Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation

U.S. Fish and Wildlife Service Proposal to Reintroduce Bull Trout to the Clackamas River, Or.

National Marine Fisheries Service (NMFS) Consultation Number: 2010/06535
Action Agency: U.S. Fish and Wildlife Service (FWS)

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Upper Willamette River (UWR) spring Chinook salmon *(Oncorhynchus tschawytscha)*	Threatened	Yes	No	No
Upper Willamette River (UWR) steelhead (*O. mykiss*)	Threatened	No	No	No
Lower Columbia River (LCR) Chinook salmon *(O. tschawytscha)*	Threatened	No	No	No
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	No	No
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	No
Columbia River chum salmon (*O.Keta*)	Threatened	No	No	No
Southern Resident (SR) killer whales (*Orcinus orca*)	Threatened	No	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	No	No

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Issued By: _____
for William W. Stelle, Jr. Regional Administrator

Date: June 27, 2011

Table of Contents

Table of Figures

Table of Tables

1. INTRODUCTION

This introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3.

1.1 Background

The biological opinion (opinion) and incidental take statement portions of this document were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402.

The NMFS also completed an Essential Fish Habitat (EFH) consultation in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, et seq.) and implementing regulations at 50 CFR 600.

The opinion and EFH conservation recommendations are both in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-5444) ("Data Quality Act") and underwent pre-dissemination review.

1.2 Consultation History

The U.S. Fish and Wildlife Service (FWS), Oregon Department of Fish and Wildlife (ODFW), U.S. Forest Service (USFS), the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and NMFS participated in numerous pre-consultation and informal consultation events, including meetings to discuss and plan reintroduction and monitoring strategies and an adaptive management framework. The list includes key events associated with this consultation:

- 2006 and 2007: FWS, ODFW, USFS and NMFS meetings of the Clackamas bull trout working group and the multi-agency effort to develop a formal feasibility assessment, ultimately published in 2007
- In 2007, NMFS began participating in both the Clackamas bull trout technical committee (R. Turner) and the Clackamas managers committee (R. Walton), both of which continue to meet multiple times annually.
- June 11, 2007 – Clackamas bull trout working group meeting
- July 11, 2007 – Clackamas bull trout working group meeting
- November 1, 2007 – Clackamas Managers Meeting
- 2008 NEPA scoping/stakeholder meetings jointly held by FWS and ODFW.
- July 21-23, 2008 FWS sponsored Clackamas expert science panel predation workshop
- October 31, 2008 – Clackamas Managers Meeting
- February 10, 2009 scoping for the foodweb baseline work November 9, 2009 Technical meeting of the Implementation and M&E committees
- In 2009, meetings to develop a scope of work for a USGS study to conduct a baseline Clackamas River foodweb investigation.

- Dec 2009 – Feb 2010 FWS held formal comment period on the proposed rule and draft EA.
- In 2009 and 2010, FWS, NMFS, & ODFW met several times to discuss methods to minimize or eliminate the possibility of the reintroduction project impacting terms of the Clackamas River Settlement Agreement associated with the FERC relicensing of PGE's Clackamas Hydroelectric Project. NMFS (Turner & Walton) did provide a 2 page informal comment letter in Feb. 2010 for FWS consideration.
- January 7, 2010 - implementation committee meeting
- February 5, 2010 - informal comments on reintroduction from NMFS to FWS
- March 23, 2010 - meeting, with ODFW, FWS, NMFS
- April 15, 2010 - Clackamas Managers Meeting
- April 30, 2010 - meeting, NMFS, PGE, ODFW, FWS to discuss Settlement Agreement
- May 27, 2010 - meeting with FWS, ODFW, NMFS to discuss Clackamas coordination
- June 17, 2010 - meeting with PGE, NMFS, FWS to discuss Settlement Agreement
- July 21, 2010 - technical meeting - Implementation and M&E committees
- October 15, 2010 - field tour with ODFW, NMFS, USFS, FWS
- October 27, 2010 - technical meeting of the M&E Committee
- November 23, 2010 - presentation and discussion with Dr. Dave Beauchamp, USGS
- November 30, 2010 - technical meeting, Implementation Committee
- November and December 2010 - comment period on the draft Implementation, Monitoring and Evaluation Plan.
- December 10, 2010 - FWS submitted a final BA.
- January 6, 2011 - implementation and M&E committees meeting
- January 21, 2011 - informal meeting FWS @ NMFS
- February 1, 2011 - informal technical meeting @ FWS
- February 24, 2011 - informal technical meeting @ NMFS
- March 15, 2011 - informal technical meeting @ FWS
- March 31, 2011- informal technical meeting @ FWS
- April 7, 13, 19, 2011 - informal technical meetings with FWS
- April 18, 2011 - implementation committee @FWS
- April 19, 2011 - Clackamas Management Committee @ FWS
- April 22, 2011 - informal technical meeting with FWS
- May 4, 9, 2011 - informal technical meetings with FWS
- May 13, 2011 – FW8S submitted amended BA to NMFS
- May 27, 2011 - Managers teleconference call
- June 2, 2011 – FWS intra-agency formal consultation on the effects to bull trout from the reintroduction of bull trout into the Clackamas River
- June 17, 2011 – FWS issues final Environmental Assessment
- June 21, 2011 – 10(j) Final Rule published in Federal Register

We initiated preconsultation upon receiving the December 10, 2010 Biological Assessment on Reintroduction of Bull Trout (*Salvelinus confluentus*) to the Clackamas River, Oregon (BA). The FWS submitted the BA jointly with ODFW. Along with the BA, the FWS submitted the December 9, 2009 draft environmental assessment, and the December 9, 2009, proposed 10 (j)

rulemaking (74 FR 65045). In the BA, the FWS determined that the proposed action is likely to adversely affect the listed salmon and steelhead residing in the Clackamas subbasin.

On May 13, 2011, NMFS initiated formal consultation after receiving the FWS amendment to the BA which included the Stepwise Impact Reduction Plan (SIRP) jointly developed with NMFS to strengthen the proposed action by including specific metrics, thresholds and management actions intended to increase the protection for Clackamas salmon and steelhead.

All the agencies involved in the proposal worked closely with the Confederated Tribes of the Warm Springs Reservation of Oregon and this tribe has been a key cooperator throughout the project's development.

A complete record of this consultation is on file with the Protected Resources Division (PRD) in Portland, Oregon.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The reintroduction of bull trout into the Clackamas River subbasin does not depend on a larger action for its justification and there are no other actions that qualify as interdependent, so NMFS determines that there are no interrelated or interdependent actions associated with the proposed action.

The proposed action for this consultation is the FWS proposal to reintroduce bull trout (*Salvelinus confluentus*), into the Clackamas River, near Portland, Oregon. As part of this proposal, the FWS formally designated bull trout in the Clackamas River as a nonessential experimental population under section 10(j) of the ESA (74 FR 65045). As we explain in Section 2.4 of this opinion, this designation provides the FWS with the authority to reverse the proposed action and remove the bull trout (which are listed as threatened under the ESA) if necessary. The FWS describes the goal of the proposed action as the re-establishment by 2030 of a self-sustaining bull trout population of 300-500 spawning adults in the Clackamas River. The FWS hopes that the population will contribute to bull trout conservation and recovery in the Willamette Basin.

We list the cooperating agencies and key elements of the action below.

Cooperators

- ODFW Co-proposing the action along with the FWS
- USFS Primary landowner in the Upper Clackamas River
- PGE Operates the Clackamas Hydroelectric Project
- CTWSRO Co-manages bull trout w/FWS and ODFW

Key Elements of the Proposed Action

The December, 2010 BA included the following:

Pathogen Screening

Screen bull trout in the Metolius River for pathogens prior to collecting them for translocation. The BA, in Section 2.5, proposes disease Screening; in Section 2.5.1, a baseline disease assessment; and in Section 2.5.2 annual testing protocols, stating in part:

> To avoid these unintended consequences, translocations of fishes between major river basins should be preceded by a thorough investigation into the potential transfer of pathogens from the donor source, as well as the resistance of the donor stock to any known pathogens present in the receiving habitat….
>
> Based on State requirements and recommendations from ODFW Fish Health Services (ODFW 2009, as cited in the BA), ripe bull trout adults must be tested for virus the fall previous to transfer by collecting (non-lethal) and testing ovarian fluid and sperm.
>
> …As long as yearly test results for both fry and adults remain negative for U-clade IHN virus, the project is cleared by ODFW Fish Health Services to collect and transfer any life-stage of bull trout from within the Metolius River/Lake Billy Chinook system that calendar year.

Designation of a 10(j) Experimental Population

Designate the Clackamas bull trout population as a non-essential population under the ESA, section 10(j).

Reintroduction of Bull Trout in Three Phases

- Initiate phase one of the reintroduction (2011-2017): translocate 30 adult between 450 mm and 650 mm in length, 30 sub-adult between 250 mm and 450 mm in length (after applying radio and PIT-tags) and 1,000 juvenile bull trout (after applying PIT-tags) from the Metolius River to the mainstem Clackamas River and tributaries above North Fork Dam in years one and two and implement monitoring and evaluation plan. Continue translocation of juveniles through 2017; continue transferring adult and sub-adult pending results of monitoring and evaluation after year two.
- Initiate phase two (2018-2024), based on monitoring, evaluation and adaptive management following phase one.
- Initiate phase three (2025-2030), discontinue active management and stop implementation; continue monitoring and evaluation program.

FWS Monitoring and Evaluation Program

Implement an on-going monitoring and evaluation program, to be covered programmatically by this consultation, with the following three major goals:

1) monitor and evaluate bull trout reintroduction effectiveness;

2) monitor and evaluate donor population status; and,
3) monitor and evaluate impacts to listed anadromous salmonids, including:
    a. determining if survival rates of listed anadromous salmonid juveniles rearing in, or moving through the PGE hydro-project area change; and,
    b. if survival rates of listed anadromous salmonid juveniles decline, determine the degree to which bull trout are responsible for the decline by utilizing field data, bioenergetics and life-cycle monitoring.

Implement these elements of the monitoring and evaluation program:

1) Using radio and PIT-tags to determine if adult and sub-adult bull trout occupy areas within the PGE hydro project during periods in which they could consume particularly high numbers of rearing or migrating juvenile salmon and steelhead.
2) If bull trout do occupy those areas, determining if survival rates of Clackamas salmon and steelhead juveniles rearing in, or moving through the PGE hydro-project area change, and
3) determining the degree to which bull trout are responsible for any decline in survival rates of juveniles by utilizing field data, bioenergetics and life-cycle monitoring.

Use these methods: minnow trapping, backpack electroshocking, snorkeling, dip-netting, seining, redd surveys, and trapping via a rotary screw trap to monitor juvenile life stages and snorkeling, radio telemetry, mobile and stationary PIT-tag antennas to monitor older life stages.

On May 17, 2011, we issued 4(d) Permit 16054, which authorized FWS to take listed salmonids incidental to its monitoring program to track juvenile bull trout in the Clackamas River, related to the reintroduction. The permit authorizes the monitoring activities until December 31, 2011, including the indirect mortality of 21 juvenile salmon or steelhead. As part of its proposed action here, FWS proposes to continue that monitoring program. When the current 4(d) permit expires, the incidental take statement included with this biological opinion will cover the take of listed salmonids in the FWS monitoring program. The terms and conditions included in the incidental take statement are the same as those included in Permit 16054.

Stepwise Impact Reduction Plan

The FWS amended the proposed action by adding the SIRP, which establishes:

- Its purpose – "to outline a sequence of management actions that, if necessary, will be taken to minimize impacts to federally listed salmon (*Oncorhynchus spp.*) and steelhead (*O. mykiss*) from the reintroduction of bull trout in the Clackamas River, and the thresholds that would trigger initiation of these actions."
- specific thresholds (described in management actions 1 and 2) which, if reached, will result in FWS and/or ODFW capturing and relocating bull trout from areas where salmon and steelhead are considered most vulnerable to predation.
- three metrics with associated thresholds for monitoring salmon and steelhead: minimum abundance threshold for adult coho, spring Chinook and steelhead; anadromous salmonid critical threshold (#s of juveniles leaving the North Fork Reservoir); and smolts per adult critical threshold.

- management action 3 to initiate detailed analyses of bull trout impacts on salmon and steelhead population trends and management actions 4 through 6 to reduce bull trout impacts (by removing them) if the thresholds are reached.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

NMFS concurs with the FWS description of the action area in Section 2.6 of the BA. Although the release sites of trans-located fish will be in the Upper Clackamas River above its confluence with the Collawash River, the migratory nature of bull trout suggests the action area for this consultation should be represented by the entire Clackamas River subbasin. The exception is the Oak Grove Fork above Timothy Lake Dam. The majority of the Oak Grove Fork watershed was not historically accessible to bull trout and anadromous salmonids due to an impassable natural barrier a short distance below the current dam site.

In addition, even though the likelihood of bull trout migrating down to the Willamette River is very low, it remains a possibility. For that reason the action area for this consultation includes the Willamette River from Willamette Falls downstream to the confluence with the Columbia River, including the Multnomah Channel.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the FWS, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, NMFS provide an opinion stating how the agencies' actions will affect listed species or their critical habitat. If incidental take is expected, section 7(b)(4) requires the provision of an incidental take statement (ITS) specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Introduction to the Biological Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species," means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or

distribution of that species (50 CFR 402.02).

This biological opinion does not rely on the regulatory definition of destruction or adverse modification' of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

Approach to the Assessment

We will use the following approach to determine whether the proposed action described in Section 1.3 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action*. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. For listed salmon and steelhead, NMFS has developed specific guidance for analyzing the status of the listed species' component populations in a "viable salmonid populations" paper (VSP; McElhany et al. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a species' status. For listed salmon and steelhead, the VSP criteria therefore encompass the species' "reproduction, numbers, or distribution" (50 CFR 402.02). In describing the range-wide status of listed species, we rely on viability assessments and criteria in technical recovery team documents and recovery plans, where available, that describe how VSP criteria are applied to specific populations, major population groups, and species. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 2.2.

- *Describe the environmental baseline for the proposed action*. The environmental baseline includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area*. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 2.3 of this opinion.

- *Analyze the effects of the proposed actions*. In this step, NMFS considers how the proposed action would affect the species' reproduction, numbers, and distribution or, in the case of salmon and steelhead, their VSP characteristics. NMFS also evaluates the proposed action's effects on critical habitat features. The effects of the action are described in Section 2.4 of this opinion.

- *Describe any cumulative effects.* Cumulative effects, as defined in NMFS' implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a) (2) of the Endangered Species Act) (November 7, 2005).

involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 2.5 of this opinion.

- *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.* In this step, NMFS adds the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2). Integration and synthesis occurs in Section 2.6 of this opinion.

- *Reach jeopardy and adverse modification conclusions*. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 2.7. These conclusions flow from the logic and rationale presented in the Integration and Synthesis (Section 2.6).

- *If necessary, define a reasonable and prudent alternative to the proposed action.* If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action in Section 2.8. The RPA must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

- *Section 2.11* of this opinion explains that the proposed action is not likely to adversely affect (NLAA) southern resident killer whales, Columbia River chum salmon, Lower Columbia River Chinook salmon or Upper Willamette steelhead.

2.2 Rangewide Status of the Species and Critical Habitat

The ESA defines species to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." NMFS adopted a policy for identifying salmon DPSs in 1991 (56 FR 58612). It states that a population or group of populations is considered an ESU if it is “substantially reproductively isolated from conspecific populations,” and if it represents “an important component of the evolutionary legacy of the species.” The policy equates an ESU with a DPS. Hence, the Chinook and coho salmon listing units in this biological opinion constitute ESUs of the species *O. tschawytscha,* and *O. kisutch* respectively. The steelhead listing unit in this biological opinion constitutes a DPS of the species *O. mykiss.* The ESUs of salmon and DPSs of steelhead include natural-origin populations and hatchery populations, as described below.

Section 4(d) protective regulations prohibit the take of naturally spawned fish and of listed

hatchery fish with an intact adipose fin, but do not prohibit take of listed hatchery fish that have their adipose fins removed prior to release into the wild (70 FR 37160, 71 FR 834, 73 FR 7816). This document evaluates impacts on natural-origin fish, since there are no hatchery programs above North Fork Dam and most hatchery-origin fish are removed at the dam.

In using the VSP criteria to organize information about a species' status, we frequently treat abundance and productivity together, particularly where recovery plans evaluate these two elements together. Abundance and productivity are closely related but distinct population parameters. They are closely related in that a more abundant population may have lower productivity than a less abundant population, yet both may still be viable. They are distinct in that they are separate measurable population attributes, and there are certain levels of each below which a population would not be considered viable, regardless of the status of the other attribute. A population's spatial structure is made up of both the geographic distribution of individuals in the population and the processes that generate that distribution (McElhany et al. 2000). Diversity in salmon populations is represented by differences within and among populations in morphology, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, developmental rate, ocean distribution patterns, male and female spawning behavior, physiology and molecular genetic characteristics (McElhany et al. 2000). We also discuss the status of the species' habitat separate from our discussion of the status of critical habitat. This is because designated critical habitat may be less than a species' total habitat.

2.2.1 Status of the Species

Table 1 includes updated risk status information on of the species and populations affected by the proposed action based on McElhaney 2007, ODFW 2010 and WDFW 2010.

Table 1. Current Risk of Extinction of Clackamas Salmonid Species and Populations

ESA-Listed Species	Clackamas Population Within ESU or DPS	Importance of the population to the ESU or DPS	Risk status in USFWS BA	Risk status in recovery plan
UW spring Chinook salmon			High Risk[2]	Very High
	Clackamas spring Chinook	1 of only 2pops in ESU with significant natural production.	Low Risk λ and R/S < 1 [3]	Moderate
LCR coho			High Risk[4]	High
	Clackamas coho	1 of only 2pops in ESU with	Low Risk[5]	Moderate (w/ considerable

[2] P 58 cites McElhany 2007; §3.2.1.5 repeats this information
[3] §3.2.1.3 and Table 3-4
[4] §3.2.3.3
[5] Table 3-9

ESA-Listed Species	Clackamas Population Within ESU or DPS	Importance of the population to the ESU or DPS	Risk status in USFWS BA	Risk status in recovery plan
		significant natural production.		uncertainty)
LCR steelhead			High Risk[6]	Moderate (Oregon) Significant (Washington)
	Clackamas steelhead		Low Risk[7]	Moderate or High

Upper Willamette River Chinook Salmon

Description and Geographic Range

On June 28, 2005, we re-affirmed our previous listing of UWR Chinook salmon as a threatened species (70 FR 37160). The listing includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River and its tributaries above Willamette Falls, Oregon. The listing excludes fall-run Chinook salmon that were introduced above the falls. Historically, migratory access above Willamette Falls was only possible during a brief period of time, which provided a powerful isolating mechanism for UWR Chinook. After the falls were laddered, other fishes could occupy the river, but only the spring-run is considered a native-run of Chinook. Seven artificial propagation programs are part of the ESU and are also listed (Table 2).

Table 2. Hatchery Stocks Included in the UWR Chinook Salmon ESU.

Artificial Propagation Program	Run	Location (Oregon)
McKenzie River Hatchery (stock #24)	Spring	McKenzie River
Marion Forks Hatchery (stock #21)	Spring	North Fork Santiam River
South Santiam Hatchery (stock #23)	Spring	South Fork Santiam River
	Spring	Calapooia River
	Spring	Molalla River
Willamette Hatchery (stock #22)	Spring	Middle Fork Willamette River
Clackamas Hatchery (stock # 19)	Spring	Clackamas River

UWR Chinook salmon exhibit both "ocean type" (i.e., emigration to the ocean as subyearlings) and "stream type" (emigration as yearlings) life histories. Individuals tend to mature at ages 4 and 5. Historically, 5-year-old fish dominated the spawning migration runs; recently, however, most fish have matured at age 4. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the Upper Willamette Basin, whereas low flows

[6] §3.2.4.3
[7] Table 3-11

in the summer and autumn prevent later-migrating fish from ascending the falls. As with UWR steelhead, low flows may serve as an isolating mechanism, separating this species from others nearby. Spring Chinook salmon in the Clackamas River are of uncertain origin, but we consider natural-origin spring Chinook salmon from this subbasin to be part of the listed species. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the listed species. Parr usually undergo a smolt transformation in the spring at which time they migrate to the ocean. Sub-adults and adults forage in coastal and offshore waters of the North Pacific Ocean before returning to spawn in their natal streams.

The Proposed Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead (ODFW 2010b) identifies seven demographically independent populations of spring Chinook salmon: Clackamas, Molalla, North Santiam, South Santiam, Calapooia, McKenzie, and the Middle Fork Willamette. The populations are delineated based on geography, migration rates, genetic attributes, life history patterns, phenotypic characteristics, population dynamics, and environmental and habitat characteristics. The plan identifies the Clackamas, North Santiam, McKenzie and Middle Fork Willamette populations as "core populations" and the McKenzie as a "genetic legacy population." Core populations are those that were historically the most productive populations.

Table 3. Historical population structure and viability status for UWR Chinook salmon (ODFW 2010c).

Population	Population Classification	Viability Status		
		A&P	Spatial	Diversity
Clackamas	Core population	M	H	M
Molalla		VL	L	L
N. Santiam	Core population	VL	L	L
S. Santiam		VL	M	M
Calapooia		VL	VL	L
McKenzie	Core and Genetic Legacy	VH	M	M
Middle Fork	Core population	VL	L	L

Abundance and Productivity

The spring-run of Chinook has been counted at Willamette Falls since 1946, but "jacks" (sexually mature males that return to freshwater to spawn after only a few months in the ocean) were not differentiated from the total count until 1952. The average estimated run-size from 1946 through 1950 was 43,300 fish, compared to an estimate of only 3,900 in 1994. Even though the number of naturally spawning fish has increased gradually in recent years, many are first generation hatchery fish. Juvenile spring Chinook produced by hatchery programs are released throughout the basin and adult Chinook returns to the ESU are typically 80-90% hatchery-origin fish. An important exception is the Clackamas subbasin, where only unmarked spring Chinook are allowed to pass above North Fork Dam. In the proposed recovery plan, ODFW (2010b) found the UWR Chinook ESU to be extremely depressed, likely numbering less than 10,000 fish, with the Clackamas and McKenzie populations accounting for most of the production (Table 4).

Table 4. Summary of the key elements including abundance for UWR Chinook and steelhead.

Species / Population	Diversity Components					Overall Risk Classification Score	Baseline Risk Classification
	Recent Wild Abundance[1]	Hatchery Proportion[2]	Fishery Exploit Rate[3]	Life History Diversity Score	Habitat Diversity Score		
Chinook							
Clackamas	1,100	0.65	0.25	2	3	2	M
Molalla	25	0.95	0.25	0	3	1	H
North Santiam	50	0.90	0.25	2	1	1	H
South Santiam	50	0.90	0.25	1	2	2	M
Calapooia	25	0.95	0.25	0	3	1	H
McKenzie	1,995	0.35	0.25	3	2	2	M
MF Willamette	50	0.95	0.25	0	1	1	H
Steelhead							
Molalla	1,915	0.19	0.16	3	3	2	M
North Santiam	3,006	0.14	0.16	3	1	2	M
South Santiam	2,092	0.04	0.16	3	2	2	M
Calapooia	304	0.00	0.16	3	3	2	M

[1] The average number of wild spawners observed in each population from 1990 to 2004 or in the case of populations with little or no data it represents a professional judgment as to what this average abundance might have been from 1990 to 2004.
[2] The 1980 to 2004 average proportion of hatchery fish mixing with the population's wild fish on the spawning grounds.
[3] Estimates of the fishing exploitation rate on the wild fish in each population.. See FWS 2011b for methodology.

The Oregon recovery plan (ODFW 2010) rates all but two of the populations as very low for abundance and productivity (Table 3). Abundance in the Clackamas population would need to nearly double, and in the North and South Santiam and Middle Fork populations a 100-fold increase is needed to meet recovery goals.

Recent data on returning adults are summarized in Table 5 (ODFW and WDFW 2005a, 2006a, 2007a, 2008a, 2009a). Abundance of adult UWR spring Chinook has declined since the highs witnessed around 2000. The 5-year average return for UWR spring Chinook salmon is 9,568 naturally produced adults and 66,071 hatchery adults (2005-2009). The average for the years 2005-2009 was a combined total of 53,781 hatchery- and naturally-produced adult Chinook.

Table 5. Return of Adult Upper Willamette River Spring Chinook Entering the Columbia River and Escapement to the Clackamas River and Willamette Falls Fish Ladder.

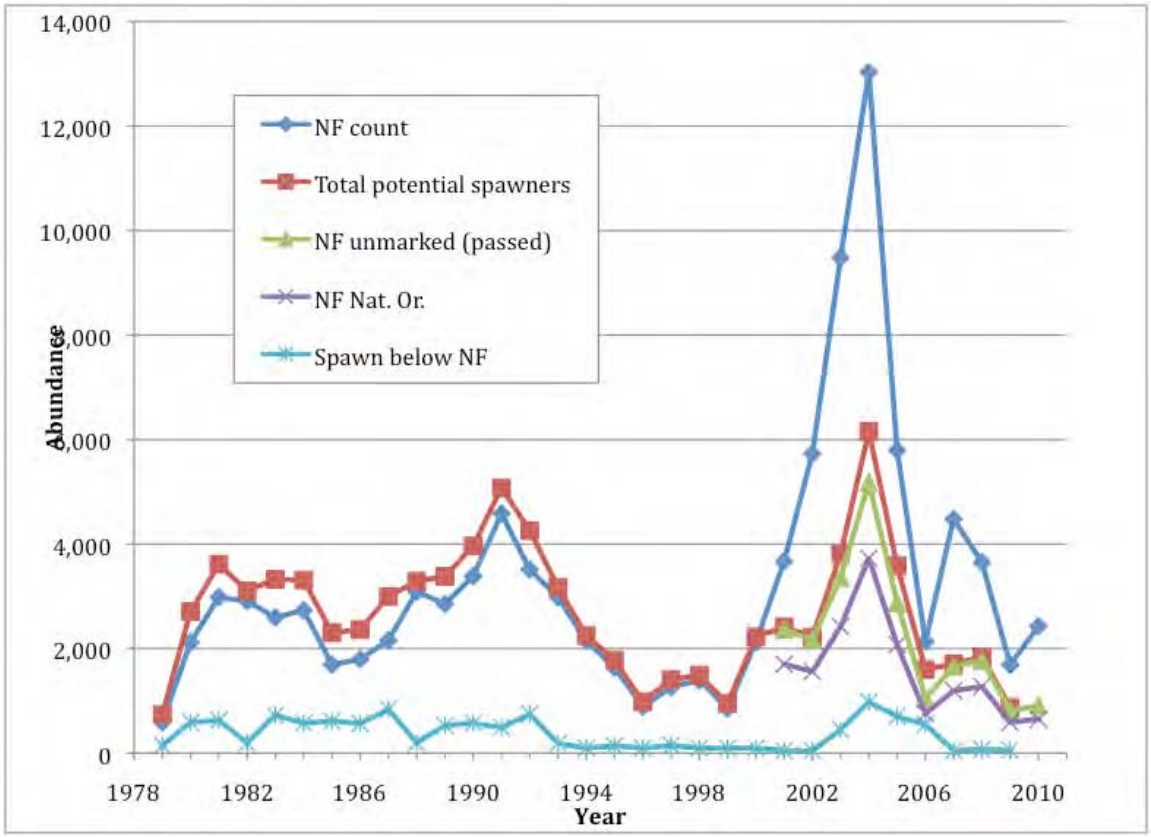
Year	Return		Natural and Hatchery Escapement[1]
	Hatchery	Natural	
2005	54,900	5,600	43,219
2006	53,133	6,567	39,719
2007	29,957	9,986	25,416
2008	19,722	7,294	18,117
2009	30,346	9,064	30,583
Average[3]	66,071	9,568	53,781

[1] Escapement is the combined total of hatchery- and naturally-produced Chinook that

escaped the fishery and may have spawned.
[2] De-listing target proposed in Oregon's proposed UWR recovery plan.
[3] Average is calculated as the 5-year geometric mean.

The Northwest Fisheries Science Center publishes juvenile abundance estimates each year in the annual memorandum estimating percentages of listed Pacific salmon and steelhead smolts arriving at various locations in the Columbia River Basin. Estimates for 2011 are not available at this time; however, the average outmigration for the years 2006-2010 is shown in Table 6 (Ferguson 2006, 2007, 2009a, 2009b, 2010).

Figure 1. Clackamas River Spring Chinook Abundance Estimates



In Figure 1, The "NF count" is the total number of Chinook counted at the North Fork Dam. Since 2001, all hatchery fish returns have been marked with an adipose fin clip. Only unmarked fish have been passed above North Fork Dam. The counts of unmarked fish passed over the dam are shown in the series labeled "NF unmarked (passed)". Studies have shown that because of incomplete marking, only about 72% of the unmarked fish passed over North Fork dam are actually of natural-origin (labeled "NF Nat. Or." in the figure). The majority of spring Chinook spawning occurs above North Fork Dam, but some spawning is estimated below the dam (labeled "Spawn below NF"). The majority of those spawning below the dam are likely of hatchery-origin. The "Total potential spawners" are the fish passed above North Fork Dam plus the estimated number of fish spawning below the dam. Data for 1979-2009 are from ODFW 2010 FMEP report. Data for 2010 are from the PGE fish count database (http://portlandgeneralelectric.net/community_environment/initiatives/protecting_fish/clackamas

river/default.aspx). Note that the PGE data only include the count up to September 9, 2010. Peak return at North Fork Dam occurs May-July but the tail of the return extends into October, so the final count for 2010 may be slightly higher than shown here.

Table 6. Average Estimated Outmigration for Listed UWR Chinook Salmon (2006-2010).

Origin	Outmigration
Natural	3,847,700
Listed hatchery intact adipose	96,600
Listed hatchery adipose clipped	5,787,924

The number of natural fish should be viewed with caution. Estimating juvenile abundance is complicated by a host of variables: (1) spawner counts and associated sex ratios and fecundity estimates can vary widely between years; (2) multiple juvenile age classes (fry, parr, smolt) are present yet comparable data sets may not exist for all of them; and (3) survival rates between life stages are poorly understood and subject to a multitude of natural and human-induced variables (e.g., predation, floods, harvest, etc.). Listed hatchery fish outmigration numbers are also affected by some of these factors; however, releases from hatcheries are generally easier to quantify than is natural production.

Spatial Structure

For the spatial structure analysis, the Oregon recovery plan evaluated the proportion of stream miles currently accessible to the species relative to the historical miles accessible (ODFW 2010c). Oregon adjusted the rating downward if portions of the currently accessible habitat were qualitatively determined to be seriously degraded. Oregon also adjusted the rating downward if the portion of historical habitat lost was a key production area. The Oregon recovery plan rates spatial structure to be low to very low in four populations, moderate in two and high in one. The populations that rate lowest have fish passage barriers, stream channel modifications, and water quality problems limiting distribution of the species.

Diversity

Willamette Falls, a natural barrier before it was laddered, prevented fall-run Chinook salmon from occupying the UWR. Thus the UWR Chinook salmon were historically composed of only the spring-run. The ladder allows Chinook with other life history traits to occupy areas in the UWR; however none are considered part of the historical populations or the ESU.

The Oregon recovery plan (ODFW 2010c) rates diversity to be moderate to low in the UWR Chinook ESU (Table 3). Loss of habitat above dams and hatchery production are two factors that have had a negative influence on diversity (Good et al. 2005). As described above, dams and other habitat alterations have reduced or eliminated tributary and mainstem areas. Introduction of fall-run Chinook and laddering the falls have increased the potential for genetic introgression between wild spring and hatchery fall Chinook.

Good et al. (2005) identified artificial propagation as a major factor affecting the variation in diversity traits of UWR Chinook salmon. Large numbers of fish from the UWR (Santiam, McKenzie, and Middle Fork Willamette Rivers) have been introduced since the 1960s. Changes

in spawning timing have been observed over the last 100 years. Regardless of origin, the existing spring-run has maintained a low to moderate level of natural production (and local adaptation) for a number of generations (NMFS 2004).

Habitat

Stream habitat in the Upper Willamette Basin has become substantially simplified since the 1800s: by removal of large woody debris to increase the river's navigability, reduction in riparian vegetation, and channel modifications for a variety of reasons. Between 1941 and 1968, the Army Corps of Engineers constructed, and now operates, a system of 13 dams and reservoirs for flood control in the Willamette River Basin. Most of the dams do not include fish passage, and those that do are not very effective at passing fish. In 1999, NMFS identified the loss of access to historical spawning grounds because of dams as a major risk factor to UWR Chinook salmon (Good et al. 2005). The overall reduction in available spawning and rearing habitat, combined with altered water flow and temperature regimes, are a major risk factor to UWR Chinook salmon (Good et al. 2005). Good et al. (2005) estimated that perhaps a third of the historical habitat used by fish in this ESU is currently inaccessible behind dams. On July 11, 2008, NOAA Fisheries issued a jeopardy biological opinion on the Willamette Project (NMFS 2008b). The biological opinion includes a schedule for completion of improvements to some of the dams so that juvenile fish can pass them safely, and improvements to water temperatures downstream from the dams to achieve a more natural seasonal pattern. Efforts to make the dams more fish-friendly and to improve river water temperatures should improve spatial structure and habitat quality.

Conclusion

The updated information provided in Oregon's recovery plan (2010) and the information contained in previous UWR Chinook salmon status reviews indicate that most spring-run populations are likely extirpated, or nearly so. The only populations considered potentially self-sustaining are the Clackamas and McKenzie River populations, but abundance is relatively low, with most fish being of hatchery-origin (except in the Clackamas Basin above North Fork Dam). Substantial changes, such as an increase in abundance and a reduction in hatchery influences, are needed before this ESU can recover. Dams, as well as other habitat alterations and hatchery and harvest effects, have affected the listed species. NMFS' Willamette Project biological opinion addresses fish passage and water temperature issues. Efforts to make the dams more fish-friendly and to improve river water temperatures should improve the status of the species, but the process has just begun, and more time is needed before we can know the effect of these actions.

Lower Columbia River Coho Salmon

Description and Geographic Range

On June 28, 2005, NMFS listed LCR coho salmon - both natural and some artificially-propagated fish - as a threatened species (70 FR 37160). The listing includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia River up to and including the Big White Salmon and Hood Rivers, and including the Willamette River to Willamette Falls, Oregon. Twenty-six artificial propagation programs are part of the ESU and are also listed (Table 7).

Table 7. Hatchery Stocks Included in the LCR Coho Salmon ESU.

Artificial Propagation Program	Run	Location (State)
Grays River	Type-S	Grays River (Washington)
Sea Resources Hatchery	Type-S	Grays River (Washington)
Peterson Coho Project	Type-S	Grays River (Washington)
Big Creek Hatchery (ODFW stock # 13)	n/a	Big Creek (Oregon)
Astoria High School (STEP) Coho Program	n/a	Youngs Bay (Oregon)
Warrenton High School (STEP) Coho Program	n/a	Youngs Bay (Oregon)
CEDC Coho Salmon Program	n/a	Youngs Bay (Oregon)
Elochoman Type-S Coho Program	Type-S	Elochoman River (Washington)
Elochoman Type-N Coho Program	Type-N	Elochoman River (Washington)
Cathlamet High School FFA Type-N Coho Program	Type-N	Elochoman River (Washington)
Cowlitz Type-N Coho Program	Type-N	Upper Cowlitz River (Washington)
Cowlitz Type-N Coho Program	Type-N	Lower Cowlitz River (Washington)
Cowlitz Game and Anglers Coho Program	n/a	Lower Cowlitz River (Washington)
Friends of the Cowlitz Coho Program	n/a	Lower Cowlitz River (Washington)
North Fork Toutle River Hatchery	Type-S	Cowlitz River (Washington)
Kalama River Coho Program	Type-N	Kalama River (Washington)
Kalama River Coho Program	Type-S	Kalama River (Washington)
Lewis River Type-N Coho Program	Type-N	North Fork Lewis River (Washington)
Lewis River Type-S Coho Program	Type-S	North Fork Lewis River (Washington)
Fish First Wild Coho Program	n/a	North Fork Lewis River (Washington)
Fish First Type-N Coho Program	Type-N	North Fork Lewis River (Washington)
Syverson Project Type-N Coho Program	Type-N	Salmon River (Washington)
Washougal River Type-N Coho Program	Type-N	Washougal River (Washington
Eagle Creek NFH	n/a	Clackamas River (Oregon)
Sandy Hatchery (ODFW stock # 11)	Late	Sandy River (Oregon)
Bonneville/Cascade/Oxbow Complex (ODFW stock # 14)	n/a	LCR Gorge (Oregon)

Coho salmon is a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from Monterey Bay, California, north to Point Hope, Alaska, through the Aleutians, and from the Anadyr River south to Korea and northern Hokkaido, Japan. From central British Columbia south, the vast majority of coho salmon adults are 3-year-olds, having spent approximately 18 months in fresh water and 18 months in salt water. Both early-and late-

run stocks were present historically and still persist in the LCR. Type S is an early type that enters the river from mid-August to September, spawns in mid-October to early November, and generally spawns in higher tributaries. Ocean migration for these fish is coastal Washington, Oregon, and Northern California. Type N is a late type that enters the river from late September to December, spawns in November to January, and generally spawns in lower tributaries. Ocean migration for these fish is coastal British Columbia, Washington, and Oregon.

The LCR coho salmon ESU includes 25 populations that historically existed in the Columbia River Basin from the Hood River downstream (Table 8). Until recently, Columbia River coho salmon were managed primarily as a hatchery stock. Coho were present in all LCR tributaries but the run now consists of very few wild fish. Twenty-one of the 24 populations in the ESU are at a very high risk of extinction (Table 8). It is possible that some native coho populations are now extinct, but the presence of naturally spawning hatchery fish makes it difficult to ascertain. The strongest remaining populations occur in Oregon and include the Clackamas River and Scappoose Creek (both at moderate risk of extinction).

Table 8. Historical Population Structure and Viability Status for LCR Coho Salmon (ODFW 2010; LCFRB 2010).

Stratum	Population	Viability Status		
		A&P	Spatial	Diversity
Coastal	Grays/Chinook	VL	H	VL
	Elochoman/Skamokawa	VL	H	VL
	Mill/Abernathy/Germany	VL	H	L
	Youngs	VL	VH	VL
	Big Creek	VL	H	L
	Clatskanine	L	VH	M
	Scappoose	M	H	M
Cascade	Lower Cowlitz	VL	M	M
	Upper Cowlitz	VL	M	L
	Cispus	VL	M	L
	Tilton	VL	M	L
	South Fork Toutle	VL	H	M
	North Fork Toutle	VL	M	L
	Coweeman	VL	H	M
	Kalama	VL	H	L
	North Fork Lewis	VL	L	L
	East Fork Lewis	VL	H	M
	Salmon Creek	VL	M	VL
	Washougal	VL	H	L
	Clackamas	M	VH	H
	Sandy	VL	H	M
Gorge	Lower Gorge	VL	M	VL
	White Salmon	VL	M	VL
	Hood	VL	VH	L

Abundance and Productivity

Wild coho in the Columbia Basin have been in decline for the last 50 years. The number of wild coho returning to the Columbia River historically was at least 600,000 fish (Chapman 1986). At a recent low point in 1996, the total return of wild fish may have been as few as 400 fish (Chilcote 1999). Coinciding with this decline in total abundance has been a reduction in the number of self-sustaining wild populations. Of the 24 historical populations that comprised the LCR coho ESU, only in the case of the Clackamas and Sandy is there direct evidence of persistence during the adverse conditions of the 1990s. This underscores the importance of the Clackamas River coho population to the Lower Columbia River ESU. Since 2000, the numbers of wild coho have increased in both the Clackamas and Sandy Basins. During this same period, naturally reproducing coho populations re-established themselves in the Scappoose and Clatskanie Basins (ODFW 2010c).

Table 9 displays the most recent returns of naturally produced and hatchery LCR coho salmon. Based on the best available data and using a three year geometric mean, the estimated run-size of LCR coho for 2010 is 20,765 naturally produced fish and 394,540 hatchery fish.

Table 9. Estimated Abundance of Adult Lower Columbia River Coho (ODFW and WDFW 2007b, 2008b, 2009b, 2010b; FPC 2010; Yakima/Klickitat Fisheries Project 2010).

Year	Total[1]	Natural[2]	Hatchery[2]
2003	626,629	31,331	595,298
2004	399,890	19,995	379,895
2005	313,031	15,652	297,379
2006	348,186	17,409	330,777
2007	278,303	13,915	264,388
2008	422,970	21,149	401,821
2009	627,017	31,351	595,666
Average[3]	**419,471**	**20,974**	**398,497**

1. Estimated abundance is calculated by subtracting the number of fish that passed Willamette Falls, Lyle Falls on the Klickitat River, and The Dalles Dam from the total return for the Columbia River. Coho salmon that pass these features are not considered to be part of the LCR coho ESU.
2. For LCR coho, the approximate percentages of origin are: 5% natural, 95% artificially propagated.
3. Average is the geometric mean of the last three years of record.

The Northwest Fisheries Science Center publishes juvenile abundance estimates each year in the annual memorandum estimating percentages of listed Pacific salmon and steelhead smolts arriving at various locations in the Columbia River Basin. Numbers for 2011 are not available at this time; however, the average outmigration for the years 2006-2010 is shown in Table 10 (Ferguson 2006, 2007, 2009a, 2009b, 2010).

Table 10. Average Estimated Outmigration for Listed LCR Coho Salmon (2007-2010).

Origin	Outmigration
Natural	1,178,205
Listed hatchery intact adipose	1,428,900
Listed hatchery adipose clipped	9,411,553

The number of natural fish should be viewed with caution, however, as it only addresses one of several juvenile life stages. Moreover, deriving any juvenile abundance estimate is complicated by a host of variables, including the facts that: (1) spawner counts and associated sex ratios and fecundity estimates can vary widely between years; (2) multiple juvenile age classes (fry, parr, smolt) are present yet comparable data sets may not exist for all of them; and (3) survival rates between life stages are poorly understood and subject to a multitude of natural and human-induced variables (e.g., predation, floods, harvest, etc.). Listed hatchery fish outmigration numbers are also affected by some of these factors; however, releases from hatcheries are generally easier to quantify than is natural production.

Spatial Structure

For the spatial structure analysis, the Oregon and Washington recovery plans evaluated the proportion of stream miles currently accessible to the species relative to the historical miles accessible (ODFW 2010; LCFRB 2010). The recovery plans adjusted the rating downward if portions of the currently accessible habitat were qualitatively determined to be seriously degraded. The recovery plans also adjusted the rating downward if the portion of historical habitat lost was a key production area. The Oregon and Washington recovery plans rate spatial structure as moderate to very high in nearly all populations of LCR coho. The populations that rate lowest have fish passage barriers. Trap and haul operations on the Cowlitz River pass adults upriver, but downstream passage and survival of juvenile fish is very low. This problem also affects spatial structure in the Cispus and Tilton populations. Merwin Dam blocks access to most of the available spawning habitat in the North Fork Lewis populations. The relicensing agreement for Lewis River hydroelectric projects calls for reintroduction of coho salmon but adequate passage through the system must be achieved to realize the habitat potential. Condit Dam on the White Salmon River blocks access to most of the historical spawning habitat. Now decommissioned, the dam is scheduled for removal in late 2011. Thus, the LCR coho salmon spatial structure is less diverse than historically, but management actions are underway to improve the situation.

Diversity

The Oregon and Washington recovery plans (ODFW 2010; LCFRB 2010) rate diversity to be low to very low in most of the coho populations (Table 3). Pervasive hatchery effects and small population bottlenecks have greatly reduced the diversity of coho salmon populations (LCFRB 2010). Hatchery-origin fish typically comprise a large fraction of the spawners in natural production areas. Widespread inter-basin (but within ESU) stock transfers have homogenized many populations. The Oregon and Washington recovery plans state that there were no observations of coho spawning in LCR tributaries during the 1980s and 1990s (ODFW 2010; LCFRB 2010). While historical population structure likely included significant genetic

differences among populations in each watershed, we can no longer distinguish genetic differences in natural populations of coho salmon in the LCR (excluding the Clackamas and Sandy Rivers in Oregon).

Habitat

As noted above, LCR coho salmon inhabit the Columbia River and its tributaries from its mouth upstream to and including the Big White Salmon and Hood Rivers, and including the Willamette River to Willamette Falls, Oregon. Estuary and Lower Columbia mainstem habitats play an important but poorly understood role in the anadromous fish life cycle. Changes in access, stream flow, water quality, sedimentation, habitat diversity, channel stability, riparian conditions, channel characteristics, and floodplain interactions have adversely affected LCR coho salmon. These large-scale changes have altered habitat conditions and processes important to migratory and resident fish and wildlife (NMFS 2006). We have not designated critical habitat for LCR coho salmon. However, the habitat upon which LCR coho depend overlaps with designated critical habitat for other listed salmon and steelhead.

Conclusion

The most serious concern for this ESU is the scarcity of naturally produced spawners and the attendant risks associated with small populations - loss of diversity and fragmentation and isolation among the remaining naturally produced fish. Trap and haul programs have begun to re-introduce coho salmon to many miles of habitat, improving the spatial structure and diversity of the species. Additionally, recent adult returns were up noticeably in some areas, and we have seen evidence for limited natural production in some areas outside the Sandy and Clackamas Rivers. However, more time is needed before we will know if their status will improve.

Lower Columbia River Steelhead

Description and Geographic Range

On January 5, 2006, NMFS listed LCR steelhead - both natural and some artificially propagated fish - as a threatened species (71 FR 834). The listing included all naturally spawned populations of steelhead in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive) and the Willamette and Hood Rivers, Oregon (inclusive). Steelhead in the Upper Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon Rivers in Washington are excluded. Ten artificial propagation programs are part of the listed species and are also listed (Table 11).

Table 11. Hatchery Stocks Included in the LCR Steelhead DPS.

Artificial Propagation Program	Run	Location (State)
Cowlitz Trout Hatchery	Late Winter	Cispus River (Washington)
Cowlitz Trout Hatchery	Late Winter	Upper Cowlitz River (Washington)
Cowlitz Trout Hatchery	Late Winter	Tilton River (Washington)
Cowlitz Trout Hatchery	Late Winter	Lower Cowlitz River (Washington)
Kalama River Wild	Winter	Kalama River (Washington)
	Summer	Kalama River (Washington)

Artificial Propagation Program	Run	Location (State)
Clackamas Hatchery (ODFW stock # 122)	Late Winter	Clackamas River (Oregon)
Sandy Hatchery (ODFW stock # 11)	Late Winter	Sandy River (Oregon)
Hood River (ODFW stock # 50)	Winter	Hood River (Oregon)
	Summer	Hood River (Oregon)

The LCR steelhead DPS includes 30 historical populations in four strata (Table 12). LCR steelhead have winter and summer runs, and several river basins contain both (e.g., Kalama River, Sandy River, Clackamas River, and Hood River although the summer runs in the Clackamas and Sandy Rivers are non-native and not included in the DPS). Most steelhead in the LCR smolt at two years and spend two years in salt water before re-entering fresh water, where they may remain up to a year before spawning. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of this listed species. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Sub-adults and adults forage in coastal and offshore waters of the North Pacific Ocean before returning to spawn in their natal streams.

Table 12. Historical Population Structure and Viability Status for LCR Steelhead (ODFW 2010; LCFRB 2010).

Stratum (Run)	Population	A&P	Spatial	Diversity
Cascade (Winter)	Lower Cowlitz	L	M	M
	Upper Cowlitz	VL	M	M
	Cispus	VL	M	M
	Tilton	VL	M	M
	South Fork Toutle	M	VH	H
	North Fork Toutle	VL	H	H
	Coweeman	L	VH	VH
	Kalama	L	VH	H
	North Fork Lewis	VL	M	M
	East Fork Lewis	M	VH	M
	Salmon Creek	VL	H	M
	Washougal	L	VH	M
	Clackamas	M	VH	M
	Sandy	L	M	M
Cascade (Summer)	Kalama	H	VH	M
	North Fork Lewis	VL	VL	VL
	East Fork Lewis	VL	VH	M
	Washougal	M	VH	M
Gorge (Winter)	Lower Gorge	L	VH	M
	Upper Gorge	L	M	M
	Hood	M	VH	M
Gorge (Summer)	Wind	VH	VH	H

Stratum (Run)	Population	A&P	Spatial	Diversity
	Hood	VL	VH	M

Unlike Pacific salmon, steelhead are iteroparous – capable of spawning more than once before death. However, it is rare for steelhead to spawn more than once before dying, and almost all that do so are females (Nickelson et al. 1992). Busby et al. (1996) reviewed data on North American populations, and first time (maiden) spawners comprised 94% of adults in the Columbia River. The majority of repeat spawners are female, presumably due to the extended time and energy males spend on the spawning ground competing for and guarding females and nests.

Abundance and Productivity

In the early 2000s, runs in the larger rivers (Cowlitz, Kalama, and Sandy River populations) were in the range of 1,000 to 2,000 fish; historical counts, however, indicate these runs were ten times higher. In general, all steelhead runs in the LCR have declined over the past 20 years, and with sharp declines from the late '90s to early 2000s (though it is difficult to accurately estimate the number of returning adult steelhead to the LCR). Escapement estimates compiled by various agencies indicate that approximately 11,900 adult steelhead may have returned in 2004 (Kostow 2004; LeFleur and Melcher 2004). In 2005, we estimated the LCR steelhead abundance at approximately 10,700 fish (Good et al. 2005).

Table 13. Abundance Estimates for LCR Steelhead Populations (Streamnet 2010; WDFW 2010a; WDFW 2010b; ODFW 2010).

Stratum (Run)	Population	Years	HOR[1]	NOR[2]	Recovery Target[3]
Cascade (Winter)	Lower Cowlitz				400
	Upper Cowlitz	1998-2002	6,122	399	500
	Cispus				500
	Tilton				200
	South Fork Toutle	2005-2009	7	514	600
	North Fork Toutle	2005-2009	0	120	600
	Coweeman	2005-2009	169	301	500
	Kalama	2005-2009	596	623	600
	North Fork Lewis				400
	East Fork Lewis	2005-2009	0	453	500
	Salmon Creek				
	Washougal	2005-2009	271	233	350
	Clackamas	1990-2005		1,168	10,655
	Sandy	1990-2005		1,040	1,510
Cascade (Summer)	Kalama	2004-2008	306	78	500
	North Fork Lewis				
	East Fork Lewis	2004-2008	86	388	500
	Washougal	2005-2008	574	94	500

Stratum (Run)	Population	Years	HOR[1]	NOR[2]	Recovery Target[3]
Gorge (Winter)	Lower Gorge				1,104
	Upper Gorge	2003-2007			322
	Hood	1992-2004		395	1,633
Gorge (Summer)	Wind	2004-2008	35	626	1,000
	Hood	1993-2005		195	1,988
Total			10,201	7,863	24,036

1. Hatchery-origin (HOR) spawners.
2. Natural-origin (NOR) spawners.
3. Recovery target for natural-origin spawners.

The recovery plans identified 16 populations as currently at low to very low viability and five with moderate viability. The Wind River and Kalama River summer-run populations are the only ones that rated high to very high for abundance and productivity. The Oregon and Washington recovery plans (ODFW 2010; LCFRB 2010) developed planning ranges for abundance of viable LCR steelhead populations; some abundance goals were not set; the range of abundance is from 322 in the Upper Gorge to 10,655 in the Clackamas. The viability ratings are based on long-term trends whereas recent abundance estimates show a slightly different picture (Table 13). Several populations appear to be approaching the abundance targets, and one (the E.F. Lewis) exceeded it.

The Northwest Fisheries Science Center publishes juvenile abundance estimates each year in the annual memorandum estimating percentages of listed Pacific salmon and steelhead smolts arriving at various locations in the Columbia River Basin. Numbers for 2011 are not available at this time; however the average outmigration for the years 2006-2010 is shown in Table 14 (Ferguson 2006, 2007, 2009a, 2009b, 2010).

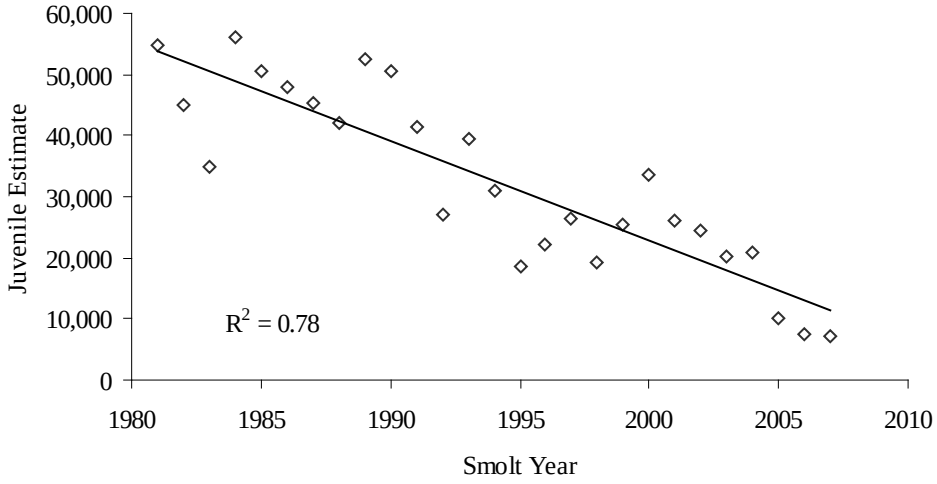
Table 14. Average Estimated Outmigration for Listed LCR Steelhead (2006-2010).

Origin	Outmigration
Natural	607,900
Listed hatchery intact adipose	82,000
Listed hatchery adipose clipped	885,344

The natural abundance number should be viewed with caution, however, as it only addresses one of several juvenile life stages. Moreover, deriving any juvenile abundance estimate is complicated by a host of variables, including the facts that: (1) spawner counts and associated sex ratios and fecundity estimates can vary widely between years; (2) multiple juvenile age classes (fry, parr, smolt) are present yet comparable data sets may not exist for all of them; (3) it is very difficult to distinguish between non-listed juvenile rainbow trout and listed juvenile steelhead; and (4) survival rates between life stages are poorly understood and subject to a multitude of natural and human-induced variables (e.g., predation, floods, harvest, etc.).

PGE provided an additional perspective on the abundance and freshwater productivity of the Clackamas steelhead population as shown in Figure 2.

Figure 2. Time series of steelhead juvenile outmigrant estimates and trendline.[8]



Spatial Structure

For the spatial structure analysis, the Oregon and Washington recovery plans evaluated the proportion of stream miles currently accessible to the species relative to the historical miles accessible (ODFW 2010; LCFRB 2010). The recovery plans adjusted the rating downward if portions of the currently accessible habitat were qualitatively determined to be seriously degraded. The recovery plans also adjusted the rating downward if the portion of historical habitat lost was a key production area.

The Oregon and Washington recovery plans rate spatial structure to be moderate to very high in nearly all populations of LCR steelhead. The populations that rate lowest have fish passage barriers. Trap and haul operations on the Cowlitz River pass adults upriver, but downstream passage and survival of juvenile fish is very low. This problem also affects spatial structure in the Cispus and Tilton populations. Merwin Dam blocks access to most of the available spawning habitat in the North Fork Lewis populations. However, the relicensing agreement for Lewis River hydroelectric projects calls for reintroduction of steelhead. Condit Dam on the White Salmon River blocks access to most of the historical spawning habitat. Now decommissioned, the dam is scheduled for removal in late 2011. Thus, the LCR steelhead current spatial structure is less diverse than its historical structure, but management actions are underway to improve the situation.

Diversity

The Oregon and Washington recovery plans (ODFW 2010; LCFRB 2010) rate diversity to be moderate to high in all but one population (Table 12). One of the leading factors affecting the diversity of this DPS is the loss of habitat associated with construction of dams. As described above, many of the historical populations were affected by dams built 60 to 90 years ago in

[8] Portland General Electric Company. 2010. Comments on the Draft Environmental Assessment: Reintroduction of Bull Trout to the Clackamas River, Oregon Submitted to: U.S. Fish and Wildlife Service Oregon Fish and Wildlife Office. Figure 4, Appendix 2. February 8, 2010

upper tributaries.

Artificial propagation has been identified as another major factor affecting diversity of LCR steelhead. For many basins, the number of stocks planted, the size and frequency of annual releases, and the percentage of smolts released changed a great deal between the time periods before and after 1985. At present, fewer stocks are used, fewer hatchery fish are released, and a higher percentage of the fish that are released are ready to quickly migrate to the ocean. This change came about in response to the development of wild fish policies in Oregon and Washington. In Washington, the development and implementation (in 1991) of a new stock transfer policy (WDF 1991) designed to foster local brood stocks resulted in a substantial reduction in the transfer of eggs and juveniles between watersheds. The policy mandates that hatchery programs use local brood stocks in rivers with extant indigenous stocks (although non-native stocks are still released into a number of basins.

Habitat

Estuary and Lower Columbia mainstem habitats play an important but poorly understood role in the anadromous fish life cycle. Fish have been adversely affected by changes in access, stream flow, water quality, sedimentation, habitat diversity, channel stability, riparian conditions, channel alternations, and floodplain interactions. These large scale changes have altered habitat conditions and processes important to migratory and resident fish and wildlife (NMFS 2005b).

Habitat conditions for anadromous fish have been fundamentally altered throughout the Columbia River Basin by the construction and operation of a complex of tributary and mainstem dams and reservoirs for power generation, navigation, and flood control. Lower Columbia salmon and steelhead are adversely affected by hydrosystem-related flow and water quality effects, obstructed and/or delayed passage, and ecological changes in impoundments. Dams in the many of the larger subbasins have blocked anadromous fishes' access to large areas of productive habitat (NMFS 2005b).

Conclusion

Most LCR steelhead populations are at relatively low abundance, and those with enough data to be modeled are estimated to have a relatively high extinction probability. The WLC-TRT described two historical populations as either extinct or at very high risk; most other populations are at high risk. The hatchery contribution to natural spawning remains high in many populations. Some populations, particularly summer run, have shown higher returns in recent years. Additionally, trap and haul programs are re-introducing steelhead to many miles of habitat improving the spatial structure and diversity of the species. However, more time is needed before we will know if their status will improve.

2.2.2 Status of the Critical Habitats

NMFS designated critical habitat on September 2, 2005 (70 FR 52630) for all Lower Columbia and Upper Willamette species, except LCR coho salmon. NMFS designated critical habitat for OC coho salmon on February 11, 2008 (73 FR 7816). In determining which areas should be critical habitat, we identified the geographic areas occupied by the species and the physical or biological features essential for the conservation of the species, as well as the primary constituent

elements (PCEs) of the habitat. For all salmon ESUs and steelhead DPSs the PCEs are those sites and habitat components that support one or more life stages, including (1) freshwater spawning sites, (2) freshwater rearing sites, and (3) freshwater migration corridors. We also identified features associated with each of these types of sites essential to maintaining habitat health. The features associated with each type of site are described in the designation notice (70 FR 52630; 73 FR 7816). In the final critical habitat designation, we excluded habitat areas where the benefits of exclusion outweighed the benefits of inclusion (for example, areas covered by existing habitat conservation plans).

As part of the designation process, we convened Critical Habitat Analytical Review Teams (CHARTs) to evaluate the status of each ESU's habitat and identify threats to habitat health. The CHARTs rated the conservation value to each ESU or DPS of each watershed, based on a number of factors including current habitat quality, habitat potential, existing threats, and relative importance of the population occupying the watershed. The following discussion of critical habitat status for each species describes the number of stream miles designated and the number of watersheds containing designated critical habitat, and the conservation ratings of the watersheds.

The CHARTs identified habitat-related human activities that affect PCE quantity and/or quality and identified these primary categories of habitat-related activities: (1) forestry, (2) agriculture, (3) channel modifications/diking, (4) road building/maintenance, (5) urbanization, (6) dams, (7) irrigation impoundments and withdrawals, and (8) wetland loss/removal. All of these activities have PCE-related impacts because they have altered one or more of the following: stream hydrology, flow and water-level modifications, fish passage, geomorphology and sediment transport, temperature, dissolved oxygen, vegetation, soils, nutrients and chemicals, physical habitat structure, and stream/estuarine/marine biota and forage.

Upper Willamette River Chinook

Critical habitat for UWR Chinook includes approximately 1,796 miles of streams in Oregon and Washington. There are 644 miles of spawning/rearing sites, 722 miles of rearing/migration sites, and 106 miles of migration corridors. The CHART rated nineteen watersheds as having low, 18 as having medium, and 22 as having high rating for their conservation value to the ESU (NMFS 2005b). Of the 60 watersheds considered for designation, we excluded 11 low conservation value and four medium-value watersheds in their entirety, and the tributary-only portions of eight low-value watersheds. As a result of these considerations, 324 miles of stream habitats were excluded from the designation.

Lower Columbia River Steelhead

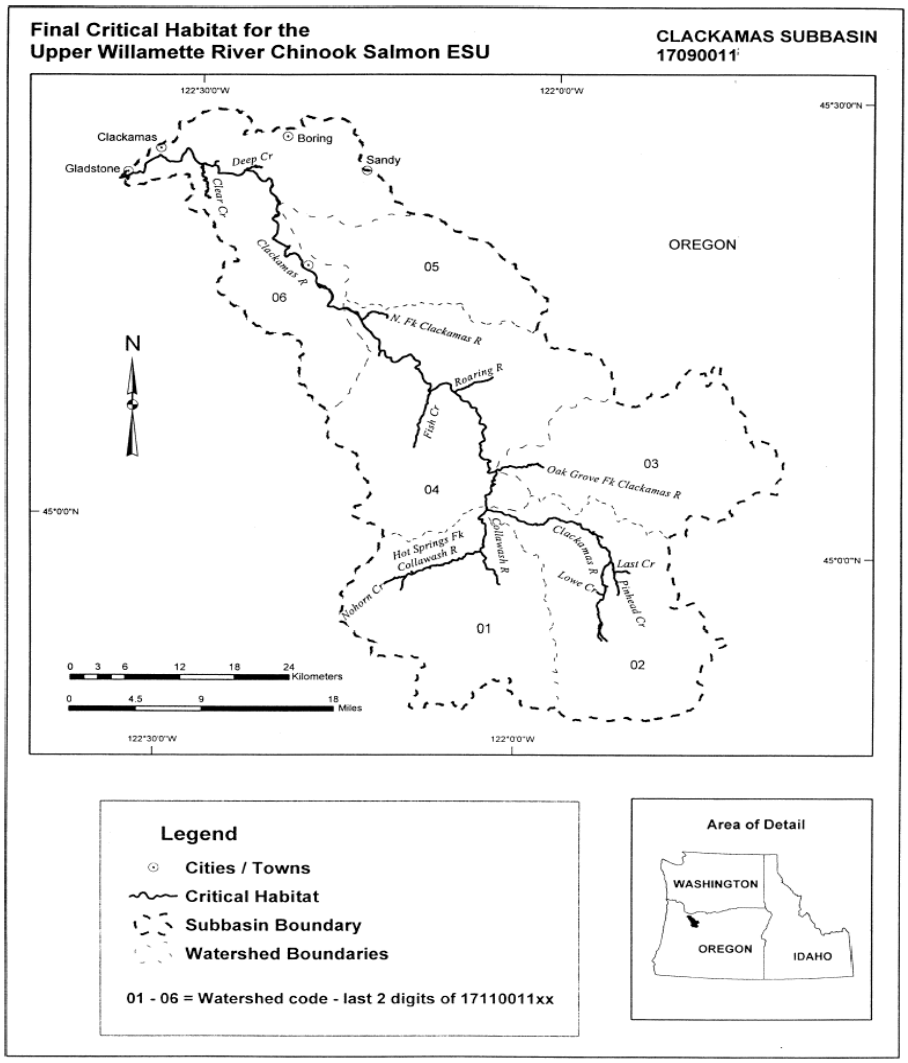
Critical habitat for LCR steelhead includes approximately 2,338 square miles of streams in Oregon and Washington. There are 1,114 miles of spawning/rearing sites, 165 miles of rearing/migration sites, and 1,059 miles of migration corridors. The CHART rated two watersheds as having low, 11 as having medium, and 28 as having high rating for their conservation value to the DPS (NMFS 2005c). Of the 41 watersheds considered for designation, we excluded one low conservation value and three medium-value watersheds in their entirety, and the tributary-only portions of one low-value watershed. Also, we excluded approximately 125 miles of stream covered by two habitat conservation plans. As a result of the considerations,

335 miles of stream habitats were excluded from the designation.

Clackamas Subbasin

Because the proposed action focuses on the Clackamas River, we include additional information on the critical habitat in this subbasin. Figure 3 shows the designation of critical habitat for UWR Chinook salmon in the Clackamas subbasin and its respective watersheds.

Figure 3. Critical habitat in the Clackamas subbasin



The CHART rated six watersheds in the Clackamas subbasin, numbered in Figure 3. Of the six watersheds reviewed, five were rated as having high conservation value and one was rated as having low conservation value. Those that received a high rating are Collawash River (HUC 1709001101), Upper Clackamas River (1709001102), Oak Grove Fork Clackamas River (1709001103), Middle Clackamas River (1709001104), and Lower Clackamas River watersheds (1709001106). The Eagle Creek watershed (1709001105) received a low rating (NMFS 2005e).

In its final designation of critical habitat, NMFS excluded the entire Eagle Creek watershed (1709001105) because the economic benefits of exclusion outweighed the benefits of designation. NMFS included the Clackamas River, Roaring River, and Collawash River in its critical habitat designations (NMFS 2005b).

2.2.3 Climate Change

As reviewed in ISAB (2007), the current status of salmon and steelhead species and their critical habitat in the Pacific Northwest has been influenced by climate change over the past 50-100 years and this change is expected to continue into the future. Average annual Northwest air temperatures have increased by approximately 1°C since 1900, which is nearly twice that for the last 100 years, indicating an increasing rate of change. The latest climate models project a warming of 0.1 to 0.6°C per decade over the next century. This change in surface temperature has already modified, and is likely to continue to modify, freshwater, estuarine, and marine habitats of salmon and steelhead, including designated critical habitat. Consequently, abundance, productivity, spatial distribution, and diversity of salmonid life stages occupying each type of affected habitat is likely to be further modified, generally in a detrimental manner. There is still a great deal of uncertainty associated with predicting specific changes in timing, location, and magnitude of future climate change. It is also likely that the intensity of climate change effects on salmon and steelhead will vary by geographic area.

Tributary Habitat

As described in ISAB (2007), effects of climate change that have influenced the habitat and species in the Northwest, and that are expected to continue to do so in the future, include: reduction of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and competition among species. Recent modeling results indicate that increased summer temperatures or decreased fall streamflow are likely to significantly reduce parr-smolt survival of salmon and steelhead by 2040.

Estuarine Habitat

As described in ISAB (2007), effects of climate change that have influenced the habitat and species in the Northwest, and that are expected to continue to do so in the future, include: higher winter freshwater flows and higher sea level elevation may lead to increased sediment deposition and wave damage; lower freshwater flows in late spring and summer may lead to upstream extension of the salt wedge, possibly influencing the distribution of salmonid prey and predators; and increased temperature of freshwater inflows may extend the range of warm-adapted non-indigenous species that are normally found only in freshwater. In all of these cases, the specific effects on salmon and steelhead abundance, productivity, spatial distribution and diversity are poorly understood.

Marine Habitat

As described in ISAB (2007), effects of climate change that have influenced the habitat and species in the action area, and that are expected to continue to do so in the future include: increased ocean temperature, increased stratification of the water column, and changes in

intensity and timing of coastal upwelling. These continuing changes will alter primary and secondary productivity, the structure of marine communities, and in turn, the growth, productivity, survival, and migrations of salmonids. A mismatch between earlier smolt migrations (due to earlier peak spring freshwater flows and decreased incubation period) and altered upwelling may reduce marine survival rates. Increased concentration of CO2 reduces the availability of carbonate for shell-forming invertebrates, including some that are prey items for juvenile salmonids.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

As stated previously, the action area for the proposed action includes the entire Clackamas River subbasin, except the Oak Grove Fork above Timothy Lake Dam and the Willamette River from Willamette Falls downstream to the confluence with the Columbia River, including the Multnomah Channel.

The environmental baseline for this opinion is therefore the result of the impacts that many activities (summarized below) have had on the various listed species' survival and recovery.

Table 15 provides a summary of the most recent counts of adult and juvenile taken by PGE at North Fork Dam (PGE 2010).

Table 15. Most recent counts of Clackamas coho, spring Chinook and steelhead

	Coho	Spring Chinook	Steelhead
Adults	1935	2381	2346
Average smolts	87,523	16,588	32,590

2.3.1 Description of the Clackamas River Basin

The Clackamas River enters the mainstem Willamette River at RM 25.1 (1.7 miles below Willamette Falls) after draining an area of 941 square miles, and is the fourth largest of the Willamette's tributaries. The Clackamas arises from the southern flank of Mt. Hood in the Cascade Mountains and has several major tributaries, including the Collawash River, Oak Grove Fork, and Fish Creek in the upper portion of its drainage network, and Eagle, Deep, and Clear creeks along the lower river (Figure 4). In all, 87 percent of the Clackamas subbasin is forestland and 69 percent of the subbasin is in public ownership (Figures 4-2).The upper portion of the Clackamas system, above River Mill Dam and Estacada, is characterized by moderate to high-gradient stream reaches within mountainous terrain, while more gently sloped stream channels and topography dominate in the lower portion. The upper portion of the subbasin is heavily forested and primarily within the Mt. Hood National Forest. The lower portion, below Estacada, is more highly developed, and includes a variety of forest, agricultural, rural-

residential, urban, and industrial land uses.

The degree of landscape alteration within the subbasin increases with proximity to urban areas near the Willamette River. Industrial uses of the river's lowlands, particularly near the Willamette, include food processing, recycling of volatile organic compounds, feedlot and dairy farm operations, and rock and aggregate mining. Estacada is the largest city entirely within the subbasin, although the Portland suburbs of Gladstone, Johnson City, and Oregon City are located near the mouth. PGE operates a multi-dam hydroelectric complex within the Clackamas subbasin, with the lower-most dam (River Mill) at RM 23.3 of the mainstem Clackamas not far below the city of Estacada. PGE's Clackamas River Hydroelectric Project (Clackamas Project) also includes Faraday Diversion and North Fork dams on the mainstem Clackamas (at RM 28.4 and 30, respectively), and two additional dams on the Oak Grove Fork above areas naturally accessible to anadromous fish. Fish passage facilities that PGE has constructed and maintained at their dams on the mainstem Clackamas River provide anadromous fish access to all historically occupied streams above River Mill Dam.

Figure 4. Map of the Clackamas subbasin.

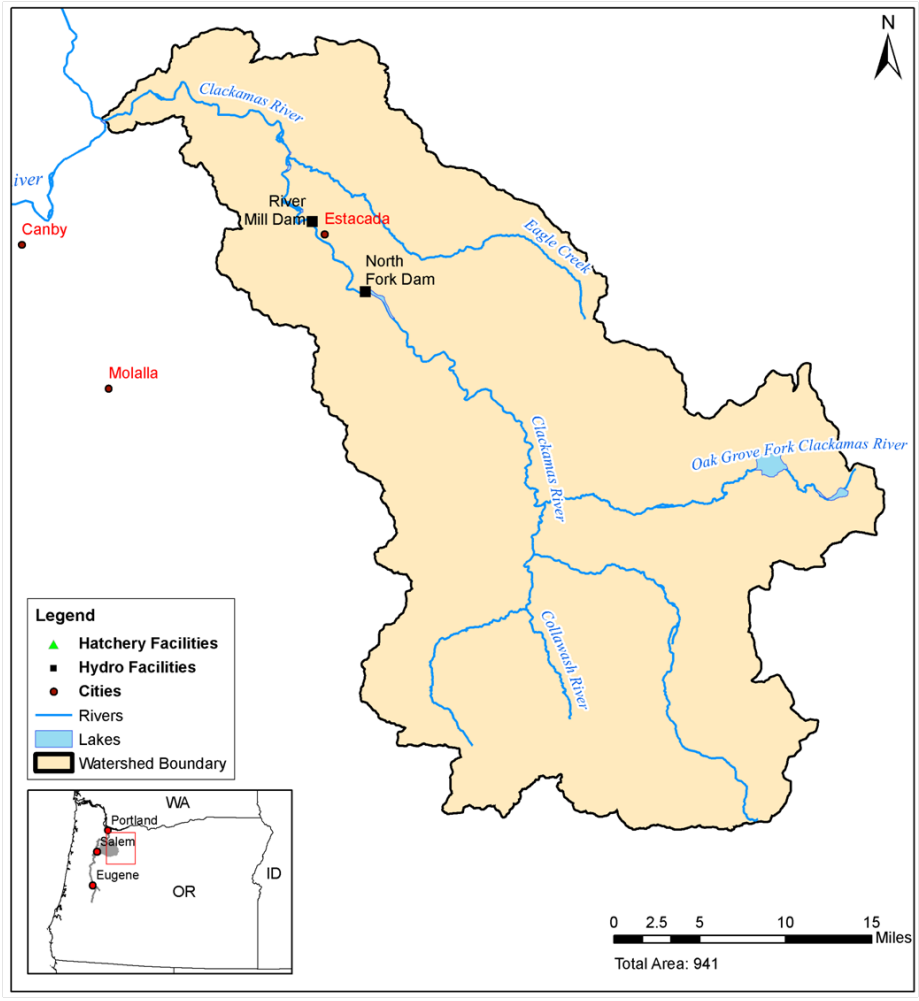
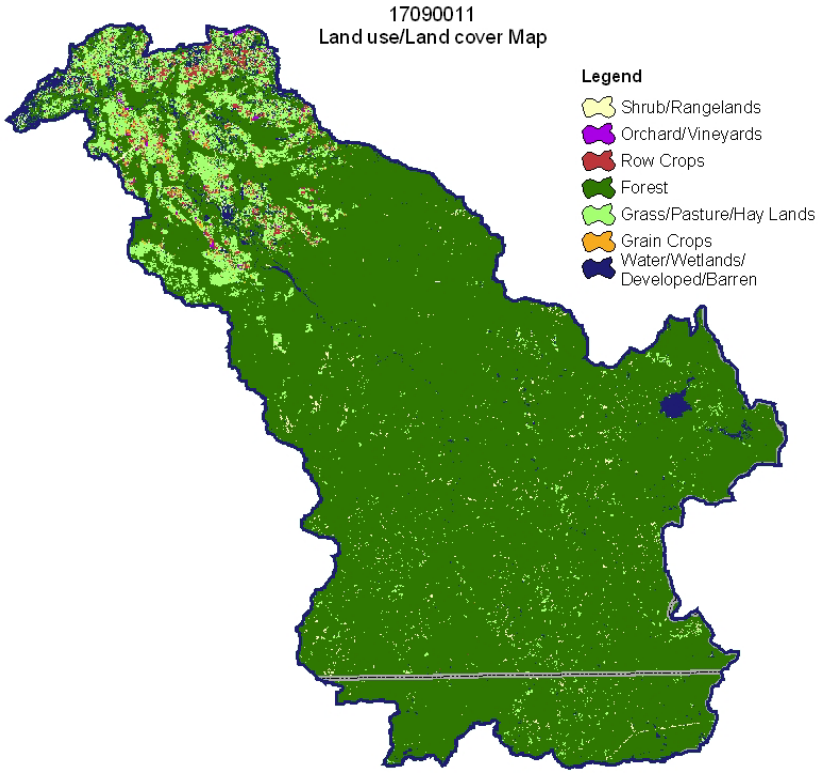


Figure 5. Patterns of land ownership (top) and land use/land cover (bottom) in the Clackamas subbasin. (source: NRCS 2005).



2.3.2 Limiting Factors and Threats to Recovery

2.3.2.1 Summary of Factors Limiting Recovery for all Listed Species

The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids. NMFS' status reviews, Technical Recovery Team publications, and recovery plans for the listed species considered in this opinion identify several factors that have caused them to decline, as well as those that prevent them from recovering (many of which are the same). Very generally, these are various types of habitat degradation caused by human development and harvest and hatchery practices. NMFS' decision to list them identified a variety of factors that were limiting their recovery. Table 16 summarizes the major factors limiting recovery of the listed species considered in this opinion; more details can also be found in the individual discussions of the species' status.

Table 16. Major Factors Limiting Recovery of Salmon and Steelhead. (Adapted from NOAA, NMFS, 2007 Report to Congress: Pacific Coast Salmon Recovery Fund FY 2000-2006, 46p.)

	Estuarine and Nearshore Marine	Floodplain Connectivity and Function	Channel Structure and Complexity	Riparian Areas and Large Woody Debris Recruitment	Stream Substrate	Stream Flow	Water Quality	Fish Passage	Hatchery-related Adverse Effects	Harvest-related Adverse Effects	Predation/Competition/ Disease	Mainstem Columbia Hydropower Adverse Effects	Other Hydropower Effects (e.g. PGE Clackamas Project)
UWR Chinook		●	●	●			●	●	●				●
LCR Coho		●	●	●	●	●	●		●	●			●
LCR Steelhead		●	●	●	●	●	●	●			●		●

Factors unfavorably affecting the status of the Clackamas ESA- listed populations of Chinook, coho and steelhead include a variety of within-basin dam effects, including imperfect fish passage, large hatchery programs, and the cumulative effects of multiple land and water use practices on aquatic habitat. Habitat degradation is a particular concern in the Lower Clackamas subbasin, below the dams, where the historic capacity to produce anadromous salmonids has been substantially diminished (WRI 2004).

2.3.2.2 Details of Factors Limiting Recovery for all Listed Species

In our Biological Opinion on the Willamette River Basin Flood Control Project (NMFS 2008b), and our opinion on the Clackamas Project (NMFS 2008c), we describe the Environmental **c**onditions including habitat access and passage impediments; water quantity/hydrograph; flow reductions, fluctuations, entrapment and stranding; water quality including temperature, nutrients and contaminants; physical habitat characteristics including woody debris; channel complexity, off channel habitat and floodplain connectivity; riparian reserves and disturbance history; hatchery programs and harvest; and the status of PCEs of designated critical habitat in the Clackamas subbasin. This opinion adopts this information by reference.

2.4 Effects of the Action on the Species and its Designated Critical Habitat

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation (50 CFR 402.02).

NMFS conducted two related analyses, one to inform its jeopardy determination (Section 2.4.2), and one (Section 2.4.3) to inform its critical habitat determination.

For the jeopardy analysis, NMFS determined whether the proposed action is likely to reduce the abundance, productivity, or distribution of a listed ESU or DPS. For the critical habitat analysis, NMFS evaluated the effect of the proposed action (PA) on the primary constituent elements (PCEs) of critical habitat and, in particular, on the essential features of that critical habitat by comparing the conditions of the habitat with and without the PA.

2.4.1 Analysis of the Effects of the Action on the Species

NMFS evaluated the effects to be caused by the proposed action, as described in the BA, and we determined that there are four mechanisms that can result in adverse effects on listed salmon and steelhead in the Clackamas River: predation by bull trout, competition with bull trout for habitat and food resources, behavioral modification and energy expenditure to avoid predation by bull trout (both of which could result in slower growth and lower survival rates), and pathogen transfer from bull trout (Section 2.4.1.3). The monitoring and adaptive management components of the proposed action are designed to limit the magnitude of these adverse effects. Beneficial effects may include bull trout predation on species that prey on salmon and steelhead (see Section 2.4.1.3). We determined that the effects of the proposed action would be independent of whether they occur directly or indirectly, so we have analyzed the direct and indirect effects together. In other words, we considered the effects whenever they happen (e.g. predation could be in the first year of the action by a bull trout trans-located from the Metolius River, or in the future, by the next generation of bull trout born in the Clackamas River), and whether they were the result of direct interactions between bull trout and listed salmon and steelhead (e.g. predation) or the result of actions such as complex changes in the food web influenced by the action.

In order to evaluate the expected effects of the proposed action to individual salmon and steelhead, we first consider the expected distribution, abundance and overlap in time and space of bull trout and Clackamas River populations of LCR coho, UWR spring Chinook, and LCR steelhead. We then describe the nature of expected interactions and finally, to the extent possible, we assess the likely extent of impacts.

There is a great deal of uncertainty in the analysis of effects, both because the success of bull trout reintroduction and the resulting bull trout distribution and population size are unknown, and because the interactions between bull trout and salmon and steelhead must be inferred generally from observations in other locations and thus are extremely difficult to quantify. Additionally, as pointed out in the BA, reintroducing bull trout to the Clackamas River will generate a response by other members of the aquatic community, which may include some beneficial effects for listed salmon and steelhead (e.g., bull trout predation on other predators that currently consume juvenile anadromous fish and eggs such as rainbow and cutthroat trout, mountain whitefish, and sculpin). In light of these uncertainties, we will base our analysis of the effects of the proposed action on available information and rely on indirect, or surrogate, methods where necessary. Our analysis also considers the likely outcome of adaptive management based on the monitoring plan and the SIRP.

2.4.1.1 Expected Distribution and Abundance of Species Following Reintroduction Bull Trout

The FWS website for threatened bull trout (http://www.fws.gov/pacific/bulltrout) provides the following summary of bull trout and their habitat requirements:

- Bull trout are a cold-water fish of relatively pristine stream and lake habitats in western North America. They are grouped with the char, within the salmonid family of fish. They have the most specific habitat requirements of salmonids, including the "Four C's": Cold, Clean, Complex and Connected habitat.
- Bull trout require colder water temperature than most salmonids.
- They require the cleanest stream substrates for spawning and rearing.
- They need complex habitats, including streams with riffles and deep pools, undercut banks and lots of large logs.
- They also rely on river, lake and ocean habitats that connect to headwater streams for annual spawning and feeding migrations.

Due to these habitat requirements, we expect bull trout will not reside in the lower Willamette and Clackamas Rivers. This forms the basis for our not likely to adversely effect determination for LCR Chinook and Columbia chum salmon and UWR steelhead in Section 2.11.

NMFS evaluated the expected numbers of bull trout of various life stages at the end of the first year of reintroduction and at the end of a 20-year period, when a stable, self-sustaining population is possible. These two conditions encompass the range of expected bull trout population abundance, with intermediate levels expected in the intervening years.

As described in Section 1.3, USFWS proposes to reintroduce 30 adult, 30 sub-adult and 1,000 juvenile bull trout during the first year. Bull trout are expected to be distributed in colder waters in the mainstem Clackamas River and tributaries above the North Fork Reservoir, with a number of the adults and sub-adults migrating into the reservoir during portions of each year (BA Sections 2.4 and 2.9). Based on the actions proposed in the SIRP, we expect FWS and/or ODFW to remove most of the bull trout that remain in the Clackamas Project area between River Mill Dam and North Fork Dam.

As described in Section 1.3, the goal of the project is a final bull trout population size of 300-500 spawning adults by 2030. For purposes of analysis, we assume a stable Clackamas bull trout population of 400 adults would include 300 first-time spawners and 100 older, multiple spawning adults and we further estimate, given reasonable assumptions about bull trout survival at multiple life stages, that the population would include about 2750 sub-adult bull trout.[9] We recognize that the effect of 500 adults would probably be greater, but we did not explicitly

[9] Radliff, Don (PGE Biologist) personal communication with Robert Walton May 2011.

analyze that number.

Salmon and Steelhead

The BA (Section 2.9 and Appendix B) and Section 2.2 describe the current and expected abundance, distribution and life histories of coho, steelhead, spring and fall Chinook in the Clackamas watershed. In summary, the available information suggests that coho, steelhead and spring Chinook spawn in the tributaries or mainstem Clackamas River above the North Fork Reservoir; coho and steelhead juveniles rear above the reservoir and migrate through it as smolts; and spring Chinook rear in both the reservoir and the river system above it.

Juveniles and Eggs

As discussed in Section 2.2, the recent 12 year average number of salmon and steelhead smolts leaving the NF reservoir (coho + steelhead + Chinook) is approximately 110,000.[10] Significant numbers of spring Chinook smolts pass North Fork Dam via the spillway and are not counted, making it likely that actual numbers are higher. Using approximate numbers of salmon and steelhead at each life stage, we estimate that the number of salmon and steelhead eggs in the Upper Clackamas subbasin is on the order of 10 million[11].

2.4.1.2 Expected Geographic Overlap in Distribution of Salmon, Steelhead, and Bull Trout

We have summarized the expected overlap in time and space between the species in Table 17, based on the expected distribution of species and life stages described or referenced in the previous section. As described in the BA, Section 5.4, the primary area of concern is the habitat altered by the hydroelectric project between River Mill Dam and the head of the North Fork Reservoir. Based on the actions proposed in the SIRP, we expect FWS or ODFW to remove many, or most, of the bull trout that remain in the project area between River Mill Dam and North Fork Dam, reducing the expected impacts there. Because of this, and the wide distribution of salmon and steelhead in the relatively pristine mainstem Clackamas River and tributary areas above the North Fork Reservoir, NMFS considers the primary concern about predation, competition and predator avoidance to be limited to the areas in the North Fork Reservoir where salmon and steelhead juveniles and smolts are concentrated during periods of peak migration.

[10] Portland General Electric. Fish Facility Report, North Fork, summarized in personal communication from Richard Turner, NMFS. May 2011.

[11] For purposes of this rough estimate, we assumed 1,000 female spawners each for coho, spring Chinook and steelhead; 3500 eggs per female for coho, 3000 for steelhead and 4500 for spring Chinook, with a 1% egg to smolt survival.

Table 17. Expected overlap, based on distributions and co-occurrence in time and space between bull trout and Clackamas salmon and steelhead.

	Below PGE Project	In PGE Project	North Fork Reservoir	Clackamas Basin above NF Reservoir (mainstem and tributaries)
Coho eggs	Yes*	No	No	Yes
Coho fry	Yes*	Yes	Yes	Yes
Coho smolts	Yes*	Yes	Yes	Yes
Steelhead eggs	Yes*	No	No	Yes
Steelhead fry	Yes*	Yes	Yes	Yes
Steelhead smolts	Yes*	Yes	Yes	Yes
Spring Chinook eggs	No	No	No	Yes
Spring Chinook fry	No	Yes	Yes	Yes
Spring Chinook smolts	No	Yes	Yes	Yes

***** As explained in Section 2.11, we do not expect bull trout to reside below North Fork Dam in significant numbers, so we expect very limited, if any, overlap with Clackamas populations of coho and steelhead in these areas.

2.4.1.3 Types of Potential Effects

Based on the expected exposure described in the previous section, NMFS provides a qualitative overview of the types of effects that NMFS bull trout could have on coho, steelhead and spring Chinook as a result of the proposed action in Table 18.

Table 18. Overview of Potential Effects of the Action on Clackamas Salmon and Steelhead.

Potential Effect of Action on Clackamas Salmon and Steelhead	Egg	Fry/Juvenile	Smolts	Adult
Predation: salmon or steelhead killed or injured	Spring Chinook, steelhead, coho			none
Reduced egg and juvenile mortality from predation by bull trout on salmon and steelhead predators:	Spring Chinook, steelhead, coho			none
Competition for food and shelter resulting in reduced	none	Spring Chinook, steelhead, coho		none

Potential Effect of Action on Clackamas Salmon and Steelhead	Egg	Fry/Juvenile	Smolts	Adult
growth rate and survival				
Predator Avoidance resulting in reduced growth rate and survival	none	Spring Chinook, steelhead, coho		none
Monitoring: Injury, and Mortality of salmon and steelhead	Spring Chinook, steelhead, coho			

Predation by Bull Trout on Salmon and Steelhead

There are a number of studies that describe bull trout as piscivorous (i.e., fish eating), including Beauchamp and Van Tassell (2001, as cited in the BA), Lowery and Beauchamp (2010) and Clarke et al. (2005, as cited in the BA). These studies document bull trout consumption of salmon eggs, juveniles and carcasses. As referenced in the BA, Goetz et al. (2004) stated that large adult, migratory bull trout are "apex predators" that feed opportunistically based on what food items are most available at any one time or location. The introduction or re-introduction of an aquatic predator such as bull trout can influence potential prey populations through both direct and indirect effects that reverberate through the host community (Stein 1979; Miller et al. 1988; He and Kitchell 1990; Vigliano et al. 2009, all as cited in the BA).

Predation by Bull Trout on Predators of Salmon and Steelhead

Based on the scientific literature cited above, we expect bull trout will eat other predators that currently consume juvenile anadromous fish and eggs. For example, Beauchamp and Van Tassell 2001, as cited in the BA) describe the diet of bull trout in Lake Billy Chinook (Oregon) as including bull trout and rainbow trout. In the Clackamas subbasin, therefore, bull trout could consume brown, rainbow and cutthroat trout, mountain whitefish, and sculpin, all of which are considered current predators of salmon and steelhead in the Clackamas subbasin.

Adverse Effects Associated with Competition for Food and Shelter and Failure to Emigrate

The BA describes available information on competition and predator avoidance, suggesting that the presence of bull trout could lead to reductions in salmon and steelhead growth and survival rates. For example, Appendix B of the BA explains:

> Predation risk can alter behavior, habitat use, foraging success, time budgets (i.e., foraging versus refuging), or temporal-spatial distribution and movement patterns of potential prey (He and Kitchell 1990, Okuyama 2009). These anti-predator behaviors can result in reduced growth rates during vulnerable life stages. Size-selective mortality can be a strong force regulating juvenile salmonid populations during freshwater (Biro et al.

2003a,b, 2005) and early marine life stages (Parker 1971; Ward et al. 1989; Henderson and Cass 1991; Sogard 1997; Beamish et al. 2004; Moss et al. 2005; Cross et al. 2009; Duffy 2009; Ruggerone et al. 2009). Therefore, factors that reduce growth during juvenile life stages can ultimately lead to significantly lower survival in subsequent life stages, particularly for anadromous fishes (Beauchamp et al. 2007; Duffy 2009).

> If juvenile Pacific salmon become vulnerable to predation by an introduced bull trout population we may see shifts in localized habitat use measured as changes in the relative abundance of juvenile Pacific salmon compared to resident fishes (tributary and reservoir). As bull trout populations expand in the reintroduction area, there may be shifts in the duration of residency in various habitats (tributary, reservoir, and mainstem). We hypothesize that the most sensitive indicators of ecological change due to the bull trout reintroduction will be changes in seasonal distribution and size structure of juvenile salmonids within and among habitats.

In this same document, FWS described the potential effect of limited food supply on fish in the Upper Clackamas subbasin. The implication is that interspecific competition for common food resources could be exacerbated by the reintroduction of bull trout, contributing to reduced growth rates and survival of juvenile salmon and steelhead.

The BA (Section 5.4) discusses the potential changes in behavior of juvenile salmon and steelhead if they avoid downstream fish passage facilities due to the presence of bull trout staging near the PGE hydro project features that concentrate migrating juveniles. This could have an adverse impact on Clackamas salmon and steelhead populations if it results in individual fish failing to emigrate.

Pathogen/Disease Transfer

Unwanted parasites and pathogens frequently have been introduced through fish transfers (Hoffman and Schubert 1984, as cited in the BA). The risk of an outbreak of disease in the Clackamas could have serious implications for both natural-origin salmon and steelhead and the hatchery facilities in the Clackamas, including Eagle Creek. The BA describes the predominant pathogens of concern to a reintroduction of bull trout to the Clackamas River as Infectious Hematopoietic Necrosis Virus (IHNV) and *Renibacterium salmoninarum* (the causative agent of BKD), both of which could affect salmon and steelhead, and the state's primary concern - U-clade IHNV to the Clackamas River, which is present in the Deschutes Basin but has not been detected in bull trout from below or above the Pelton-Round Butte Project.

Monitoring Effects

The proposed action includes two categories of monitoring – one targeting bull trout, the other targeting salmon and steelhead.

The BA, in Section 5.7, describes the types of proposed monitoring that targets bull trout:

> As noted in the proposed action, the effectiveness monitoring associated with the bull trout reintroduction project is expected to result in the limited take of juvenile salmon and steelhead. This take is expected to be generally non-lethal in nature, caused by surveys

for bull trout in areas bull trout and anadromous salmonids overlap. Monitoring methodologies may include: minnow trapping, backpack electroshocking, snorkeling, dip-netting, seining, redd surveys, and trapping via a rotary screw trap. Methodologies for monitoring older life stages will include snorkeling, radio telemetry, mobile and stationary PIT-tag antennas.

The proposed action also includes goals to monitor and evaluate impacts to listed salmon and steelhead, as summarized in Section 1.3, but it does not describe the specific activities to monitor salmon and steelhead. The June 2011 Implementation, Monitoring and Evaluation IM&E) Plan (FWS 2011b) provides additional details of the monitoring plans, and explains that FWS intends to rely on information provided by PGE and ODFW in order to accomplish the monitoring goals. The PGE and ODFW activities include handling and tagging juvenile salmon and steelhead which we expect will cause some injury and mortality.

2.4.1.4 Expected Adverse Effects Due to Exposure to Bull Trout

As described above, the proposed action is likely to have several types of adverse effects and at least one form of beneficial effect on the three populations of listed salmon and steelhead in the Clackamas River. The purpose of this section is to determine the extent of each type of effect, and the likely impact of the combination of those effects, on the listed species.

The best available information is insufficient to allow a meaningful quantitative analysis of most of the types of effects that are likely to occur as a result of this proposed action. Although some quantitative analyses are included in this section, they should be interpreted as indicators of the relative magnitude of potential impacts, rather than as precise numerical estimates. Furthermore, reintroducing bull trout to the Clackamas River will generate responses by other members of the aquatic community, which may modify expected effects of bull trout on listed salmon and steelhead.

Predation by Bull Trout on Salmon and Steelhead

Although there is ample evidence that bull trout are piscivorous, as described in the BA, few studies have attempted to quantify bull trout predation impacts on sympatric fish species, so there is considerable uncertainty about the magnitude of interactions between bull trout and listed salmon and steelhead in the Clackamas subbasin.

Our estimates of potential impacts of bull trout predation on juvenile Clackamas salmon and steelhead (Table 19) focus on PGE's Clackamas Project area since juvenile salmon and steelhead utilize project reservoirs, especially North Fork Reservoir, for migration and rearing. Additionally, fish collection facilities to aid downstream migration of smolts necessarily concentrate the juvenile fish, increasing their vulnerability to predation and/or avoidance of collection facilities due to the presence of a predator.

Bull trout are also anticipated to prey on eggs and juvenile (fry and smolt) salmon and steelhead in the Upper Clackamas subbasin above North Fork Reservoir as part of their forage base. However, vulnerability of salmon and steelhead eggs and juveniles in these areas, when compared to vulnerability in areas within PGE's Clackamas Project area, is likely to be much

lower due to greater prey diversity, greater habitat availability, and habitat partitioning in which sympatric species utilize different resources, thereby reducing direct interactions. This strategy was documented in several studies investigating interactions between bull trout and cutthroat trout (Marnell 1985; Nakano et al. 1992; as cited in the BA) and bull trout and rainbow trout (McPhail and Baxter 1996, as cited in the BA).

Vulnerability of juvenile salmon and steelhead in areas below Rivermill Dam is also expected to be very low when compared to areas within PGE's Project area, due to the limited suitability of habitat for bull trout, greater diversity of prey, and lower expected probability of occupation based on bull trout behavior in other populations in the LCR. (BA, Section 5.4 and this opinion, Section 2.11).

Table 19. Summary of assumptions and methods for assessing the effects of predation by bull trout on Clackamas salmon and steelhead.

<table>
<tr><th></th><th>Below PGE Project</th><th>In PGE Project</th><th>In NF Reservoir</th><th>Above NF Reservoir</th></tr>
<tr><td>Eggs</td><td rowspan="3">We assume that bull trout will not reside below the project in any significant numbers because conditions (water temperate and other habitat features) are not conducive to bull trout residency (See Section 2.11)</td><td rowspan="3">The SIRP (FWS 2011a) requires removal of bull trout that remain in project areas below NF Dam. We expect limited predation by transient bull trout in the project area. See Section 2.4.1.2.</td><td>None</td><td rowspan="3">As discussed above, we expect predation by adult, sub adult and juvenile bull trout. However, it isn't practical to quantify the expected level of predation due to many uncertainties. The effect of predation is inferred from comparisons with other watersheds in which bull trout and other salmonids co-occur and from the limits of potential impacts specified in the adaptive management plan.</td></tr>
<tr><td>Fry/juveniles</td><td rowspan="2">Bioenergetic model analysis of reservoir predation scenarios provides an approximation of the range of impacts on listed salmon and steelhead.</td></tr>
<tr><td>Smolts</td></tr>
</table>

Predation in North Fork Reservoir

Three populations are affected by predation in North Fork reservoir: Clackamas coho, Clackamas steelhead, and Clackamas spring Chinook. To evaluate the approximate range of predation expected from bull trout in North Fork Reservoir, FWS staff, working with NMFS and University of Washington personnel, applied the 'Wisconsin bioenergetics model'[12] to estimate the predation of listed salmon and steelhead in the North Fork Reservoir. As described above, NMFS evaluated the expected numbers of bull trout of various life stages at the end of the first year following reintroduction and at the end of a 20-year period, when a stable, self-sustaining population is possible. These two conditions encompass the range of expected bull trout

[12] Hanson et al 1997. FWS applied parameters for bull trout from Matt Mesa, Research Fishery Biologist, USGS Columbia River Research Laboratory USGS Cook, unpublished data.

population abundance during the period of the proposed action, with intermediate levels expected in the intervening years. Results from modeling the initial reintroduction of 30 adult and 30 sub-adult bull trout in 2011 are summarized in Table 20 and described in more detail in Koski (2011).

Table 20. Estimated Losses of Listed Coho, Steelhead and Spring Chinook Due to Predation by 30 Adult and 30 Sub-adult Bull Trout in North Fork Reservoir Translocated in the First Year.

Scenario Description: 30 adult and 30 sub-adult bull trout	**Listed salmon and steelhead eaten/year assuming two water temperatures**		**Comments**
	Low water temp.	**High water temp.**	
Max consumption rate all year. 100% of BT diet is salmonid (salmon, steelhead, trout) 25% of salmonids consumed are listed coho, steelhead and Chinook juveniles	11,400	15,470	This number of coho, steelhead and Chinook consumed is higher than we expect because the assumptions are unrealistic: • assumes that there is no bull trout mortality and that all 60 adults/sub-adults will move into North Fork Reservoir; • the bull trout will not eat at their maximum consumption rate all year; • hatchery rainbow trout, whitefish, sucker, sculpin and other fish are expected to be part of the bull trout diet in addition to salmon, steelhead and trout; • The SIRP will result in removal of "problem" bull trout from areas of the reservoir where smolts are most concentrated, as described in Section 2.4, reducing their presence and efficiency, especially during peak migration times.
Limited consumption rate; 35-75% of diet is salmonids. 25% of salmonids consumed are listed coho, steelhead and Chinook juveniles	675	725	This number is a more realistic estimate because: • it reflects a more realistic average annual consumption rate; • it reflects the expected diverse diet • it includes the SIRP actions described above. However, this scenario still assumes that all 60 sub-adult/adult bull trout are residing within the reservoir and no bull trout are removed for any reason. So, we expect these numbers would be even lower during the first year following reintroduction.

The bioenergetic modeling results in Table 20 indicate that, based upon the modeled assumptions, bull trout in North Fork Reservoir could consume approximately 700 to 15,000 juvenile salmon and steelhead in the first year following reintroduction.

NMFS considers the lower consumption rate assumptions to be realistic, not the higher rates, for several reasons. First, the higher rates are based on the assumption that salmonids make up 100% of the bull trout diet, but we expect there to be other prey in the bull trout diet, especially the 60,000 to 70,000 hatchery rainbow trout outplanted by ODFW in the North Fork Reservoir each year for a 'put-and-take' fishery. All these rainbow trout will be potential prey for the adult and sub-adult bull trout. Furthermore, even the low consumption rate scenarios assume that 100% of the bull trout population will reside in North Fork reservoir, which is not likely. As described in Section 2.4.1.1, bull trout are expected to be distributed in colder waters in the mainstem Clackamas River and tributaries above the North Fork Reservoir.

It is unknown what proportion of sub-adult and adult bull trout will reside entirely in the river (fluvial life history) versus the reservoir, except during spawning (adfluvial life history). However, we are reasonably certain that less than 100% of adults will reside in North Fork Reservoir and that modeling results based upon this assumption over-estimate the impacts of bull trout on listed salmon and steelhead. Additionally, for the first-year predation estimates, the modeling assumes 100% survival of the 30 adults and 30 sub-adults introduced to the Clackamas River, which also is unlikely. Finally, we consider the high temperature scenario to be conservative, since we expect the water to be between the low and high temperatures shown. For these reasons, we relied on the "limited consumption rate" scenario from Table 20 to analyze impacts of the proposed action on listed salmon and steelhead.

To determine the effect of likely levels of bull trout predation on the listed species fish t rearing in or passing through North Fork reservoir (Clackamas spring Chinook, coho, and steelhead), we compared the number of smolts expected to be consumed with the number of smolts present. As described in Section 2.4.1.1, the recent 12 year average number of smolts leaving the NF reservoir is approximately 110,000. This number may be lower than the actual number, because significant numbers of spring Chinook smolts pass North Fork Dam via the spillway and are not counted. If we assume that each species is consumed in proportion to its relative abundance, the survival of any one species during the initial phase of bull trout reintroduction would be reduced by less than 1% (725 ÷ 110,000 = 0.7%).

In subsequent years, if the bull trout reintroduction is successful, there could be 300 to 500 adults (BA Section 2). For purposes of our analysis, we assumed 400 adults and 2750 subadults. In Table 21, we extrapolate the numbers in the initial reintroduction bioenergetics modeling, estimating the potential predation by the Clackamas bull trout population if it contained 400 adults and 2750 sub-adults. As we discussed above, we do not expect the maximum consumption rate scenario to occur and consider the limited consumption rate scenario to be realistic. If we assume 110,000 smolts, and assume each salmonid species is consumed in proportion to its relative abundance, the survival of any one species would be reduced by approximately 21% (23,300 ÷ 110,000 = 21.2%; with 23,300 derived from 7,300 smolts eaten by adult bull trout and 16,000 smolts eaten by sub-adult bull trout per Table 21). This is a theoretical level of consumption in the

future if the reintroduction is successful in achieving a bull trout population with 400 adults and salmon and steelhead numbers do not increase from their current levels. On Section 2.6 we consider the adaptive management plan and mechanisms to ensure that bull trout presence, even if it contains 300-500 adults, does not affect the rate of salmonid recovery.

Table 21. Estimated losses due to predation by large bull trout population in North Fork Reservoir

Scenario Description	# listed salmon and steelhead consumed by 400 adult and 2,750 sub-adult bull trout		
		Lower water temperature	High water temperature
Max consumption rate all year. 100% of BT diet is salmonid	For 400 adults, multiply # in Table 20 by 13.3	105,000	140,000
Limited consumption rate		5,800	7,300
Max consumption rate all year.	For 2750 sub-adults, multiply # in Table 20 by 90	313,000	452,000
Limited consumption rate;		12,000	16,000

Predation Upstream of North Fork Reservoir

Three populations are affected by predation upstream of North Fork reservoir: Clackamas coho, Clackamas steelhead, and Clackamas spring Chinook. The BA (Section 5.2) describes feeding by juvenile and adult bull trout in riverine systems similar to the Clackamas above North Fork Reservoir and indicates extreme variability in diet, making it impossible to model likely effects of predation on listed salmon and steelhead. In areas like the Skagit River, with large runs of salmon and steelhead, salmon eggs, juveniles, and adult carcasses can be the most significant component of the bull trout diet (Lowery 2009, as cited in the BA). Conversely, in other areas, adults and sub-adults may feed primarily on other fish such as sculpins and whitefish. It is expected that bull trout will prey on eggs, fry, juveniles and smolts of the three salmon and steelhead populations in this reach, but the rate of predation and likely reduction in egg-to-smolt survival is unknown. Because of the opportunistic feeding of bull trout, the predation rate on salmon and steelhead is likely to be highest in the years of highest returns and lowest when fewer salmon and steelhead return to the Clackamas, as described in the BA.

An important point relative to smolt mortality from predation above North Fork Reservoir is that the combination of predation in all areas of the Clackamas is expected to be less than the smolt mortality rate described for North Fork Reservoir. This is because the bioenergetics modeling assumed that the entire population of adult and sub-adult bull trout resides in the reservoir. It is unlikely under any scenario that the entire bull trout population would live above the reservoir. In addition, the water temperature in the river above the reservoir is significantly cooler than the 'high [reservoir] water temperature' assumed in the calculations above, thus the consumption rate would be lower.

Predation Downstream of North Fork Reservoir

As described in Section 2.4.1.1, few bull trout are expected to reside downstream of the North Fork Reservoir It is not possible to quantify the mortality resulting from potential predation in this reach but it is likely to be very low, if any, because of the low abundance of bull trout in this

area.

Predation by Bull Trout on Predators of Salmon and Steelhead

The BA does not estimate the number of predators that bull trout are expected to consume following reintroduction and we do not have sufficient information to quantify an estimate. However, the evidence strongly suggests (see Section 2.4.1.3 and the BA, Appendix B) that the initial reintroduction of bull trout is likely to reduce the number of other predatory fish in the Clackamas subbasin. Based on this qualitative information, we determine that there will be a reduction from the current level of predation of coho, steelhead and spring Chinook above North Fork Dam and this will have a positive impact on salmon and steelhead survival.

Competition and Failure to Emigrate (Predator Avoidance)

NMFS has determined that there is insufficient information available to quantify the adverse effects of competition between bull trout and salmon and steelhead for food and shelter. The same is true for the likely consequences of salmon and steelhead modifying their behavior in an effort to avoid bull trout predators. The evidence is clear that salmon and steelhead populations can (and still do) co-exist with bull trout in watersheds such as the McKenzie and Skagit Rivers and elsewhere. In the Clackamas subbasin above North Fork Reservoir, where the ecosystem is large and relatively healthy, we expect salmon and steelhead will be able to find sufficient food and shelter in spite of potential competition from the initial bull trout reintroduction as suggested in the BA, Section 5.1:

> Habitat partitioning among sympatric species allows the utilization of different resources thereby reducing direct competition. This strategy was documented in several studies investigating interactions between bull trout and cutthroat trout (Marnell 1985; Nakano et al. 1992) and bull trout and rainbow trout (McPhail and Baxter 1996).

We considered the possibility of requiring the monitoring of the size (and therefore growth rates) of salmon and steelhead in order to determine if reintroduction of bull trout causes a significant reduction in the size of outmigrating salmon or steelhead juveniles, but concluded this would be impractical because of the natural variability in smolt size (due to temperature, density and other factors) and lack of adequate baseline data.

As discussed in the previous section, there is also a possibility that juvenile salmon and steelhead would avoid areas in the Clackamas Project where predatory bull trout are staging. Under some circumstances, this could be so severe that some juveniles would stay away from the passage routes at the dam and fail to emigrate. We do not expect this to occur to a significant extent due to the actions proposed in the SIRP which will result in the removal of bull trout staging in areas that could prevent juvenile passage.

Pathogen/Disease Transfer

ODFW has completed the prescribed pathogen testing for the first translocation of bull trout form the Metoleous to Clackamas Rivers (ODFW 2011). We assume the proposed pathogen screening protocols required by the BA will be adequate to preclude pathogen transfers that affect salmon and steelhead in the Clackamas watershed. Continued monitoring of bull trout,

salmon and steelhead will be necessary to ensure this is the case.

Monitoring Effects

Two categories of monitoring effort will affect salmon and steelhead.

Regarding the proposed bull trout monitoring, NMFS expects the radio and PIT tagging operations to have no effect on salmon or steelhead, but the other methods can have some effects. Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them, thus making them easy to capture. It can cause a suite of effects ranging from simply disturbing the fish to actually killing them. Salmon and steelhead can also be injured or killed when caught in nets.

The effects of the proposed bull trout monitoring program on salmon or steelhead are described in the BA in Section 5.7:

> Given that bull trout surveys will likely be concentrated in headwater areas of the Clackamas subbasin, upstream from most anadromous juvenile rearing areas, we expect impacts from this take to be extremely limited with lethal take anticipated to be less than one percent of fish handled.

As mentioned in Section 1.3, on May 17, 2011, we issued 4(d) Permit 16054, the purpose of which is to track juvenile bull trout in the Clackamas River related to this proposed action. The permit authorizes the monitoring activities until December 31, 2011, including the indirect mortality of 21 juvenile salmon or steelhead. We consider this effect to be negligible for the affected salmon and steelhead populations.

The other category of monitoring, directed at salmon and steelhead population status, includes the handling of juvenile salmon and steelhead that is required by our opinion on the Clackamas Project (NMFS 2008c). We analyzed the effects of these activities and included them in the Clackamas Project opinion (NMFS 2010b).

Role of the Monitoring and Adaptive Management Plan in Limiting Adverse Effects

An important factor in determining the effect of the proposed action on each species is the role of the monitoring and adaptive management program, especially the SIRP, in limiting the potential for adverse effects to listed salmon and steelhead. Although there is a great deal of uncertainty associated with the effects of this action, the monitoring program ensures that a significant decline in the status of coho, spring Chinook or steelhead populations will be detected in time to modify the action before the salmon and steelhead populations are harmed significantly. That is, the adaptive management and decision-making process proposed in the original BA and SIRP (including the 10(j) non-essential experimental population designation), taken together, amount to an effective means to reverse the proposed action, if warranted.

As summarized in Section 1.3, the SIRP includes stepwise modifications that will be made in response to the monitoring information, up to and including cessation of the reintroduction project and removal of bull trout from the Clackamas Basin. In actions 1 and 2, FWS will remove bull trout from the high vulnerability zones described in the SIRP. In action 3,

FWS will initiate follow-up modeling and studies to further evaluate the effects of the reintroduction. In actions 4 through 6, FWS will remove increasing numbers of bull trout as specific thresholds of salmon and steelhead metrics are reached. The analysis in this section was predicated on an assumption that FWS will be successful in designating the reintroduced bull trout as a nonessential experimental population under section 10(j) of the ESA (this designation was finalized in June, 2011). The 10(j) designation is important because it provides the authority for FWS to implement the SIRP actions that include relocation and removal of listed bull trout if warranted.

The SIRP triggers for Clackamas River coho, spring Chinook, and steelhead populations ensure that, if any combination of the bull trout reintroduction program and other baseline effects in the action area result in critically low abundance and productivity, steps will be taken to curtail the reintroduction program or even to remove bull trout from the system. Scientists from NOAA's Northwest Fisheries Science Center (NWFSC) participated in the design of the thresholds described in actions 3-6 of the SIRP, which are based on concepts developed for the Adaptive Management Implementation Plan (AMIP) within the 2010 FCRPS Supplemental BiOp (NMFS 2010a) the 'early warning indicator' and 'significant decline trigger'. The SIRP establishes the 'anadromous salmonid critical threshold' and 'smolts per adult critical threshold' which utilize the most practical, readily available metrics (juvenile salmon and steelhead leaving the North Fork Reservoir and adults returning to the same reservoir) for monitoring freshwater productivity of the Clackamas coho, spring Chinook and steelhead. These thresholds provide conservative 'triggers' for the management actions proposed by FWS, meaning the thresholds are set low enough that they will not be reached unless there is solid reason for concern about the status of the salmon or steelhead populations, yet they are high enough that they will allow time for management actions to take effect to reduce possible bull trout impacts.

Other key aspects of the monitoring and adaptive management program have previously been described and considered in evaluating specific effects of the action. For example, bull trout will be removed from the reach between River Mill and North Fork Dams. Bull trout will also be relocated or removed from high vulnerability zones, such as around juvenile fish collectors, in North Fork Reservoir.

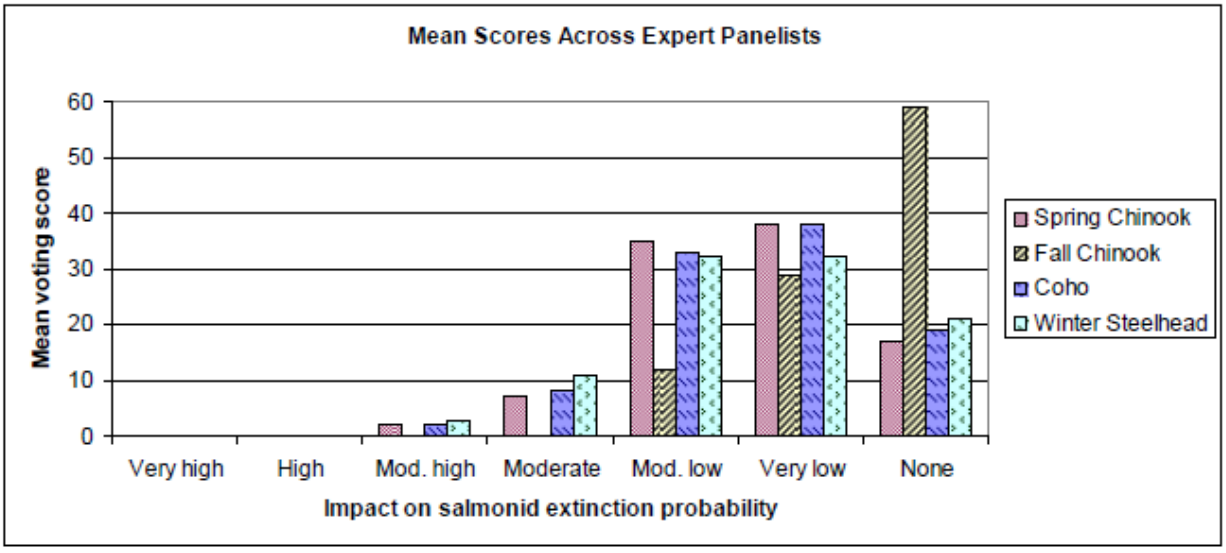
Expert Panel Assessment on the Relative Impact of the Proposed Action on Listed Salmon and Steelhead

The FWS convened an expert panel of academic and agency scientists, including one member from the NWFSC, to review available information and assess the relative impact of the proposed action on the risk of extinction for listed salmon and steelhead populations (BA Appendix A). The panelists reviewed and discussed: the bull trout reintroduction program feasibility assessment and draft proposed action; the status and distribution of ESA-listed anadromous fish species in the Clackamas River and current recovery planning efforts; Portland General Electric's (PGE) hydro projects, reservoirs, and fish bypass systems in the Clackamas River system; and bull trout trophic interactions and food webs. Using a modified Delphi method (Marcot 2006, Marcot et al. 2006, as described in the BA), the panelists qualitatively determined the relative importance of bull trout reintroduction, compared to other threats and stressors, on the extinction risk of the listed salmon and steelhead species. The results were qualitative, based on the following scale (BA Appendix A):

Very High	=	bull trout influence contributes to 100% of the extinction probability
High	=	bull trout influence contributes to about 95% of the extinction probability
Moderately High	=	bull trout influence contributes to about 75% of the extinction probability
Moderate	=	bull trout influence contributes to about 50% of the extinction probability
Moderately Low	=	bull trout influence contributes to about 25% of the extinction probability
Very Low	=	bull trout influence contributes to about 5% of the extinction probability
None	=	bull trout influence has no contribution to the extinction probability

The panel allocated most of their scores to "None" and "Very Low" outcomes for the Clackamas fall Chinook population, and most of their scores to "Very Low" and "Moderately Low" for the other three salmon and steelhead populations (Figure 6). Score allocations included some ratings of "None," "Moderate," and "Moderately High." The range of scores for each population indicates uncertainty regarding the impacts.

Figure 6. Mean scores of expert panel analysis of the potential proportional contribution of bull trout reintroduction to the total extinction risk of four listed salmon and steelhead populations in the Clackamas River Basin. See text above for explanation of qualitative categories.



While the expert panel did not relate their ratings of proportion of risk contributed by bull trout to the total risk currently estimated for each population, information presented in Section 2.2.1, Table 1, can be used for this purpose. This information is presented in Table 22 and indicates

that, although the proportional influence of bull trout introduction described by the expert panel was about the same for the spring Chinook, coho, and steelhead populations, the absolute increase in extinction risk would be greater for Clackamas steelhead than for the other two populations because the current extinction risk is greater for that population.

Table 22. Inferences regarding additional extinction risk for four listed salmon and steelhead populations posed by the reintroduction of bull trout. Current extinction risk from Table 1. Proportional contribution from Figure 6 and discussion above. Inferences approximated by multiplying current risk by proportional contribution, with qualitative categories as described for proportional contribution.

Population	Current Risk of Extinction	Proportional Contribution of Bull Trout Reintroduction to Future Risk of Extinction	Inferences Regarding Absolute Contribution to Future Risk of Extinction
Clackamas Population of UWR spring Chinook	Moderate (5 - 25%)	Very Low to Moderately Low (5 - 25%)	Very Low increase in extinction risk (on the order of <1% to5%)
Clackamas Population of Columbia River Coho	Moderate (5-25%)	Very Low to Moderately Low (5-25%)	Very Low increase in extinction risk (on the order of <1% to 5%)
Clackamas Population of UWR Steelhead	Moderate to High (25-60%)	Very Low to Moderately Low (5-25%)	Very Low to Moderately Low increase in extinction risk (on the order of 1% to 15%)

Summary of the Extent of Effects of the Action on the Clackamas Spring Chinook, Winter Steelhead and Coho Populations

Based on the preceding analysis, we do not expect significant adverse effects from the initial translocations of bull trout. That analysis, however, also suggests that absent further action a large self-sustaining population of bull trout could produce a significant adverse impact on listed coho, steelhead and spring Chinook from predation, competition and predator avoidance. Therefore, it is critical that NMFS considers the thresholds and management actions in the SIRP to be well designed to monitor the size and distribution of bull trout in the high vulnerability zones in the Clackamas subbasin as well as the status of the salmon and steelhead populations. Successful implementation of the monitoring and actions will be of particular importance if the bull trout abundance increases significantly**.** This places added importance on the IM&E Plan proposed in the BA and the recommendations contained in Appendix B of the BA.

- We expect adverse effects including predation, competition, and predator avoidance (failure to emigrate). As described in Section 2.4.1.4, the expected effect of competition is low because of observed resource partitioning in other systems in which bull trout and salmon and steelhead co-occur. We also expect predator

avoidance impacts on smolt size and migration timing to be minor for the same reason. The likelihood of smolts failing to emigrate because of predator avoidance around collectors in North Fork Reservoir is low because bull trout will be removed from that area if ongoing monitoring indicates that they are preying on listed smolts. We also evaluated potential adverse effect of disease transfer but determined that this is very unlikely to occur (discountable).

- The most significant adverse effect is predation. The impact on this population is expected to be relatively low in the early years of reintroduction (less than 1% mortality) and will likely have a minimal effect on the survival of this population. In later years, when self-sustaining bull trout population size is reached, predation can have a significant adverse effect on the population, theoretically resulting in mortality to 20% or more of the smolts.

- Beneficial effects of the action include predation on salmon and trout predators, which may offset some of the bull trout predation impacts.

- The monitoring and adaptive management program should limit the rate of bull trout predation such that it does not reach the high level theoretically possible predicted for the end of the project. The SIRP will result in a reversal of the bull trout reintroduction program if monitoring indicates that abundance and productivity of any of the populations is reduced below critical levels as a result of the combination of bull trout reintroduction and all other factors influencing numbers and productivity of this population. Because the impacts of the bull trout reintroduction are so minor during the initial years and because the final bull trout population size is not expected to be achieved for approximately 20 years, we expect there would be sufficient time to stop the reintroduction and remove bull trout from the Clackamas before the survival and potential for recovery of this population is appreciably reduced.

- Overall survival and potential for recovery of the Clackamas populations of UWR spring Chinook, LCR coho and steelhead is unlikely to be reduced significantly by the proposed action. This finding is consistent with that of the FWS-convened expert panel, which indicates a very low increase in extinction risk for this population as a result of the bull trout reintroduction program.

2.4.2 Analysis of the Effects of the Action on the Critical Habitat of the Species

The reintroduction and monitoring program associated with this proposed action will not result in the installation of any structures in the Clackamas subbasin and the potential removal of bull trout in accordance with the SIRP is not expected to cause any stream disturbances.

In Section.8.5 of the BA, FWS reviewed the PCEs essential for the conservation of the listed species and determined that the bull trout may affect, but will not likely adversely affect any of the PCEs described in Section 2.2.2 of this BiOp. FWS suggests the only two PCEs that appear to be potentially affected by bull trout are freshwater rearing and migration corridors, neither of which lists predation or competition with other native fish as a negative impact on the PCE.

NMFS concurs with this determination.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 consultation of the Act.

Future state, tribal, and local government actions will likely be in the form of legislation, administrative rules, or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities, and added to the many private landholdings; make any analysis of cumulative effects difficult and speculative.

As part of the FCRPS Biological Opinion remand collaboration process (NMFS 2010d), the states of Oregon, Washington, and Idaho provided information on various ongoing and future or expected projects that NMFS determined are reasonably certain to occur and will affect recovery efforts in the Lower Columbia Basin (see lists of projects in Chapter 17 in Corps et al. 2007). These include tributary habitat actions that will benefit specific populations of Chinook, steelhead, and coho, as well as actions that should be generally beneficial throughout each ESU/DPS. Generally, these actions are completed, ongoing, or reasonably certain to occur.

They address protection and/or restoration of existing or degraded fish habitat, instream flows, water quality, fish passage and access, and watershed or floodplain conditions that affect stream habitat. Significant actions and programs include growth management programs (planning and regulation), a variety of stream and riparian habitat projects, watershed planning and implementation, acquisition of water rights and sensitive areas, instream flow rules, stormwater and discharge regulation, Total Maximum Daily Load (TMDL) implementation, and hydraulic project permitting. Responsible entities include cities, counties, and various state agencies. Many of these actions will have positive effects on the viability (abundance, productivity, spatial structure, and/or diversity) of salmon and steelhead populations and the functioning of PCEs in critical habitat designated for coho, steelhead, and UWR Chinook. Therefore, these activities are likely to have cumulative effects that will significantly improve conditions for the three species that occur within the action area.

Some types of human activities that contribute to cumulative effects are expected to have adverse impacts on populations and PCEs, many of which are activities that have occurred in the recent past and have affected the environmental baseline. These can also be considered reasonably certain to occur in the future because they are currently ongoing or occurred frequently in the recent past, especially if authorizations or permits have not yet expired. Within the action area, non-Federal actions are likely to include urban development and other land use practices. Based on trends in U.S. census data, Crossett et al. (2004) predicted that the area of the Pacific Northwest that includes Clackamas County would grow another 10 to 15 percent between 2003

and 2008 and we assume that trend will continue. Although state, tribal, and private actions that provide infrastructure and services for population growth, including water supply and runoff from impermeable surfaces, are likely to continue within the action area, past effects on listed salmonids and their habitat are not a guarantee of a continuing level of effect. That depends on whether there are economic, administrative, and legal impediments (or in the case of contaminants, safeguards), as described above. We find it likely that the cumulative effects of these activities will have adverse effects commensurate to those of similar past activities.

In summary, the cumulative effects are both positive and negative. Human population increases will continue to have a negative effect while recovery efforts in the LCR will have a positive effect. NMFS is not aware of any additional State or private action in the Project area that is reasonably certain to occur or that would affect the listed species or their proposed critical habitat.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

Species

As described in Section 2.4, the proposed action is likely to cause adverse effects to three salmon and steelhead populations in the Clackamas subbasin, but we have determined that the initial translocations of bull trout are likely to have minor adverse impacts on these populations.

We are concerned about the current status of the Clackamas salmon and steelhead populations and the theoretical possibility that if the bull trout population eventually achieves stability with 300 to 500 adults, and if predation occurs at the rates indicated in the bioenergetic modeling analysis described in Section 2.4.1.4, it could result in major declines in the coho, spring Chinook and steelhead populations. While a significant long-term impact (≈ 20%) is possible, significant reductions in abundance or productivity are unlikely because of (a) the lack of evidence that this has occurred elsewhere in the many watersheds where the species co-occur naturally, and (b) the protective measures provided by the SIRP, including the following.

- The SIRP will significantly reduce the extent of adverse impacts on listed salmon and steelhead in the Clackamas Basin that result from reintroducing bull trout, and limit the ultimate extent of adverse impacts. Key features are the ability to track bull trout location and remove them from the areas where they are most likely to have the greatest impacts on salmon and steelhead and increased confidence in our ability to monitor the relationships between bull trout and listed salmon and steelhead status, and to take action to reduce bull trout impacts if warranted by degraded status of the listed salmon and

steelhead.

- The SIRP accomplishes these benefits by establishing effective metrics, thresholds and triggers for management actions that will detect declines in salmon and/or steelhead status in sufficient time to take actions to reduce possible bull trout impacts.

- The adaptive management and decision-making process proposed in the original BA and SIRP, (including the 10(j) non-essential experimental population designation) taken together, amount to an effective means to reverse the proposed action, if deemed necessary, to protect the listed salmon and steelhead populations in the Clackamas River from unacceptable impacts from bull trout.

All the analyses discussed to this point have been at the individual and Clackamas population level. The proposed action is not expected to have any effect on other populations within the ESUs and DPS considered in this opinion. As described in Section 2.2, all three populations are critical for recovering their respective listed species. If it appeared that the high predation rates indicated by the bioenergetics model were likely for the Clackamas populations of spring Chinook, steelhead, and coho, the effect on UWR Chinook, LCR steelhead, and LCR coho would be significant. However, as described above, these high predation rates are unlikely given the monitoring and adaptive management program. After considering the status of the species, environmental baseline and cumulative effects, (Section 2.2), we have determined that the proposed action is not expected to appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution, based on the above analysis and the following explicit understanding of how the proposed action will be implemented.

1. The SIRP will be implemented as written, unless modified through the adaptive management process with NMFS approval.
2. The monitoring plan will be funded and implemented as proposed, with the additional elements described in Section 2.8.3, unless modified through the adaptive management process with NMFS approval.
3. The PGE Clackamas Project will continue to be implemented in accordance with the NMFS Biological Opinion (NMFS 2008c) as described in the Environmental Baseline section.

Critical Habitat

As noted earlier, we do not expect the action to have any appreciable effect on any listed species' critical habitat so we determined that the proposed action is not expected to reduce the value of designated or proposed critical habitat for the conservation of the species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR coho salmon, LCR steelhead, or UWR spring Chinook salmon, or to destroy or adversely modify their

designated critical habitat.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[13] Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

Due to Bull Trout

Because reintroduced bull trout are likely to prey on juvenile salmon and steelhead, compete for food and shelter and cause predator avoidance behavior, take in the form of harm and killing is reasonably certain to occur. As described in Section 2.4, while it is possible to approximate the numerical take of the smolt life stage caused by predation in one portion of the action area, it is not possible to quantify take for all effects, all parts of the action area, and all life stages. Furthermore, other than examining the stomach contents of bull trout, it is not feasible to directly or indirectly monitor the numerical take of smolts resulting from predation in North Fork reservoir, from the take of eggs or juvenile salmon and steelhead in the subbasin above the reservoir, or the take resulting from changes in behavior that salmon and steelhead may make as a result of the reintroduction of bull trout. As a result, NMFS uses a surrogate measure to define the extent of take on the basis of the expected numbers of bull trout in the Clackamas River resulting from the proposed action. The expected bull trout numbers are:

1. No more than 30 adult, 30 sub-adult and 1000 juvenile bull trout in the Clackamas River in 2011
2. No more than 60 adults, 60 sub-adults, and 2000 juveniles in 2012; and
3. No more than 500 adult bull trout, on average, in subsequent years of the proposed action.

[13] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the U.S. Fish and Wildlife interpretation of the term.

Due to Monitoring and Research

NMFS expects the effects of the ongoing monitoring, evaluation and research activities related to bull trout that are included in the proposed action to remain at or below the limit of 21 indirect mortalities allowed in 4(d) Permit 16054.

2.8.2 Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species.

2.8.3 Reasonable and Prudent Measures and Terms and Conditions

Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). NMFS concludes that the following measures are necessary and appropriate to minimize the take of listed species as a result of the proposed action:

The FWS will ensure adequate funding for and implementation of:

1. a "robust monitoring and evaluation program," implemented each year as described in the amended BA, capable of detecting if "unacceptably high population level impacts are occurring to federally listed salmon and steelhead in the Clackamas River" (BA, Section 2), including Appendix B and the final IM&E Plan (any inconsistencies between these will be need to be reconciled by the management committee); the monitoring plan will include the additional elements described in the terms and conditions described below, unless modified through the adaptive management process with NMFS approval;
2. the pathogen screening protocols required by the State of Oregon, as described in the BA;
3. the management actions described in the SIRP;
4. a check-in with NMFS after the second year of the project prior to a third year of translocation of adult and sub-adult bull trout into the Clackamas subbasin;
5. the 10(j) designation on the *Establishment of a Nonessential Experimental Population of Bull Trout in the Clackamas River, Oregon* published in June 2011 (76 FR 35979), and the Environmental Assessment (EA) published in June, 2011 (USFWS 2011c); and
6. annual reports.

Terms and Conditions

"Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). FWS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary and must be carried out for the exemption in section 7(o)(2) to apply.

1. Monitoring and Evaluation

The following terms and conditions apply to the monitoring and evaluation program included in the proposed action:

1a. Monitoring bull trout:

- FWS will ensure that, as proposed in the BA, Section 2.9, juvenile, sub-adult and adult bull trout life stages, will all be PIT-tagged; that all adults and sub-adults for the first two years will be tagged with radio tags.
- FWS will use radio tags on adult and sub-adult bull trout in subsequent years, if deemed important (by the management committee) to ensure the adequacy of the monitoring plan.
- FWS will ensure that tracking bull trout movement by radio and PIT-tag systems will occur on a frequent basis and data will be uploaded, evaluated, and made available to the management committee at least once a week during peak migration periods, and as determined by the management committee during other times.
- FWS will ensure that the necessary authorities are in place to implement the monitoring program.
- FWS will include gastric lavage of bull trout to the extent practicable.
- FWS will utilize acoustic tags to track bull trout in the North Fork Reservoir in the second year (and in subsequent years if deemed necessary) of the project unless determined to be unnecessary by the management committee, including NMFS concurrence.

1b. Monitoring Salmon and steelhead:

FWS will ensure that the following are substantially implemented, using data from the existing monitoring program being implemented as part of the Clackamas Project if available or, if needed, by initiating new monitoring activities.

i. Annually monitor and record the counts of adult and juvenile coho, spring Chinook and steelhead passing North Fork Dam.
ii. Replicate the baseline food web work conducted by Lowery and Beauchamp following reintroduction.

1c. Monitoring plans and standards

i) FWS will provide an annual plan for all research and monitoring activities to be conducted related to anadromous fish to NMFS no later than January 1 of each year. NMFS will review these plans, and approve, approve with changes, or disapprove the study plans within three months after submission.
ii) FWS must make reasonable modifications to the plans to meet NMFS' approval.
iii) Research and monitoring activities conducted in relation to the opinion will conform to the conditions described in the Appendix - *NMFS* Common Elements for Proposed Research.

2. FWS or ODFW shall implement and report on the pathogen screening protocols required by the State of Oregon, as described in the BA, each year prior to translocation of bull trout.

3. FWS will include NMFS in preparations for implementation of the management actions described in the SIRP and ensure that actions 1 through 6 of the SIRP are implemented as quickly as practicable if and when thresholds are reached, including removal of bull trout

meeting the criteria, using the appropriate methods determined by ODFW and/or FWS; (this may require the use of nets if other methods are ineffective).

4. FWS will convene a meeting of the management committee to review the results of the action as a check-in with NMFS after the second year of the project and prior to subsequent translocations of adult and sub-adult bull trout into the Clackamas subbasin in order to ensure that the effects of the action are consistent with this opinion.

5. On or before January 31st of every year, FWS must submit to NMFS a post-season report describing the activities associated with the action, including research activities, the number of listed fish counted and taken in the monitoring efforts and the type of take. Falsifying annual reports or permit records is a violation of this incidental take statement.

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

The FWS should work closely with NMFS, ODFW, USFS, USGS, universities and others in monitoring the Clackamas subbasin ecosystem functions in order to better understand and improve any conditions that adversely impact bull trout, salmon, steelhead and other species.

The FWS should work with NMFS, ODFW and others to fund a PhD. Student, employee or contractor to enhance the monitoring and evaluation efforts in the Clackamas subbasin. This should be an integrated effort to monitor Clackamas bull trout, salmon and steelhead.

2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion (specifically, if any of the anadromous salmonid thresholds established for each listed population in action # 6 of the SIRP are reached and the corresponding actions are not implemented), or 4) a new species is listed or critical habitat designated that may be affected by the action.

In instances where it is determined that the amount or extant of take is exceeded, NMFS may immediately request that FWS reinitiate section 7 consultation. Upon reinitiation of consultation, the actions considered in this opinion may continue, until the FWS and NMFS determine what changes, if any, need to be implemented.

Among other considerations, NMFS may seek reinitiation of this consultation if a key component of the environmental baseline, the actions required by NMFS (2008) - the Biological Opinion on the FERC license for the Clackamas Project, is not completed on time, including the 1,000 cfs collector at North Fork Dam. This does not constitute any new or additional measures, nor is it a requirement of FWS, but it the effects of the proposed action were added to the environmental baseline and a significant change to the baseline would indicate new information revealing effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion. It underscores the extent to which this opinion relies on the actions PGE is taking in accordance with the company's Clackamas River Hydroelectric Project (FERC Project No.2195).

2.11 "Not Likely to Adversely Affect" Determinations

NMFS concurrence with a determination that an action "is not likely to adversely affect" listed species or critical habitat is based on our finding that the effects are expected to be discountable, insignificant, or completely beneficial (FWS and NMFS 1998). Insignificant effects relate to the extent of the impact and should never reach the scale where take occurs; discountable effects are those that are extremely unlikely to occur; and beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat.

Southern Resident Killer Whale Determination

The BA did not address the potential adverse affect of the proposed action on killer whales, but NMFS has considered the potential since the proposed actions also have the potential to affect SR killer whales and their critical habitat by diminishing the whales' prey base.

The SR killer whale DPS composed of J, K, and L pods was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). The final rule listing SR killer whales as endangered identified several potential factors that may have caused their decline or may be limiting recovery. These are: quantity and quality of prey, toxic chemicals which accumulate in top predators, and disturbance from sound and vessel traffic. The rule also identified oil spills as a potential risk factor for this species. The final recovery plan includes more information on these potential threats to SR killer whales (NMFS 2008).

Southern Residents spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and move south into Puget Sound in early autumn. Pods make frequent trips to the outer coast during this season. In the winter and early spring, SR killer whales move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California.

Southern Residents consume a variety of fish and one species of squid, but salmon, and Chinook salmon in particular, are their primary prey (review in NMFS 2008b). Ongoing and past diet studies of Southern Residents conduct sampling during spring, summer and fall months in inland waters of Washington State and British Columbia (i.e., Ford and Ellis 2006; Hanson et al. 2010; ongoing research by NWFSC). Therefore, our knowledge of diet is specific to inland waters. Less is known about diet of Southern Residents off the Pacific Coast. However, chemical analyses support the importance of salmon in the year-round diet of Southern Residents (Krahn

et al. 2002; Krahn et al. 2007). The predominance of Chinook salmon in the Southern Residents' diet when in inland waters, even when other species are more abundant, combined with information indicating that the killer whales consume salmon year round, makes it reasonable to expect that Southern Residents predominantly consume Chinook salmon when available in coastal waters.

The proposed actions may affect Southern Residents indirectly by reducing availability of their primary prey, Chinook salmon. As described in the effects analysis for salmonids, take of juvenile salmonids could affect prey availability to the whales in future years in coastal waters of their range.

Nonetheless, and for reasons described in Section 2.4, the estimated mortality of juvenile Chinook is not expected to appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution.

In the event of a worst-case scenario, however, it is conceivable that bull trout could devour most of an age class of Clackamas juvenile spring Chinook emigrating from the Upper Clackamas Basin through the North Fork Reservoir. However unlikely this may be, the result can be estimated by the most recent five-year average abundance of natural-origin spring Chinook above North Fork Dam – less than 1,000 adult spring Chinook. If this were to happen twice, the actions described in the SIRP would result in removal of some bull trout, and if it were to happen three times, action number six would result in total removal of bull trout from the Clackamas River, ending the effect of the reintroduction project.

Given the total quantity of prey available to SR killer whales throughout coastal range, this theoretical reduction in prey is extremely small, and although measurable is not anticipated to be different than zero by multiple decimal places (based on NMFS previous analysis of the effects of salmon harvest on Southern Residents; e.g., NMFS 2008). Because the reduction is so small, there is also a very low probability that any of the juvenile Chinook salmon lost as a result of bull trout reintroduction would have later (in 3-5 years time) been intercepted by the killer whales across their vast coastal range in the absence of the reintroduction project. Therefore, the anticipated take of salmonids associated with the proposed action would result in an insignificant reduction in adult equivalent prey resources for SR killer whales.

Given these circumstances, and the fact that there will be no direct interaction between the (freshwater bull trout) and the SR killer whales, NMFS finds that potential adverse effects of the proposed reintroduction of bull trout into the Clackamas River are insignificant and determines that the proposed action may affect, but is not likely to adversely affect SR killer whales.

Columbia River Chum Salmon Determination

The BA mentioned chum salmon in Section 4.1, in the discussion of historic populations, but did not discuss the possible effect of the action on Columbia River chum salmon, which are listed as threatened, but were extirpated from the Clackamas River. Because the Lower Columbia Recovery Plan has a goal of restoring a chum population to the Clackamas subbasin eventually, NMFS considered the potential effect of the proposed action on this species but because chum salmon have not been reported in or near the Clackamas River watershed at this time, NMFS determined that it is not likely that that bull trout, after being reintroduced into the Upper

Clackamas subbasin, will overlap with chum salmon in time and space. We have therefore determined that the proposed action will have a discountable effect on chum salmon and is therefore not likely to adversely affect the Columbia River chum ESU.

Lower Columbia River Chinook Salmon and Upper Willamette Steelhead Determination

The BA did not mention LCR Chinook salmon or UWR steelhead and did not request concurrence with a determination of "not likely to adversely affect." However, NMFS evaluated the effects on these species since they occur in the action area. As described in Section 2.4.1.1, and in the BA, Section 1.2, bull trout require cold water and other habitat conditions generally not found in the Clackamas River below the River Mill Dam and in the Willamette River. LCR fall Chinook in the Clackamas reside almost exclusively below Rivermill Dam in the PGE Clackamas Project[14] and Upper Willamette River steelhead are not found in the Upper Clackamas subbasin. As a result, we have determined that it is not likely that that bull trout, after being reintroduced into the Upper Clackamas subbasin, will overlap with LCR fall Chinook salmon or UWR steelhead in time and space. We have therefore determined that the proposed action will have a discountable effect on the Lower Columbia River Chinook salmon ESU or the Upper Willamette DPS and is therefore not likely to adversely affect either the ESU or DPS.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for Chinook salmon, coho salmon, and Puget Sound pink salmon as part of the Pacific salmon plan (PFMC 1999). The proposed action and action area for this consultation are described in Section 1 of this document. The action area includes areas designated as EFH for various life-history stages of Chinook salmon and coho salmon. There are no effects downstream of the mouth of the Clackamas River from this Project.

Based on information provided in the BA and the analysis of effects presented in this opinion, NMFS concludes that proposed action, with the SIRP, monitoring and related measures in effect,

[14] Doug Cramer, Portland General Electric Biologist: Personal communication to Robert Walton May 23, 2011 reporting that fewer than 30 have been counted at the North Fork Reservoir trap in over 35 years.

will not have adverse effects on EFH designated for Chinook and coho salmon and steelhead as long as the terms and conditions described in the Incidental Take Statement are implemented.

The specific effects and their duration and intensity are described in the Section 2 of the attached opinion. This analysis is based, in part, the descriptions of EFH for Pacific Coast salmon (PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The essential fish habitat for Clackamas Chinook, coho and steelhead populations is describe in Sections 2.2 and 2.3 of this opinion.

3.2 Adverse Effects on Essential Fish Habitat

As described in Section 2.4.3, NMFS concurs with the FWS determination that the reintroduction of bull trout into the Clackamas subbasin may affect, but will not likely adversely affect any of the PCEs described in Section 2.2.2 of this opinion.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS expects that the proposed action will not threaten any habitat designated EFH for Pacific Coast salmon and steelhead.

3.4 Statutory Response Requirement

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds, or carries out any action that may adversely affect EFH - in this case, EFH for Pacific salmon. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response to NMFS within 30 days of receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation, the agency must explain its reasons for not following the recommendation.

However, in this instance, no conservation recommendations are necessary. As the opinion above describes, the proposed action is not likely to adversely affect the habitat upon which Pacific salmon or steelhead depend.

3.5 Supplemental Consultation

The FWS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations [50 CFR 600.920(l)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554 - the Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

This ESA section 7 consultation on the issuance of the incidental take statement concluded that the actions will not jeopardize the continued existence of any species. Therefore, the FWS may carry out the action. Pursuant to the MSA, NMFS determined that no conservation recommendations were needed to conserve EFH.

The intended users of this consultation are the FWS, ODFW and USFS. The agencies and the American public will benefit from the consultation.

Individual copies were made available to the FWS, ODFW and USFS. This consultation will be posted on the NMFS NW Region web site (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NOAA Fisheries in accordance with relevant information technology security policies, and standards set out in Appendix III, "Security of Automated Information Resources," Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan.

Standards

This consultation and its supporting documents are clear, concise, complete, unbiased, and were developed using commonly accepted scientific research methods. They adhere to published standards including the NOAA Fisheries ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information

This consultation and its supporting documents use the best available information, as referenced in the literature cited section. The analyses in this biological opinion/EFH consultation contain more background on information sources and quality.

Referencing

All supporting materials, information, data, and analyses are properly referenced. They follow standard scientific referencing style.

Review Process

This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

5. REFERENCES

Federal Register Notices

November 20, 1991 (56 FR 58612). Notice of Policy: Policy on Applying the Definition of Species under the Endangered Species Act to Pacific Salmon.

January 17, 2002 (50 FR 600). Magnuson-Stevens Act Provisions – Essential Fish Habitat.

September 2, 2005 (70 FR 52630). Final Rule: Designated Critical Habitat: Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho.

June 28, 2005 (70 FR 37160). Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs.

November 18, 2005 (70 FR 69903). Endangered and Threatened Wildlife and Plants: Endangered Status for Southern Resident Killer Whales.

January 5, 2006 (71 FR 834). Final Rule: Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead.

November 29, 2006 (71 FR 69054). Endangered and Threatened Species; Designation of Critical Habitat for Southern Resident Killer Whale.

February 11, 2008 (73 FR 7816). Final Rule: Endangered and Threatened Species: Final Threatened Determination, Final Protective Regulations, and Final Designation of Critical Habitat for Oregon Coast Evolutionarily Significant Unit of Coho Salmon.

October 1, 2008 (50 FR 402.02) Interagency Cooperation – Endangered Species Act of 1973, as amended, Definitions.

December 9, 2009 (74 FR 65045). Proposed rule on the Establishment of a Nonessential Experimental Population of Bull Trout in the Clackamas River, Oregon.

June 21, 2011 (76 FR 35979). Endangered and Threatened Wildlife and Plants; Establishment of a Nonessential Experimental Population of Bull Trout in the Clackamas River Subbasin, OR.

Literature Cited

Biro, P.A., J.R. Post, and E.A. Parkinson. 2003a. Population consequences of a predator-induced habitat shift by trout in whole-lake experiments. Ecology 84:3:691-700

Biro, P.A., J.R. Post, and E.A. Parkinson. 2003b. From individuals to populations: prey fish risktaking mediates mortality in whole-system experiments. Ecology 84:2419-2134.

Biro, P.A., J.R. Post, and M.V. Abrahams. 2005. Ontogeny of energy allocation reveals selective pressure promoting risk-taking behaviour in young fish cohorts. Proceedings of the Royal Society B 272:1443-1448.

Church, M.R., J.L. Ebersole, K.M. Rensmeyer, R.B. Couture, F.T. Barrows, and D.L.G. Noakes. 2009. Mucus: a new tissue fraction for rapid determination of fish diet switching using stable isotope analysis. Canadian Journal of Aquatic and Fisheries Sciences.

Cramer, D. P. 2011. Portland General Electric, Portland, Oregon. Personal communication to Robert Walton May 23, 2011.

Ferguson, J.W. 2006. Memorandum to James Lecky. Estimation of percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2006. Northwest Fisheries Science Center. June 13, 2006. ESA Section 7 Consultation Number 2010/02572

Ferguson, J.W. 2007. Memorandum to James Lecky: Estimation of percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2007. Northwest Fisheries Science Center. September 13, 2007.

Ferguson, J.W. 2009a. Memorandum to James H. Lecky: Final Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2008. Northwest Fisheries Science Center. January 26, 2009.

Ferguson, J.W. 2009b. Memorandum to James H. Lecky: Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2009. Northwest Fisheries Science Center. October 15, 2009.

FWS 2009. Draft Environmental Assessment on the Establishment of a Nonessential Experimental Population of Bull Trout in the Clackamas River, Oregon. December 9, 2009.

FWS 2010. Biological Assessment, Reintroduction of Bull Trout (*Salvelinus confluentus*) to the Clackamas River, Oregon December 10, 2010.

FWS 2011a. USFWS Amendment to the 12/10/2010 Biological Assessment on the Reintroduction of Bull Trout to the Clackamas River May 13, 2011.

FWS 2011b. Clackamas River Bull Trout Reintroduction Implementation, Monitoring, and

Evaluation Plan. U.S. Fish and Wildlife Service Oregon Fish and Wildlife Office and Columbia River Fisheries Program Office, In collaboration with Oregon Department of Fish and Wildlife. June 2011.

FWS 2011c. Final Environmental Assessment on the Reintroduction of Bull Trout to the Clackamas River, Oregon. June 17, 2011

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-66, 598 p.

Hanson, P. C., T. B. Johnson, D. E. Schindler and J. F. Kitchell 1997. Fish Bioenergetics 3.0. Madison, Wisconsin, University of Wisconsin - Madison Center for Limnology and University of Wisconsin Sea Grant Institute.

Hogarth. 2005. Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a) (2) of the Endangered Species Act). November 7, 2005.

ISAB (Independent Scientific Advisory Board). 2007. Climate change impacts on Columbia River Basin fish and wildlife. ISAB, Report 2007-2, Portland, Oregon.

Koski, Marci. 2011. U.S. Fish and Wildlife Service. Personal Communication to Robert Walton. May 24, 2011. Applied Hanson et al 1997 with parameters for bull trout from Matt Mesa, Research Fishery Biologist, USGS Columbia River Research Laboratory USGS Cook, unpublished data.

Kostow K.E. 2004. Differences in juvenile phenotypes and survival between hatchery stocks and a natural population provide evidence for modified selection due to captive breeding. Can J Fish Aquat Sci 61:577–589

Krahn, M.M., M.B. Hanson, R.W. Baird, R.H. Boyer, D.G. Burrows, C.E. Emmons, J.K.B. Ford, L.L. Jones, D.P. Noren, P.S. Ross, G.S. Schorr, and T.K. Collier. 2007. Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. Marine Pollution Bulletin 54(12): 1903-1911.

Krahn, M. M., P. R. Wade, S. T. Kalinowski, M. E. Dahlheim, B. L. Taylor, M. B. Hanson, G. M. Ylitalo, R. P. Angliss, J. E. Stein, and R. S. Waples. 2002. Status review of southern resident killer whales (Orcinus orca) under the Endangered Species Act. NOAA ESA Section 7 Consultation Number 2010/02572 Technical Memorandum NMFS-NWFSC-54, U.S. Department of Commerce, Seattle, Washington.

LCFRB 2010. Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. June 10, 2010.

LeFleur, C. and C. Melcher. 2004. Addendum to the Wild Winter Steelhead Biological

Assessment. November 2, 2004.

Marnell, L. 1985. Bull trout investigations in Glacier National Park, Montana. P. 33-35 In D.D. MacDonald (ed.) Flathead River Basin bull trout biology and population dynamics modeling information exchange. Fisheries Branch, British Columbia Ministry of Environment, Cranbrook, British Columbia.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-42, 156p.

McElhany, P., M. Chilcote, J. Myers, and R. Beamesderfer. 2007. Viability Status of Oregon Salmon and Steelhead Populations in the Willamette and Lower Columbia Basins. Report prepared for Oregon Department of Fish and Wildlife and National Marine Fisheries Service.

McPhail, J.D. and J.S. Baxter. 1996. A review of bull trout (Salvelinus confluentus) life-history and habitat use in relation to compensation and improvement opportunities. Department of Zoology, University of British Columbia. Fisheries Management Report No. 104. Vancouver, British Columbia, Canada.

Myers, J. M., R. G. Kope, G. Bryant, et al. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. NOAA Tech. Memo., NMFS-NWFSC-35. 443 p.

Nakano, S., K.D. Fausch, T. Furukawa-Tanaka, K. Maekawa, and H. Kawanabe. 1992. Resource utilization by bull char and cutthroat trout in a mountain steam in Montana, U.S.A. Japanese J. of Ichthyology 39:211-217.

NMFS 2004. Status Evaluation of Salmon and Steelhead Populations in the Willamette and Lower Columbia River Basins. Willamette/Lower Columbia Technical Recovery Team. July 2004.

NMFS 2005a. ESA Recovery Planning for Salmon and Steelhead in the Willamette and Lower Columbia River Basins. Status of Planning Effort and Strategy for Completing Plans. December 2005.

NMFS 2005b. Green Sturgeon (Acipenser medirostris) Status Review Update. Biological Review Team. Santa Cruz Laboratory. Southwest Fisheries Science Center. NOAA Fisheries. February 2005.

NMFS 2005c. Endangered and threatened species; designation of critical habitat for 12 evolutionarily significant units of West Coast salmon and steelhead in Washington, Oregon, and Idaho. Final rule. Federal Register, Vol. 70, Pg. 52630-52858, September 2, 2005.

NMFS 2007. PCSRF (Pacific Coastal Salmon Recovery Fund). 2007. 2007 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2006. National Marine Fisheries Service, Seattle, Washington.

NMFS, 2008a Endangered Species Act - Section 7 Consultation Effects of the Pacific Coast Salmon Plan During the 2008-2009 Annual Regulatory Cycle on the Southern Resident Killer Whale (Orcinus orca) Distinct Population Segment. May 19, 2008

NMFS 2008b. National Marine Fisheries Service (NMFS). 2008. Endangered Species Act Section 7 Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Consultation: Consultation on the Willamette River Basin Flood Control Project. NMFS, Portland, Oregon. July 11.

NMFS 2008c. Endangered Species Act - Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Consultation on Operation of Portland General Electric Company's Clackamas River Hydroelectric Project Under its New License, Clackamas River Hydroelectric Project FERC No. 2195. September 3, 2008.

NMFS 2010a. Endangered Species Act - Section 7 Consultation Supplemental Biological Opinion. Supplemental consultation on remand for operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin, and ESA Section 10(a)(I)(A) permit for Juvenile fish transportation program. May 20, 2010. NMFS, Portland, Oregon.

NMFS 2010b. Endangered Species Act Section 7 Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations for the Operation of Portland General Electric Company's Clackamas River Hydroelectric Project (FERC Project No.2195). September 3, 2010.

NMFS 2010c. Endangered Species Act Section 4(d) Permit # 16054. Clackamas River Bull Trout Investigations.. May 17, 2011

NMFS 2010d. Endangered Species Act - Section 7 Consultation Supplemental Biological Opinion. Supplemental consultation on remand for operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin, and ESA Section 10(a)(I)(A) permit for Juvenile fish transportation program. NMFS, Portland, Oregon.

NRCS (Natural Resources Conservation Service). 2005. Final 8-digit hydrologic unit profile: Clackamas – 17090011. U.S. Department of Agriculture, NRCS, Washington, D.C.

ODFW. 2005. Fisheries Management and Evaluation Plan for the Lower Columbia River Coho in Oregon Freshwater Fisheries of the Lower Columbia River Tributaries (between the Pacific Ocean and Hood River). September 2005.

ODFW. 2005a. Oregon Department of Fish and Wildlife, Fisheries Management and Evaluation Plan for the Lower Columbia River Coho in Oregon Freshwater Fisheries of the Lower Columbia River Tributaries (between the Pacific Ocean and Hood River). September 2005.

Oregon Department of Fish and Wildlife (ODFW). 2005b. 2005 Oregon Native Fish Status Report. Oregon Department of Fish and Wildlife, Fish Division, 3406 Cherry Avenue N.E., Salem, OR 97303-4924.

ODFW. 2007. Draft Upper Willamette Recovery Plan. Available at http://www.dfw.state.or.us/fish/esa/upper-willamette/

ODFW. 2010a. Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead. Public Review Draft. April 19, 2010.

ODFW. 2010b. Willamette Falls Fish Passage Counts. Available at http://www.dfw.state.or.us/fish/fish_counts/willamette%20falls.asp ESA Section 7 Consultation Number 2010/02572

ODFW. 2010c. Proposed Upper Willamette conservation and recovery plan for Chinook and steelhead (October 22, 2010) Oregon Department of Fish and Wildlife and NMFS.

ODFW 2011. Email from Richard W Stocking to Brett Hodgson. May 27, 2011

PGE 2010. Portland General Electric Company Comments on the Draft Environmental Assessment: Reintroduction of Bull Trout to the Clackamas River, Oregon Submitted to: U.S. Fish and Wildlife Service Oregon Fish and Wildlife Office. Figure 4, Appendix 2. February 8, 2010

PGE 2011. Portland General Electric. Fish Facility Report, North Fork, summarized in personal communication from Richard Turner, NMFS. May 2011.

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.

Radliff, Don (PGE Biologist) personal communication with Robert Walton May 2011.

Shively, D., C. Allen, T. Alsbury, B. Bergamini, B. Goehring, T. Horning, and B. Strobel 2007 Clackamas River bull trout reintroduction feasibility assessment. USDA Forest Service, Mt. Hood National Forest.

WDFW. 1991. Revised stock transfer guidelines. Memo, 28 May 1991, Salmon Culture Division, Olympia, WA, 10 p.

WRI (Willamette Restoration Initiative). 2004. Willamette Subbasin Plan. Prepared for the Northwest Power and Conservation Council, Portland, Oregon.

APPENDIX: NMFS Common Elements for Proposed Research

The BA, in Section 2.11, states in part:

> We propose to cover programmatically, by way of this consultation, the incidental take of listed juvenile salmon and steelhead associated with monitoring the effectiveness of the bull trout reintroduction project.

As explained in Sections 1.3 and 2.8 of this opinion, we issued 4(d) Permit 16054 on May 17, 2011, which authorized FWS to take listed salmonids incidental to its monitoring program to track juvenile bull trout in the Clackamas River, related to the reintroduction. The permit authorizes the monitoring activities until December 31, 2011, including the indirect mortality of 21 juvenile salmon or steelhead. As part of its proposed action here, FWS proposes to continue that monitoring program. When the current 4(d) Permit expires, the incidental take statement included with this biological opinion will cover the take of listed salmonids in the FWS monitoring program. The terms and conditions included in the incidental take statement are the same as those included in Permit 16054.

When NMFS issues research permits, we lay out the conditions to be followed before, during, and after the research activities are conducted. These conditions are intended to (a) ensure that research activities are coordinated among permit holders and between permit holders and NMFS, (b) minimize impacts on listed species, and (c) ensure that NMFS receives information about the effects the permitted activities have on the species concerned. All research permits NMFS' NWR issues have the following conditions:

1. The permit holder must ensure that listed species are taken only at the levels, by the means, in the areas and for the purposes stated in the permit application, and according to the terms and conditions in the permit.

2. The permit holder must not intentionally kill or cause to be killed any listed species unless the permit specifically allows intentional lethal take.

3. The permit holder must handle listed fish with extreme care and keep them in cold water to the maximum extent possible during sampling and processing procedures. When fish are transferred or held, a healthy environment must be provided; e.g., the holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, the permit holder must process listed fish first to minimize handling stress.

4. The permit holder must stop handling listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, listed fish may only be visually identified and counted. In addition, electrofishing is not permitted if water temperature exceeds 64 degrees Fahrenheit.

5. If the permit holder anesthetizes listed fish to avoid injuring or killing them during handling, the fish must be allowed to recover before being released. Fish that are only

counted must remain in water and not be anesthetized.

6. The permit holder must use a sterilized needle for each individual injection when passive integrated transponder tags (PIT-tags) are inserted into listed fish.

7. If the permit holder unintentionally captures any listed adult fish while sampling for juveniles, the adult fish must be released without further handling and such take must be reported.

8. The permit holder must exercise care during spawning ground surveys to avoid disturbing listed adult salmonids when they are spawning. Researchers must avoid walking in salmon streams whenever possible, especially where listed salmonids are likely to spawn. Visual observation must be used instead of intrusive sampling methods, especially when the only activity is determining fish presence.

9. The permit holder using backpack electrofishing equipment must comply with NMFS' Backpack Electrofishing Guidelines (June 2000) available at http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits. A permit holder engaging in boat electrofishing must comply with all applicable standards from the Guidelines. The permit holder is not authorized to intentionally target adult salmonids while backpack or boat electrofishing. If an adult salmonid is encountered the permit holder must immediately stop electrofishing.

10. The permit holder must obtain approval from NMFS before changing sampling locations or research protocols.

11. The permit holder must notify NMFS as soon as possible but no later than two days after any authorized level of take is exceeded or if such an event is likely. The permit holder must submit a written report detailing why the authorized take level was exceeded or is likely to be exceeded.

12. The permit holder is responsible for any biological samples collected from listed species as long as they are used for research purposes. The permit holder may not transfer biological samples to anyone not listed in the application without prior written approval from NMFS.

13. The person(s) actually doing the research must carry a copy of this permit while conducting the authorized activities.

14. The permit holder must allow any NMFS employee or representative to accompany field personnel while they conduct the research activities.

15. The permit holder must allow any NMFS employee or representative to inspect any records or facilities related to the permit activities.

16. The permit holder may not transfer or assign this permit to any other person as

defined in section 3(12) of the ESA. This permit ceases to be in effect if transferred or assigned to any other person without NMFS' authorization.

17. NMFS may amend the provisions of this permit after giving the permit holder reasonable notice of the amendment.

18. The permit holder must obtain all other Federal, state, and local permits/authorizations needed for the research activities.

19. On or before January 31st of every year, the permit holder must submit to NMFS a post-season report in the prescribed form describing the research activities, the number of listed fish taken and the location, the type of take, the number of fish intentionally killed and unintentionally killed, the take dates, and a brief summary of the research results. Falsifying annual reports or permit records is a violation of this permit.

20. If the permit holder violates any permit condition they will be subject to any and all penalties provided by the ESA. NMFS may revoke this permit if the authorized activities are not conducted in compliance with the permit and the requirements of the ESA or if NMFS determines that its ESA section 10(d) findings are no longer valid.

"Permit holder" means the permit holder or any employee, contractor, or agent of the permit holder. Also, NMFS may include conditions specific to the proposed research in the individual permits.

Finally, NMFS will use the annual reports to monitor the actual number of listed fish taken annually in the scientific research activities and will adjust permitted take levels if they are excessive or if cumulative take levels rise to the point where they are detrimental to the listed species.