockeye ESU (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 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.

The hatchery-origin sockeye salmon produced by the Umbrella Creek and Big River programs were included as part of the ESU and listed with natural-origin sockeye as protected under the ESA (70 FR 37160, June 28, 2005).

The Ozette Lake sockeye salmon tributary reintroduction programs on Umbrella Creek and the Big River continued to operate, consistent with actions and practices described in the Makah Tribe's hatchery and research, monitoring, and evaluation resource management plan (MFM 2000). The plan was approved by NMFS in 2003 under Limit 6 of the ESA 4(d) rule for the listed ESU (NMFS 2003), as the plan was found to be adequate for the conservation of listed Ozette Lake sockeye salmon. Annual operational and stock status reports submitted to NMFS by the Makah Tribe indicate that practices and management actions applied to minimize genetic and other hatchery-related risks to listed sockeye salmon remain as originally authorized under the ESA 4(d) approval. The hatchery programs were authorized for a 12-year duration (unless stock status evaluations indicate a need to continue the program). If the program terminates after 12 years, the last adult hatchery-origin fish produced through the reintroduction effort would return to the tributaries in 2019. These hatchery programs are the only artificial propagation efforts functioning in the basin, and there are no new programs requiring consideration for membership to the ESU.

For the reasons stated, hatchery-origin sockeye produced through the Umbrella Creek and Big River hatchery programs should continue to be included in the ESU hatchery populations and considered for their contribution to the status of the ESU. The Ozette Lake sockeye hatchery program has not changed substantially from the previous ESA status review to suggest that its level of divergence relative to the local natural populations has changed. Therefore, we do not recommend any change in ESU hatchery membership.



## 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 measurable 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 Does the species have a final, approved recovery plan containing objective, measurable criteria?

ESU Name	YES	NO
Ozette Lake Sockeye Salmon	X	

### 2.2.2 Adequacy of recovery criteria

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

ESU Name	YES	NO
Ozette Lake Sockeye Salmon	X	

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

ESU Name	YES	NO
Ozette Lake Sockeye Salmon	X	

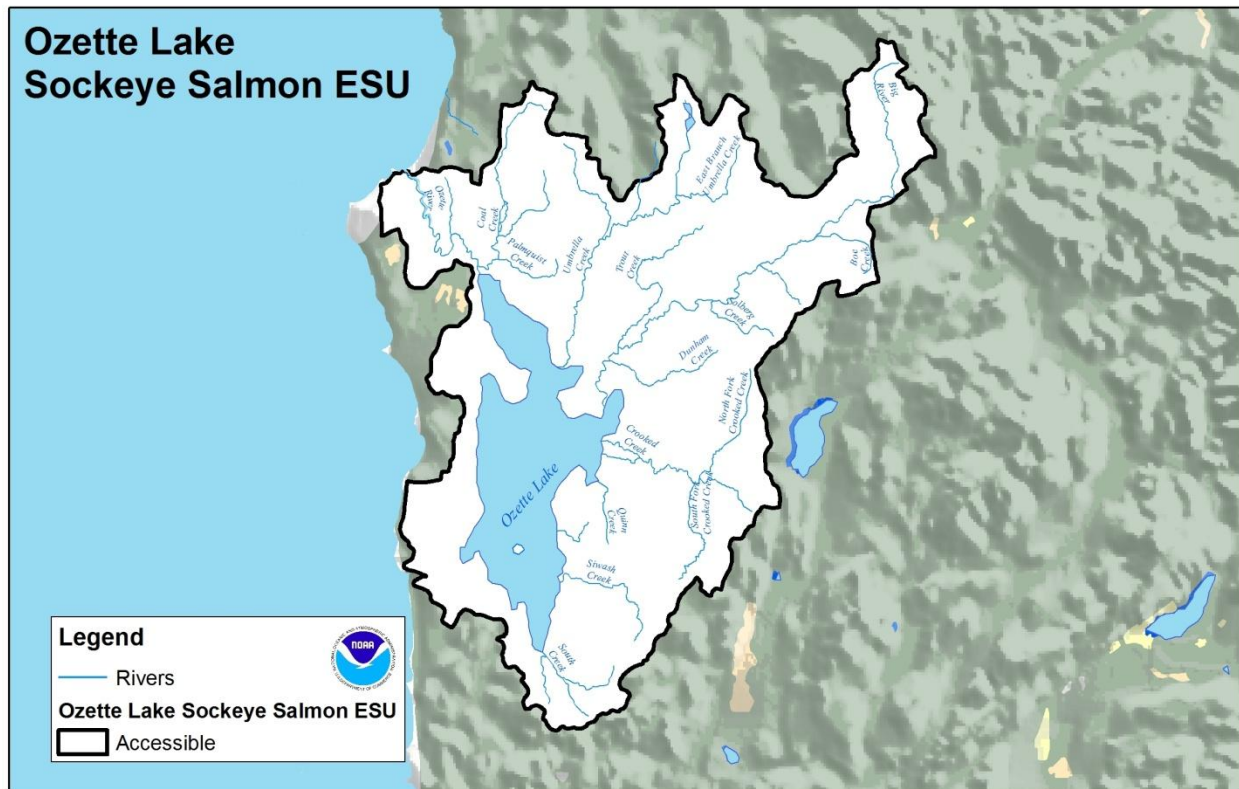
### 2.2.3 List the recovery criteria as they appear in the recovery plan

For the purposes of reproduction, salmon typically exhibit a metapopulation structure (Schtickzelle and Quinn 2007; McElhany et al. 2000). Rather than interbreeding as one large aggregation, ESUs typically function as a group of 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. For the purpose of recovery planning, NMFS appointed a Puget Sound Technical Recovery Team (PSTRT) to identify independent populations and develop biological viability criteria for the ESA listed salmon and steelhead species in Puget Sound and Lake Ozette. For the Ozette Lake Sockeye Salmon Recovery Plan (NMFS 2009), NMFS used the population structure and biological viability criteria identified by the PSTRT.

The PSTRT used biological principles for developing their ESU and population criteria described in NMFS' VSP concept technical memorandum (McElhany et al. 2000). The viability

of the ESU is based on the collective viability of individual populations that make up the ESU – their characteristics and their distribution throughout the ESU’s geographic range.

**Figure 1. Ozette Lake sockeye salmon population structure<sup>1</sup>**



The PSTRT determined that unlike most salmon ESUs, the Ozette Lake sockeye salmon ESU was historically made up of only one independent population (Figure 1) (Currens et al. 2009). The extant spawning aggregations located on two beaches on Ozette Lake—Allen’s and Olsen’s beaches—and in two tributaries (Umbrella Creek and Big River) to Ozette Lake are considered subpopulations.

<sup>1</sup> The map above generally shows the accessible and historically accessible areas for the Ozette Lake sockeye salmon ESU. The area displayed is consistent with the regulatory description of the boundaries of the Ozette Lake sockeye salmon ESU at 50 CFR 17.11, 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.

The two remaining beach-spawning aggregations are probably fewer than the number of aggregations that occurred historically, but there is insufficient evidence to determine how many subpopulations occurred in the ESU historically (Currens et al. 2009). Both tributary-spawning groups were initiated through a hatchery-introduction program.

The Ozette Lake Sockeye Recovery Plan (NMFS 2009) provides the following biological viability recovery criteria for naturally self-sustaining adults in the Ozette Lake sockeye ESU (Rawson et al. 2009).

### **Abundance**

To define abundance criteria for the Ozette Lake population, the PSTRT combined two methods of analysis: (1) population viability analysis; and (2) estimates of habitat capacity. Because of uncertainties in the available data, the PSTRT provided a “planning range” for abundance, with upper and lower bounds, rather than a point estimate. This planning range is based on the assumption of at least 1:1 spawner/adult replacement, and the assumption that the population maintains and recovers adequate historical spatial structure and diversity, i.e., that spawning takes place throughout the spawning range of the population (which is also the ESU). Based on current available information, a viable sockeye population in Ozette Lake will range in abundance between 31,250 and 121,000 adult spawners annually over a number of years (Rawson et al. 2009).

### **Productivity**

The productivity (growth rate) of a population is a measure of its ability to sustain itself or its ability to rebound from low numbers. Productivity is measured in terms of recruits from natural spawners. The PSTRT’s population viability analysis assumes that the population growth rate is stable or increasing, and that the population will sustain itself at the viability abundance level. The PSTRT recommended that the growth rate for Ozette Lake sockeye, once viability is achieved, should average one. Until the ESU achieves viability, the growth rate must be greater than one (Rawson et. al 2009).

### **Spatial Structure**

Spatial structure relates to the geographic distribution of a population in the habitat it uses throughout its life cycle and the processes that affect the distribution. The PSTRT determined that the current, limited distribution of the Ozette Lake sockeye spawners puts the ESU at high risk. The PSTRT spatial structure criterion recommends that a viable sockeye population in Ozette Lake should have multiple, spatially distinct and persistent spawning aggregations throughout the historical range of the population. A viable population will therefore contain multiple, persistent, and spatially distinct spawning aggregations along the lake beaches (known as historical spawning areas), augmented by self-sustaining spawning aggregations in one or more tributaries to the lake.

## Diversity

Salmon exhibit considerable diversity within and among populations in their life history, morphological, physiological and genetic traits. Because the environment continually changes as a result of many different factors, populations exhibiting greater diversity are more resilient to short- and long-term changes. The Recovery Plan's diversity criteria for a viable Ozette Lake sockeye population is that it includes one or more persistent spawning aggregations for each major genetic and life-history group historically present within the population (Rawson et al 2009). In addition, a viable population of sockeye in Ozette Lake would maintain the historical genetic diversity and distinctness between anadromous sockeye salmon and kokanee salmon also present in Ozette Lake (Rawson et al. 2009).

The Recovery Plan also includes "broad sense recovery goals" that describe a range of objectives that go beyond viability status necessary for ESA delisting in order to recognize and achieve diverse societal, economic, and ecological goals (NMFS 2009).

The Recovery Plan presents a broad range of recovery strategies and actions that address the limiting factors impeding the survival of Ozette Lake sockeye. These strategies include habitat restoration, assessing hydrologic conditions, implementing the Hatchery and Genetic Management Plan (HGMP), eliminating or strictly limiting fishing-related mortalities, and restoring predator-prey balance within the Ozette watershed. If, as we believe, Ozette Lake sockeye limiting factors are affected by habitat degradation, impaired water quality and stream flow, predation, and competition, then actions taken to improve, change, and reduce the effects of these factors will result in increased survival and improvements in abundance, productivity, spatial structure and diversity over time for Ozette Lake sockeye salmon.

## 2.3 Updated Information and Current Species' Status

In addition to recommending recovery criteria, the Puget Sound Technical Recovery Team also assessed the current status of the Ozette Lake sockeye ESU. NMFS based its most recent status assessments, like the recovery criteria, on evaluation of the viability parameters of abundance, productivity, spatial structure and diversity, according to the guidelines of the VSP concept (McElhany et al. 2000). NMFS described the conditions under which the population's status will have a low risk of extinction based on an integrated assessment of the four VSP parameters. The information below is based on this analysis and is summarized from the *Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Northwest* (Ford et al. 2010).

### 2.3.1 Analysis of VSP Criteria (including discussion of whether recovery criteria have been met)

New data for the Ozette Lake sockeye ESU are from the annual resource management report from the Makah Tribe (Peterschmidt and Hinton 2005, 2006, 2008; and Peterschmidt et al. 2007). Escapement data are available from 1977-2007, although the escapement weir data was not expanded in the reports (the weir is located at the outlet of the lake in the Ozette River). Estimates of sockeye returning to Ozette Lake are generally made based on weir counts and represent the returns to the lake before pre-spawning mortality such as in-lake predation. Estimating returns and spawners has been difficult; weir operation has been problematic and the method for expanding weir counts has changed periodically. The lack of reliable spawning estimates makes it difficult to assess the status or any changes that might be occurring over time for this population (Ford et al. 2010).

#### Abundance and Productivity

Estimating spawning abundance and hatchery contributions remains difficult for this species. Various reports give slightly different estimates and weir counts have not been expanded by the co-managers since 2003. A review of average escapement over five-year intervals—between 1977 and 2007—show the years 1993-1997 having relatively low abundances and 1998-2002 having relatively high abundances. The most current five-year average data for natural-origin spawning escapement is 2,679 sockeye salmon. This is well below the PSTRT's minimum abundance planning goal of 31,250 sockeye. Productivity is measured in terms of recruits from natural spawners. Most Ozette Lake sockeye return to the lake at age 4, but there are estimates of a few age-5 spawners on the beaches and both age 3-5 spawners returning to the tributaries. Using available age data, cohort run reconstruction is done to provide recruit-per-spawner estimates for brood years 1977-2003. As is normal for salmon, productivity varies greatly from year to year. However, the most recent brood years (1999-2003) have the lowest average recruit-per-spawner ratio (0.79) for Ozette Lake sockeye data available from 1977 to 2003. This level of productivity is below the PSTRT's recommended productivity goal of one recruit per spawner.

Based on this information, neither the trend in spawning abundance nor growth rate shows any indication of increasing population growth. Therefore, neither the abundance nor productivity criteria have been met (Ford et al. 2010).

### **Spatial Structure and Diversity**

Spatial structure and diversity are important factors in determining viability of salmon populations. These viability factors for Ozette Lake sockeye are measured using spawning location as the indicator. It is therefore important to monitor the spawning distribution of this population, not only between beach and tributary spawners, but also among locations within each of these spawning types. There is currently a weir at the mouth of Umbrella Creek where there is a hatchery supplementation program that monitors escapement to that tributary. However, there is currently no quantitative program to monitor beach spawning or spawning in other tributaries. Due to the lack of data regarding the distribution of beach spawners in Ozette Lake, we are unable to determine if the spatial structure goals established by the PSTRT are being achieved.

In 1983, hatchery releases into Umbrella Creek began with the purpose of introducing tributary spawners into this sockeye ESU. The ESA listing of Ozette Lake sockeye in 1999 necessitated the development of a Hatchery and Genetic Management Plan (HGMP) for the Makah Tribe's hatchery program to receive Federal authorization under the ESA. The HGMP limits the tributary reintroduction program to 12 years, or three sockeye salmon generations. After 12 years (in 2012), the program will be evaluated.

In a 2004 assessment of the Makah Ozette Lake hatchery program, NMFS concluded that the hatchery program is increasing the abundance of naturally spawning sockeye in the ESU. However, tributary spawners from the program are isolated (by design) from the beach spawning aggregations, and are therefore unlikely to benefit the abundance or productivity parameters of the natural-origin beach spawners (NMFS 2004).

NMFS concluded that the hatchery program is likely to improve the spatial structure of the ESU, although it is not likely to improve the spatial structure of the beach spawning aggregations. The program is expected to affect the ESU's diversity by extending the range of spatial distribution, which may in turn contribute to life-history diversity and increase the resiliency of the population (NMFS 2004).

### **Updated Risk Summary**

Population data for the Ozette Lake sockeye salmon ESU remain highly variable and uncertain. This makes it difficult to detect changes in abundance or productivity trends in recent years. We do know, however, that population levels remain very low compared to historical levels when harvest on these stocks was plentiful. Assessment methods must improve in order to evaluate the status of this species and its responses to recovery actions.

The Ozette Lake sockeye ESU does not currently meet the PSTRT viability criteria for the ESU. In addition, several of the factors cited during the previous status review (Good et al. 2005)

remain concerns. These include: loss of adequate quality and quantity of spawning and rearing habitat; predation and disruption of natural predator-prey relationships; introduction of non-native fish and plant species; and poor ocean conditions. Key uncertainties remain and hamper our ability to thoroughly assess the status of this ESU.

The relatively small amount of new information available does not indicate a change in the biological status since the last status review. The ESU is not currently considered to be viable and has made little progress toward meeting the recovery criteria. Conversely, the new information does not indicate that this ESU's extinction risk has increased significantly. Although abundance and productivity have fluctuated widely during the last several years, this ESU does not appear to be in immediate 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**

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 are expected to benefit the survival and productivity of the targeted Ozette Lake sockeye population, we do not yet have evidence demonstrating that improvements in habitat conditions have led to improvements in population viability. Improvements in 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 the Ozette Lake sockeye ESU in the future. Generally, it takes one to five decades to demonstrate such increases in viability. Below, we summarize several noteworthy restoration and protection actions that have been implemented since the last review. We also note areas where concerns remain about the habitat conditions for this ESU.

Implementation of the Ozette Lake Sockeye Recovery Plan is in the early stages as the plan was finalized in 2009. Since the previous status review Federal land managers, Tribes, and local partners have developed numerous plans and implemented key actions to improve and restore habitat within the Ozette Lake watershed. Particular plans and actions include:

- Adoption of the Final Ozette Lake Sockeye Recovery Plan and Limiting Factors Analysis in 2009 (NMFS 2009; Haggerty et al. 2009).

- Implementation of actions from the Recovery Plan to date include: tributary land acquisition, invasive weed control, fish passage and habitat improvements.
- The Washington State Forest Practices Habitat Conservation Plan (FPHCP) and Washington Department of Natural Resources State Land Habitat Conservation Plan (WDNR State Land HCP) for private and state forestland which are consistent with recovery goals (WDNR 2005). Implementation to date includes improvements to fish passage and road management. The Road Maintenance and Abandonment Plans (RMAPs) that are required under the Forest Practices regulations describe plans to properly abandon or stabilize existing forest roads, and improve standards on how new roads are to be built. The RMAPs are the part of the HCPs that most directly focus on recovery of salmon. However, the pace of RMAP implementation and lack of reporting are areas of concern.
- A newly adopted Olympic National Park Management Plan consistent with Recovery Plan goals, which include habitat improvement actions for Ozette Lake.
- Designation of the Olympic Marine Sanctuary and development of a proposed management plan in 2011, which will improve and protect nearshore areas.
- Juvenile migrant trapping to collect baseline information on survival and productivity.

Although numerous commitments and actions to improve habitat conditions in the Ozette Lake area have been implemented, monitoring data and evaluation of such actions demonstrating a positive impact to the viability of the Ozette Lake sockeye is not available.

Water quality is of key concern for Ozette Lake as mercury and PCB levels are among the highest in Washington State, despite the remote location of the lake (WDOE 2008). Continued local monitoring of pollutant levels and institution of a Cooperative Monitoring Evaluation & Research location within the Ozette Lake watershed are key to documenting these trends and developing strategies to address degraded water quality.

Water quantity is also a potential concern as restoration of normative hydrologic function to Ozette Lake watershed, as appropriate, is key to the long-term viability of the Ozette Lake sockeye ESU.

New information available since the last status review indicates that there have been some improvements in freshwater 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, particularly regarding beach and riparian conditions. The low productivity of the beach spawning aggregation(s) is a continuing concern. The current poor status of the beach spawning aggregations suggests that the implementation of further habitat restoration efforts is needed and that additional time is necessary for viability benefits to accrue and be manifested.



**Overutilization for commercial, recreational, scientific, or educational purposes**

Changes in harvest management were implemented in the 1980s and no commercial or recreational harvest of Ozette Lake sockeye has been authorized since 1982. There have been no commercial fisheries allowed in the Ozette Lake Basin since 1982. Incidental take from other fisheries (e.g., ocean harvest) is not likely a risk factor (NMFS 2009; Haggerty et al. 2009). Since 2004, the implementation of additional protective regulations (as specified in the recovery plan) for fisheries within the Olympic National Park include:

- Anglers may only use a single, barbless hook with no bait.
- Recreational fisheries for salmonids other than sockeye in the Ozette River are only open from Aug. 1 - Feb 28, and closed the remainder of the year to avoid the late-winter and spring juvenile and adult sockeye migration periods in the river. This truncated fishing season minimizes the risk of incidental capture, injury, and mortality of listed sockeye salmon.
- Fisheries directed at other fish species in Ozette Lake are restricted to opening from the last Saturday of April to October 31. This restriction reduces the risk of incidental capture, injury and mortality of adult sockeye spawning in beach spawning areas, and on adult fish staging to enter Umbrella Creek and Big River.
- There are no recreational fishery harvest limits in the Ozette River and Ozette Lake when open on bass, perch, bullhead, or pikeminnow. This measure is implemented to maximize removal of potential sockeye predator and competitor species, and reduce the abundance of the species for the benefit of juvenile sockeye survival in the basin.

Consistent with the analysis in the Recovery Plan and based on new information that has become available since the last status review, there is a high likelihood that the risk from overutilization has decreased, which is likely to result in improved viability of the Ozette Lake sockeye ESU.

**Disease or predation**

Fishing regulations implemented in 2004 removed catch limits on the harvest of non-native predator fish species such as bass, pikeminnow, perch and bullhead. As noted above, these measures should reduce predation levels on juvenile sockeye. Current operation and management of the weir at Ozette Lake creates increased opportunity for pikeminnow, harbor seal, and river otter predation of migrating juvenile and/or adult sockeye encountering the weir. Alternative means to census juvenile and adult sockeye salmon are being investigated that would allow removal of the full channel-spanning weir. The weir currently acts as a constraint to sockeye migration and delays in upstream and downstream fish passage caused by the weir result in increased fish and mammal predation.

The increasing pinniped population along the Pacific coast may lead to increased sea lion predation, although the effects in nearshore areas merit further evaluation to inform the development of management alternatives. The impact on the beach spawning population of sockeye resulting from predation by harbor seals is also uncertain.

Additionally, sediment deposition and the non-natural hydrograph likely increase water temperatures, and may thereby exacerbate disease risks. This needs further investigation as identified in the Recovery Plan.

New information available since the last status review indicates there may be a slight increase in the level of pinniped predation on Ozette Lake sockeye salmon and small increase in the disease risks. At this time, we do not have information available that would allow us to quantify the change in extinction risk. We therefore conclude that the risk to the species' persistence because of predation or disease has increased by a small, but unquantifiable 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:

- Ocean and Freshwater Fisheries Management Plans;
- Habitat Conservation Plans for state and private forest practices;
- Marine Sanctuary Protection Regulations; and
- Olympic National Park Management Plan.

These programs are discussed in detail in other sections of this report. We conclude that the risk to the species' persistence because of the inadequacy of existing regulatory mechanisms has decreased slightly, based on the improvements noted above. Although the adequacy of regulatory programs has improved, additional monitoring is needed to determine whether the additional protection is resulting in improved habitat quality and improved viability of the Ozette Lake sockeye ESU.

### **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:

- Increased 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 areas.

Expected climate change impacts to ocean conditions include:

- Increasing ocean acidification (although there is uncertainty 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.

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.

Implementation of the Big River and Umbrella Creek supplementation programs will result in positive contributions to spatial structure, abundance, and diversity for the ESU. These programs provide an essential safety net for the core beach spawning population while habitat concerns are

being addressed. Since the previous status review these programs have demonstrated effectiveness in producing increased levels of natural-origin recruitment and smolt production (Peterschmidt and Hinton 2005; Peterschmidt and Hinton 2006; Peterschmidt et al. 2007; Hinton et al. 2010).

Based on the new information that has become available since the last ESA status review, we concluded that the hatchery supplementation programs have likely reduced risks to the Ozette Lake sockeye ESU.

### **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's 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 review completed by our Northwest Fisheries Science Center indicates that the ESU is not currently meeting the viability criteria in the Ozette Lake Sockeye Salmon Recovery Plan. Current abundance for natural origin spawning escapement is 2,679 sockeye salmon, which is well below the PSTRT's minimum abundance planning goal of 31,250 fish. The lack of reliable spawning estimates, particularly for beach spawners, makes it difficult to assess the status or any changes that might be occurring over time for this ESU. While little improvement in ESU viability has been observed over the last five years, there is also no new information to indicate that the extinction risk has increased significantly. The Science Center concluded, after reviewing the available new information that the biological risk category for this ESU 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 Ozette Lake sockeye salmon ESU's persistence has decreased slightly since our final listing determination in 2005. There have been improvements to habitat condition and the risks from overutilization have decreased due to the adoption of more conservative fishery management practices. The risk to the species' persistence because of the inadequacy of existing regulatory mechanisms has decreased slightly and existing hatchery programs help reduce extinction risks to this ESU. 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 Ozette Lake sockeye salmon ESU and the current status of its ESA section 4(a)(1) factors, we conclude that the status of this ESU has not improved significantly since it was listed in 2005. Although some of the risks posed by the 4(a)(1) factors have decreased, no commensurate improvement in ESU viability has been observed. Full benefits from the habitat restoration and protection efforts implemented during the last five years will likely take another five to 20 years to be realized. By continuing to

implement actions that address the factors limiting ESU survival and monitoring the effects of the actions over time, we will ensure that restoration efforts meet the biological needs of the ESU and, in turn, contribute to the recovery of this species. The Ozette Lake

Sockeye Salmon Recovery Plan is the primary guide for identifying future actions to target and address ESU limiting factors and threats. Over the next five years, it will be important continue to implement these actions and monitor our progress. Future improvements in data collection methods and analysis are also essential to better assess ESU abundance and productivity.

#### **2.4.1 DPS Delineation and Hatchery Membership**

- The Northwest Fisheries Science Center's review found that no new information has become available that would potentially justify a change in boundaries of the Ozette Lake Sockeye ESU (Ford et al. 2010).
- The Ozette Lake sockeye Umbrella Creek and Big River hatchery programs have not changed substantially from the previous ESA status review to suggest that their levels of divergence relative to the local natural population have changed.

#### **2.4.2 ESU/DPS Viability and Statutory Listing Factors**

- The Northwest Fisheries Science Center's review of updated viability information does not change the biological risk category since the time of the last ESA status review (Ford et al. 2010).
- Our review of new information for each of the 4(a)(1) factors indicates that the collective risk to the Ozette Lake sockeye salmon ESU's persistence has decreased slightly since our final listing determination in 2005. Some concerns remain, particularly regarding climate change, degraded beach habitat, and increased pinniped predation.

## **3 · Results**

### **3.1 Classification**

#### **Listing status:**

Based on the information identified above, we determine that no reclassification for the Ozette Lake sockeye salmon ESU is appropriate, and therefore this ESU should remain listed as threatened.

#### **ESU delineation:**

Based on the information identified above, we conclude that the current species delineation for the Ozette Lake sockeye salmon ESU is accurate and needs no adjustment.

#### **Hatchery membership:**

The Ozette Lake sockeye Umbrella Creek and Big River hatchery programs have not changed substantially from the previous ESA status review to suggest that their levels of divergence relative to the local natural populations have changed. Therefore, we conclude that no change in hatchery membership for the Ozette Lake sockeye salmon ESU is needed.

### **3.2 New Recovery Priority Number**

There are no changes in the recovery priority number listed in Table 4 for the Ozette Lake sockeye ESU.

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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 Ozette Lake sockeye salmon ESU. Implementation of the recently adopted Recovery Plan for Ozette Lake sockeye (NMFS 2009) - specifically recovery strategies and actions in Section 7, the Habitat Conservation Plans, Olympic National Park's Master Plan, provisions of the HGMP, and addressing the impacts of the existing weir—are the most important actions to be taken over the next five years. Improved coordination and cooperation of Federal, state, tribal and local partners, such as the Ozette Lake Sockeye Steering Committee, is critical to the successful implementation of these plans. Efforts to implement research, monitoring and evaluation actions to address critical uncertainties identified in the Recovery Plan, addressing predation impacts, and improving habitat conditions described in the Recovery Plan represent the greatest opportunities to advance recovery for the Ozette Lake sockeye salmon ESU and should be aggressively pursued.

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**National Marine Fisheries Service  
5-Year Review**

**Ozette Lake Sockeye Salmon**

**Conclusion:**

Based on the information identified above, we conclude:

- The Ozette Lake sockeye salmon should remain listed as threatened

**REGIONAL OFFICE APPROVAL**

**Northwest Regional Administrator, NOAA Fisheries**

Approve:  Date: July 26, 2011