Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Section 7(a)(2) Not Likely to Adversely Affect Determination, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation

Entiat National Fish Hatchery Summer Chinook Salmon Hatchery Program.

NMFS Consultation Number: NWR-2012-00841

Action Agencies: United States Fish and Wildlife Service
United States Bureau of Reclamation

Affected Species and Determinations:

ESA-Listed Species	Status	Is the Action Likely to Adversely Affect Species or Critical Habitat?	Is the Action Likely To Jeopardize the Species?	Is the Action Likely To Destroy or Adversely Modify Critical Habitat?
Upper Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened	No	No	No
Upper Columbia River spring-run Chinook salmon (*O. tshawytscha*)	Endangered	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does the Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, Northwest Region, Salmon Management Division

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

Date: 4-18-2013

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1. INTRODUCTION

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

The Proposed Action is funded by the United States Bureau of Reclamation (BOR) and the United States Fish and Wildlife Service (FWS). The FWS proposes to operate a new hatchery program at the Entiat National Fish Hatchery (ENFH) that releases summer Chinook salmon into the Entiat River Basin (Table 1). Summer Chinook salmon are not listed under the Endangered Species Act (ESA). This program replaces a spring Chinook salmon hatchery program that was a risk to the spring Chinook salmon population in the Entiat River and to the Upper Columbia River (UCR) spring Chinook salmon Evolutionarily Significant Unit (ESU). Spring Chinook salmon production at ENFH ceased in 2007 and the last adult hatchery spring Chinook salmon returned to the Entiat River in 2010.

The hatchery program, as described in Section 1.8 of the Hatchery Genetic Management Plan (HGMP) the (Proposed Action), "is intended to function as a segregated/isolated[1] program for harvest benefits." Fish from the program are not intended to spawn naturally and are not intended to establish, supplement, or support any summer Chinook salmon population(s) occurring in the natural environment.

Table 1. The Proposed Action, including program operator and funding agency.

Hatchery and Genetics Management Plan	Program Operator	Funding Agency
Entiat Summer Chinook Salmon	FWS	BOR and FWS

*The U.S. Bureau of Reclamation (BOR) is the primary funding agency. The ENFH is part of the Leavenworth Fisheries Complex and was built to mitigate for the construction and operation of Grand Coulee Dam.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the ESA of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402. The opinion documents consultation on the action proposed by the FWS and the BOR.

The NMFS also completed an Essential Fish Habitat (EFH) consultation. It was prepared 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, incidental take statement, and EFH conservation recommendations are 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. The project files for both consultations are held at the Salmon Management Division (SMD) of NMFS in Portland, Oregon.

[1] These terms are defined in Section 2.4.1.

1.2. Consultation History

The first hatchery consultations in the Columbia Basin followed the first listings of Columbia Basin salmon under the ESA. Snake River sockeye salmon were listed as an endangered species on November 20, 1991, Snake River spring/summer Chinook salmon and Snake River fall Chinook salmon were listed as threatened species on April 22, 1992, and the first hatchery consultation and opinion was completed on April 7, 1994 (NMFS 1994; NMFS 2008d). The 1994 opinion was superseded by “Endangered Species Act Section 7 Biological Opinion on 1995-1998 Hatchery Operations in the Columbia River Basin, Consultation Number 383” completed on April 5, 1995 (NMFS 1995b). This opinion determined that hatchery actions jeopardize listed Snake River salmon and required implementation of reasonable and prudent alternatives (RPAs) to avoid jeopardy.

A new opinion was completed on March 29, 1999, after UCR steelhead were listed under the ESA (62 FR 43937, August 18, 1997) and following the expiration of the previous opinion on December 31, 1998 (NMFS 1999). That opinion concluded that Federal and non-Federal hatchery programs jeopardize Lower Columbia River (LCR) steelhead and Snake River steelhead protected under the ESA and described RPAs necessary to avoid jeopardy. Those measures and conditions included restricting the use of non-endemic steelhead for hatchery broodstock and limiting stray rates of non-endemic salmon and steelhead to less than 5% of the annual natural population in the receiving stream. Soon after, NMFS reinitiated consultation when LCR Chinook salmon, UCR spring Chinook salmon, Upper Willamette Chinook salmon, Upper Willamette steelhead, Columbia River chum salmon, and Middle Columbia steelhead were added to the list of endangered and threatened species (Smith 1999).

Between 1991 and the summer of 1999, the number of distinct groups of Columbia Basin salmon and steelhead listed under the ESA increased from 3 to 12, and this prompted NMFS to reassess its approach to hatchery consultations. In July 1999, NMFS announced that it intended to conduct five consultations and issue five opinions “instead of writing one biological opinion on all hatchery programs in the Columbia River Basin.” Opinions would be issued for hatchery programs in the, (1) Upper Willamette, (2) Middle Columbia River (MCR), (3) LCR, (4) Snake River, and (5) UCR, with the UCR NMFS’ first priority (Smith 1999). Between August 2002 and October 2003, NMFS completed consultations under the ESA for approximately twenty hatchery programs in the UCR. For the MCR, NMFS completed a draft opinion and distributed it to hatchery operators and to funding agencies for review on January 4, 2001, but completion of consultation was put on hold pending several important basin-wide review and planning processes.

The increase in ESA listings during the mid to late 1990s triggered a period of investigation, planning, and reporting across multiple jurisdictions and this served to complicate, at least from a resources and scheduling standpoint, hatchery consultations. A review of Federal funded hatchery programs ordered by Congress was underway at about the same time that the 2000 Federal Columbia River Power System (FCRPS) opinion was issued by NMFS (NMFS 2000). The Northwest Power and Conservation Council (Council) was asked to develop a set of coordinated policies to guide the future use of artificial propagation, and RPA 169 of the FCRPS opinion called for the completion of NMFS-approved hatchery operating plans (i.e., HGMPs) by the end of 2003. The RPA required the Action Agencies to facilitate this process, first by assisting in the development of HGMPs, and then by helping to implement identified hatchery reforms (NMFS 2001). Also at this time, a new *U.S. v. Oregon* Columbia River Fisheries Management Plan (CRFMP), which included goals for hatchery management, was under negotiation and new information and science on the status and recovery goals for salmon and steelhead was emerging from Technical Recovery Teams (TRTs). Work on HGMPs under the FCRPS opinion was undertaken in cooperation with the Council's Artificial Production Review and Evaluation process, with CRFMP negotiations, and with ESA recovery planning (Jones 2002; Foster 2004). HGMPs were submitted to NMFS under RPA 169; however, many were incomplete and, therefore, were not found to be sufficient[2] for ESA consultation.

ESA consultations and an opinion were completed in 2007 for nine hatchery programs that produce a substantial proportion of the total number of salmon and steelhead released into the Columbia River annually. These programs are located in the LCR and MCR and are operated by the FWS and by the Washington Department of Fish and Wildlife (WDFW). NMFS' opinion (NMFS 2007a) determined that operation of the programs would not jeopardize salmon and steelhead protected under the ESA.

On May 5, 2008, NMFS published a Supplemental Comprehensive Analysis (SCA) (NMFS 2008d) and an opinion and RPAs for the FCRPS to avoid jeopardizing ESA-listed salmon and steelhead in the Columbia Basin (NMFS 2008c). The SCA environmental baseline included "the past effects of hatchery operations in the Columbia River Basin. Where hatchery consultations have expired or where hatchery operations have yet to undergo ESA section 7consultation, the effects of future operations cannot be included in the baseline. In some instances, effects are ongoing (e.g., returning adults from past hatchery practices) and included in this analysis despite the fact that future operations cannot be included in the baseline. The Proposed Action does not encompass hatchery operations per se, and therefore no incidental take coverage is offered through this biological opinion to hatcheries operating in the region. Instead, we expect the operators of each hatchery to address its obligations under the ESA in separate consultations, as required" (see NMFS 2008d, p. 5-40).

Because it was aware of the scope and complexity of ESA consultations facing the co-managers and hatchery operators, NMFS offered substantial advice and guidance to help with the consultations. In September 2008, NMFS announced its intent to conduct a series of ESA consultations and that "from a scientific perspective, it is advisable to review all hatchery programs (i.e., Federal and non-Federal) in the UCR affecting ESA-listed salmon and steelhead concurrently" (Walton 2008). In November 2008, NMFS expressed again, the need for re-evaluation of UCR hatchery programs and provided a "framework for ensuring that these hatchery programs are in compliance with the Federal Endangered Species Act" (Jones 2008).

[2] "Sufficient" means that an HGMP meets the criteria listed at 50 CFR 223.203(b)(5)(i), which include (1) the purpose of the hatchery program is described in meaningful and measureable terms, (2) available scientific and commercial information and data are included, (3) the Proposed Action, including any research, monitoring, and evaluation, is clearly described both spatially and temporally, (4) application materials provide an analysis of effects on ESA-listed species, and (5) preliminary review suggests that the program has addressed criteria for issuance of ESA authorization such that public review of the application materials would be meaningful.

NMFS also "promised to share key considerations in analyzing HGMPs" and provided those materials to interested parties in February 2009 (Jones 2009).

On April 28, 2010 (Walton 2010), NMFS issued a letter to "co-managers, hatchery operators, and hatchery funding agencies" that described how NMFS "has been working with co-managers throughout the Northwest on the development and submittal of fishery and hatchery plans in compliance with the Federal Endangered Species Act (ESA)." NMFS stated, "In order to facilitate the evaluation of hatchery and fishery plans, we want to clarify the process, including consistency with *U.S. v. Oregon*, habitat conservation plans and other agreements…." With respect to "Development of Hatchery and Harvest Plans for Submittal under the ESA," NMFS clarified: "The development of fishery and hatchery plans for review under the ESA should consider existing agreements and be based on best available science; any applicable multiparty agreements should be considered, and the submittal package should explicitly reference how such agreements were considered. In the Columbia River, for example, the *U.S. v. Oregon* agreement is the starting place for developing hatchery and harvest plans for ESA review…."

This opinion is based on a series of documents submitted to NMFS by the FWS and the BOR. A complete record of this consultation is on file with the SMD in Portland, Oregon. On July 31, 2009, the FWS submitted an HGMP and requested initiation of formal consultation under section 7 of the ESA to "cover the new summer Chinook salmon hatchery program at ENFH" (USFWS 2009). The HGMP described the Proposed Action and the potential effects of the action on UCR spring Chinook salmon and UCR steelhead.

NMFS completed its review of the HGMP and determined it sufficient for formal consultation on March 9, 2011 (Busack 2011). Subsequently and during formal ESA consultation, NMFS received additional information and analysis, comments and proposals from the FWS and the BOR. NMFS received an updated biological assessment dated February 13, 2012 on the potential effects of the ENFH on ESA listed species and critical habitat under FWS jurisdiction (USFWS 2012). On February 15, 2012, FWS advised NMFS of a change in the Proposed Action as it related to the diversion of surface waters for hatchery operation and provided a "new, updated Section 4 Water Source to replace the Section 4 currently in the July 31, 2009 HGMP" (Irving 2012a). NMFS received additional information and analysis, and proposals in letters dated June 4, 2012 (Irving 2012b), September 11, 2012 (Irving 2012c), and September 13, 2012 (Puckett 2012).

The FWS requested that the consultation be effective for up to ten years so that research, monitoring, and evaluation (RM&E) included in the HGMP can provide meaningful results and inform future management decisions. The temporal scope of NMFS's effects analysis must be long enough to make a meaningful determination of effects, and thus the analysis in this Opinion is not limited to a ten-year period. However, given the FWS request, in addition to the standard regulatory reinitiation triggers, reinitiation will be required if implementation of the Proposed Action is to continue beyond April 1, 2023.

1.3. Proposed Action

"Action" means all activities, 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.

NMFS describes a hatchery program as a group of fish that have a separate purpose and that may have independent spawning, rearing, marking and release strategies (NMFS 2008c). The operation and management of every hatchery program is unique in time, and specific to an identifiable stock and its native habitat (Flagg et al. 2004). In this specific case, the Proposed Action is described in the July 31, 2009, HGMP determined sufficient for formal consultation, as modified by Irving (2012a), Irving (2012b), and Irving (2012c).

The Proposed Action is the operation of a hatchery program that produces non-ESA-listed UCR summer Chinook salmon. It would use "a commingled stock destined for the UCR" but it would follow protocols and practices that promote the divergence of hatchery fish at ENFH from the UCR summer Chinook salmon ESU. Duration of the Proposed Action is ten years. The purpose or reason for the hatchery program is to mitigate for losses in salmon production caused by the construction and operation of Grand Coulee Dam. The goal for the program is to provide summer Chinook salmon for harvest. On average, approximately 1,600 ENFH summer Chinook salmon could be harvested annually.

Fisheries are not part of this proposed action and there are no fisheries that exist because of the proposed hatchery program, i.e. the "but for" test does not apply and therefore there are no interrelated and interdependent fishery actions. The ENFH is a new hatchery program, and to the extent that fisheries may be developed to specifically target ENFH summer Chinook salmon they will be subject to future section 7 consultation. To the extent that there are existing fisheries that may catch ENFH fish, they are mixed fisheries and would exist with or without ENFH (and have previously been evaluated in a separate biological opinion (NMFS 2008b).

Describing the Proposed Action

Proposed hatchery broodstock collection

- Broodstock origin and number: The Proposed Action is derived from UCR summer Chinook salmon collected at Wells Dam (Figure 1). At least 150 pairs of ENFH adult summer Chinook salmon will be collected for hatchery broodstock annually. As the progeny of the initial Wells Hatchery collections return as adults to ENFH, they will be used as broodstock and the number of adults supplied by Wells Hatchery will be reduced. It is anticipated that, by brood year 2016, salmon volunteering to ENFH will satisfy 100% of the program's broodstock requirements.
- Proportion of natural-origin fish in the broodstock (pNOB): Zero. Only ENFH summer Chinook salmon (i.e., hatchery summer Chinook salmon only), identifiable by an adipose fin clip, will be used for hatchery broodstock.
- Broodstock selection: A representative sample from throughout the hatchery fish return will be used for broodstock purposes.
- Method and location for collecting broodstock: Broodstock will be collected as they voluntarily enter ENFH through the facility's fish ladder. A mixture of surface and ground water will be used to attract fish into the ladder.

- Duration of collection: ENFH will keep the fish ladder open between early July and November.
- Encounters, sorting and handling, with ESA listed fish, adults and juveniles: Natural-origin spring Chinook salmon volunteering into the hatchery will be immediately returned to the Entiat River. Only five natural-origin fish have entered the facility since 1994. Hatchery-origin spring Chinook salmon that volunteer into the ladder will be removed and they will not be returned to the river. These hatchery fish are strays and they pose risks to the ESA-listed natural population of spring Chinook salmon in the Entiat River. ESA listed steelhead are not expected to be encountered since they are not in the vicinity of the ladder during broodstock collection operations.

Proposed mating protocols

- A 1:1 female to male spawning ratio is proposed. There will be no selectivity in mating. The Enzyme-Linked Immunosorbent Assay (ELISA) method will be used to detect bacterial kidney disease, and eggs will not be combined until fish health reports are complete.

Proposed protocols for each release group (annually)

- Life stage: Smolts at 15-20 fish per pound.
- Acclimation (Y/N) and duration of acclimation: Yes, at the ENFH.
- Volitional release (Y/N): No. Fish will be forced out of the hatchery and enter the Entiat River at the base of the fish ladder where they will be later collected as returning adults.
- External mark(s): All fish will be adipose fin clipped.
- Internal marks/tags: At least 200,000 fish will receive a coded-wire-tag (CWT). To evaluate post-release migration, passive integrated transponder (PIT) tags will be used as appropriate.
- Maximum number released: Maximum annual production will be 400,000 smolts.
- Release location(s): All fish will be acclimated and released from ENFH at river-mile (RM) 6.7.
- Time of release: April.
- Fish health certification: Reporting and control of specific fish pathogens will be conducted in accordance with FWS' Fish Health Policy and Implementation Guidelines.

Proposed adult management

- Anticipated number or range in hatchery fish returns originating from this program: This is a new program and there is no information yet on the return rate of ENFH summer Chinook salmon to the Entiat Basin. Using a similar program in the Okanogan/Similkameen as a surrogate, estimates are that up to 3,000 adults will return to the Entiat River and vicinity.
- Removal of hatchery-origin fish and the anticipated number of natural-origin fish encountered: All ENFH summer Chinook salmon that enter the fish ladder will be removed and they will not be returned to the river. This is intended to reduce the potential for superimposition on spring Chinook salmon redds. Up to 50 adipose present CWT spring Chinook salmon volunteering into the ENFH ladder will removed and will

not be returned to the Entiat River. This is intended to reduce interbreeding between stray hatchery fish and fish from the Entiat spring Chinook salmon population.

- Appropriate uses for hatchery fish that are removed: hatchery broodstock, harvest, human consumption (e.g., food banks), and in-stream nutrient enhancement.
- Are hatchery fish intended to spawn naturally (Y/N): No
- Performance standard for pHOS (proportion of naturally spawning fish that are of hatchery-origin): FWS does not propose a pHOS standard for this program.
- Performance standard for stray rates into natural spawning areas: There is no stray rate standard proposed for this program. This is a new program and there is no information on straying. Using the Okanogan/Similkameen summer Chinook salmon hatchery program as a surrogate, the maximum number of stray hatchery fish could exceed 200.

Proposed research, monitoring, and evaluation

- Adult sampling, purpose, methodology, location, and the number of ESA-listed fish handled: The Proposed Action will monitor and report the abundance, distribution, and timing of ENFH summer Chinook salmon that spawn naturally and the incidence of superimposition of spring Chinook salmon redds.
- Juvenile sampling, purpose, methodology, location, and the number of ESA-listed fish handled: None is proposed.

Proposed operation, maintenance, and construction of hatchery facilities

- Water source(s) and quantity for hatchery facilities: The Proposed Action includes a water supply system that has the ability to withdraw water from either wells, a surface diversion, or a combination of both, not to exceed 22.5 cubic feet per second (cfs). The surface water intake is located on the Entiat River at RM 7.2 and water is returned to the river (minus any leakage and evaporation) at RM 6.7 (the program is non-consumptive). Surface water diversion will not exceed 10% of the mean daily flow whenever the combination of flow minus the amount of hatchery surface diversion is less than 100 cfs from November 1 through April 30, and 5% of the mean daily flow whenever the combination of flow minus the amount of hatchery surface diversion is less than 200 cfs from May 1 through October 31. ENFH also has a water right for up to 7 cfs from Limekiln (Packwood) spring.
- Water diversions meet NMFS screen criteria (Y/N): Yes. The water intake, at the diversion, is screened in compliance with NMFS guidelines (NMFS 1994) to protect juvenile fishes.
- Permanent or temporary barriers to juvenile or adult fish passage (Y/N): No. There are no barriers to juvenile or adult passage. There is no weir and therefore nothing to impair juvenile and adult fish spatial distribution.
- Instream structures (Y/N): Yes. There is a diversion structure at RM 7.2, a water return at RM 6.7, and the entrance to the fish ladder at RM 6.7.

- Streambank armoring or alterations (Y/N): Yes. Minor armoring would be maintained at three locations, at the diversion structure, water return, and at the entrance to the fish ladder.
- Pollutant discharge and location(s): The return water system operates under National Pollutant Discharge Elimination System (NPDES) permit number WAG-13-0000.

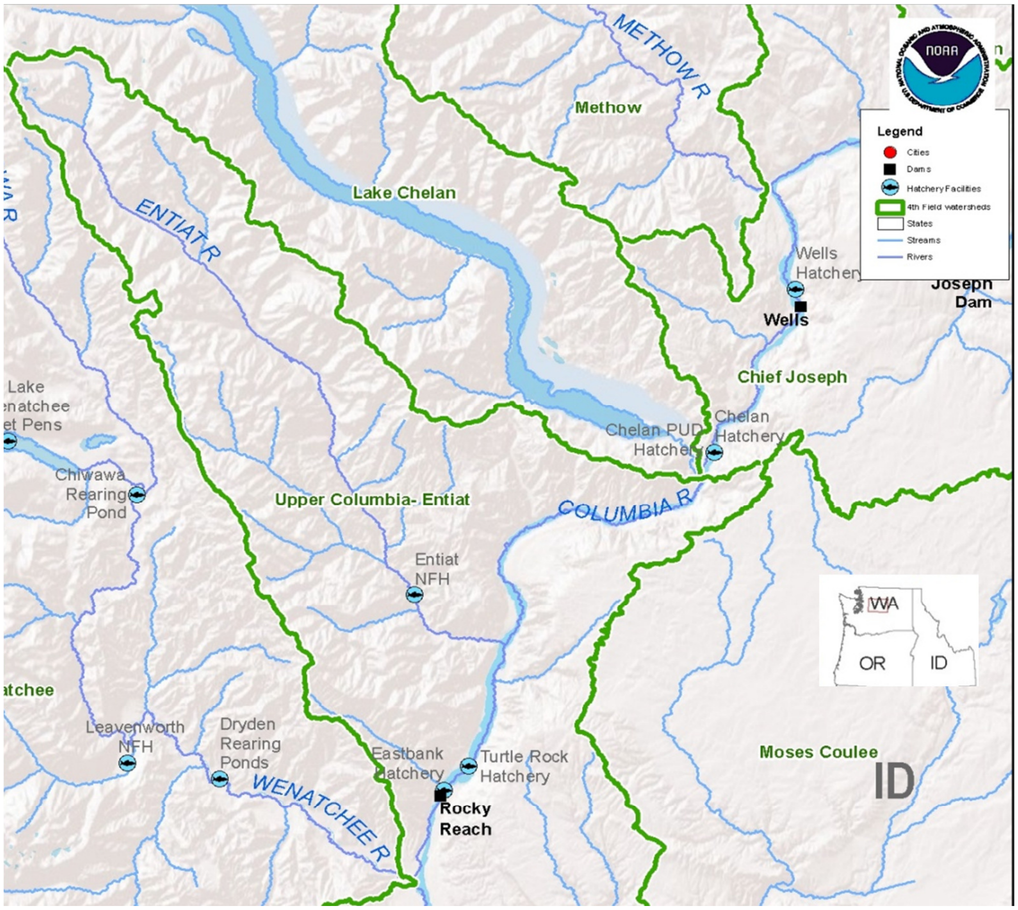

Figure 1. Location of ENFH.

1.4. Action Area

The "action area" means all areas to be affected directly or indirectly by the Proposed Action, in which the effects of the action can be meaningfully detected measured, and evaluated (50 CFR 402.02). The action area resulting from this analysis is the Entiat River from RM 28.1 to its confluence with the Columbia River at RM 484. RM 28.1 is the uppermost limit for spawning spring Chinook salmon in the Entiat River and ENFH summer Chinook salmon have the potential to expand their spawning distribution into this area (Hamstreet 2013).

The ENFH releases hatchery fish into the Lower Entiat River at RM 6.7, compared to the upstream limit of spring Chinook salmon migration, which is RM 54. The water diversion for the hatchery is at RM 7.2 and water is returned to the river at RM 6.7.

NMFS considered whether the mainstem Columbia River, the estuary, and the ocean should be included in the action area. The potential concern is a relationship between hatchery production and density dependent interactions affecting salmon growth and survival. However, NMFS has determined that, based on best available science, it is not possible to establish any meaningful causal connection between hatchery production on the scale anticipated in the Proposed Action and any such effects.

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 upon 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, the Service provide an opinion stating how the agencies' actions will affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires the consulting agency to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

2.1. Approach to the Analysis

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, 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. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts on the conservation value of 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 the species in the wild by reducing the reproduction, numbers, or distribution of that species or reduce the value of designated or proposed critical habitat (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, it relies on the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[3]
We will use the following approach to determine whether the Proposed Action is likely to jeopardize a listed species or destroy or adversely modify critical habitat:

- First, the current status of listed species and designated critical habitat, relative to the conditions needed for recovery, are described in Section 2.2.
- Next, the environmental baseline in the action area is described in Section 2.3.
- In Section 2.4, we consider how the Proposed Action would affect the species' abundance, productivity, spatial structure, and diversity and the Proposed Action's effects on critical habitat features.
- Section 2.5 describes the cumulative effects in the action area, as defined in our implementing regulations at 50 CFR 402.02

[3] 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).

- In Section 2.6, the status of the species and critical habitat (Section 2.2), the environmental baseline (Section 2.3), the effects of the Proposed Action (Section 2.4), and cumulative effects (Section 2.5) are integrated and synthesized to assess the effects of the Proposed Action on the survival and recovery of the species in the wild and on the conservation value of designated or proposed critical habitat.
- Our conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 2.7.
- If our conclusion in Section 2.7 is that the Proposed Action is likely to jeopardize the continued existence of a listed species or destroy or adversely modify designated critical habitat, we must identify a RPA to the action in Section 2.8.

In addition, NMFS has determined that the Proposed Action is likely to affect, but not likely to adversely affect, UCR steelhead, as described in Section 2.11.

2.2. Range-wide Status of the Species and Critical Habitat

This opinion examines the status of each species and designated critical habitat that would be affected by the Proposed Action. The species and the designated critical habitat that are likely to be affected by the Proposed Action, and any existing protective regulations, are described in Table 2.[4] Status of the species is the level of risk that the listed species face based on parameters considered in documents such as recovery plans, status reviews, and ESA listing determinations. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the status and conservation value of critical habitat in the action area and discusses the current function of the essential physical and biological features that help to form that conservation value.

Table 2. Federal Register notices for the final rules that list species, designate critical habitat, or apply protective regulations to ESA listed species considered in this consultation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Upper Columbia River spring-run	Endangered 70 FR 37160; June 28, 2005	70 FR 52630; Sept 2, 2005	70 FR 37160; June 28, 2005

"Species" Definition: The ESA of 1973, as amended, 16 U.S.C. 1531 *et seq.* defines "species" to include any "distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature." To identify DPSs of salmon species, NMFS follows the "Policy on Applying the Definition of Species under the ESA to Pacific Salmon" (56 FR 58612, November 20, 1991). Under this policy, a group of Pacific salmon is considered a DPS and

[4] ESA-listed bull trout (*Salvelinus confluentus*) are administered by the FWS and the proposed hatchery program is currently covered under a separate FWS section 7 consultation (FWS ref # 01E00000-2012-I-0031). Take associated with hatchery monitoring and evaluation activities is covered under USFWS TE-702631, sub-permit MCFRO-13.

hence a "species" under the ESA if it represents an evolutionarily significant unit (ESU) of the biological species. The group must satisfy two criteria to be considered an ESU: (1) It must be substantially reproductively isolated from other con-specific population units; and (2) It must represent an important component in the evolutionary legacy of the species. To identify DPSs of steelhead, NMFS applies the joint FWS-NMFS DPS policy (61 FR 4722, February 7, 1996). Under this policy, a DPS of steelhead must be discrete from other populations, and it must be significant to its taxon. UCR spring Chinook salmon constitute an ESU (salmon DPS) of the taxonomic species *Oncorhynchus tshawytscha*, and as such each are considered a "species" under the ESA.

2.2.1. Status of Listed Species

For Pacific salmon and steelhead, NMFS commonly uses four parameters to assess the viability of the populations that, together, constitute the species: abundance, productivity, spatial structure, and diversity (McElhany et al. 2000). These "viable salmonid population" (VSP) criteria therefore encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These parameters or attributes are substantially influenced by habitat and other environmental conditions.

"Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment.

"Productivity," as applied to viability factors, refers to the entire life cycle; i.e., the number of naturally-spawning adults (i.e., progeny) produced per naturally spawning parental pair. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on accessibility to the habitat, on habitat quality and spatial configuration, and on the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation at single genes to complex life history traits (McElhany et al. 2000).

In describing the range-wide status of listed species, we rely on viability assessments and criteria in TRT documents and recovery plans, when available, that describe VSP parameters at the population, major population group (MPG), and species scales (i.e., salmon ESUs and steelhead DPSs). For species with multiple populations, once the biological status of a species' populations and MPGs have been determined, NMFS assesses the status of the entire species. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as meta-populations (McElhany et al. 2000).

2.2.1.1. Life History and Current Rangewide Status of the UCR Spring Chinook Salmon ESU

Chinook salmon (*Oncorhynchus tshawytscha)* have a wide variety of life history patterns that include: variation in age at seaward migration; length of freshwater, estuarine, and oceanic residence; ocean distribution; ocean migratory patterns; and age and season of spawning migration. Two distinct races of Chinook salmon are generally recognized: “stream-type” and “ocean-type” (Healey 1991; Myers et al. 1998). The Proposed Action produces “ocean-type” Chinook, which have very different characteristics compared to ESA-listed UCR spring Chinook salmon, which are the “stream type. Ocean-type Chinook salmon reside in coastal ocean waters for 3 to 4 years compared to stream-type Chinook salmon, which spend 2 to 3 years and exhibit extensive offshore ocean migrations. They also enter freshwater later, upon returning to spawn, than the stream type, May and June compared to February through April. Ocean-type Chinook salmon use different areas – they spawn and rear in lower elevation mainstem rivers and they typically reside in fresh water for no more than 3 months compared to spring Chinook salmon that spawn and rear high in the watershed and reside in freshwater for a year.

Three MPGs and eight populations comprise the UCR spring Chinook salmon ESU, however the ESU is currently limited to one MPG and three extant populations. Approximately half of the area that originally produced spring Chinook salmon in this ESU is blocked by dams. What remains of the ESU includes all naturally spawned fish upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington State, excluding the Okanogan River (64 FR 14208, March 24, 1999) (Figure 2). Six artificial propagation programs are included in the ESU including the Twisp, Chewuch, Methow Composite, Winthrop NFH, Chiwawa, and White River hatchery programs (70 FR 37204, June 28, 2005).

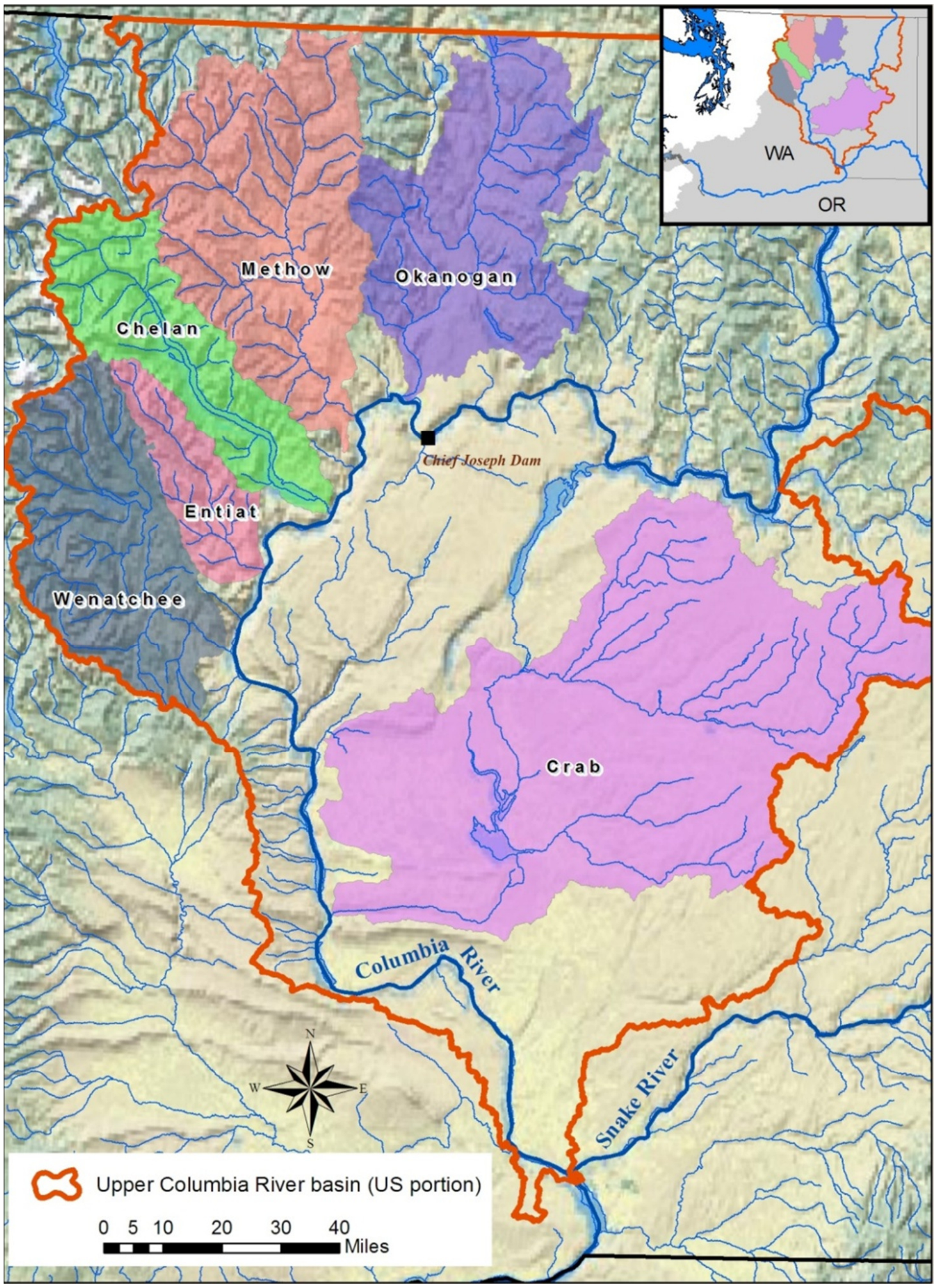

Figure 2. The UCR spring Chinook salmon ESU includes all naturally spawned fish in the Wenatchee, Entiat, and Methow River basins.

Abundance, Productivity, Spatial Structure, and Diversity

Status of the species is determined based on the abundance, productivity, spatial structure, and diversity of its constituent natural populations. Best available information indicates that the species, in this case the UCR spring Chinook salmon ESU, is at high risk and remains at endangered status. The ESA Recovery Plan (UCSRB 2007) calls for improvement in each of the three extant spring Chinook salmon populations (no more than a 5% risk of extinction in 100 years) and for a level of spatial structure and diversity that restores the distribution of natural populations to previously occupied areas and allows natural patterns of genetic and phenotypic diversity to be expressed. This corresponds to a threshold of at least "viable" status for each of the three natural populations (Figure 3).

Risk Rating for Abundance /Productivity	Risk Rating for Spatial Structure / Diversity: Very Low	Low	Moderate	High
Very Low (<1%)	Highly Viable	Highly Viable	Viable	Maintained
Low (<5%)	Viable	Viable	Viable	Maintained
Moderate (<25%)	Maintained	Maintained	Maintained	High Risk
High	High Risk	High Risk	High Risk	High Risk

Figure 3. Matrix used to assess population status across VSP parameters or attributes. Percentages for abundance and productivity scores represent the probability of extinction in a 100-year time period (ICTRT 2007).

For the most recent period (1987–2009), abundance has increased but productivity, for two of the three populations, remains below replacement and has actually declined substantially (Table 3). For spatial structure and diversity, there is a consistent and substantial decline in the proportion of natural-origin fish on the spawning grounds for all three populations. Natural-origin fish now make up fewer than fifty percent of the spawners for all three populations (Table 4).

Although increases in natural-origin abundance relative to the extremely low levels observed during the mid-1990s are encouraging, overall productivity has decreased to extremely low levels for the two largest populations (Wenatchee and Methow populations) and the predominance of hatchery fish on the spawning grounds, particularly for the Wenatchee and Methow populations, is an increasing risk. Populations that rely on hatchery spawners are not viable (McElhany et al. 2000). Based on the combined ratings for abundance/productivity and spatial structure/diversity, all three extant populations and the ESU remain at high risk of extinction.

Table 3. Risk levels and viability ratings for UCR spring Chinook salmon populations (Ford 2011).

Population	**Abundance Criteria for ESA De-listing, Abundance, and Productivity Measures and Integrated Abundance and Productivity (A/P) Risk**				**Risk Levels for Spatial Structure and Diversity and Integrated Spatial Structure and Diversity (SS/D) Risk**			**Overall Risk Rating for A/P and SS/D**
	Minimum Natural-Origin Fish Abundance Criteria for ESA Delisting	***Natural-Origin Fish Spawning Abundance***	***Productivity***	***A/P Risk***	***Natural Processes Risk***	***Diversity Risk***	***SS/D Risk***	
Wenatchee River 1987-2009	**2000**	**449 (119-1,050)**	**0.61 (0.40-0.95)**	**High**	Low	High	**High**	**High Risk**
1981-2003		*222 (18-1,050)*	*0.93 (0.57-1.53)*	*High*				
Entiat River 1999-2009	**500**	**105 (27-291)**	**1.08 (0.75-1.55)**	**High**	Moderate	High	**High**	**High Risk**
1981-2003		*59 (10-291)*	*0.72 (0.59-0.93)*	*High*				
Methow River 1999-2009	**2000**	**307 (79-1,979)**	**0.45 (0.26-0.8)**	**High**	Low	High	**High**	**High Risk**
1981-2003		*180 (20-1,979)*	*0.80 (0.52-1.24)*	*High*				

Table 4. Estimates of natural-origin spawning escapement for UCR spring Chinook salmon populations (Ford 2011).

Population	% Natural-Origin (5-year average)		
	1991 to 1996	**1997 to 2001**	**2003 to 2008**
Wenatchee River	*69%*	*58%*	**31%**
Entiat River	*82%*	*58%*	**46%**
Methow River	*78%*	*41%*	**29%**

There are many factors that affect the abundance, productivity, spatial structure, and diversity of the UCR spring Chinook salmon ESU. Factors that limit the ESU's survival and recovery include survival through the FCRPS, the degradation and loss of estuarine areas that help the fish survive the transition between fresh and marine waters, spawning and rearing areas that have lost deep pools, cover, side-channel refuge areas, high quality spawning gravels, and interbreeding and competition with hatchery fish that far outnumber fish from natural populations.

2.2.2. Range-wide Status of Critical Habitat

This section of the opinion examines the range-wide status of designated critical habitat for the affected salmonid species. For UCR spring Chinook salmon, critical habitat is designated in 70 FR 52630 (September 2, 2005). It includes all Columbia River estuarine areas and river reaches proceeding upstream to Chief Joseph Dam, as well as specific stream reaches in the following subbasins: Chief Joseph, Methow, Upper Columbia/Entiat and Wenatchee.

NMFS determines the range-wide status of critical habitat by examining the condition of its physical and biological features (also called "primary constituent elements," or PCEs, in some designations) that were identified when critical habitat was designated. These features are essential to the conservation of the listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). PCEs for UCR spring Chinook salmon (70 FR 52731, September 2, 2005), including the Entiat spring Chinook salmon population include:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

(2) Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

(4) Estuarine areas free of obstruction and excessive predation with: (i) Water quality, water quantity, salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(5) Near-shore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

(6) Offshore marine areas with water-quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

There are 31 watersheds within the range of this ESU. NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC 5) in terms of the conservation value they provide to each listed species they support[5]; the conservation rankings are high, medium or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams (CHARTs) (NMFS 2005b) evaluated the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, and side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Thus, even a location that has poor quality of habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (e.g., one of a very few spawning areas), a unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or the fact that it serves another important role (e.g., obligate area for migration to upstream spawning areas). In the final analysis, five watersheds received a *medium* rating and 26 received a *high* rating for conservation value to the UCR Spring Chinook Salmon ESU.

2.2.3. Climate Change

Climate change has negative implications for designated critical habitats in the Pacific Northwest (CIG 2004; Scheuerell and Williams 2005; Zabel et al. 2006; ISAB 2007). Average annual Northwest air temperatures have increased by approximately 1ºC since 1900, or about 50% more than the global average over the same period (ISAB 2007). The latest climate models project a warming of 0.1 ºC to 0.6 ºC per decade over the next century. According to the Independent

[5] The conservation value of a site depends upon "(1) the importance of the populations associated with a site to the ESU [or DPS] conservation, and (2) the contribution of that site to the conservation of the population through demonstrated or potential productivity of the area" (NMFS 2005a).

Scientific Advisory Board (ISAB), these effects pose the following impacts over the next 40 years:

- Warmer air temperatures will result in diminished snowpacks and a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.
- With a smaller snowpack, these watersheds will see their runoff diminished earlier in the season, resulting in lower stream-flows in the June through September period. River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.
- Water temperatures are expected to rise, especially during the summer months when lower stream-flows co-occur with warmer air temperatures.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Low-lying areas are likely to be more affected. Climate change may have long-term effects that include, but are not limited to, depletion of important cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species (ISAB 2007).

To mitigate for the effects of climate change on listed salmonids, the ISAB (2007) recommends planning now for future climate conditions by implementing protective tributary, mainstem, and estuarine habitat measures, as well as protective hydropower mitigation measures. In particular, the ISAB (2007) suggests increased summer flow augmentation from cool/cold storage reservoirs to reduce water temperatures or to create cool water refugia in mainstem reservoirs and the estuary; and the protection and restoration of riparian buffers, wetlands, and floodplains.

2.3. Environmental Baseline

Under the Environmental Baseline, NMFS describes what is affecting listed species and designated critical habitat before including any effects resulting from the Proposed Action. The 'Environmental Baseline' includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area and the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation (50 CFR 402.02).

In order to understand what is affecting a species, it is first necessary to understand the biological requirements of the species. Each stage in a species' life-history has its own biological requirements (Groot and Margolis 1991; NRC 1996; Spence et al. 1996). Generally speaking, anadromous fish require clean water with cool temperatures and access to thermal refugia, dissolved oxygen near 100 percent saturation, low turbidity, adequate flows and depths to allow passage over barriers to reach spawning sites, and sufficient holding and resting sites. Anadromous fish select spawning areas based on species-specific requirements of flow, water quality, substrate size, and groundwater upwelling. Embryo survival and fry emergence depend on substrate conditions (*e.g.*, gravel size, porosity, permeability, and oxygen concentrations), substrate stability during high flows, and, for most species, water temperatures of 13ºC or less. Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting. Migration of juveniles to rearing areas, whether the ocean, lakes, or other stream reaches, requires free access to these habitats.

Wide varieties of human activities have affected UCR spring Chinook salmon and PCEs in the action area. These activities, more recently, include reclamation actions that are having beneficial effects. The Entiat subbasin encompasses 268,000 acres. The area is nearly 42 miles long and varies in width from five to fourteen miles. Approximately 224,000 acres of the subbasin is in public ownership, primarily the United States Forest Service (USFS), the Bureau of Land Management (BLM) and some lands are administered by the WDFW.

Historically, low intensity wildfires maintained forests dominated by widely spaced, larger trees with little underbrush. Management practices of fire suppression, timber harvest, and livestock grazing have altered the forest ecology, increased tree density and underbrush, and changed the fire regime to high intensity, stand replacement, large wildfires (USFS 2000). As a result, much of the Entiat River watershed has been susceptible to high intensity large fires. From 1970 to 1994, over 60% of the watershed was affected by large-stand-replacing wildfires, and in 1994 alone, the Tyee wildfire burned 33% of the watershed (Andonaegui 1999).

Starting in the uppermost areas of the Entiat watershed, riparian vegetation from the headwaters to Entiat Falls, near RM 34 (transport zone) consists of grand fir, Engelmann spruce, Douglas-fir, lodgepole pine, western red cedar, cottonwood, grasses, and forbs (USFS 1996). Riparian zone function as a buffer to stream sediment input is considered adequate where vegetative ground cover is good. Shade levels and the recruitment of large woody debris into riparian/aquatic habitat are good to excellent. About 6.6 miles of road in this zone is within 300 feet of a stream channel, with road densities below 1.0 mile per square mile. Riparian area impacts at developed campgrounds in this zone are localized and minimal, except for the concentrated use at Cottonwood Campground.

From Entiat Falls to McCrea Creek, near river-mile 25 (transitional zone), riparian species consist of Engelmann spruce and western hemlock at the higher elevations and cottonwood, red cedar, grand fir, dogwood, and alder at the lower elevations. Riparian zone function as a buffer to stream sediment is adequate where there is good vegetative ground cover. Large woody debris (LWD) recruitment and shade levels are fair to excellent. There are 43 miles of road within 300 feet of stream channels, with most of native surface with minimal surface water control features (USFS 1996).

The lower 20-25 miles of the Entiat River, representing more than 70% of the area accessible to anadromous fish, is predominately in private ownership. There are about 1,300 acres of orchard land in the lower valley, much of it classified as prime agricultural land. Riparian vegetation and function in the lower portion of the Entiat watershed (below the USFS boundary) has been affected by wildfire, agricultural encroachment on the floodplain, past flood control and channel straightening efforts, historic grazing, and rural residential development in the floodplain (Andonaegui 1999). Wildfires were noted as one of the primary disturbance factors affecting riparian vegetation. Vegetation from McCrea Creek to the river mouth (depositional zone) consists of primarily deciduous species, with alder, willow, cottonwood, aspen, elderberry, redosier dogwood, river birch, and maple as the dominant species. Conifers (Ponderosa pine and Douglas-fir) are also present. Shade and LWD recruitment is poor to good (USFS 1996). In some reaches, loss of vigorous shrubs in the riparian zone has reduced instream organic input and shade, and contributed to unstable stream banks and associated erosion. There are 205 miles of road identified within 300 feet of streams in this zone, with many having native surface with minimal surface water control features. Roads adjacent to streams and associated road management have reduced LWD recruitment. Riparian zone function as a sediment delivery buffer is poor in the roaded segments and in some of the riparian area that is not roaded.

The Lower Entiat River has been confined to a uniform channel and lacks habitat complexity. The Natural Resources Conservation Service Stream Team performed an extensive survey of the lower 20 RMs of the Entiat River in 1995. Beginning in the early 1970s, the construction of dikes and levees acted to disconnect the Entiat river from most of its floodplain. This resulted in the alteration of hydrologic and geomorphic processes that create and sustain conditions fish need to survive, including overwintering rearing habitat for juvenile fishes, and more generally, it reduced the ability of the Entiat River watershed to fully sustain salmon populations (Andonaegui 1999). The lower 14 miles of river have been transformed from rearing and refuge areas into mostly shallow riffles, with few pools and little habitat complexity. Habitat complexity (large pools, off-channel refugia, etc.) helps juvenile salmon avoid predators and provides shelter during flood flows, harsh winter conditions, and low instream flows. The quality and frequency of large-pool habitat was reduced by approximately 85 percent within the Lower Entiat River (Yakama Nation and Chelan County 2004). Adding to these problems and creating obstacles to juvenile and adult salmon spatial distribution have been push-up dams constructed to maintain surface water elevations for irrigation diversions. More recently, boulders, large wood, and root wads have been placed in the river reach where those habitat features are presently lacking.

Development in the lower subbasin has also increased the deposition of fine sediments, increased fertilizer and other pollutant inputs to the river, and decreased streamflows leading to increased water temperatures and potential barriers to fish passage. Restoration projects during the last five years will over time add streambank cover and complexity, filter pollutants, provide shade helping to moderate water temperature, reduce unusually high inputs of fine sediments, provide detritus to the aquatic habitat, and forage species, namely terrestrial insects for fish. The decommissioning of a surface water diversion is expected to increase flows and improve spring Chinook salmon spatial distribution during the summer-early fall seasons.

Another important aspect of the Environmental Baseline is hatchery effects – effects from hatchery programs located in the Entiat Basin and from fish that stray into the Entiat Basin from programs outside the basin. Hatchery spring Chinook salmon were first released into the Entiat River between 1942 and 1944 and then again on an annual basis starting in 1974. The program used non-local fish for broodstock that were a threat to the diversity and productivity of the natural spring Chinook salmon population (Table 5). Eggs for the program originated from the Cowlitz River (1974), Carson NFH (1975-1982), Little White Salmon NFH (1976-1979 and 1981), Leavenworth NFH (1979-1981 and 1994), and from Winthrop NFH (1988). In 2001, spawning ground surveys confirmed that spring Chinook salmon from ENFH were bypassing the hatchery and spawning naturally and genetic analysis indicated that it was likely that hatchery spring Chinook salmon were interbreeding with fish from the natural population. This led NMFS to conclude that the spring Chinook salmon hatchery program at ENFH was detrimental to preserving or restoring stock structure (NMFS 2004) and the program was terminated in 2007.

The last returns of these fish to the Entiat River were in 2010. Not as great a threat (these fish are largely from the same UCR Spring-run Chinook Salmon ESU) are fish from other hatchery programs that stray into the Entiat Basin. In 2011, 49 of the 54 hatchery fish carcasses recovered during spawning ground surveys in the Entiat River were stray hatchery-origin spring Chinook salmon from the Chiwawa spring Chinook salmon hatchery program in the Wenatchee River Basin (Hamstreet 2013).

After termination of the spring Chinook salmon program at ENFH in 2007, fisheries were used, on several occasions, to remove hatchery spring Chinook salmon and prevent them from spawning naturally in the Entiat. The last returns from this program were in 2010 and there has not been a fishery since.

The Pacific Coastal Salmon Recovery Fund (PCSRF) was established by Congress to help protect and recover salmon and steelhead populations and their habitats (NMFS 2007b). The states of Washington, Oregon, California, Idaho, and Alaska, and the Pacific Coastal and Columbia River tribes, receive PCSRF appropriations from NMFS each year. The fund supplements existing state, tribal and local programs to foster development of Federal-state-tribal-local partnerships in salmon and steelhead recovery. The PCSRF has made substantial progress in achieving program goals, as indicated in annual Reports to Congress, workshops, and independent reviews.

Information relevant to the environmental baseline is discussed in detail in Chapter 5 of the Supplemental Comprehensive Analysis (SCA) (NMFS 2008d), which cross-references back to the related 2008 FCRPS biological opinion (NMFS 2008c). Chapter 5 of the SCA and related portions of the FCRPS Opinion provide an analysis of the effects of past and ongoing human and natural factors on the current status of the species, their habitats and ecosystems, within the entire Columbia River Basin. In addition, Chapter 5 of the SCA, and related portions of the FCRPS Opinion evaluate the effects of those ongoing actions on designated critical habitat with that same area. Those portions of Chapter 5 of the SCA and environmental baseline section of the FCRPS Opinion that deal with effects in the action area (described in Section 1.4) are hereby incorporated by reference.

2.4. Effects on ESA Protected Species and on Designated Critical Habitat

This section describes the effects of the Proposed Action, independent of the Environmental Baseline and Cumulative Effects. The methodology and best scientific information NMFS follows for analyzing hatchery effects is summarized first in Section 2.4.1 and then application of the methodology and analysis of the Proposed Action itself follows in Section 2.4.2. The "effects of the action" means the direct and indirect effects of the action on the species and on designated critical habitat, together with the effects of other activities that are interrelated or interdependent, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur. Effects of the Proposed Action that are expected to occur later in time (i.e., after the 10-year timeframe of the Proposed Action) are included in the analysis in this opinion to the extent they can be meaningfully evaluated. In Section 0, the Proposed Action, the status of ESA-protected species and designated critical habitat, the Environmental Baseline, and the Cumulative Effects of future state and private activities within the action area that are reasonably certain to occur are analyzed comprehensively to determine whether the Proposed Action is likely to appreciably reduce the likelihood of survival and recovery of ESA protected species or result in the destruction or adverse modification of their designated critical habitat.

2.4.1. Factors That Are Considered When Analyzing Hatchery Effects

NMFS has substantial experience with hatchery programs and has developed and published a series of guidance documents for designing and evaluating hatchery programs following best available science. These documents are available upon request from the NMFS Salmon Management Division in Portland, Oregon. "Pacific Salmon and Artificial Propagation under the Endangered Species Act" (Hard et al. 1992) was published shortly following the first ESA-listings of Pacific salmon on the West Coast and it includes information and guidance that is still relevant today. In 2000, NMFS published "Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units" (McElhany et al. 2000) and then followed that with a "Salmonid Hatchery Inventory and Effects Evaluation Report" for hatchery programs up and down the West Coast (NMFS 2004). In 2005, NMFS published a policy that provided greater clarification and further direction on how it analyzes hatchery effects and conducts extinction risk assessments (NMFS 2005c). NMFS then updated its inventory and effects evaluation report for hatchery programs on the West Coast (Jones 2006) and followed that with "Artificial Propagation for Pacific Salmon: Assessing Benefits and Risks & Recommendations for Operating Hatchery Programs Consistent with Conservation and Sustainable Fisheries Mandates" (NMFS 2008a). More recently, NMFS published its biological analysis and final determination for the harvest of Puget Sound Chinook salmon which included discussion on the role and effects of hatchery programs (NMFS 2011).

A key factor in analyzing a hatchery program for its effects, positive and negative, on the status of salmon and steelhead are the genetic resources that reside in the program. Genetic resources that represent the ecological and genetic diversity of a species can reside in a hatchery program. "Hatchery programs with a level of genetic divergence relative to the local natural population(s) that is no more than what occurs within the ESU are considered part of the ESU and will be included in any listing of the ESU" (NMFS 2005c). NMFS monitors hatchery practices for whether they promote the conservation of genetic resources included in an ESU or steelhead DPS and updates the status of genetic resources residing in hatchery programs every five years. Jones (2011) provides the most recent update of the relatedness of Pacific Northwest hatchery programs to 18 salmon ESUs and steelhead DPSs listed under the ESA. Generally speaking, hatchery programs that are reproductively connected or "integrated" with a natural population, if one still exists, and that promote natural selection over selection in the hatchery, contain genetic resources that represent the ecological and genetic diversity of a species and are included in an ESU or steelhead DPS.

When a hatchery program actively maintains distinctions or promotes differentiation between hatchery fish and fish from a native population, then NMFS refers to the program as "isolated". Generally speaking, isolated hatchery programs have a level of genetic divergence, relative to the local natural population(s), that is more than what occurs within the ESU and are not considered part of an ESU or steelhead DPS. They promote domestication or selection in the hatchery over selection in the wild and select for and culture a stock of fish with different phenotypes, for example different ocean migrations and spatial and temporal spawning distribution, compared to the native population (extant in the wild, in a hatchery, or both). For Pacific salmon, NMFS evaluates extinction processes and effects of the Proposed Action beginning at the population scale (McElhany et al. 2000). NMFS defines population performance measures in terms of natural-origin fish and four key parameters or attributes: abundance, productivity, spatial structure, and diversity and then relates effects of the Proposed Action at the population scale to the MPG level and ultimately to the survival and recovery of an entire ESU or DPS.

"Because of the potential for circumventing the high rates of early mortality typically experienced in the wild, artificial propagation may be useful in the recovery of listed salmon species. However, artificial propagation entails risks as well as opportunities for salmon conservation" (Hard et al. 1992). A Proposed Action is analyzed for effects, positive and negative, on the attributes that define population viability, including abundance, productivity, spatial structure, and diversity. The effects of a hatchery program on the status of an ESU or steelhead DPS "will depend on which of the four key attributes are currently limiting the ESU, and how the hatchery fish within the ESU affect each of the attributes" (70 FR 37215, June 28, 2005). The presence of hatchery fish within the ESU can positively affect the overall status of the ESU by increasing the number of natural spawners, by serving as a source population for repopulating unoccupied habitat and increasing spatial distribution, and by conserving genetic resources. "Conversely, a hatchery program managed without adequate consideration can affect a listing determination by reducing adaptive genetic diversity of the ESU, and by reducing the reproductive fitness and productivity of the ESU". NMFS also analyzes and takes into account the effects of hatchery facilities, for example, weirs and water diversions, on each VSP attribute and on designated critical habitat.

NMFS' analysis of the Proposed Action is in terms of effects it would be expected to have on ESA-listed species and on designated critical habitat, based on the best scientific information on the general type of effect of that aspect of hatchery operation in the context of the specific application in the Entiat River. This allows for quantification (wherever possible) of the various factors of hatchery operation to be applied to each applicable life-stage of the listed species at the population level (in Section 2.4.2), which in turn allows the combination of all such effects with other effects accruing to the species to determine the likelihood of posing jeopardy to the species as a whole (Section 0).

The effects, positive and negative, for two categories of hatchery programs are summarized in Table 5. Generally speaking, effects range from beneficial to negative for programs that use local fish[6] for hatchery broodstock and from negligible to negative when a program does not use local fish for broodstock[7]. Hatchery programs can benefit population viability but only if they use genetic resources that represent the ecological and genetic diversity of the target or affected natural population(s). When hatchery programs use genetic resources that do not represent the ecological and genetic diversity of the target or affected natural population(s), NMFS is particularly interested in how effective the program will be at isolating hatchery fish and avoiding co-occurrence and effects that potentially disadvantage fish from natural populations. The range in effects for a specific hatchery program are refined and narrowed after available

[6] The term "local fish" is defined to mean fish with a level of genetic divergence relative to the local natural population(s) that is no more than what occurs within the ESU or steelhead DPS (70 FR 37215, June 28, 2005).
[7] Exceptions include restoring extirpated populations and gene banks.

scientific information and the circumstances and conditions that are unique to individual hatchery programs are accounted for.

Table 5. Overview of the range in effects on natural population viability parameters from two categories of hatchery programs. The range in effects are refined and narrowed after the circumstances and conditions that are unique to individual hatchery programs are accounted for.

Natural population viability parameter	Hatchery broodstock originate from the local population and are included in the ESU or DPS	Hatchery broodstock originate from a non-local population or from fish that are not included in the same ESU or DPS
Productivity	**Positive to negative effect** Hatcheries are unlikely to benefit productivity except in cases where the natural population's small size is, in itself, a predominant factor limiting population growth (i.e., productivity) (NMFS 2004).	**Negligible to negative effect** This is dependent on differences between hatchery fish and the local natural population (i.e., the more distant the origin of the hatchery fish the greater the threat), the duration and strength of selection in the hatchery, and the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect).
Diversity	**Positive to negative effect** Hatcheries can temporarily support natural populations that might otherwise be extirpated or suffer severe bottlenecks and have the potential to increase the effective size of small natural populations. Broodstock collection that homogenizes population structure is a threat to population diversity.	**Negligible to negative effect** This is dependent on the differences between hatchery fish and the local natural population (i.e., the more distant the origin of the hatchery fish the greater the threat) and the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect).
Abundance	**Positive to negative effect** Hatchery-origin fish can positively affect the status of an ESU by contributing to the abundance and productivity of the natural populations in the ESU (70 FR 37204, June 28, 2005, at 37215).	**Negligible to negative effect** This is dependent on the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect), handling, RM&E and facility operation, maintenance and construction effects.
Spatial Structure	**Positive to negative effect** Hatcheries can accelerate re-colonization and increase population spatial structure, but only in conjunction with remediation of the factor(s) that limited spatial structure in the first place. "Any benefits to spatial structure over the long term depend on the degree to which the hatchery stock(s) add to (rather than replace) natural populations" (70 FR 37204, June 28, 2005 at 37213).	**Negligible to negative effect** This is dependent on facility operation, maintenance, and construction effects and the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect).

Information that NMFS needs to analyze the effects of a hatchery program on ESA-listed species must be included in an HGMP. Draft HGMPs are reviewed by NMFS for their sufficiency before formal review and analysis of the Proposed Action can begin.

Analysis of an HGMP or Proposed Action for its effects on ESA-listed species and on designated critical habitat depends on seven factors. These factors are:

(1) the hatchery program does or does not promote the conservation of genetic resources that represent the ecological and genetic diversity of a salmon ESU or steelhead DPS,
(2) hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities,
(3) hatchery fish and the progeny of naturally spawning hatchery fish in juvenile rearing areas,
(4) hatchery fish and the progeny of naturally spawning hatchery fish in the migration corridor, estuary, and ocean,
(5) RM&E that exists because of the hatchery program,
(6) the operation, maintenance, and construction of hatchery facilities that exist because of the hatchery program, and
(7) fisheries that exist because of the hatchery program, including terminal fisheries intended to reduce the escapement of hatchery-origin fish to spawning grounds.

The analysis assigns an effect for each factor from the following categories. The categories are:

(1) positive or beneficial effect on population viability,
(2) negligible effect on population viability, and
(3) negative effect on population viability.

"The effects of hatchery fish on the status of an ESU will depend on which of the four key attributes are currently limiting the ESU, and how the hatchery within the ESU affect each of the attributes" (NMFS 2005c). The category of affect assigned is based on an analysis of each factor weighed against the affected population(s) current risk level for abundance, productivity, spatial structure and diversity, the role or importance of the affected natural population(s) in ESU or steelhead DPS recovery, the target viability for the affected natural population(s), and the Environmental Baseline including the factors currently limiting population viability.

2.4.1.1. Factor 1. The hatchery program does or does not promote the conservation of genetic resources that represent the ecological and genetic diversity of a salmon ESU or steelhead DPS

This factor considers broodstock practices and whether they promote the conservation of genetic resources that represent the ecological and genetic diversity of a salmon ESU or steelhead DPS.

A primary consideration in analyzing and assigning effects for broodstock collection is the origin and number of fish collected. The analysis considers whether broodstock are of local origin and the biological pros and the biological cons of using ESA-listed fish (natural or hatchery-origin) for hatchery broodstock. It considers the maximum number of fish proposed for collection and the proportion of the donor population tapped to provide hatchery broodstock. “Mining” a natural population to supply hatchery broodstock can reduce population abundance and spatial structure. Also considered here is whether the program “backfills” with fish from outside the local or immediate area.

2.4.1.2. Factor 2. Hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities

NMFS also analyzes the effects of hatchery fish and the progeny of naturally spawning hatchery fish on the spawning grounds. There are two aspects to this part of the analysis: genetic effects and ecological effects. NMFS generally views genetic effects as detrimental because at this time, based on the weight of available scientific information, we believe that artificial breeding and rearing is likely to result in some degree of genetic change and fitness reduction in hatchery fish and in the progeny of naturally spawning hatchery fish relative to desired levels of diversity and productivity for natural populations. Hatchery fish thus pose a threat to natural population rebuilding and recovery when they interbreed with fish from natural populations.

However, NMFS recognizes that there are benefits as well, and that the risks just mentioned may be outweighed under circumstances where demographic or short-term extinction risk to the population is greater than risks to population diversity and productivity. Conservation hatchery programs may accelerate recovery of a target population by increasing abundance faster than may occur naturally(Waples 1999). Hatchery programs can also be used to create genetic reserves for a population to prevent the loss of its unique traits due to catastrophes (Ford 2011). Furthermore, NMFS also recognizes there is considerable uncertainty regarding genetic risk. The extent and duration of genetic change and fitness loss and the short and long-term implications and consequences for different species, for species with multiple life-history types, and for species subjected to different hatchery practices and protocols remains unclear and should be the subject of further scientific investigation. As a result, NMFS believes that hatchery intervention is a legitimate and useful tool to alleviate short-term extinction risk, but otherwise managers should seek to limit interactions between hatchery and natural-origin fish and implement hatchery practices that harmonize conservation with the implementation of treaty Indian fishing rights and other applicable laws and policies (NMFS 2011).

Hatchery fish can have a variety of genetic effects on natural population productivity and diversity when they interbreed with natural-origin fish. Although there is biological interdependence between them, NMFS considers three major areas of genetic effects of hatchery programs: within-population diversity, outbreeding effects, and hatchery-induced selection. As we have stated above, in most cases, the effects are viewed as risks, but in small populations these effects can sometimes be beneficial, reducing extinction risk.

Within-population genetic diversity is a general term for the quantity, variety and combinations of genetic material in a population (Busack and Currens 1995). Within-population diversity is gained through mutations or gene flow from other populations (described below under outbreeding effects) and is lost primarily due to genetic drift, a random loss of diversity due to population size. The rate of loss is determined by the population’s effective population size (N_e), which can be considerably smaller than its census size. For a population to maintain genetic diversity reasonably well, the effective size should be in the hundreds (e.g., Lande and Barrowclough 1987), and diversity loss can be severe if N_e drops to a few dozen.

Hatchery programs, simply by virtue of creating more fish, can increase N_e. In very small populations this can be a benefit, making selection more effective and reducing other small-population risks (e.g., Lacy 1987; Whitlock 2000; Willi et al. 2006). Conservation hatchery programs can thus serve to protect genetic diversity; several, such as the Snake River sockeye salmon program are important genetic reserves. However, hatchery programs can also directly depress N_e by two principal methods. One is by the simple removal of fish from the population so that they can be used in the hatchery. If a substantial portion of the population is taken into a hatchery, the hatchery becomes responsible for that portion of the effective size, and if the operation fails, the effective size of the population will be reduced (Waples and Do 1994). N_e can also be reduced considerably below the census number of broodstock by using a skewed sex ratio, spawning males multiple times (Busack 2007), and by pooling gametes. Pooling semen is especially problematic because when semen of several males is mixed and applied to eggs, a large portion of the eggs may be fertilized by a single male (Gharrett and Shirley 1985; Withler 1988). Factorial mating schemes, in which fish are systematically mated multiple times, can be used to increase N_e (Fiumera et al. 2004; Busack and Knudsen 2007). An extreme form of N_e reduction is the Ryman-Laikre effect (Ryman and Laikre 1991; Ryman et al. 1995), when N_e is reduced through the return to the spawning grounds of large numbers of hatchery fish from very few parents.

Inbreeding depression, another N_e-related phenomenon, is caused by the mating of closely related individuals (e.g., sibs, half-sibs, cousins). The smaller the population, the more likely spawners will be related. Related individuals are likely to contain similar genetic material, and the resulting offspring may then have reduced survival because they are less variable genetically or have double doses of deleterious mutations. The lowered fitness of fish due to inbreeding depression accentuates the genetic risk problem, helping to push a small population toward extinction.

Outbreeding effects are caused by gene flow from other populations. Gene flow occurs naturally among salmon and steelhead populations, a process referred to as straying (Quinn 1993; Quinn 1997). Natural straying serves a valuable function in preserving diversity that would otherwise be lost through genetic drift and in re-colonizing vacant habitat, and straying is considered a risk only when it occurs at unnatural levels or from unnatural sources. Hatchery programs can result in straying outside natural patterns for two reasons. First, hatchery fish may exhibit reduced homing fidelity relative to natural-origin fish (Grant 1997; Quinn 1997; Jonsson et al. 2003; Goodman 2005), resulting in unnatural levels of gene flow into recipient populations, either in terms of sources or rates. Second, even if hatchery fish home at the same level of fidelity as natural-origin fish, their higher abundance can cause unnatural straying levels into recipient populations. One goal for hatchery programs should be to ensure that hatchery practices do not lead to higher rates of genetic exchange with fish from natural populations than would occur naturally (Ryman 1991). Rearing and release practices and ancestral origin of the hatchery fish can all play a role in straying (Quinn 1997).

Gene flow from other populations can have two effects. It can increase genetic diversity (e.g., Ayllon et al. 2006) (which can be a benefit in small populations) but it can also alter established allele frequencies (and co-adapted gene complexes) and reduce the population's level of adaptation, a phenomenon called outbreeding depression (Edmands 2007; McClelland and Naish 2007). In general, the greater the geographic separation between the source or origin of hatchery fish and the recipient natural population, the greater the genetic difference between the two populations (ICTRT 2007), and the greater potential for outbreeding depression. For this reason, NMFS advises hatchery action agencies to develop locally derived hatchery broodstocks. Additionally, unusual rates of straying into other populations within or beyond the population's MPG or ESU or a steelhead DPS can have an homogenizing effect, decreasing intra-population genetic variability (e.g., Vasemagi et al. 2005), and increasing risk to population diversity, one of the four attributes measured to determine population viability. Reduction of within-population and among-population diversity can reduce adaptive potential.

The proportion of hatchery fish among natural spawners is often used as a surrogate measure of gene flow. Appropriate cautions and qualifications should be considered when using this proportion to analyze hatchery affects. Adult salmon may wander on their return migration, entering and then leaving tributary streams before finally spawning (Pastor 2004). These "dip-in" fish may be detected and counted as strays, but may eventually spawn in other areas, resulting in an overestimate of the number of strays that potentially interbreed with the natural population (Keefer et al. 2008). Caution must also be taken in assuming that strays contribute genetically in proportion to their abundance. Several studies demonstrate little genetic impact from straying despite a considerable presence of strays in the spawning population (Saisa et al. 2003; Blankenship et al. 2007). The causative factors for poorer breeding success of strays are likely similar to those identified as responsible for reduced productivity of hatchery-origin fish in general, e.g., differences in run and spawn timing, spawning in less productive habitats, and reduced survival of their progeny (Reisenbichler and McIntyre 1977; Leider et al. 1990; McLean et al. 2004; Williamson et al. 2010).

Hatchery-induced selection (often called domestication) occurs when selection pressures imposed by hatchery spawning and rearing differ greatly from those imposed by the natural environment and causes genetic change that is passed on to natural populations through interbreeding with hatchery-origin fish, typically from the same population. These differing selection pressures can be a result of differences in environments or a consequence of protocols and practices used by a hatchery program. Hatchery selection can range from relaxation of selection, that would normally occur in nature, to selection for different characteristics in the hatchery and natural environments, to intentional selection for desired characteristics (Waples 1999).

Genetic change and fitness reduction resulting from hatchery-induced selection depends on: (1) the difference in selection pressures; (2) the exposure or amount of time the fish spends in the hatchery environment; and, (3) the duration of hatchery program operation (i.e., the number of generations that fish are propagated by the program). On an individual level, exposure time in large part equates to fish culture, both the environment experienced by the fish in the hatchery and natural selection pressures, independent of the hatchery environment. On a population basis, exposure is determined by the proportion of natural-origin fish being used as hatchery broodstock and the proportion of hatchery-origin fish spawning in the wild (Lynch and O'Hely

2001; Ford 2002), and then by the number of years the exposure takes place. In assessing risk or determining impact, all three levels must be considered. Strong selective fish culture with low hatchery-wild interbreeding can pose less risk than relatively weaker selective fish culture with high levels of interbreeding.

Most of the empirical evidence of fitness depression due to hatchery-induced selection comes from studies of species that are reared in the hatchery environment for an extended period – one to two years – prior to release (Berejikian and Ford 2004). Exposure time in the hatchery for fall and summer Chinook salmon and Chum salmon is much shorter, just a few months. One especially well-publicized steelhead study (Araki et al. 2007; Araki et al. 2008), showed dramatic fitness declines in the progeny of naturally spawning hatchery steelhead. Researchers and managers alike have wondered if these results could be considered a potential outcome applicable to all salmonid species, life-history types, and hatchery rearing strategies.

Critical information for analysis of hatchery-induced selection includes the number, location and timing of naturally spawning hatchery fish, the estimated level of interbreeding between hatchery-origin and natural-origin fish, the origin of the hatchery stock (the more distant the origin compared to the affected natural population, the greater the threat), the level and intensity of hatchery selection and the number of years the operation has been run in this way.

Ecological effects for this factor (i.e., hatchery fish and the progeny of naturally spawning hatchery fish on the spawning grounds) refer effects from competition for spawning sites and redd superimposition, contributions to marine derived nutrients, and the removal of fine sediments from spawning gravels. Ecological effects on the spawning grounds may be positive or negative. To the extent that hatcheries contribute added fish to the ecosystem, there can be positive effects. For example, when anadromous salmonids return to spawn, hatchery-origin and natural-origin alike, they transport marine-derived nutrients stored in their bodies to freshwater and terrestrial ecosystems. Their carcasses provide a direct food source for juvenile salmonids and other fish, aquatic invertebrates, and terrestrial animals, and their decomposition supplies nutrients that may increase primary and secondary production (Kline et al. 1990; Piorkowski 1995; Larkin and Slaney 1996; Gresh et al. 2000; Murota 2003; Quamme and Slaney 2003; Wipfli et al. 2003). As a result, the growth and survival of juvenile salmonids may increase (Hager and Noble 1976; Bilton et al. 1982; Holtby 1988; Ward and Slaney 1988; Hartman and Scrivener 1990; Johnston et al. 1990; Larkin and Slaney 1996; Quinn and Peterson 1996; Bradford et al. 2000; Bell 2001; Brakensiek 2002).

Additionally, studies have demonstrated that perturbation of spawning gravels by spawning salmonids loosens cemented (compacted) gravel areas used by spawning salmon (e.g., Montgomery et al. 1996). The act of spawning also coarsens gravel in spawning reaches, removing fine material that blocks interstitial gravel flow and reduces the survival of incubating eggs in egg pockets of redds.

The added spawner density resulting from hatchery-origin fish spawning in the wild can have negative consequences in that to the extent there is spatial overlap between hatchery and natural spawners, the potential exists for hatchery-derived fish to superimpose or destroy the eggs and embryos of ESA listed species. Redd superimposition has been shown to be a cause of egg loss in pink salmon and other species (e.g., Fukushima et al. 1998).

The analysis also considers the effects from encounters with natural-origin that are incidental to the conduct of broodstock collection. Here, NMFS analyzes effects from sorting, holding, and handling natural-origin fish in the course of broodstock collection. Some programs collect their broodstock from fish volunteering into the hatchery itself, typically into a ladder and holding pond, while others sort through the run at large, usually at a weir, ladder, or sampling facility. Generally speaking, the more a hatchery program accesses the run at large for hatchery broodstock – that is, the more fish that are handled or delayed during migration – the greater the negative effect on natural-origin and hatchery-origin fish that are intended to spawn naturally and to ESA-listed species. The information NMFS uses for this analysis includes a description of the facilities, practices, and protocols for collecting broodstock, the environmental conditions under which broodstock collection is conducted, and the encounter rate for ESA-listed fish.

NMFS also analyzes the effects of structures, either temporary or permanent, that are used to collect hatchery broodstock. NMFS analyzes effects on fish, juveniles and adults, from encounters with these structures and effects on habitat conditions that support and promote viable salmonid populations. NMFS wants to know, for example, if the spatial structure, productivity, or abundance of a natural population is affected when fish encounter a structure used for broodstock collection, usually a weir or ladder. NMFS also analyzes changes to riparian habitat, channel morphology and habitat complexity, water flows, and in-stream substrates attributable to the construction/installation, operation, and maintenance of these structures. NMFS also analyzes the effects of structures, either temporary or permanent, that are used to remove hatchery fish from the river or stream and prevent them from spawning naturally, effects on fish, juveniles and adults, from encounters with these structures and effects on habitat conditions that support and promote viable salmonid populations.

2.4.1.3. Factor 3. Hatchery fish and the progeny of naturally spawning hatchery fish in juvenile rearing areas

NMFS also analyzes the potential for competition, predation, and premature emigration when the progeny of naturally spawning hatchery fish and hatchery releases share juvenile rearing areas. Generally speaking, competition and a corresponding reduction in productivity and survival may result from direct interactions when hatchery-origin fish interfere with the accessibility to limited resources by natural-origin fish or through indirect means, when the utilization of a limited resource by hatchery fish reduces the amount available for fish from the natural population (SIWG 1984). Naturally produced fish may be competitively displaced by hatchery fish early in life, especially when hatchery fish are more numerous, are of equal or greater size, when hatchery fish take up residency before naturally produced fry emerge from redds, and if hatchery fish residualize. Hatchery fish might alter naturally produced salmon behavioral patterns and habitat use, making them more susceptible to predators (Hillman and Mullan 1989; Steward and Bjornn 1990). Hatchery-origin fish may also alter naturally produced salmonid migratory responses or movement patterns, leading to a decrease in foraging success (Hillman and Mullan 1989; Steward and Bjornn 1990). Actual impacts on naturally produced fish would thus depend on the degree of dietary overlap, food availability, size-related differences in prey selection, foraging tactics, and differences in microhabitat use (Steward and Bjornn 1990).

Competition may result from direct interactions, or through indirect means, as when utilization of a limited resource by hatchery fish reduces the amount available for naturally produced fish

(SIWG 1984). Specific hazards associated with competitive impacts of hatchery salmonids on listed naturally produced salmonids may include competition for food and rearing sites (NMFS 2012). In an assessment of the potential ecological impacts of hatchery fish production on naturally produced salmonids, the Species Interaction Work Group (SIWG 1984) concluded that naturally produced coho and Chinook salmon and steelhead are all potentially at “high risk” due to competition (both interspecific and intraspecific) from hatchery fish of any of these three species. In contrast, the risk to naturally produced pink, chum, and sockeye salmon due to competition from hatchery salmon and steelhead was judged to be low.

Several factors influence the risk of competition posed by hatchery releases: whether competition is intra- or interspecific; the duration of freshwater co-occurrence of hatchery and natural-origin fish; relative body sizes of the two groups; prior residence of shared habitat; environmentally induced developmental differences; and, density in shared habitat (Tatara and Berejikian 2012). Intraspecific competition would be expected to be greater than interspecific, and competition would be expected to increase with prolonged freshwater co-occurrence. Although newly released hatchery smolts are commonly larger than natural-origin fish, and larger fish usually are superior competitors, natural-origin fish have the competitive advantage of prior residence when defending territories and resources in shared natural freshwater habitat. Tatara and Berejikian (2012) further reported that hatchery-induced developmental differences from co-occurring natural-origin fish life stages are variable and can favor both hatchery- and natural-origin fish. They concluded that of all factors, fish density of the composite population in relation to habitat carrying capacity likely exerts the greatest influence.

En masse hatchery salmon smolt releases may cause displacement of rearing naturally produced juvenile salmonids from occupied stream areas, leading to abandonment of advantageous feeding stations, or premature out-migration (Pearsons et al. 1994). Pearsons et al. (1994) reported small-scale displacement of juvenile naturally produced rainbow trout from stream sections by hatchery steelhead. Small-scale displacements and agonistic interactions observed between hatchery steelhead and naturally produced juvenile trout were most likely a result of size differences and not something inherently different about hatchery fish.

A proportion of the smolts released from a hatchery may not migrate to the ocean but rather reside for a period of time in the vicinity of the release point. These non-migratory smolts (residuals) may directly compete for food and space with natural-origin juvenile salmonids of similar age. They also may prey on younger, smaller-sized juvenile salmonids. Although this behavior has been studied and observed, most frequently in the case of hatchery steelhead, residualism has been reported as a potential issue for hatchery coho and Chinook salmon as well. Adverse impacts from residual Chinook and coho hatchery salmon on naturally produced salmonids is definitely a consideration, especially given that the number of smolts per release is generally higher, however the issue of residualism for these species has not been as widely investigated compared to steelhead. Therefore, for all species, monitoring of natural stream areas in the vicinity of hatchery release points may be necessary to determine the significance or potential effects of hatchery smolt residualism on natural-origin juvenile salmonids.

The risk of adverse competitive interactions between hatchery-origin and natural-origin fish can be minimized by:

- Releasing hatchery smolts that are physiologically ready to migrate. Hatchery fish released as smolts emigrate seaward soon after liberation, minimizing the potential for competition with juvenile naturally produced fish in freshwater (Steward and Bjornn 1990; California HSRG 2012).
- Operating hatcheries such that hatchery fish are reared to sufficient size that smoltification occurs in nearly the entire population.
- Releasing hatchery smolts in lower river areas, below areas used for stream-rearing naturally produced juveniles.
- Monitoring the incidence of non-migratory smolts (residuals) after release and adjusting rearing strategies, release location and timing if substantial competition with naturally rearing juveniles is determined likely.

Critical to analyzing competition risk is information on the quality and quantity of spawning and rearing habitat in the action area,[8] including the distribution of spawning and rearing habitat by quality and best estimates for spawning and rearing habitat capacity. Additional important information includes the abundance, distribution, and timing for naturally spawning hatchery fish and natural-origin fish; the timing of emergence; the distribution and estimated abundance for progeny from both hatchery and natural-origin natural spawners; the abundance, size, distribution, and timing for juvenile hatchery fish in the action area; and the size of hatchery fish relative to co-occurring natural-origin fish.

Another potential ecological effect of hatchery releases is predation. Salmon and steelhead are piscivorous and can prey on other salmon and steelhead. Predation, either direct (direct consumption) or indirect (increases in predation by other predator species due to enhanced attraction), can result from hatchery fish released into the wild. Considered here is predation by hatchery-origin fish and by the progeny of naturally spawning hatchery fish and by avian and other predators attracted to the area by an abundance of hatchery fish. Hatchery fish originating from egg boxes and fish planted as non-migrant fry or fingerlings can prey upon fish from the local natural population during juvenile rearing. Hatchery fish released at a later stage, so they are more likely to emigrate quickly to the ocean, can prey on fry and fingerlings that are encountered during the downstream migration. Some of these hatchery fish do not emigrate and instead take up residence in the stream (residuals) where they can prey on stream-rearing juveniles over a more prolonged period. The progeny of naturally spawning hatchery fish also can prey on fish from a natural population and pose a threat. In general, the threat from predation is greatest when natural populations of salmon and steelhead are at low abundance and when spatial structure is already reduced, when habitat, particularly refuge habitat, is limited, and when environmental conditions favor high visibility.

SIWG (1984) rated most risks associated with predation as unknown, because there was relatively little documentation in the literature of predation interactions in either freshwater or marine areas. More studies are now available, but they are still too sparse to allow many generalizations to be made about risk. Newly released hatchery-origin yearling salmon and steelhead may prey on juvenile fall Chinook and steelhead, and other juvenile salmon in the

[8] "Action area" means all areas to be affected directly or indirectly by the action in which the effects of the action can be meaningfully detected and evaluated.

freshwater and marine environments (Hargreaves and LeBrasseur 1986; Hawkins and Tipping 1999; Pearsons and Fritts 1999). Low predation rates have been reported for released steelhead juveniles (Hawkins and Tipping 1999; Naman and Sharpe 2012). Hatchery steelhead timing and release protocols used widely in the Pacific Northwest were shown to be associated with negligible predation by migrating hatchery steelhead on fall Chinook fry, which had already emigrated or had grown large enough to reduce or eliminate their susceptibility to predation when hatchery steelhead entered the rivers (Sharpe et al. 2008). Hawkins (1998) documented hatchery spring Chinook salmon yearling predation on naturally produced fall Chinook salmon juveniles in the Lewis River. Predation on smaller Chinook salmon was found to be much higher in naturally produced smolts (coho salmon and cutthroat, predominately) than their hatchery counterparts.

Predation may be greatest when large numbers of hatchery smolts encounter newly emerged fry or fingerlings, or when hatchery fish are large relative to naturally produced fish (SIWG 1984). Due to their location in the stream or river, size, and time of emergence, newly emerged salmonid fry are likely to be the most vulnerable to predation. Their vulnerability is believed to be greatest immediately upon emergence from the gravel and then their vulnerability decreases as they move into shallow, shoreline areas (USFWS 1994). Emigration out of important rearing areas and foraging inefficiency of newly released hatchery smolts may reduce the degree of predation on salmonid fry (USFWS 1994).

Some reports suggest that hatchery fish can prey on fish that are up to 1/2 their length (Pearsons and Fritts 1999; HSRG 2004) but other studies have concluded that salmonid predators prey on fish 1/3 or less their length (Horner 1978; Hillman and Mullan 1989; Beauchamp 1990; Cannamela 1992; CBFWA 1996). Hatchery fish may also be less efficient predators as compared to their natural-origin conspecifics, reducing the potential for predation impacts (Sosiak et al. 1979; Bachman 1984; Olla et al. 1998).

There are several steps that hatchery programs can implement to reduce or avoid the threat of predation:

- Releasing all hatchery fish as actively migrating smolts through volitional release practices so that the fish migrate quickly seaward, limiting the duration of interaction with any co-occurring natural-origin fish downstream of the release site.
- Ensuring that a high proportion of the population have physiologically achieved full smolt status. Juvenile salmon tend to migrate seaward rapidly when fully smolted, limiting the duration of interaction between hatchery fish and naturally produced fish present within, and downstream of, release areas.
- Releasing hatchery smolts in lower river areas near river mouths and below upstream areas used for stream-rearing young-of-the-year naturally produced salmon fry, thereby reducing the likelihood for interaction between the hatchery and naturally produced fish.
- Operating hatchery programs and releases to minimize the potential for residualism.

2.4.1.4. Factor 4. Hatchery fish and the progeny of naturally spawning hatchery fish in the migration corridor, in the estuary, and in the ocean

Based on a review of the scientific literature, NMFS' conclusion is that the influence of density-dependent interactions on the growth and survival of salmon and steelhead is likely small compared with the effects of large-scale and regional environmental conditions and, while there is evidence that large-scale hatchery production can effect salmon survival at sea, the degree of effect or level of influence is not yet well understood or predictable. The same thing is true for mainstem rivers and estuaries. NMFS will watch for new research to discern and to measure the frequency, the intensity, and the resulting effect of density-dependent interactions between hatchery and natural-origin fish. In the meantime, NMFS will monitor emerging science and information and will consider that re-initiation of section 7 consultation is required in the event that new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation (50 CFR 402.16).

2.4.1.5. Factor 5. Research, monitoring, and evaluation that exists because of the hatchery program

NMFS also analyzes proposed RM&E for its effects on listed species and on designated critical habitat. Generally speaking, negative effects to the fish from RM&E are weighed against the value or benefit of new information, particularly information that tests key assumptions and that reduces critical uncertainties. RM&E actions including but not limited to collection and handling (purposeful or inadvertent), holding the fish in captivity, sampling (e.g., the removal of scales and tissues), tagging and fin-clipping, and observation (in-water or from the bank) can cause harmful changes in behavior and reduced survival. These effects should not be confused with handling effects analyzed under broodstock collection. In addition, NMFS also considers the overall effectiveness of the RM&E program. There are five factors that NMFS takes into account when it assesses the beneficial and negative effects of hatchery RM&E: (1) the status of the affected species and effects of the proposed RM&E on the species and on designated critical habitat, (2) critical uncertainties over effects of the Proposed Action on the species, (3) performance monitoring and determining the effectiveness of the hatchery program at achieving its goals and objectives, (4) identifying and quantifying collateral effects, and (5) tracking compliance of the hatchery program with the terms and conditions for implementing the program. After assessing the proposed hatchery RM&E and before it makes any recommendations to the action agencies, NMFS considers the benefit or usefulness of new or additional information, whether the desired information is available from another source, the effects on ESA-listed species, and cost.

Hatchery actions also must be assessed for masking effects. For these purposes, masking is when hatchery fish included in the Proposed Action mix with and are not identifiable from other fish. The effect of masking is that it undermines and confuses RM&E and status and trends monitoring. Both adult and juvenile hatchery fish can have masking effects. When presented with a proposed hatchery action, NMFS analyzes the nature and level of uncertainties caused by masking and whether and to what extent listed salmon and steelhead are at increased risk. The analysis also takes into account the role of the affected salmon and steelhead population(s) in recovery and whether unidentifiable hatchery fish compromise important RM&E.

2.4.1.6. Factor 6. Construction, operation, and maintenance, of facilities that exist because of the hatchery program

The construction/installation, operation, and maintenance of hatchery facilities can alter fish behavior and can injure or kill eggs, juveniles and adults. It can also degrade habitat function and reduce or block access to spawning and rearing habitats altogether Here, NMFS analyzes changes to riparian habitat, channel morphology and habitat complexity, in-stream substrates, and water quantity and water quality attributable to operation, maintenance, and construction activities and confirms whether water diversions and fish passage facilities are constructed and operated consistent with NMFS criteria.

2.4.1.7. Factor 7. Fisheries that exist because of the hatchery program

There are two aspects of fisheries that are potentially relevant to NMFS' analysis of HGMP effects in a section 7 consultation. One is where there are fisheries that exist because of the HGMP (i.e. the fishery is an interrelated and interdependent action) and listed species are inadvertently and incidentally taken in those fisheries. The other is when fisheries are used as a tool to prevent the hatchery fish associated with the HGMP, including hatchery fish included in an ESA-listed ESU or steelhead DPS from spawning naturally. "Many hatchery programs are capable of producing more fish than are immediately useful in the conservation and recovery of an ESU and can play an important role in fulfilling trust and treaty obligations with regard to harvest of some Pacific salmon and steelhead populations. For ESUs listed as threatened, NMFS will, where appropriate, exercise its authority under section 4(d) of the ESA to allow the harvest of listed hatchery fish that are surplus to the conservation and recovery needs of the ESU, in accordance with approved harvest plans" (NMFS 2005c). In any event, fisheries must be strictly regulated based on the take, including catch and release effects, of ESA-listed species.

2.4.2. Effects of the Proposed Action

Analysis of the Proposed Action identified one factor that is likely to have a negative effect and one factor that is likely to have a beneficial effect on ESA protected spring Chinook salmon and on designated critical habitat (Table 6). An overview of the analysis is described below.

Table 6. A summary of the effects of the ENFH program on UCR spring Chinook salmon and on designated critical habitat. The framework NMFS followed for analyzing effects of the hatchery program is described in Section 2.4.1 of this opinion.

Factor	Range in Potential Effects for this Factor	Analysis of Effects for each Factor
The hatchery program does not promote the conservation of genetic resources that represent the ecological and genetic diversity of a salmon ESU or steelhead DPS	Negligible to negative effect	**Negligible effect** Broodstock are summer Chinook salmon and are not included in an ESA listed ESU or DPS.
Hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities	Negligible to negative effect	**Negative effect** Negative effects are reasonably likely to occur after weighing both positive and negative effects associated with this factor. The proposed action: 1. Is not expected to result in gene flow or harmful genetic effects. Natural spawn timing for ENFH summer Chinook salmon and ESA-listed spring Chinook salmon is not expected to overlap and, thus, interbreeding and genetic affects are not anticipated, 2. Is likely to result in increased competition for spawning sites (i.e., redd superimposition). There already is overlap in the spatial distribution of naturally spawning summer Chinook salmon and spring Chinook salmon, primarily between RM 16.2 and 18.7. The first returns of adult hatchery summer Chinook salmon will be in 2013. The action agencies will monitor and report the number, location, and timing of naturally spawning hatchery fish and the incidence of spring Chinook salmon redd superimposition. They will also monitor and report on the incidence of straying of ENFH summer Chinook salmon into other UCR tributary streams, 3. Hatchery spring Chinook salmon that enter ENFH will not be returned to the river. This will reduce the number of stray hatchery-origin spring Chinook salmon on the spawning grounds that are a threat to Entiat spring Chinook salmon population diversity and productivity. To the extent that hatchery fish from the spring Chinook ESU do not volunteer to ENFH and make their way to the spawning grounds, they are from another hatchery and their effects cannot be attributed to the Proposed Action, 4. No more than five natural-origin spring Chinook salmon entered the facility during broodstock collection activities, between 1994 and 2009. Natural-origin spring Chinook salmon that enter the facility will be immediately

Factor	Range in Potential Effects for this Factor	Analysis of Effects for each Factor
		released back into the river, and 5. ENFH summer Chinook salmon that escape to spawn naturally will contribute marine-derived nutrients to the system, a beneficial effect
Hatchery fish and the progeny of naturally spawning hatchery fish in juvenile rearing areas	Negligible to negative effect	**Negligible effect** Summer Chinook salmon and spring Chinook salmon co-exist, naturally, in areas throughout the UCR. Summer Chinook salmon use different reaches of the Entiat River for rearing purposes, different micro-habitats and spend far less time in freshwater relative to spring Chinook salmon. For the short period (up to three months) that summer Chinook salmon rear in freshwater, rearing habitat is rarely limited (due to the season and higher flows) and the threat of competition is further reduced. Since this is a new program, the action agencies will validate that hatchery fish act as expected and that competition with ESA protected spring Chinook salmon is not a threat. The action agencies will monitor the incidence of non-migratory smolts (residuals) after release from the hatchery and adjust rearing strategies, release location, and timing of hatchery fish releases if competition with ESA-listed spring Chinook salmon juveniles is determined to have a negative effect. Summer Chinook salmon are too small to prey on spring Chinook salmon. The progeny of naturally spawning hatchery fish are expected to leave the Entiat after a short period (up to three months) and are smaller than spring Chinook salmon. ENFH smolts are expected to leave the Entiat within hours or days after release and there is no expectation that they will attract predators that would stay to prey on spring Chinook salmon. ENFH smolts are released in lower river areas, away from upstream areas used for stream-rearing young-of-the-year naturally produced spring Chinook salmon, thereby avoiding competition between hatchery and natural-origin fish. Summer Chinook salmon are not expected to influence the natural emigration of spring Chinook salmon because they are not in close proximity, they are much smaller, and because hatchery Chinook salmon leave the Entiat within a matter of hours or at most days from the time of release.

Factor	Range in Potential Effects for this Factor	Analysis of Effects for each Factor
Hatchery fish and the progeny of naturally spawning hatchery fish in the migration corridor, estuary, and ocean	Negligible to negative effect	**Negligible effect** Effects of the Proposed Action are not detectable. Available information does not show the level of hatchery production that leads to measureable competition, nor does it identify how and to what extent listed species would be disadvantaged. The conditions under which competitive interactions occur, and competitive advantages and disadvantages for different life-history stages, populations, ESUs and DPSs, and for hatchery and natural-origin fish are not detectable.
RM&E that exists because of the hatchery program	Beneficial to negative effect	**Beneficial effect** Benefits to UCR spring Chinook salmon are reasonably certain to occur. The information provided by RM&E will inform adaptive management and that will benefit the survival of the Entiat River spring Chinook salmon population. RM&E will include annual surveys to determine the location and extent of superimposition of spring Chinook salmon redds by summer Chinook salmon and the prevalence of hatchery summer Chinook salmon in spring Chinook salmon natural spawning areas. The effect of observational sampling is expected to be negligible. Post-release survival and behavior of ENFH smolts will be monitored to determine the speed of emigration and the level of residualism in the Entiat River Basin.
Construction, operation, and maintenance of facilities that exist because of the hatchery program	Beneficial to negative effect	**Negligible effect** No new construction is proposed. Except for the fish ladder entrance and water diversion, facilities are located away from the river and do not effect designated critical habitat. There is no hatchery weir. Hatchery diversion screens protect juvenile fish from entrainment and injury and satisfy NMFS screen criteria. Operation of the facility is not expected to degrade water quality. Water is treated before it is returned to the river and the program has a current NPDES permit. Proposed surface water diversion, for rearing juvenile fish in the hatchery, will not affect the spatial distribution of adult or juvenile spring Chinook salmon but it could reduce summer Chinook salmon homing fidelity back to the hatchery. The action agencies will monitor the escapement of adult hatchery summer Chinook salmon, in the Entiat River. No maintenance activities are expected to adversely modify designated critical habitat.

Factor	Range in Potential Effects for this Factor	Analysis of Effects for each Factor
Fisheries that exist because of the hatchery program	Beneficial to negative effect	**NA**. Fisheries are not proposed as part of the Proposed Action and there are no fisheries that exist because of the Proposed Action..

2.4.2.1. Factor 1. The hatchery program does not promote the conservation of genetic resources that represent the ecological and genetic diversity of a salmon ESU or steelhead DPS

Negligible effect: The Proposed Action uses summer Chinook salmon, which are not listed under the ESA.

2.4.2.2. Factor 2. Hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities

Negative effect: There is data for the Entiat River that reveals an overlap in the spatial distribution of naturally spawning summer Chinook salmon and spring Chinook salmon and, thus, it is possible that ENFH summer Chinook salmon that escape to spawn naturally will have a negative effect on ESA listed spring Chinook salmon – through redd superimposition.

As yet, the number and spatial distribution of ENFH summer Chinook salmon that spawn naturally is unknown. This is a new program and the first adult hatchery fish will return in 2013. What is also lacking is any information, for the Entiat, describing conditions for spawning and whether spring Chinook salmon and summer Chinook salmon share the same or similar preferences for spawning substrates, water velocities, and water depths and any measure of summer Chinook salmon disturbing or destroying spring Chinook salmon eggs (i.e., superimposition). Available data for the Entiat show that there is some overlap in the spatial distribution of summer Chinook salmon and spring Chinook salmon natural spawners (Hamstreet 2012): summer Chinook salmon spawn in the same reach as approximately 18% of the spring Chinook salmon. Spring Chinook salmon generally prefer areas higher in the watershed for spawning purposes, compared to summer Chinook salmon, and fifteen years of survey data for the Entiat River confirm this. More than 80% of all spring Chinook salmon spawn upstream of RM 18.7. A few summer Chinook salmon have been observed spawning upstream of RM 25.8 but more than 80% of all summer Chinook salmon spawn downstream of RM 18.7. Where most of the overlap in spawning distribution occurs is between RM 16.2 and 18.7. While more detailed information on the distribution of natural spawners in the Entiat will need to be collected over the next few years, the information described here is consistent with spawning preferences between spring and summer Chinook salmon life history types in other parts of the basin.

There are two potential scenarios for effects of the proposed action once hatchery fish from ENFH begin returning to the river. One is that the spatial distribution of natural spawning summer Chinook salmon will increase, particularly in years when hatchery returns are high, and, thus, the overlap in spawning distribution and the potential for spring Chinook salmon redd superimposition will likewise increase. Second, hatchery summer Chinook salmon will spawn in the vicinity of the hatchery and there will be little or no change in the overlap in spawning distribution and the resulting effects on ESA-listed spring Chinook salmon. This is a plausible scenario considering that summer Chinook salmon juveniles are released from the hatchery at RM 6.7 and hatchery fish, and salmon in general, are known to congregate and spawn, years later, in the general vicinity of their place of origin (i.e., incubation or release site). The release site is nearly 10 miles downstream from the nearest spring Chinook salmon spawning areas. No hatchery summer Chinook salmon volunteering into the hatchery will be returned to the river and this will further reduce the number of hatchery fish that escape to spawn naturally and the potential for hatchery summer Chinook salmon to superimpose spring Chinook salmon redds. Based on these facts, is NMFS' expectation that spring Chinook salmon redd superimposition will be 15 percent or less, measured annually, following full implementation of ENFH.

Summer Chinook salmon from ENFH are not expected to interbreed with spring Chinook salmon and, thus, there will be no genetic effects. Spawn timing for summer and spring Chinook salmon in the Entiat River does not overlap now and the addition of ENFH summer Chinook salmon, beginning in the summer of 2013, is not expected to change that. According to surveys that have been conducted in the Entiat River since 1997, spring Chinook salmon spawn 3-4 weeks earlier than summer Chinook salmon and thus there is little or no gene-flow between the different Chinook salmon types.

Another effect here is inadvertent encounters with ESA-listed spring Chinook salmon during summer Chinook salmon broodstock collection – both natural-origin and hatchery-origin. The Proposed Action uses only hatchery summer Chinook salmon for broodstock, which are not protected under the ESA. By the time the collection ladder opens every year, the vast majority of ESA-listed spring Chinook salmon are expected to be upstream of the hatchery and, therefore, few are expected to enter the fish ladder and adult holding ponds. Between 1994 and 2009, when ENFH produced spring Chinook salmon, "fewer than six natural-origin spring Chinook salmon entered the facility" (see section 2.2.3 in USFWS 2009). In the event that natural-origin spring Chinook salmon enter the facility, they will be returned to the river immediately to continue their migration. Handling of such fish is not expected to affect their ability to continue their upstream migration or successfully spawn. Spring Chinook salmon can be quickly identified and easily returned to the river which is in close proximity to the holding ponds.

Hatchery-origin spring Chinook salmon may enter the facility in greater numbers, based on information about the proportion of hatchery-origin versus natural-origin fish on the spawning grounds. Many of these hatchery-origin fish are likely to be ESA-listed. Removal of the ESA-listed fish represents take, but there is considered to be a net benefit to the listed species: because they introduce an unnatural source and level of straying, and if they were released to the spawning grounds they would pose genetic and ecological threats to the Entiat River's separate and distinctive natural population. The level of straying and the origin of the stray fish contribute to the high risk level for spatial structure and diversity for the Entiat spring Chinook salmon population (Figure 3). In 2011, stray hatchery-origin spring Chinook salmon comprised 46% of the carcasses recovered during spring Chinook salmon redd surveys in the Entiat River (Hamstreet 2012). Gene flow occurs naturally among salmon and steelhead populations, a process referred to as straying (Quinn 1993; Quinn 1997) and this serves a valuable function in preserving diversity that would otherwise be lost through genetic drift and in re-colonizing vacant habitat. But, straying is considered a risk when it occurs at unnatural levels or from unnatural sources and that is the case in the Entiat Basin for spring Chinook salmon.

The proposed action intends to prevent at least some stray hatchery-origin spring Chinook salmon from spawning naturally in the Entiat River and this will have a beneficial effect on the Entiat spring Chinook salmon population and on the UCR Spring Chinook Salmon ESU. Stray hatchery-origin spring Chinook salmon that enter ENFH will be removed and prevented from having genetic and ecological effects when they spawn naturally. Many are expected to be ESA-listed spring Chinook salmon. At least 90% of the fish collected in 2011were UCR ESA-listed spring Chinook salmon originating from the Chiwawa hatchery program in the Wenatchee Basin. Handling of ESA-listed fish constitutes a take however so does the release of these fish back into the Entiat River (64 FR 60727, November 8, 1999). However, in NMFS' view, removing these hatchery-origin fish is a net benefit to the Entiat spring Chinook salmon population and to the UCR Spring Chinook Salmon ESU and the more stray fish that are removed and prevented from spawning naturally the better. The BA anticipates that up to 50 hatchery-origin spring Chinook may enter ENFH each year. In NMFS' view, even if 100 ESA-listed hatchery-origin spring Chinook were intercepted and removed at ENFH, the benefits associated with preventing them reaching the spawning ground would outweigh any detriments associated with taking them.

Also considered here was the potential for ENFH summer Chinook salmon to stray into other river basins and effect ESA-listed spring Chinook salmon. Using another summer Chinook hatchery program in the UCR as a surrogate, stray rates of summer Chinook salmon from ENFH are expected to be low, less than 2 percent annually or approximately 200 fish. This is just too few fish to pose a threat to natural populations of spring Chinook salmon in the Wenatchee and Methow Basins. Once ENFH summer Chinook salmon begin returning as adults, FWS will monitor tag recovery information and report on the extent and location of straying.

2.4.2.3. Factor 3. Hatchery fish and the progeny of naturally spawning hatchery fish in juvenile rearing areas

Negligible effect: Hatchery smolts and the juvenile progeny of naturally spawning hatchery summer Chinook salmon are not expected to affect, in any measureable way, juvenile fish from the Entiat River spring Chinook salmon population.

Summer Chinook salmon from ENFH (i.e., smolts) are expected to only spend hours in the Entiat River before they reach the Columbia River and join tens of millions of natural-origin and hatchery smolts bound for the Pacific Ocean. There are several reasons for this. The first is that hatchery fish are released only after reaching a physiological stage in their development (i.e., smoltification) that prompts them to leave freshwater for the ocean. Hatchery fish reach this stage and leave en masse in contrast to natural-origin spring Chinook salmon that reach this physiological condition over a more prolonged period and begin leaving rearing areas far upstream in the Entiat River over the course of several months. Second, the release site is only 6.7 miles upstream from the Columbia River, far downstream from the nearest spring Chinook salmon rearing areas. Third, ENFH will release their fish when river flows are increasing or high, helping to flush the fish out of the area and into the Columbia River.

Summer Chinook salmon from ENFH are not intended to spawn naturally but some number inevitably will. The question is, will the progeny of these fish compete with and pose a threat to spring Chinook salmon? Regarding interactions between the progeny of naturally spawning summer Chinook salmon from ENFH and natural-origin spring Chinook salmon, there are no data to show – and there is no reason to expect – that the Proposed Action is a threat in this way to spring Chinook salmon in the Entiat River. For the short period (up to three months) that summer Chinook salmon occur in freshwater, they largely use different areas of the river and are at a competitive disadvantage with spring Chinook because of their smaller size. Hatchery summer Chinook salmon that return as adults and do not volunteer into the hatchery are expected to home to and spawn near the hatchery where they were reared, acclimated, and released. This behavior is common and is observed at locations throughout the Pacific Northwest. Since this location is almost ten miles downstream from the nearest areas where spring Chinook salmon spawn, the progeny of naturally spawning hatchery summer Chinook salmon are not expected to use the same areas for juvenile rearing as spring Chinook salmon. In addition, summer Chinook salmon are "ocean-type" Chinook salmon (Section 2.2.1) and spend only a short-time in their natal stream (up to 3 months) before leaving for the ocean. Summer Chinook salmon prefer estuarine and ocean areas for rearing compared to spring Chinook salmon, which prefer freshwater tributary habitats for early rearing.

En masse hatchery salmon smolt releases may cause the displacement of naturally produced juvenile salmonids leading to the abandonment of advantageous feeding stations or premature out-migration (Pearsons et al. 1994). Displacement and premature out-migration would be expected to reduce population spatial structure and abundance. This possibility was considered but rejected because, in this case, hatchery summer Chinook salmon are released 9.5 miles downstream from the nearest spring Chinook salmon rearing areas and because spring Chinook salmon are already actively migrating to the ocean by the time they reach the Lower Entiat River where hatchery fish are released.

Predation is dependent upon two factors: the predatory fish and their prey must overlap temporally and spatially, and the prey must be less than 1/2 to 1/3 the length of the predatory fish. USFWS (2009) anticipates that hatchery summer Chinook salmon will average approximately 152mm in length at the time of release. Using the 1/2 to 1/3 rule, hatchery Chinook salmon would not prey on fish larger than approximately 76mm in length. Desgroseillier et al. (2009) found that spring Chinook salmon captured at a screw trap immediately downstream from ENFH between March and May ranged between 97-104mm. The juvenile progeny of naturally spawning hatchery fish are the same size or even a little smaller than juvenile spring Chinook salmon. Considering the observed sizes of spring Chinook salmon juveniles, and the fact that hatchery and natural-origin fish do not co-occur during juvenile rearing, it appears unlikely that hatchery smolts or the progeny of naturally spawning hatchery fish could prey on juvenile spring Chinook salmon. It is also unlikely that hatchery released fish that remain in the Entiat River (residuals) would survive to grow to a large enough size to prey on spring Chinook salmon because conditions in the Lower Entiat River are very poor and do not support rearing summer Chinook salmon. Adult hatchery summer Chinook salmon are not active feeders during the spawning migration and few if any juvenile spring Chinook salmon co-occur with adult hatchery fish.

The Proposed Action will reduce interactions and the potential for adverse effects to negligible levels by:

- Releasing hatchery smolts that are physiologically ready and emigrate seaward soon after liberation, minimizing the potential for competition with juvenile natural-origin fish in freshwater.
- Operating the hatchery such that hatchery fish are reared to sufficient size that smoltification occurs within nearly the entire population.

- Releasing hatchery smolts in lower river areas, below areas used for stream-rearing natural-origin juveniles.
- Monitoring the spawning location of ENFH summer Chinook salmon.

2.4.2.4. Factor 4. Hatchery fish and the progeny of naturally spawning hatchery fish in the migration corridor, estuary, and ocean

Negligible effect: Best available information does not indicate that the Proposed Action at ENFH would exacerbate density-dependent effects on ESA-listed species in the mainstem Columbia River, in the estuary, or in the Pacific Ocean.

NMFS has been investigating this factor for some time. The Proposed Recovery Plan for Snake River Salmon (NMFS 1995a), described the issue in this manner. There is intense debate over the issues of carrying capacity and density-dependent effects on natural populations of salmon. However, there is little definitive information available to directly address the effects of ecological factors on survival and growth in natural populations of Pacific salmon. Thus, many of the ecological consequences of releasing hatchery fish into the wild are poorly defined. The proposed recovery plan called on hatchery operators and funding entities to "limit annual releases of anadromous fishes from Columbia Basin hatcheries", and in fact, releases have declined substantially. Hatchery releases for the entire Columbia Basin now vary between 130 and 145 million fish annually compared to a previous annual production of approximately 200 million fish.

More recently, NMFS has reviewed the literature for new and emerging scientific information over the role and the consequences of density-dependent interactions in estuarine and marine areas. While there is evidence of density-dependent effects effecting salmon survival, the currently available information does not support a meaningful causal link to a particular category of hatchery program. The SCA for the FCRPS opinion (NMFS 2008d) and the September 2009 FCRPS Adaptive Management Implementation Plan (AMIP) (NMFS 2009) both concluded that available knowledge and research abilities are insufficient to discern any important role or contribution of hatchery fish in density-dependent interactions affecting salmon and steelhead growth and survival in the mainstem Columbia River, the Columbia River estuary, and the Pacific Ocean.

Our conclusion, based on available information, is that hatchery production on the scale proposed in this action and considered in this opinion will have a negligible effect on the survival and recovery of the UCR spring Chinook salmon ESU. At full production, releases from ENFH will constitute less than 0.04 percent of the total hatchery production and less than 0.025 percent of all juvenile salmonids in the Columbia Basin. Upon release into the wild, following a year of hatchery rearing, less than half of these fish survive the journey to the Pacific Ocean to join tens of millions of other juvenile salmon and steelhead. There is CWT recovery information from fish harvest at sea but these data "do not give us insight into fish behavior nor inter-specific interactions among stocks in the ocean" (USFWS 2009).

Consequently, as the Proposed Action contributes so little to the potential issue and the science does not show a likelihood of impacts generally, we are confident that the effects of the Proposed

Action on the UCR spring Chinook salmon ESU in the migration corridor, in the estuary and in the Pacific Ocean are negligible.

NMFS will continue to monitor emerging science and information and will reinitiate section 7 consultation in the event that new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation (50 CFR 402.16).

2.4.2.5. Factor 5. Research, monitoring, and evaluation that exists because of the hatchery program

Beneficial effect: The Proposed Action addresses the five factors that NMFS takes into account when it analyzes and weighs the beneficial and negative effects of hatchery RM&E (Section 2.4.1. Research, monitoring, and evaluation). It includes RM&E to monitor compliance with this opinion and to inform future decisions over how the hatchery program can make adjustments that further reduce risks to ESA-listed spring Chinook salmon. The potential for lethal or sub-lethal effects to UCR spring Chinook salmon are negligible.

Surface water diversion, as described in the Proposed Action, is expected to have a negligible effect on spring Chinook salmon and FWS will monitor Entiat River stream-flows and fish passage conditions to validate this conclusion and ensure that the spatial distribution of UCR spring Chinook salmon is not affected.

This is a new program and adult hatchery fish have yet to return to the area, but it is possible that in the future, ENFH summer Chinook salmon that escape to spawn naturally will have a negative effect on ESA listed spring Chinook salmon – through redd superimposition. RM&E will include surveys, annually, to determine the prevalence of hatchery summer Chinook salmon in spring Chinook salmon natural spawning areas and the location and extent of superimposition of spring Chinook salmon redds by summer Chinook salmon. Effects on UCR spring Chinook salmon from these surveys are expected to be negligible.

Hatchery fish from the Proposed Action will not confuse or conceal the status of any natural population(s) or the effects of the hatchery program on any natural population(s). Summer Chinook salmon have very different life-history characteristics, relative to spring Chinook salmon, and it is expected that there will be little spatial or temporal overlap in distribution between the species to cause masking. In addition, hatchery summer Chinook salmon will be 100 percent adipose fin-clipped and at least 200,000 fish will have a CWT for easy identification.

2.4.2.6. Factor 6. Construction, operation, and maintenance of facilities that exist because of the hatchery program

Negligible effect: Operations, maintenance, and construction activities included in the Proposed Action will have a negligible effect on ESA-protected spring Chinook salmon and on designated critical habitat. The existing facility is located high in the floodplain and has not led to altered channel morphology and stability, reduced and degraded floodplain connectivity, excessive sediment input, or the loss of habitat diversity and no new facilities are proposed.

Broodstock collection facilities do not affect fish passage and the spatial distribution of juvenile and adult spring Chinook salmon because there is no barrier in the river and there is no evidence that flows from the fish ladder delay upstream migrations.

The water supply system is designed and operated such that groundwater extraction and surface water diversion are not expected to reduce spatial distribution and productivity of the Entiat spring Chinook salmon population. In NMFS' opinion, flows in the bypass reach, between RM 6.7 and 7.2 will not impair juvenile or adult spring Chinook salmon passage. In order to protect ESA-listed UCR spring Chinook salmon, the FWS will monitor stream-flows at the USGS gage site #12452990 to ensure that surface water diversion: (1) does not exceed 10% of the mean daily flow whenever the combination of flow minus the amount of hatchery surface diversion is less than 100 cfs from November 1 through April 30; and (2) does not exceed 5% of the mean daily flow whenever the combination of flow minus the amount of hatchery surface diversion is less than 200 cfs from May 1 through October 31. The FWS will also monitor and report on juvenile and adult passage conditions between the upstream diversion site and the location downstream where water is returned to the river. ENFH intends on gradually increasing its surface water withdrawal so that the combined groundwater and surface water withdrawal does not exceed 22.5 cfs. All of the water used by the hatchery is returned to the Entiat River less any leakage and evaporation.

The diversion intake is screened and meets NMFS criteria for protecting anadromous salmonids. The return water system operates under NPDES permit number WAG-13-0000 and effluent is monitored weekly to ensure compliance with permit requirements. The ESA recovery plan does not identify effluent from ENFH as a threat to spring Chinook salmon survival and recovery and NMFS concludes that effects from effluent discharge are negligible.

2.4.2.7. Factor 7. Fisheries that exist because of the hatchery program

There are no fisheries-related effects associated with the Proposed Action. As indicated above, fisheries are not part of this proposed action and there are no fisheries that exist because of the proposed hatchery program, i.e. the "but for" test does not apply and therefore they are not interrelated and interdependent actions. The ENFH is a new hatchery program, and to the extent that fisheries may be developed to specifically target ENFH summer Chinook salmon they will be subject to future section 7 consultation. To the extent that there are existing fisheries that may catch ENFH fish, they are mixed fisheries and would exist with or without ENFH (and have previously been evaluated in a separate biological opinion (NMFS 2008b)).

2.4.2.8. Effects of the Action on Critical Habitat

Negligible effect: This consultation analyzed the Proposed Action for its effects on designated critical habitat and has determined that operation of the hatchery program will have a negligible effect on PCEs in the action area.

Existing hatchery facilities have not led to altered channel morphology and stability, reduced and degraded floodplain connectivity, excessive sediment input, or the loss of habitat diversity and no new facilities are proposed. Except for the ladder entrance and water diversion, hatchery facilities are located away from the river and do not effect designated critical habitat.

Proposed surface water diversion for rearing juvenile fish in the hatchery and the return of that water to the Entiat River, will not affect the spatial distribution of adult or juvenile ESA protected spring Chinook salmon. The Proposed Action includes strict criteria for diverting water from the river and will not have any discernible effect or result in any adverse modification to critical habitat. This reach of the Entiat River, RM 6.7 to 7.2, is strictly a migration corridor for ESA-listed spring Chinook salmon and flow requirements specified in the HGMP will provide safe passage for adult and juvenile salmon. Surface water diversion will not exceed 10% of the mean daily flow whenever the combination of flow minus the amount of hatchery surface diversion is less than 100 cfs from November 1 through April 30, and 5% of the mean daily flow whenever the combination of flow minus the amount of hatchery surface diversion is less than 200 cfs from May 1 through October 31. Hatchery diversion screens protect juvenile fish from entrainment and injury and satisfy NMFS screen criteria.

Operation of the facility is not expected to degrade water quality. Water will be treated before it is returned to the river and the program has a current NPDES permit.

No hatchery maintenance activities are expected to adversely modify designated critical habitat.

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). For the purpose of this analysis, the action area is that part of the Columbia River Basin described in Section 1.4. To the extent ongoing activities have occurred in the past and are currently occurring, their effects are included in the baseline (whether they are Federal, state, tribal or private). To the extent those same activities are reasonably certain to occur in the future (and are tribal, state or private), their future effects are included in the cumulative effects analysis. This is the case even if the ongoing tribal, state or private activities may become the subject of section 10(a)(1)(B) incidental take permits in the future. The effects of such activities are treated as cumulative effects unless and until an opinion for the take permit has been issued.

Currently-occurring non-Federal actions described in the Baseline section are expected to continue to affect spring Chinook salmon in the Entiat River Basin at similar levels of intensity.

State, tribal, and local governments have developed plans and initiatives to benefit listed species and these plans must be implemented and sustained in a comprehensive manner for NMFS to consider them "reasonably foreseeable" in its analysis of cumulative effects. The Federally approved Recovery Plan for UCR Spring Chinook Salmon and steelhead (UCSRB 2007) is such a plan and it describes, in detail, the on-going and proposed Federal, state, tribal, and local government actions that are targeted to reduce known threats to ESA listed UCR spring Chinook salmon in the Entiat River. It is acknowledged, however, that such future state, tribal, and local government actions will likely be in the form of legislation, administrative rules, or policy initiatives, and land use and other types of permits and that government actions are subject to political, legislative and fiscal uncertainties.

2.6. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the Proposed Action. In this section, NMFS adds the effects of the Proposed Action (Section 2.4.2) to the environmental baseline (2.3) and to cumulative effects (2.5) to formulate the agency's 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. This assessment is made in full consideration of the status of the species and critical habitat and the status and role of the affected population(s) in recovery (Sections 2.2.1, 2.2.2, and 2.2.3).

In assessing the overall risk of the Proposed Action on each species, NMFS considers the risks of each factor discussed in Section 2.4.2., above, in combination, considering their potential additive effects with each other and with other actions in the area (environmental baseline and cumulative effects). This combination serves to translate the positive and negative effects posed by the Proposed Action into a determination as to whether the Proposed Action as a whole would appreciable reduce the likelihood of survival and recovery of the listed species and their designated critical habitat.

2.6.1. UCR Spring Chinook Salmon

Best available information indicates that the species, in this case the UCR Spring Chinook Salmon ESU, is at high risk and remains at endangered status. Based on the combined ratings for abundance/productivity and spatial structure/diversity, all three extant populations and the ESU remain at high risk of extinction.

As set out in the Environmental Baseline, see section 2.3, habitat conditions in the action area and stray hatchery fish have a negative effect on ESA listed spring Chinook salmon in the Entiat River. Alteration of hydrologic and geomorphic processes that create and sustain conditions fish need to survive, including overwintering rearing habitat for juvenile fishes, has reduced the ability of the Entiat River watershed to fully sustain salmon populations (Andonaegui 1999). The Entiat River spring Chinook salmon population may be adversely effected by climate change). Hatchery-origin spring Chinook salmon, primarily from hatchery programs in the Wenatchee Basin, that stray into the Entiat Basin are a threat to the spatial structure and diversity of the rebuilding Entiat River spring Chinook salmon population.

NMFS analyzes seven factors to determine the effects of a hatchery program on ESA-listed species and on designated critical habitat (Section 2.4.1) and for the Proposed Action at ENFH, the majority are expected to have negligible effects.

One factor, hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities, is likely to have negative effects, although the effects are expected to be minor (see Section 2.4.2.). Hatchery summer Chinook salmon are likely to cause superimposition of spring Chinook salmon reddsand ESA-listed spring Chinook salmon (both natural-origin and hatchery-origin) are expected to be encountered and handled at ENFH.

Redd superimposition: In the Entiat River, we have no information or evidence of spring Chinook salmon redd superimposition in the Environmental Baseline and it is unknown where and how many ENFH summer Chinook salmon will spawn naturally, until the first adult hatchery fish return in the summer of 2013. Since other summer Chinook in the Entiat River spawn in some of the same river reaches as ESA-listed spring Chinook salmon, ENFH summer Chinook salmon that escape to spawn naturally could superimpose spring Chinook salmon redds. To reduce this risk, all ENFH summer Chinook salmon that enter the fish ladder will be removed and they will not be returned to the river. Based on best available science, we anticipate redd superimposition of 15 percent or less. Given the measures to minimize superimposition and the 15 percent or less expected rate, NMFS concludes that the effects are likely to be adverse but not substantially so, especially at the ESU scale. When hatchery fish begin returning to the Entiat, the FWS will monitor and report annually on their distribution in the wild and on the incidence of redd superimposition.

Encounters with natural-origin and hatchery fish at adult collection facilities: Based on past experience, natural-origin spring Chinook salmon wander into ENFH but it is a relative rare event (≤ 5 per year). FWS will monitor and report, annually, on the number and condition of natural-origin spring Chinook salmon handled during broodstock collection and any fish encountered will be immediately released back into the Entiat River. The handling is not expected to disrupt successful migration and spawning and, in any event, the small number of fish involved would not have an impact at the population level. On the other hand, hatchery-origin spring Chinook salmon that stray into the Entiat Basin disrupt natural patterns of gene flow and are a risk to natural population spatial structure and diversity. Thus, all hatchery spring Chinook salmon that stray into ENFH will be removed and prevented from spawning naturally. Although many of these hatchery fish are likely to be ESA-listed, the benefit of removing them from the spawning ground outweighs the take of individual fish (no matter how many).

NMFS analyzed the remaining factors and determined that they will have negligible or inconsequential effects, and beneficial effects in one case, on the UCR spring Chinook salmon ESU. This is because hatchery summer Chinook salmon are expected to be largely isolated, both temporarily and spatially, from ESA-listed UCR spring Chinook salmon. NMFS has yet to see where ENFH summer Chinook salmon will spawn, and hatchery and ESA-listed fish do not share the same rearing habitats. It is not possible to detect any competitive interactions caused by ENFH summer Chinook salmon in the migration corridor, estuary, and ocean, proposed RM&E does not include any handling of ESA-listed fish, and hatchery facilities are constructed and operated in compliance with standards designed to protect both juvenile and adult salmon. Further, none of these factors is identified in the federally approved plan as a factor limiting UCR spring Chinook salmon recovery.

Added to the Environmental Baseline and effects of the Proposed Action are the effects of future state, private, or tribal activities, not involving Federal activities, within the action area. To the extent those same activities are reasonably certain to occur in the future, their future effects are included in the cumulative effects analysis. Many of the state and private activities identified in the Baseline are anticipated to occur at similar levels of intensity into the future. The Federally approved Recovery Plan for UCR Spring Chinook Salmon and steelhead (UCSRB 2007) describes, in detail, the on-going and proposed state, tribal, and local government actions that are targeted to reduce known threats to ESA-listed UCR spring Chinook salmon in the Entiat River. It is acknowledged, however, that such future state, tribal, and local government actions will likely be in the form of legislation, administrative rules, or policy initiatives, and land use and other types of permits and that government actions are subject to political, legislative and fiscal uncertainties.

This analysis has considered the potential effects of the Proposed Action, combined with the environmental baseline and cumulative effects, and determined that the Proposed Action will not appreciably reduce the likelihood of survival and recovery of UCR spring Chinook salmon in the wild by reducing the reproduction, number, or distribution of the ESU.

2.6.2. Critical Habitat

Critical habitat for ESA-listed UCR spring Chinook salmon is described in Section 2.2.2 of this opinion. After reviewing the Proposed Action and conducting the effects analysis, NMFS has determined that the Proposed Action will not impair PCEs designated as essential for spawning, rearing, juvenile migration, and adult migration purposes.

The hatchery water diversion and the discharge pose only a negligible effect on designated critical habitat in the action area (Section 2.4.2). Existing hatchery facilities have not contributed to altered channel morphology and stability, reduced and degraded floodplain connectivity, excessive sediment input, or the loss of habitat diversity and no new facilities or changes to existing facilities are proposed. The Proposed Action includes strict criteria for diverting water from the river and will not impair PCEs. ESA-listed spring Chinook salmon do not spawn or rear in the vicinity of the water diversion or in that reach of the river between the point of diversion and point of water return. This reach of the Entiat River, RM 6.7 to 7.2, is strictly a migration corridor for ESA-listed spring Chinook salmon and flow requirements specified in the HGMP will provide safe passage for adult and juvenile salmon.

The Federally approved Recovery Plan for UCR spring Chinook salmon and steelhead (UCSRB 2007) identified a number of limiting factors and threats to the Entiat River spring Chinook salmon population, including water quality, sediment routing dysfunction, blocked and impaired fish passage, degraded floodplain and channel structure, and hydrologic alterations (Section 2.2.). None of these factors will be affected in a measureable way by the Proposed Action.

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, including effects of the Proposed Action that are likely to persist following expiration 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 the UCR spring-run Chinook Salmon ESU, or destroy or adversely modify 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 (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For the 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 substantially altered.[9] Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not prohibited under the ESA, if that action is performed in compliance with the terms and conditions of the ITS.

2.8.1. Amount or Extent of Take

NMFS analyzed seven factors and identified one that is likely to result in take: hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities.

Encounters with natural-origin and hatchery fish at adult collection facilities: In the course of collecting hatchery summer Chinook salmon for hatchery broodstock, the Proposed Action is expected to handle, annually, up to five adult *natural-origin* spring Chinook salmon. These are fish that volunteer into ENFH. All natural-origin spring Chinook salmon handled during broodstock collection must be released, immediately, back into the Entiat River.

Adult *hatchery-origin* spring Chinook salmon are also expected to volunteer into ENFH during broodstock collection. Hatchery spring Chinook salmon that enter ENFH are from other populations, mostly from the Wenatchee spring Chinook salmon population, and while these fish may have conservation value in the Wenatchee, they are a threat to the extant population in the Entiat, and to the status of the UCR Spring-run Chinook Salmon ESU as a whole. Stray hatchery-fish represent an unnatural source and level gene flow and are a threat to natural patterns of genetic and phenotypic diversity. Preventing stray hatchery fish from spawning naturally is therefore a benefit to the UCR Spring-run Chinook Salmon ESU and any hatchery spring Chinook salmon that enter ENFH will not be returned to the river. All hatchery-origin spring Chinook salmon that stray into the facility, some portion of which will be ESA-listed, will be killed and/or handled in order to be returned to the hatchery program of origin. In the accompanying opinion, NMFS has concluded that the benefits of preventing these listed fish from reaching the spawning grounds outweighs the negative effects of taking them – and that the more that are intercepted, the better for the listed species. Thus, no benefit would be served if consultation was reinitiated because an amount of this type of take was exceeded. Nevertheless,

[9] 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 that 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.

in the accompanying opinion, NMFS has expressly analyzed the effects of up to 100 ESA-listed hatchery-origin spring Chinook being intercepted at ENFH.

Spring Chinook salmon redd superimposition: ENFH summer Chinook salmon that are not intercepted at the hatchery may result in ecological interactions on the spawning grounds. In defining "harm" under the ESA, NMFS included as one of the activities that constitute take:

> "6. Releasing non-indigenous or artificially propagated species into a listed species' habitat or where they may access the habitat of listed species" (64 FR 60727, November 8, 1999).

Ecological interactions on the spawning grounds refers to the potential for summer Chinook salmon from ENFH to superimpose redds (i.e., disturb or destroy embryos and/or alevins) made by ESA-listed spring Chinook salmon in the Entiat River.

It is not possible to accurately quantify the take of species caused by redd superimposition; specifically, we cannot quantify how many salmon embryos or alevins will be disturbed as a result of redd superimposition. NMFS will therefore rely on a surrogate take indicator that relates to the take of salmon embryos or alevins as a result of redd superimposition: the number of redds affected. Superimposition, caused by ENFH summer Chinook salmon, is not expected to affect more than 10 percent of the total number of redds produced by spring Chinook salmon in the Entiat River annually, and, therefore, the surrogate take indicator is superimposition of more than 10 percent of spring Chinook salmon redds in the Entiat River. This surrogate take indicator is capable of measurement, and is rationally connected to the take of species identified above, since the number of redds correlates closely with the number of embryos or alevins in the river, and with the number of alevins or embryos affected by hatchery fish.

Take in the form of delayed or displaced natural spawning resulting from surveys for spawner distribution and for redd superimposition is not expected. Survey methods proposed by the action agencies, including visual observations and redd measurements, are not expected to delay or displace natural spawning spring Chinook salmon.

2.8.2. Effect of the Take

In Section 2.7, NMFS determined that the level of anticipated take, coupled with other effects of the Proposed Action, is not likely to result in jeopardy to the UCR spring Chinook salmon ESU or in the destruction or adverse modification of designated critical habitat.

2.8.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(a)(2) to apply.

NMFS concludes that the following reasonable and prudent measures are necessary and appropriate to minimize incidental take. This opinion requires that Action Agencies, FWS, and BOR:

1. Minimize the number of natural-origin spring Chinook salmon that enter the hatchery, and the impacts of handling such fish in the course of broodstock collection.
2. Minimize the number of stray hatchery-origin spring Chinook salmon that spawn in the Entiat River.
3. Document spring Chinook salmon redd superimposition and minimize the number of ENFH adult fish that spawn in the Entiat River.
4. Implement the hatchery program as described in the HGMP and monitor its operation and effects on ESA-listed species.

2.8.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and the Action Agencies must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The Action Agencies have a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will lapse. This opinion requires that the Action Agencies to:

1. Operate the fish ladder, to the extent possible, to limit the number of natural-origin spring Chinook salmon that volunteer into the hatchery and return natural-origin spring Chinook salmon that enter ENFH back into the river without delay and in the best possible condition. Monitor the number of these fish, annually, that enter ENFH – and advise NMFS immediately if more than five enter in a given year.

2a. Remove all hatchery spring Chinook salmon that enter ENFH and prevent them from returning to the river to spawn naturally.

2b. Monitor the origin and number of stray hatchery-origin spring Chinook salmon that annually enter ENFH.

3a. Operate the fish ladder, to the extent possible, to attract and capture as many hatchery summer Chinook salmon as possible. Remove all hatchery summer Chinook salmon that enter ENFH and prevent them from returning to the river to spawn naturally.

3b. Conduct surveys, annually, to determine the timing, abundance, and distribution of ENFH summer Chinook salmon that spawn naturally and the prevalence of hatchery summer Chinook salmon spawning in spring Chinook salmon natural spawning areas.

3c. Conduct surveys, annually to determine the location and extent of superimposition of spring Chinook salmon redds by hatchery summer Chinook salmon

4. The FWS shall implement the hatchery program as described in the HGMP. NMFS' SMD must be notified in advance of any change in hatchery program operation and implementation that potentially would result in increased take of ESA-listed species. The FWS shall provide one comprehensive annual report to the SMD, on or before April 1 of each year, that includes the RM&E described in Terms and Conditions number 1, 2b, 3b, and 3c. The numbers of fish released, release dates and locations, and tag/mark information shall be included in the annual report. All reports, as well as all other

notifications required in the permit, shall be submitted electronically to the NMFS point of contact for this program:

Craig Busack (503) 230-5412, craig.busack@noaa.gov

Written materials may also be submitted to:

NMFS - Salmon Management Division
Production and Inland Fisheries Branch
1201 N.E. Lloyd Boulevard, Suite 1100
Portland, Oregon 97232

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 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 (50 CFR 402.02). NMFS has identified one conservation recommendation appropriate to the Proposed Action:

1. The FWS, in cooperation with the NMFS and other entities, should continue to investigate the level of ecological interactions between hatchery-produced salmon and ESA-listed spring Chinook salmon within the Entiat River Basin to identify additional methods to minimize these interactions.

2.10. Re-initiation of Consultation

As provided in 50 CFR 402.16, re-initiation 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 that may affect listed species or 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 that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In addition, reinitiation is required if implementation of the Proposed Action is to continue beyond April 15, 2023.

2.11. "Not Likely to Adversely Affect" Determinations

NMFS has determined that, while the Proposed Action may affect UCR steelhead, due to their presence in the Entiat River, the Proposed Action is not likely to adversely affect UCR steelhead. This determination was made pursuant to section 7(a)(2) of the ESA implementing regulations at

50 CFR 402, and agency guidance for preparation of letters of concurrence[10], and is described here.

The applicable standard to find that a Proposed Action is "not likely to adversely affect" ESA listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial[11]. Beneficial effects are contemporaneous positive effects without any adverse effects on the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are extremely unlikely to occur.

UCR steelhead are listed as threatened under the ESA (71 FR 834, January 5, 2006)[12]. UCR steelhead return to freshwater between May and October and are in a sexually immature condition. They seek-out areas with adequate flows and cover to hold in until spawning occurs between January and May (Chapman et al. 1994). Progeny typically reside in freshwater for two years before migrating to the ocean, but freshwater residence can vary between 1 and 4 years.

The UCR Steelhead DPS was composed of three MPGs before the construction of Grand Coulee Dam. It is currently limited to one MPG and four extant populations; a fifth population in the Crab Creek drainage is believed to be extinct. What remains of the DPS includes all naturally spawned fish in all tributaries accessible to steelhead upstream from the Yakima River in Washington State, to the U.S.-Canada border. The four extant populations are the Wenatchee, Methow, Okanogan, and Entiat. The Proposed Action may affect only the Entiat steelhead population. Six hatchery programs are considered part of the DPS, but none are in the Entiat River.

Critical habitat is designated for UCR steelhead in the Entiat River within the action area (70 FR 52630, September 2, 2005). Critical habitat includes the stream channels within the proposed stream reaches. NMFS reviews the status of critical habitat by examining the condition and trends of PCEs throughout the action area. The action area for this Proposed Action is the Entiat River from RM 28.1 to its confluence with the Columbia River. PCEs consist of the physical and biological elements identified as essential to the conservation of the species. PCEs defined for UCR steelhead in the Entiat River are similar to those described for UCR spring Chinook salmon (Section 2.2.2 above).

Overall, best available information indicates that all four UCR steelhead populations remain at high risk and the DPS as a whole remains at threatened status. Assuming that hatchery-origin and natural-origin spawners are equally effective, productivity is below replacement for all four populations (even at low to moderate spawning levels) and spatial structure and diversity metrics have not improved because the proportion of natural-origin spawners in each population remains

[10] Memorandum from D. Robert Lohn, Regional Administrator, to ESA consultation biologists (guidance on informal consultation and preparation of letters of concurrence) (January 30, 2006).

[11] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered Species Act consultation handbook: procedures for conducting section 7 consultations and conferences. March 1998. Final p.3-12.

[12] UCR steelhead were listed as endangered under the ESA on August 18, 1997 (62 FR 43937, August 18, 1997). On January 5, 2006, NMFS reclassified the UCR steelhead DPS as threatened (71 FR 834, January 5, 2006). On June 13, 2007, UCR steelhead were reinstated to endangered status per a U.S. District Court decision. On June 18, 2009, UCR steelhead were once again listed as threatened by a U.S. District Court decision.

extremely low. The ESA Recovery Plan (UCSRB 2007) calls for each of the four extant populations to reach a risk rating for abundance and productivity of no more than a 5% risk of extinction in 100 years and for a level of spatial structure and diversity that restores the distribution of naturally produced steelhead to previously occupied areas and allows natural patterns of genetic and phenotypic diversity to be expressed. This corresponds to a threshold of at least "viable" status compared to the current status, which falls into the category "high risk" (Figure 3).

Effects of the Proposed Action on the UCR Steelhead DPS are insignificant and/or discountable for all seven factors analyzed by NMFS, individually and cumulatively. Generally speaking, there is little to no co-occurrence or interaction between UCR steelhead and summer Chinook salmon from ENFH. There is no overlap in the spawning and rearing distribution or in adult migration timing and only inconsequential overlap in juvenile migration between the species. Based on years of experience, steelhead are not present in the action area during hatchery broodstock collection and, thus, they are not encountered by the hatchery. UCR steelhead do not spawn or rear in close proximity to the location in the lower river where hatchery fish are released or in proximity to the hatchery facilities themselves, hatchery fish leave the Entiat River soon after release, and hatchery diversions are screened to protect juvenile fish from entrainment and injury as they move through the lower river on their way to the ocean.

The hatchery water diversion and the discharge pose only a negligible effect on designated critical habitat in the action area (Section 2.4.2). Existing hatchery facilities have not contributed to altered channel morphology and stability, reduced and degraded floodplain connectivity, excessive sediment input, or the loss of habitat diversity and no new facilities or changes to existing facilities are proposed. ESA-listed UCR steelhead do not spawn or rear in the vicinity of the water diversion or in that reach of the river between the point of diversion and point of water return. After reviewing the Proposed Action and evaluating the likely physical effects of the facility, NMFS has determined that the Proposed Action will not impair PCEs designated as essential for UCR steelhead spawning, rearing, juvenile migration, and adult migration purposes.

Conclusion

Based on this analysis, NMFS concludes that all effects of the proposed action are not likely to adversely affect UCR steelhead and their designated critical habitat.

Reinitiation

This concludes informal ESA consultation on this action in accordance with 50 CFR 402.14 (b)(1), and MSA consultation in accordance with 50 CFR 600.920 (e)(3). FWS and BOR must reinitiate consultation on this action if new information becomes available, or if circumstances occur that may affect listed species, designated critical habitat, or EFH in a manner, or to an extent, not previously considered.

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.

This analysis is based, in part, on descriptions of EFH for Pacific Coast salmon (PFMC 2003) 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 Proposed Action is the implementation of one hatchery program in the Entiat River, as described in detail in Section 1.3. The action area of the Proposed Action includes habitat described as EFH for Chinook salmon. Because EFH has not been described for steelhead, the analysis is restricted to the effects of the Proposed Action on EFH for Chinook salmon.

The area affected by the Proposed Action includes the Entiat River from RM 18.7 to the confluence of the Entiat and Columbia Rivers (Figure 1).

As described by PFMC (2003):

> "Freshwater EFH for [C]hinook salmon consists of four major components, (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and adult holding habitat."

The aspects of EFH that might be affected by the Proposed Action include effects of hatchery operations on ecological interactions in spawning and rearing areas.

3.2. Adverse Effects on Essential Fish Habitat

The Proposed Action generally does not have effects on the major components of EFH. Spawning and rearing locations and adult holding habitat are not expected to be affected by operation of the program, as no modifications to these areas would occur, and no structures that would impede migration are included or proposed to be constructed. Potential effects on EFH by the Proposed Action are only likely to occur in the migration corridor in the Entiat River downstream from RM 7.2.

As described in Section 2.4.2, water withdrawal for hatchery operations can adversely affect salmon by reducing streamflow, impeding migration, or reducing other stream-dwelling organisms that could serve as prey for juvenile salmonids. Water withdrawals can also kill or injure juvenile salmonids through impingement upon inadequately designed intake screens or by entrainment of juvenile fish into the water diversion structures. The proposed hatchery program includes designs to minimize each of these effects. Criteria for surface water withdrawal are set to avoid impacts on spring Chinook salmon and steelhead spatial structure. Further, the amount of water to be removed will be largely returned to the river approximately 0.5 miles from the point of withdrawal and the intake is screened in compliance with NMFS criteria.

The PFMC (2003) recognized concerns regarding the "genetic and ecological interactions of hatchery and wild fish… [which have] been identified as risk factors for wild populations." The biological opinion describes in considerable detail the impacts hatchery programs might have on natural populations (Section 2.4.1). Hatchery fish returning to the Entiat River are expected to largely spawn and rear near the hatchery and not compete for space with spring Chinook salmon or steelhead. Some summer Chinook from ENFH will stray into other rivers but not in numbers that would cause the carrying capacities of natural production areas to be exceeded, or that would result in increased incidence of disease or increases in predators. Predation by adult hatchery salmon on juvenile natural Chinook salmon would not occur due to timing differences and the fact that adult salmon stop feeding by the time they reach spawning areas, and predation by juvenile offspring of hatchery salmon on juvenile natural-origin Chinook salmon would not occur for reasons discussed in Section 2.4.2. To the extent that hatchery fish from ENFH and from other hatcheries volunteer into ENFH, they will be removed and prevented from returning to the Entiat River in order to reduce adverse ecological and genetic effects on extant Entiat River natural populations.

3.3. Essential Fish Habitat Conservation Recommendations

For each of the potential adverse effects by the Proposed Action on EFH for Chinook salmon, NMFS believes that the Proposed Action, as described in (USFWS 2009) and the ITS (Section 2.8) includes the best approaches to avoid or minimize those adverse effects. The Reasonable and Prudent Measures and Terms and Conditions included in the ITS constitute NMFS recommendations to address potential EFH effects. FWS and BOR shall ensure that the ITS, including Reasonable and Prudent Measures and implementing Terms and Conditions are carried out.

To address the potential effects on EFH of hatchery fish on natural fish in natural spawning and rearing areas, the PFMC (2003) provided an overarching recommendation that hatchery programs:

> "[c]omply with current policies for release of hatchery fish to minimize impacts on native fish populations and their ecosystems and to minimize the percentage of nonlocal hatchery fish spawning in streams containing native stocks of salmonids."

NMFS adopts this recommendation as a specific conservation recommendation for this Proposed Action. The biological opinion explicitly discusses the potential risks of hatchery fish on fish from natural populations and their ecosystems, and describes operation and monitoring appropriate to minimize these risks on Chinook salmon in the Entiat River Basin. In abiding by the Terms and Conditions of the opinion, the NMFS considers the FWS and BOR will be implementing the EFH conservation recommendation.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation from NMFS. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations, unless NMFS and the Federal agency have agreed to use alternative time frame for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that, in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5. Supplemental Consultation

The FWS and BOR 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) ("Data Quality Act") 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, document compliance with the Data Quality Act, and certifies that this opinion has undergone pre-dissemination review.

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. NMFS has determined, through this ESA section 7 consultation, that operation of ENFH as proposed will not jeopardize ESA-listed species and will not destroy or adversely modify designated critical habitat. Therefore, NMFS can issue an ITS. The intended users of this opinion are the FWS and the BOR (funding entity). The scientific community, resource managers, and stakeholders benefit from the consultation through the anticipated increase in returns of salmonids to the Columbia and Entiat Rivers, and through the collection of data indicating the potential effects of the operation on the viability of natural populations of UCR steelhead and Chinook salmon. This information will improve scientific understanding of hatchery-origin Chinook salmon effects that can be applied broadly within the Pacific Northwest area for managing benefits and risks associated with hatchery operations. This opinion will be posted on NMFS' Northwest 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 NMFS 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 supporting documents are clear, concise, complete, and unbiased, and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS 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 supporting documents use the best available information, as described in the references 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, consistent with 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.

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