UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232

May 21, 2019

Dear Recipient:

In accordance with provisions of the National Environmental Policy Act (NEPA), we announce the availability for review of the Draft Environmental Assessment (DEA) for Snake River Basin Hatcheries.

The proposed action is to make Endangered Species Act (ESA) section 4(d) determinations for the 15 hatchery programs for spring and summer Chinook salmon, summer steelhead, and coho salmon to operate in the Snake River Basin.

These programs are operated by the Idaho Department of Fish and Game, the Nez Perce Tribe, and the Shoshone-Bannock Tribes and are funded by the Columbia River Inter-Tribal Fish Commission, the Lower Snake River Compensation Plan, the Idaho Power Company, and the Bonneville Power Administration.

The document is accessible electronically through the National Marine Fisheries Service (NMFS) West Coast Region website at: http://www.westcoast.fisheries.noaa.gov/hatcheries/SRHatcheries/snake16_hatch_rvw.html. Hard copies or CD copies of the document may be obtained from the NMFS Comment Coordinator for this action, Emi Kondo, at the contact information provided below.

Written comments may be submitted to NMFS via electronic mail, physical mail, or fax to the Comment Coordinator during the public comment period (the closing date for the public comment period is noted at the above website). When submitting comments, please include the identifier “Snake River Hatcheries DEA comments” in the subject line or fax cover page.

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Thank you in advance for your input and assistance in finalizing the Environmental Assessment.

Sincerely,

Barry A. Thom
Regional Administrator

Environmental Assessment

Snake River Basin Hatcheries

Snake River Basin

June 2019

Snake River Basin Hatcheries
Draft Environmental Assessment

June 2019

Lead Agency:	National Marine Fisheries Service, West Coast Region National Oceanic and Atmospheric Administration
Responsible Official:	Regional Administrator, West Coast Region National Marine Fisheries Service
Cooperating Agency:	Bonneville Power Administration
DOE document number:	DOE/EA-2083

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Acronym List

BKD	Bacterial kidney disease
BMP	Best Management Practice
BOD	Biochemical oxygen demand
BPA	Bonneville Power Administration
cfs	Cubic feet per second
CRITFC	Columbia River Inter-Tribal Fish Commission
CWT	Coded-wire tag
DPS	Distinct Population Segment
EA	Environmental Assessment
ESA	Endangered Species Act
ESPA	Eastern Snake Plain Aquifer
ESU	Evolutionarily Significant Unit
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FH	Fish hatchery
HCSA	Hells Canyon Settlement Agreement
HGMP	Hatchery Genetics Management Plan
HOR	Hatchery-origin fish
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Technical Recovery Team
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
IHN	Infectious hematopoietic necrosis
IHNV	Infectious hematopoietic necrosis virus
IPAC	Information, Planning, and Consultation System
IPC	Idaho Power Company
ISAB	Independent Scientific Advisory Board
JCAPE	Johnson Creek Artificial Propagation Enhancement
LSRCP	Lower Snake River Compensation Plan
MPG	Major population group
NEPA	National Environmental Policy Act

NFH	National fish hatchery
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
ODFW	Oregon Department of Fish and Wildlife
OHWM	Ordinary high water mark
PBF	Physical and biological feature
PBT	Parentage-based tagging
pHOS	Proportion of hatchery-origin fish on spawning grounds
PIT	Passive Integrated Transponder
PNI	proportionate natural influence
PNOS	proportion of natural-origin spawners
ppm	Parts per million
RM&E	Research, monitoring, and evaluation
SFCEP	South Fork Chinook Salmon Eggbox Project
SOP	Standard operating procedure
SSI	Steelhead Streamside Incubator
TMDL	Total Maximum Daily Load
USBR	U.S. Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WDE	Washington Department of Ecology
WDFW	Washington Department of Fish and Wildlife
WLA	Wasteload Allocation

1 Introduction

The National Marine Fisheries Service (NMFS) is the lead agency responsible for administering the Endangered Species Act (ESA) as it relates to listed salmon and steelhead. Actions that may affect listed species are reviewed by NMFS under section 7, section 10, or section 4(d) of the ESA. Under section 4(d), the Secretary of the Interior issues regulations that are “necessary and advisable to provide for the conservation of such species.” NMFS is considering making determinations under ESA section 4(d) for the continued operation and maintenance of 15 hatchery programs in the Snake River Basin in Idaho. Each program includes the collection and spawning of adult salmon or steelhead, incubation of eggs, and rearing and release of juveniles (or eggs for two programs) as described in Hatchery and Genetic Management Plans (HGMPS). The 4(d) determination would affirm that the programs do not jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Determinations under Section 4(d) have no expiration date. These programs are designed to enhance the propagation and survival of Clearwater River coho salmon (*Oncorhynchus kisutch*), Snake River spring/summer Chinook salmon (*O. tshawytscha*) and Snake River steelhead (*O. mykiss*). The 15 hatchery programs, including facility operations specific to these programs, under consideration and their operators are:

- Clearwater River Coho Salmon (at Dworshak and Kooskia National Fish Hatcheries), Nez Perce Tribe
- South Fork Clearwater (at Clearwater Hatchery) B-run Steelhead, Idaho Department of Fish and Game (IDFG)
- Hells Canyon Snake River A-run Summer Steelhead, IDFG
- Hells Canyon Snake River Spring Chinook Salmon, IDFG
- Little Salmon River A-run Summer Steelhead, IDFG
- Little Salmon River Basin Spring Chinook Salmon (at Rapid River Fish Hatchery), IDFG
- South Fork Salmon River Summer Chinook Salmon, IDFG
- Johnson Creek Artificial Propagation Enhancement (JCAPE) Project (Chinook Salmon), Nez Perce Tribe
- South Fork Chinook Salmon Eggbox Project, Shoshone-Bannock Tribes
- Pahsimeroi A-run Summer Steelhead, IDFG
- Pahsimeroi Summer Chinook Salmon, IDFG
- East Fork Salmon River Natural A-run Steelhead, IDFG
- Salmon River B-run Steelhead, IDFG
- Upper Salmon River Spring Chinook Salmon (at Sawtooth Hatchery), IDFG
- Steelhead Streamside Incubator Project A-run and B-run, Shoshone-Bannock Tribes

The ESA applications submitted to NMFS by IDFG, the Nez Perce Tribe, and the Shoshone-Bannock Tribes include HGMPs that outline the rearing and release of Clearwater River coho salmon, Snake River spring/summer Chinook salmon, and Snake River steelhead using existing facilities. NMFS’s section 4(d) determinations of the HGMPs constitute a Federal action that is subject to analysis as required by the National Environmental Policy Act (NEPA) and is the topic of this environmental assessment (EA) review.

NMFS is choosing to evaluate these programs as the Proposed Action in one NEPA analysis because many overlaps and links exist among the programs. All of the programs would be implemented in the Snake River Basin during the same time and include the same or similar activities that lead to the release of coho salmon, spring/summer Chinook salmon, or steelhead.

The following activities are included in the HGMPs, and are described in more detail in Section 2, Description of Alternatives, of this EA:

- Broodstock collection, including methods and facility operations
- Identification, holding, and spawning of adult fish
- Egg incubation and rearing
- Marking of hatchery-origin juveniles
- Juvenile releases
- Adult management
- Research, monitoring, and evaluation (RM&E) to assess program performance

Bonneville Power Administration (BPA), as a cooperating agency for the development of this EA, has a decision for their portion of the Proposed Action, as described in Chapter 2, as to whether BPA will provide funding to the Nez Perce Tribe for the JCAPE program and the quantity of fish production that would occur with that funding. Prior to making this decision, BPA is required under NEPA to assess the potential environmental effects related to BPA's funding of the program. If, based on the analysis in this EA, BPA determines that these impacts are not significant and adopts the EA, BPA would issue a Finding of No Significant Impact (FONSI). If, however, BPA determines that any of these potential impacts are significant, BPA would proceed with preparation of an Environmental Impact Statement (EIS) for the proposal. At the conclusion of the NEPA process – either issuance of a FONSI or completion of the EIS process – BPA would make its decision on whether to provide the requested funding and at what level.

BPA's funding activities may include the continued operation and maintenance of a temporary adult Chinook salmon trap and weir; adult holding and spawning at the South Fork Salmon River Satellite; egg incubation and juvenile rearing of JCAPE fish at McCall Fish Hatchery; transportation of broodstock, eggs, and smolts between facilities; and the direct release of smolts into Johnson Creek.

To inform these hatchery actions, BPA may fund RM&E activities, such as fish tagging and marking; spawning ground surveys; fish capture, including rotary screw trap collection; and habitat quality, such as water temperature data collection in the South Fork Salmon basin. The hatchery program helps supplement the Johnson Creek summer Chinook salmon population which has low natural abundance and productivity.

1.1 Purpose and Need

NMFS's purpose and need for the Proposed Action is to:

- Evaluate the proposed hatchery programs to make a determination under ESA section 4(d) to ensure the sustainability of Snake River salmon and steelhead by conserving the productivity, abundance, diversity, and distribution of listed species of salmon and steelhead in the Snake River.

BPA needs to respond to the Nez Perce Tribe's request for continued funding for the JCAPE Program and associated operation and maintenance (O&M), monitoring and evaluation (M&E), which includes a requested increase in the annual production and release of summer Chinook salmon juveniles from

100,000 up to 150,000. In meeting BPA's need to take funding action, the alternatives considered should achieve BPA's purposes listed below.

- Support efforts to mitigate for effects of the development and operation of the Federal Columbia River Power System on fish and wildlife in the Columbia River and its tributaries, including the Snake River, under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act) (16 U.S.C. 839 et seq.);
- Implement BPA's Fish and Wildlife Implementation Plan EIS and Record of Decision policy direction, which calls for protecting weak stocks—like the Snake River spring/summer run Chinook salmon—while sustaining overall populations of fish for their economic and cultural values (BPA 2003);
- Minimize harm to natural and human resources, including species listed under the ESA (16 U.S.C. 1531 et seq.).

1.2 Project Area and Study Area

The project area is the geographic area where the Proposed Action would take place. It includes the fish traps and collection sites, hatchery facilities, and release locations as described in the HGMPs (Section 2.1, Alternative 1, No Action). It also includes the broader area where direct and indirect impacts of the program operations could affect environmental and human resources. As such, the project area includes the three subbasins of the Proposed Action: Clearwater River Subbasin, the Hells Canyon reach of the Snake River Basin from the Lower Granite Dam up to Hells Canyon Dam, and the Salmon River Subbasin (Figure 1-1). It also includes the mainstem Snake River downstream from the Hells Canyon reach to Ice Harbor Dam, and areas upstream from Hells Canyon Dam near Oxbow, Hagerman National, Niagara Springs and Magic Valley fish hatcheries (Section 2.1, Alternative 1, No Action).

The study area is the geographic extent that is being evaluated for a particular resource. Although the project area encompasses the full extent of project influence, the study area is specific to the resource being analyzed. For some resources, such as wildlife and human health, the study area is limited to the area immediately surrounding the project facilities where operations could have a direct affect. For other resources, such as salmon and steelhead, project operations could have wider reaching effects. The study area for each resource is described in Section 3, Affected Environment. In addition, a larger study area was defined to consider past, present, and reasonably foreseeable future actions, which with the Proposed Action, could result in cumulative impacts on the human or natural environment. The evaluation of this larger study area for cumulative impacts is described in Section 5, Cumulative Impacts.

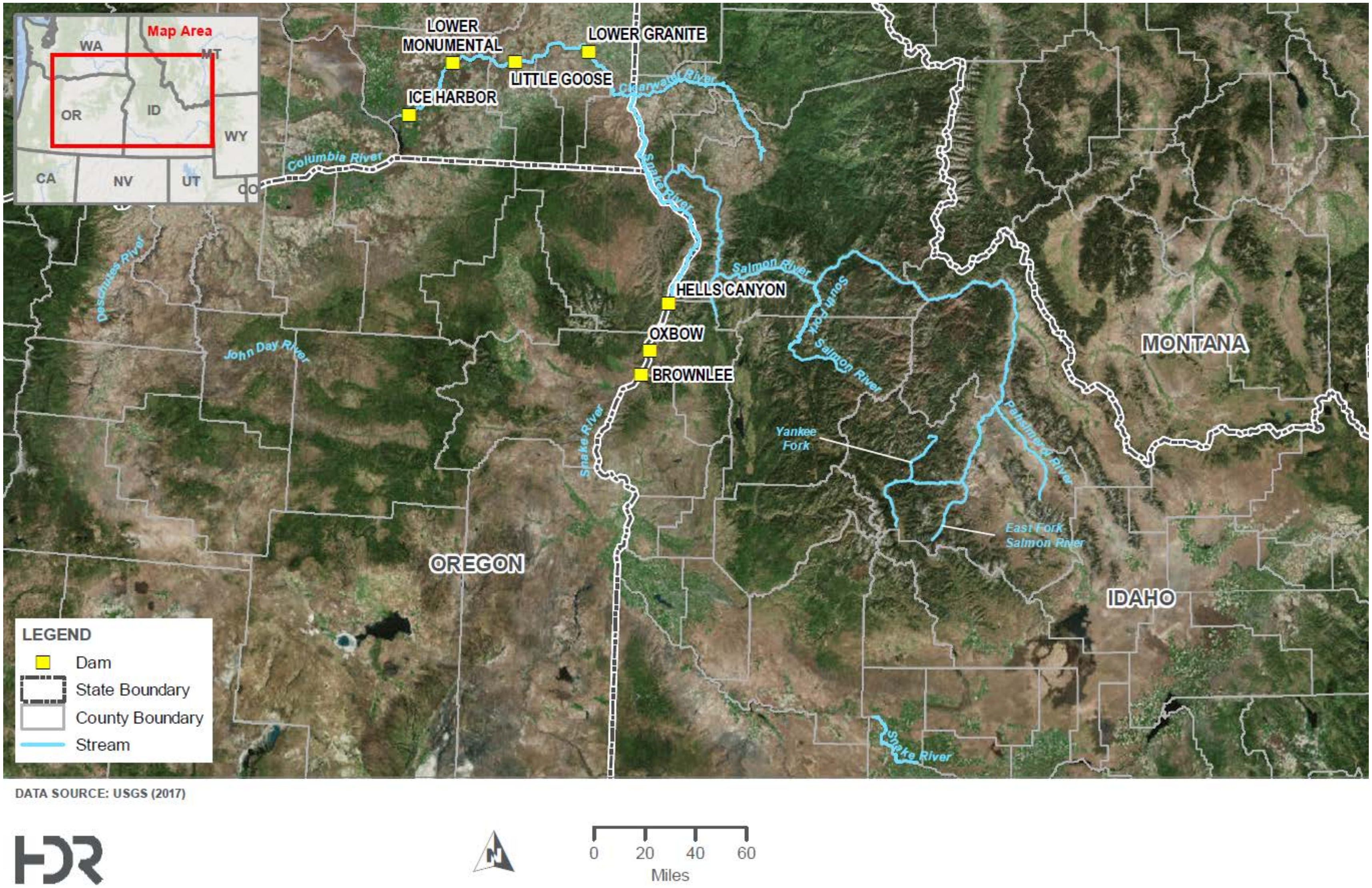


Figure 1-1. Map of Project Area, highlighting the river reaches that are specifically included in this EA.

1.3 Relationship to Other Plans, Regulations, Agreements, Laws, Secretarial Orders, and Executive Orders

1.3.1 Tribal Trust Responsibility under the Endangered Species Act

The United States government has a trust or special relationship with tribes. The unique and distinctive political relationship between the United States and tribes is defined by statutes, executive orders, judicial decisions, and agreements, and differentiates tribes from other entities that deal with, or are affected by the Federal government.

Secretarial Order, *American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the ESA* (Secretarial Order) clarifies the responsibilities of the agencies when actions are taken under the ESA (USFWS and NMFS 1997). Specifically, USFWS and NMFS shall, among other things:

- Work directly with tribes on a government-to-government basis to promote healthy ecosystems
- Recognize that tribal lands are not subject to the same controls as Federal public lands
- Assist tribes in developing and expanding tribal programs so that healthy ecosystems are promoted and conservation restrictions are unnecessary
- Be sensitive to tribal culture, religion, and spirituality

NMFS considers the responsibilities described above when taking ESA actions such as making section 4(d) determinations associated with this EA. Furthermore, NMFS has specified that the statutory goals of the ESA and the federal trust responsibility to Indian tribes are complementary (Terry Garcia, U.S. Department of Commerce, letter sent to Ted Strong, Executive Director, Columbia River Inter-Tribal Fish Commission, July 21, 1998, regarding federal trust responsibility). The federal trust obligation is independent of the statutory duties and informs the way that statutory duties are implemented.

1.3.2 U.S. v. Oregon

The court in *U.S. v. Oregon,* 302 F.Supp. 899 (D. Or. 1968), ruled that state regulatory power over Indian fishing is limited because the 1855 treaties between the United States and the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes preserved the tribes' right to fish at all usual and accustomed places, whether on or off reservation. Because of this decision, fisheries in the Columbia River Basin, including the Snake River Basin, are governed through the Columbia River Fish Management Agreement (Management Agreement; *U.S. v. Oregon* 2018*)*, which was carefully negotiated by the Federal and state governments and the involved treaty Indian tribes. The most recent Management Agreement, entered as a court order in 2018 and set to expire on December 31, 2027, provides the current framework for managing fisheries and hatchery programs in much of the Columbia River Basin. The agreement includes a list of hatchery programs with stipulated production levels, and a list of tribal and non-tribal salmonid fisheries in the Columbia River Basin, including designated off-channel sites that are intended to: (1) ensure fair sharing of harvestable fish between tribal and non-tribal fisheries in accordance with Treaty fishing rights standards and *U.S. v. Oregon*, and (2) be responsive to the needs of ESA-listed species. For more details about the history of the Management Agreement, see the Mitchell Act Final Environmental Impact Statement (FEIS) Subsection 1.7.4, *U.S. v. Oregon* (NMFS 2014a) and the U.S. v. Oregon FEIS Subsection 1.61.1, *U.S. v. Oregon* (NMFS 2017e).

1.3.3 Northwest Power Act/Council's Fish and Wildlife Program

The Northwest Power Act directs BPA to protect, mitigate, and enhance fish and wildlife affected by the development and operation of federal hydroelectric facilities on the Columbia River and its tributaries. To assist in accomplishing this, the Council makes recommendations to BPA concerning which fish and wildlife projects to fund. The Council gives deference to project proposals developed by state and Tribal fishery managers.

As part of its Fish and Wildlife Program, the Council has a three-step process for review of artificial propagation projects (i.e., hatcheries) proposed for BPA funding (Council 2006). Step 1 is conceptual planning, represented primarily by master plan development and approval. The master plan provides the scientific rationale for the activities proposed as part of a fish production program, and presents initial designs for proposed new facilities. Step 2 provides preliminary designs and cost estimates and environmental review. Step 3 is the final design review. The Council's Independent Scientific Review Panel (ISRP) reviews the proposed projects as they move from one stage of the process to the next. The production of the JCAPE Program was reviewed by the Council and approved through the three-step process in 2005.

2 Description of Alternatives

Four alternatives are considered in this EA: (1) No Action, NMFS would not make ESA section 4(d) determinations and BPA would not fund the JCAPE Program, but the programs would be operated as proposed in the HGMPs; (2) Proposed Action, NMFS would make section 4(d) determinations consistent with the HGMPs and the programs would be operated as proposed in the HGMPs. BPA would either fund the JCAPE Program or not fund the JCAPE Program; (3) NMFS would make section 4(d) determinations consistent with the HGMPs, but juvenile releases from all programs would be reduced by 50 percent, and BPA would either (1) fund JCAPE at a level to produce juvenile releases that are reduced by 50 percent of the number outlined in the HGMP or (2) not fund JCAPE; and (4) NMFS would not make ESA section 4(d) determinations, BPA would not fund the JCAPE Program, and the programs would terminate.

2.1 Alternative 1, No Action

Under this alternative, NMFS would not make a 4(d) determination, and BPA would not fund the JCAPE Program. For analysis purposes, NMFS has defined the No Action Alternative as the choice by the applicants to operate the programs as described in the HGMPs because the applicants have been voluntarily improving their programs over the years to include the changes to historic operations that are now found in the HGMPs. Therefore, the No Action Alternative would reflect the HGMP production for the hatchery programs (Table 2-1), as well as for RM&E, and operations and maintenance (Section 2.1.3, Research Monitoring, and Evaluation; Section 2.1.4, Operation and Maintenance).

The hatchery programs, as named in pertinent biological opinions (NMFS 2017a, 2017b, 2017c, 2017d), are described in detail in the following subsections, with some official program names assigned a shorter name (in parentheses) for simplicity:

- Two in the Clearwater River Subbasin (Figure 2-1) and two in the Hells Canyon reach of the Snake River (Figure 2-2):
    - Clearwater River Coho Salmon (at Dworshak and Kooskia National Fish Hatcheries) (Clearwater Coho Salmon)
    - South Fork Clearwater (at Clearwater Hatchery) B-run Steelhead (South Fork Clearwater Steelhead)
    - Hells Canyon Snake River A-run Summer Steelhead
    - Hells Canyon Snake River Spring Chinook Salmon
- Eleven in the Salmon River Subbasin (Figure 2-3):
    - Little Salmon River A-run Summer Steelhead
    - Little Salmon River Basin Spring Chinook Salmon (Little Salmon/Rapid River Spring Chinook Salmon)
    - South Fork Salmon River Summer Chinook Salmon
    - Johnson Creek Artificial Propagation Enhancement (JCAPE) - Summer Chinook Salmon
    - South Fork Chinook Salmon Eggbox Project (SFCEP)
    - Pahsimeroi A-run Summer Steelhead
    - Pahsimeroi Summer Chinook Salmon
    - East Fork Salmon River Natural A-run Steelhead

- o Steelhead Streamside Incubator Project A-run and B-run (SSI)
- o Salmon River B-run Steelhead,
- o Upper Salmon River Spring Chinook Salmon (at Sawtooth Hatchery) (Upper Salmon Spring Chinook Salmon)

The HGMPs collectively describe the management of Clearwater River coho salmon, Snake River spring/summer Chinook salmon, and Snake River steelhead under the 15 described programs (Shoshone-Bannock Tribes and IDFG 2010a, 2010b; IDFG 2011a, 2011b, 2011c, 2011d, 2011e, 2011f, 2015a, 2015b, 2016a, 2016b, 2016c; Nez Perce Tribe 2016, 2017; Shoshone-Bannock Tribes 2016); these programs include several rearing facilities and satellite facilities.

Eleven of the 15 programs included in this EA are currently operated as part of either the Lower Snake River Compensation Plan (LSRCP) or the Hells Canyon Settlement Agreement. (HCSA) (Table 2-1). The LSRCP was authorized by the Water Resources Development Act of 1976 (Public Law 94-587) to mitigate salmon and steelhead losses caused by the construction and operation of the four Lower Snake River dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite) (Figure 1-1). The HCSA is an agreement approved by the Federal Energy Regulatory Commission (FERC) defining mitigation requirements for the Idaho Power Company (IPC) associated with construction and operation of the Hells Canyon Dam Complex (Hells Canyon, Oxbow, and Brownlee dams) (Figure 1-1).

In 2014, NMFS completed the Mitchell Act FEIS to assess Columbia River Basin hatchery operations and funding of the Mitchell Act hatchery programs (NMFS 2014a). The Mitchell Act FEIS analyzed a wide range of hatchery programs throughout the Columbia River Basin, including the programs included in this EA, across a suite of alternatives[1]. These alternatives were related to how hatcheries might be operated

[1] The alternatives in the Mitchell Act FEIS were designed to give consideration to distributing funds in a manner which would have the effect of reducing or minimizing the adverse effects or increasing the benefits of hatchery operations on natural-origin salmon and steelhead populations. The alternatives are varying application of two hatchery performance goals that are either intermediate or stronger than the baseline conditions:

- Alternative 1 – No action; under this alternative, the Columbia River Basin hatchery production would continue as baseline conditions.
- Alternative 2 – No Mitchell Act funding; under this alternative, all Mitchell Act-funded hatchery programs and facilities would be closed. Other programs would operate to intermediate performance goals, and production levels would be reduced for those programs designed to meet mitigation requirements only when those production levels conflicted with the ability of a hatchery program to meet performance goals.
- Alternative 3 – All Hatchery Programs Meet Intermediate Performance Goal; under this alternative, all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations would meet the intermediate performance goal.
- Alternative 4 – Willamette/Lower Columbia River Hatchery Programs Meet Stronger Performance Goal; under this alternative, all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Interior Columbia Recovery Domain would meet the intermediate performance goal, and all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain would meet the stronger performance goal.
- Alternative 5 – Interior Columbia River Hatchery Programs Meet Stronger Performance Goal; under this alternative, all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain would meet the intermediate performance goal, and all hatchery programs in the

to manage effects (negative and positive) on natural salmon and steelhead populations, both ESA-listed and non-listed. Although the Mitchell Act FEIS analyzed the likely comprehensive effects of hatchery production on broad scales, it did not contain site-specific analyses for the programs included in this EA. Where relevant, this EA compares production levels from the 15 included programs to the alternatives analyzed in the Mitchell Act FEIS to inform the analysis of program effects relative to the range of alternatives analyzed in the Mitchell Act FEIS (Table 2-1).

Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Interior Columbia Recovery Domain would meet the stronger performance goal.

- Alternative 6 – All Hatchery Programs Meet Stronger Performance Goal; under this alternative, all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations would meet the stronger performance goal

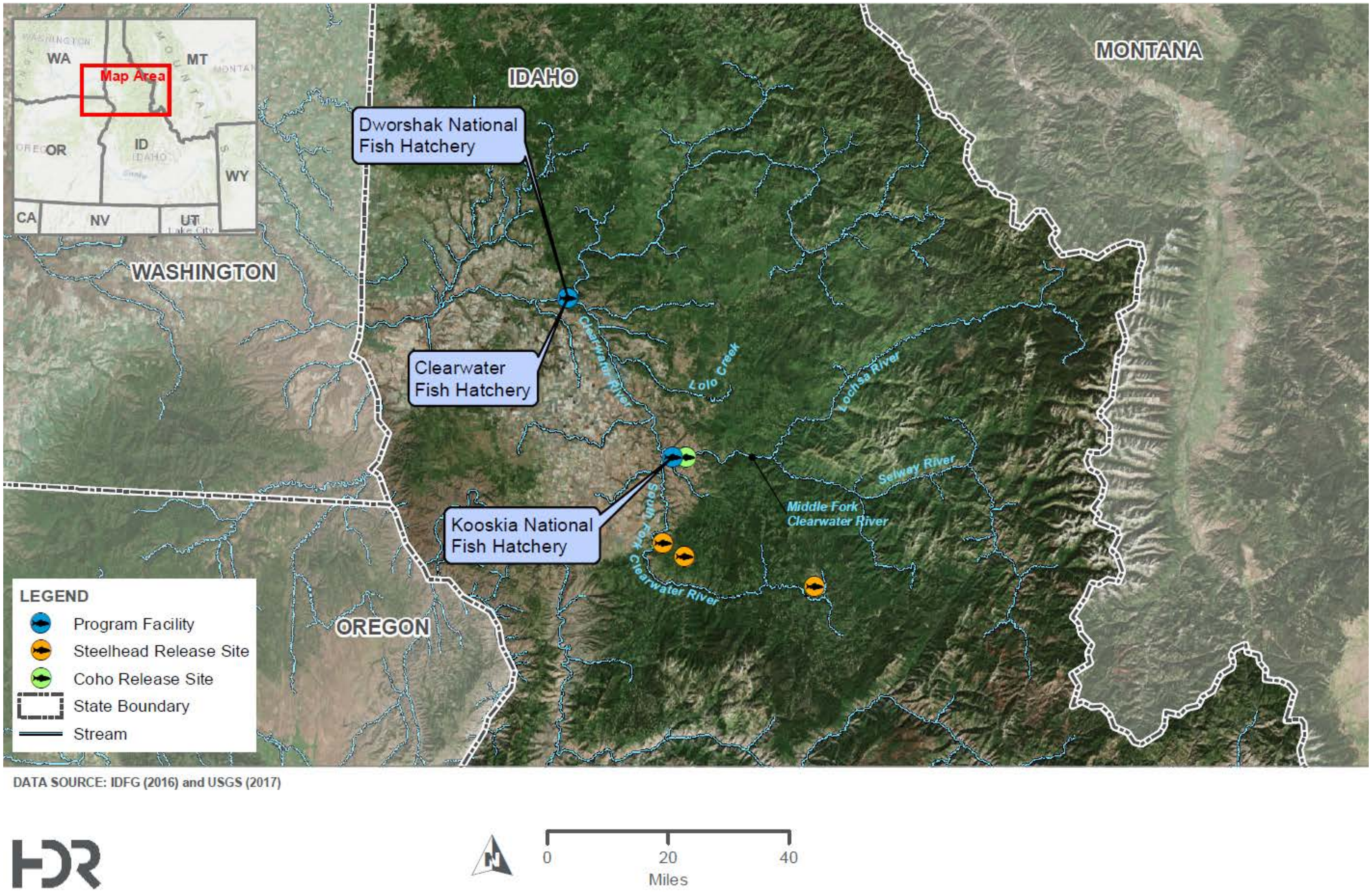


Figure 2-1. Hatchery facilities and release sites for programs in the Clearwater River Subbasin included in this EA.

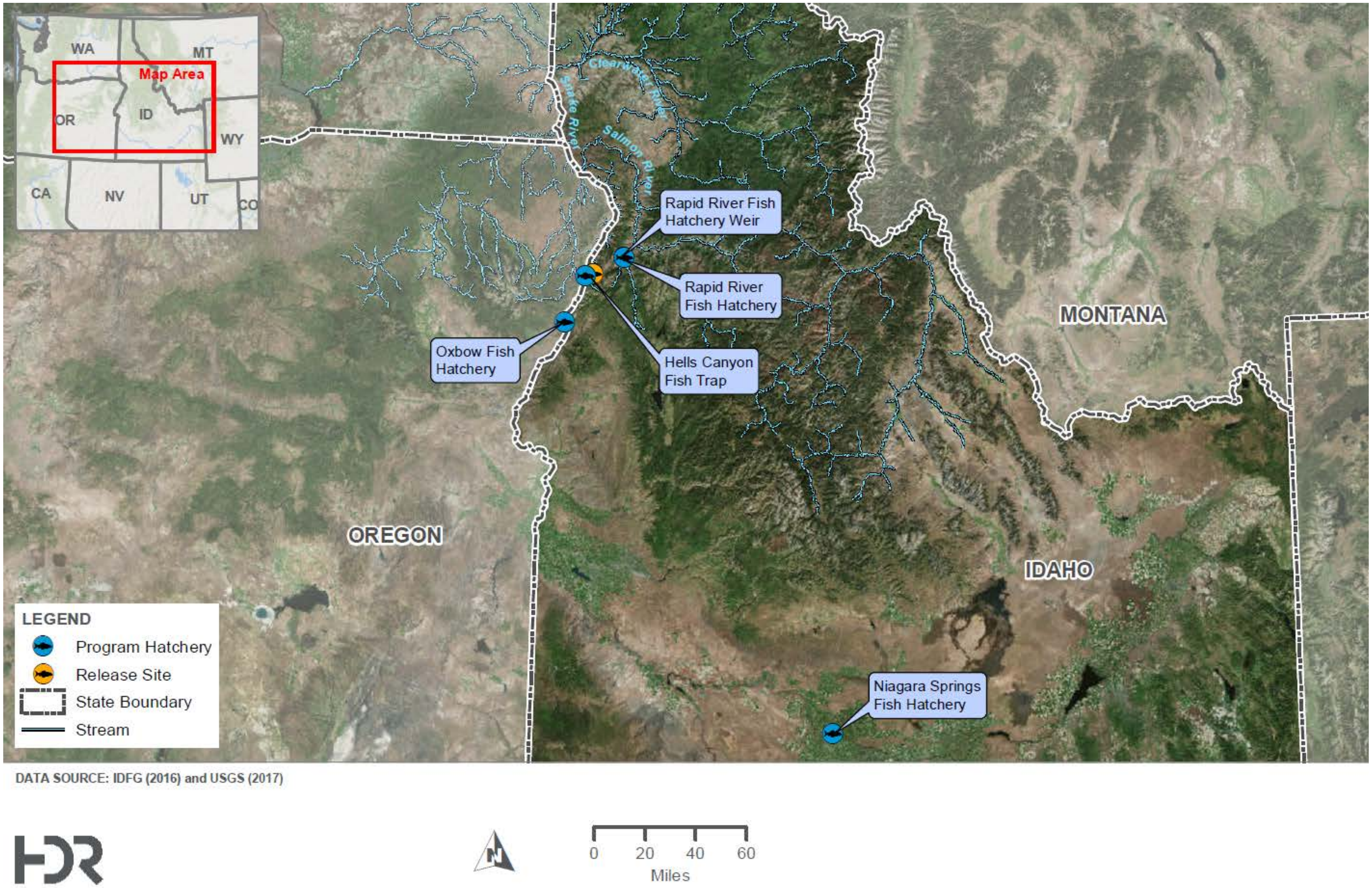


Figure 2-2. Hatchery facilities and release sites for programs in the Hells Canyon Reach of the Snake River included in this EA.

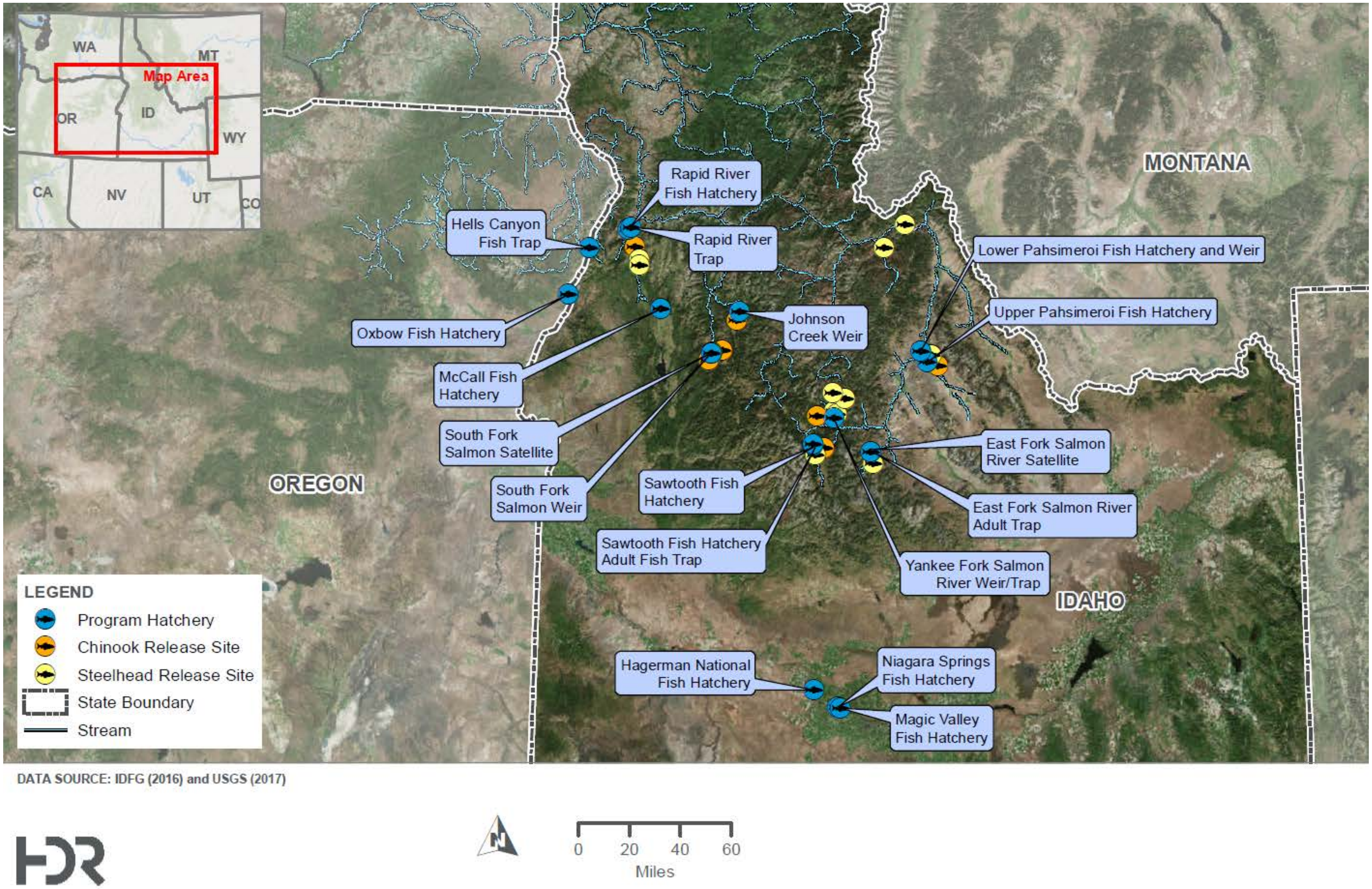


Figure 2-3. Hatchery facilities and release sites for programs in the Salmon River Subbasin included in this EA.

Table 2-1. Smolt and egg releases for the (identical) No Action / Proposed Action alternatives versus releases defined for alternatives in the Mitchell Act FEIS (NMFS 2014a).

Program	Operator	Funding Source[1]	No Action/Proposed Production Level	Life Stage at Release	Relation of Release Numbers under the Proposed Action to those under the Six Mitchell Act FEIS Alternatives
Clearwater River Subbasin					
Clearwater Coho Salmon	Nez Perce Tribe	CRITFC	500,000	Smolts	Between Alternative 2 (0 smolts) and Alternative 1, Alternative 3, Alternative 4, Alternative 5, and Alternative 6 (843,480 smolts)
South Fork Clearwater Steelhead	IDFG	LSRCP	843,000	Smolts	Lower than all alternatives (1,050,344 smolts)
Hells Canyon Reach					
Hells Canyon Snake River A-run Summer Steelhead	IDFG	IPC	550,000	Smolts	Slightly greater than, but similar to all alternatives (525,388 smolts)
Hells Canyon Snake River Spring Chinook Salmon	IDFG	IPC	350,000	Smolts	Greater than all alternatives (299,536 smolts)
Salmon River Subbasin					
Little Salmon River A-run Summer Steelhead	IDFG	LSRCP and IPC	636,000	Smolts	Slightly lower than, but similar to all alternatives (645,044 smolts)
Little Salmon/Rapid River Spring Chinook Salmon	IDFG	IPC	2,650,000	Smolts	Slightly greater than, but similar to all alternatives (2,600,160 smolts)
South Fork Salmon River Summer Chinook Salmon	IDFG	LSRCP	1,000,000	Smolts	Greater than Alternative 2, Alternative 3, and Alternative-4 (223,344 smolts), and similar to Alternative 1, Alternative 5, and Alternative 6 (999,464 smolts)
Johnson Creek Artificial Propagation Enhancement	Nez Perce Tribe	BPA	150,000	Smolts	Greater than all alternatives (101,165 smolts)
South Fork Chinook Salmon Eggbox	Shoshone-Bannock Tribes	Various	300,000	Eyed-eggs	Not applicable
Pahsimeroi A-run Summer Steelhead	IDFG	IPC	800,000	Smolts	Lower than Alternative 1, Alternative 2, Alternative 3, Alternative 4, Alternative 5 (1,009,515 smolts), and Alternative 6 (1,009,720 smolts)
Pahsimeroi Summer Chinook Salmon	IDFG	IPC	1,000,000	Smolts	Greater than Alternative 5 (799,900 smolts) and similar to Alternative 1, Alternative 2, Alternative 3, Alternative 4, and Alternative 6 (999,400 smolts)

Program	Operator	Funding Source[1]	No Action/Proposed Production Level	Life Stage at Release	Relation of Release Numbers under the Proposed Action to those under the Six Mitchell Act FEIS Alternatives
East Fork Salmon River Natural A-run Steelhead	IDFG Shoshone-Bannock Tribes	LSRCP	60,000	Smolts	Between Alternative 2, Alternative 3, and Alternative 4 (0 smolts) and Alternative 1, Alternative 5, and Alternative 6 (180,172 smolts)
Steelhead Streamside Incubator Project A-run and B-run	Shoshone-Bannock Tribes	Various	1,000,000	Eyed-eggs	Not applicable
Salmon River B-run Steelhead	IDFG and Shoshone-Bannock Tribes	LSRCP	1,085,000	Smolts	Between Alternative 6 (1,042,767 smolts) and Alternative 5 (1,339,000 smolts)
Upper Salmon Spring Chinook Salmon	IDFG	LSRCP	1,700,000[3]	Smolts	Between Alternative 5 (1,200,461 smolts) and Alternative 6 (2,099,866 smolts)

[1]CRITFC = Columbia River Inter-Tribal Fish Commission, LSRCP = Lower Snake River Compensation Plan, IPC = Idaho Power Company (through the Hells Canyon Settlement Agreement, BPA = Bonneville Power Administration.

[2]Hatchery managers have agreed to target the release number as specified in the Proposed Action; however, because of the variability in within-hatchery survival, some flexibility is needed. Therefore, the Proposed Action includes juvenile release targets that include a cushion, not to exceed an additional 10 percent of each program's release target, by the hatchery annually, which must be approved by the managers (NMFS 2017a).

[3]An additional 300,000 smolts reared at Sawtooth Fish Hatchery for release into the Yankee Fork Salmon River are included in a separate EA currently being drafted, as Yankee Fork Salmon River releases are part of a different program.

2.1.1 Clearwater Subbasin and Hells Canyon Programs

2.1.1.1 Clearwater Subbasin

Clearwater Coho Salmon

The Nez Perce Tribe initiated a Clearwater River Coho Restoration Project in 1994 to reintroduce coho salmon to the Clearwater River Subbasin[2]. An agreement under U.S. v. Oregon allowed the Nez Perce Tribe to use surplus coho salmon eggs from the Lower Columbia River to reintroduce the species in the Clearwater River Subbasin for supplementation purposes. The release of 500,000 coho salmon smolts at Kooskia National Fish Hatchery on Clear Creek in the Middle Fork Clearwater River watershed is included as part of this action.

Adult collection and spawning occurs at Dworshak National Fish Hatchery (adults may also be collected in Clear Creek, at Kooskia National Fish Hatchery, and at a weir on Lapwai Creek), and incubation and rearing occur at both Dworshak and Kooskia national fish hatcheries (Table 2-2; Figure 2-1). Juvenile fish are acclimated at Kooskia National Fish Hatchery and released as smolts directly into Clear Creek.

South Fork Clearwater Steelhead

The segregated[3] South Fork Clearwater Steelhead program is intended to mitigate for fish losses caused by the construction and operation of the four Lower Snake River Federal dams. In addition to harvest mitigation, approximately 40 percent of the steelhead production at Clearwater Fish Hatchery is dedicated to producing steelhead intended to supplement natural spawners in the Upper South Fork Clearwater River. The total production target is 843,000 localized steelhead smolts released into the South Fork Clearwater River watershed.

Broodstock for this program were historically trapped at Dworshak National Fish Hatchery. As part of the transition to becoming locally adapted, broodstock are now collected by anglers in the South Fork Clearwater River and transported to Dworshak National Fish Hatchery for spawning (Table 2-2). If needed, broodstock are collected at Dworshak National Fish Hatchery. Eyed eggs are transported to Clearwater Fish Hatchery for incubation and rearing. All juvenile fish are transported as smolts to release sites in the South Fork Clearwater River watershed (Table 2-2; Figure 2-1).

2.1.1.2 Hells Canyon

Hells Canyon Snake River A-run Summer Steelhead

The segregated Hells Canyon Snake River A-run Summer Steelhead Program was established to mitigate for anadromous fish losses caused by the construction and continued operation of the Hells Canyon Complex. The release target for the HCSA includes 550,000 smolts released downstream from

[2] While the long-term goal of the program is to include natural-origin broodstock when the natural populations are restored, this program is analyzed as a segregated program at this time because hatchery-origin broodstock will primarily be used for production until the natural populations are restored.

[3] Segregated programs use hatchery-origin fish for broodstock and intend to minimize interbreeding between hatchery stock and the natural population, maintaining high genetic divergence. Integrated programs intend to minimize genetic divergence between the hatchery stock and the natural population with which it is expected to exchange spawners.

Hells Canyon Dam in the mainstem Snake River in March and April. Release levels are slightly higher than those described for all Mitchell Act FEIS alternatives.

Broodstock for the program are collected at the Hells Canyon Fish Trap and transported to Oxbow Fish Hatchery for spawning and incubation (Table 2-2; Figure 2-2). Final egg incubation and juvenile rearing occurs at Niagara Springs Fish Hatchery. Smolts are released within the Hells Canyon reach of the Snake River, downstream of Hells Canyon Dam.

Hells Canyon Snake River Spring Chinook Salmon

The segregated Hells Canyon Snake River Spring Chinook Salmon program was established to mitigate for anadromous fish losses caused by the construction and continued operation of the Hells Canyon Complex. Operations, rearing, smolt releases, and broodstock collection are managed in conjunction with the Little Salmon/Rapid River Spring Chinook Salmon Program at Rapid River Fish Hatchery (Section 2.1.2.1, Little Salmon River). The total production target for the combined program includes 3 million yearling smolts. The portion of the release considered herein is 350,000 smolts released below Hells Canyon Dam in March or April. Release levels are slightly higher than those described for all Mitchell Act FEIS alternatives.

Broodstock for the program are collected at the Rapid River Fish Trap located approximately 1.5 miles downstream from Rapid River Fish Hatchery and at the Hells Canyon Fish Trap (Table 2-2; Figure 2-2). Approximately 88 to 90 percent of the annual broodstock is collected at the Rapid River Fish Trap, and the remaining 10 to 12 percent of the annual broodstock is collected at the Hells Canyon fish trap. The Rapid River Fish Hatchery is located on the Rapid River, a tributary to the Little Salmon River. Adults collected from both sites are managed as a single broodstock. In the rare event that brood needs for Rapid River and Hells Canyon facilities cannot be met, Rapid River and Hells Canyon programs can include excess Clearwater Subbasin fish.

Holding, spawning, and rearing occur at Rapid River Fish Hatchery. However, 1.8 million green eggs between this program and the Little Salmon/Rapid River Spring Chinook Salmon Program are transferred to Oxbow Fish Hatchery for early incubation. These eggs are retuned back to Rapid River Fish Hatchery for incubation. Smolts are released from the Rapid River Fish Hatchery holding ponds and directly into the Snake River downstream of Hells Canyon Dam.

2.1.2 Salmon River Programs

2.1.2.1 Little Salmon River

Little Salmon River A-run Summer Steelhead

The segregated Little Salmon River A-run Summer Steelhead program was established to mitigate for fish losses caused by the construction and continued operation of the Hells Canyon Complex and the four Lower Snake River Federal dams. Under that portion of the program considered in this EA, 636,000 smolts are released in the Little Salmon River.

Broodstock for the program are collected at the Hells Canyon Fish Trap, Lower Pahsimeroi Fish Hatchery, and Dworshak National Fish Hatchery (Table 2-3; Figure 2-3). Early incubation occurs at Clearwater, Oxbow, Sawtooth or Lower Pahsimeroi fish hatcheries. Final egg incubation and juvenile rearing occurs at Niagara Springs and Magic Valley fish hatcheries. Smolts are released into the Little Salmon River in April.

Little Salmon/Rapid River Spring Chinook Salmon

The segregated Little Salmon/Rapid River Spring Chinook Salmon program was established to mitigate for anadromous fish losses caused by the construction and operation of the Hells Canyon Complex. The production goal included in this EA is 2.65 million smolts.

Broodstock for the program are collected at the adult trap located on the Rapid River, downstream of Rapid River Fish Hatchery, and at the Hells Canyon Fish Trap (Table 2-4; Figure 2-2; Figure 2-3). Holding, spawning, and rearing occur at Rapid River Fish Hatchery. However, 1.8 million green eggs between this program and the Hells Canyon program are transferred to Oxbow Fish Hatchery for early incubation. These eggs are returned back to Rapid River Fish Hatchery for incubation. Smolts are released from the Rapid River Fish Hatchery holding ponds and into the Rapid River, Little Salmon River, and Hells Canyon. Of the 2.65 million smolts, the first 2.5 million smolts are released into the Rapid River and release of the remaining 150,000 smolts alternates between Hells Canyon and the Little Salmon River in 100,000 and 50,000 intervals, respectively.

2.1.2.2 South Fork Salmon River

South Fork Salmon River Summer Chinook Salmon

The South Fork Salmon River Summer Chinook Salmon program was established to mitigate for fish losses caused by the construction and operation of the four Lower Snake River Federal dams. The program includes both segregated harvest and integrated conservation components which, combined, release 1 million hatchery-origin yearlings into the South Fork Salmon River. The program is designed to move towards being fully integrated depending on natural origin returns (NORs). However, at low natural-origin escapement levels, these releases include 850,000 fish from the segregated component and 150,000 fish from the integrated component.

The segregated and integrated components of the program are related genetically because a percentage of returning fish from the integrated component are used as broodstock for the segregated component. The number of hatchery and natural-origin adults that are either retained for broodstock (for integrated components) or released to spawn naturally is based on a sliding scale. Under the sliding scale approach, fully implemented in 2014, the size of the integrated smolt program increases with a corresponding increase in the number of NORs to the collection weir (Table 2-5). Therefore, the abundance of NOR Chinook salmon determines the proportion of natural-origin fish retained for broodstock (pNOB) and the numbers of hatchery-origin adults released to spawn naturally (pHOS).

Broodstock for the program are collected at the South Fork Salmon River Satellite, a facility located on the South Fork Salmon River, approximately 71 river miles upstream from the mouth (Table 2-4; Figure 2-3). If the natural-origin returns in a given year are forecasted to be fewer than 50 adults to the satellite, managers contact NMFS prior to initiating broodstock collection.

Fish are held at the South Fork Salmon River Satellite for spawning. Eggs are transferred to McCall Fish Hatchery for incubation and rearing[4].Smolts are released in the South Fork Salmon River at Knox Bridge, approximately 1 mile upstream from the satellite facility.

[4] Broodstock collection at the South Fork Salmon River Weir and the productions at the McCall Fish Hatchery also include the South Fork Salmon River Chinook Salmon Eggbox Program, as discussed below.

Johnson Creek Artificial Propagation Enhancement

The primary goal of the JCAPE program is to use indigenous stock only to provide for the restoration of summer Chinook salmon in Johnson Creek and to mitigate for fish losses occurring as a result of the construction and operation of the four Lower Snake River dams. The program is an integrated recovery program for mitigation and is managed to recover and sustain the population and to provide harvest opportunities in years of abundant returns.

The production target is up to 150,000 smolts (current and historical production targets are, and have been, 100,000 smolts) using natural-origin broodstock collected at a temporary picket weir and trap placed in Johnson Creek, approximately 5.1 miles above the confluence of Johnson Creek and the East Fork of the South Fork of the Salmon River (Table 2-4; Figure 2-3). If natural-origin returns are under 100, then managers consult with NMFS to determine broodstock numbers. Upon collection, adults are transported to and held at the South Fork Salmon Satellite for spawning. Eggs are transferred to McCall Fish Hatchery for incubation and rearing and smolts are released in Johnson Creek at Moose Creek. No additional water or rearing facilities at McCall Fish Hatchery would be required for the increase in JCAPE production. Eggs or fish in excess of hatchery capacity may at times require early release into Upper Johnson Creek.

South Fork Chinook Salmon Eggbox

The SFCEP began in 1997 and uses Chinook salmon production from McCall Fish Hatchery to help maintain, rehabilitate, and enhance Chinook salmon in tributary habitat of the South Fork Salmon River. The program currently uses 300,000 eyed-eggs from the South Fork Salmon River segregated program (see above, South Fork Salmon River Summer Chinook Salmon), but returns permitting, the South Fork Salmon River integrated program may be able to provide eggs to the SFCEP.

The production target includes the release of 300,000 eggs into egg boxes. Eggs are currently placed in six egg boxes in Lower Cabin Creek and six egg boxes in Lower Curtis Creek, with 150,000 eggs per creek; both creeks are tributaries to the South Fork Salmon River, upstream of the South Fork Salmon Satellite and Trap (Table 2-6; Figure 2-3). Adult broodstock are collected at the South Fork Salmon Satellite, and spawning and incubation occur at McCall Fish Hatchery. After hatching, fry volitionally migrate from egg boxes to the stream. Release sites are accessed the following spring to remove the boxes and estimate hatch success.

2.1.2.3 Pahsimeroi River

Pahsimeroi A-run Summer Steelhead

The purpose of the segregated Pahsimeroi A-run Summer Steelhead Program is to mitigate for fish losses caused by the construction and continued operation of the Hells Canyon Complex. Of the smolts produced from broodstock collected at the Lower Pahsimeroi Fish Hatchery, approximately 800,000 are targeted for release in the Pahsimeroi River immediately downstream of the weir and are included in this alternative and Alternative 2.

Broodstock for the program are collected at the Lower Pahsimeroi Fish Hatchery through use of a weir that spans the Pahsimeroi River, and diverts adults through an attraction canal and a fish ladder (Table 2-3; Figure 2-3). If needed, broodstock for this program may also be collected at the Hells Canyon Trap or Sawtooth Fish Hatchery. Egg incubation is conducted at Upper Pahsimeroi Fish Hatchery, and final incubation and rearing are conducted at Niagara Springs Fish Hatchery. Smolts for the program are released directly into the Pahsimeroi River, below the weir. Some production may be used for the Steelhead Streamside Incubator A-run program in Panther Creek (Table 2-6).

Pahsimeroi Summer Chinook Salmon

The purpose of the Pahsimeroi Summer Chinook Salmon Program is to mitigate for anadromous fish losses caused by the construction and operation of the Hells Canyon Dam Complex. The majority of the program is operated as a segregated harvest program; however, a component of the hatchery program includes an integrated conservation program intended to supplement natural spawning above the hatchery weir. Of the 1.0 million smolts released under the program, 65,000 comprise the integrated program and 935,000 smolts are part of the segregated component of the program.

The numbers of integrated hatchery-origin and natural-origin adults that are either retained for broodstock or released to spawn naturally are based on sliding scales. If returns of integrated adults are in excess of integrated broodstock and natural escapement needs, some may be included in the segregated component of the program, based on a sliding scale (Table 2-7).

The abundance of natural-origin returns (NORs) determines the proportion of natural-origin fish retained for broodstock (pNOB) and the number of hatchery-origin adults released to spawn naturally above the weir (pHOS) in both program components. Broodstock for the program are collected at the Lower Pahsimeroi Fish Hatchery through use of the adult weir (Table 2-4; Figure 2-3). Adults are also held and spawned at the Lower Pahsimeroi Fish Hatchery. Incubation and rearing are conducted at the Upper Pahsimeroi Fish Hatchery. Hatchery-origin yearling smolts are volitionally released from two holding ponds at Upper Pahsimeroi Fish Hatchery in late March to mid-April.

2.1.2.4 East Fork Salmon River

East Fork Salmon River Natural A-run Steelhead

The purpose of the integrated East Fork Salmon River Natural A-run Summer Steelhead Program is to increase the abundance of the natural population. It is part of the LSRCP to mitigate for fish losses caused by the construction and operation of the four Lower Snake River Federal dams. This program is operated as an integrated conservation program and releases 60,000 smolts into the East Fork Salmon River.

Broodstock are collected at an adult trapping facility on the East Fork Salmon River, located 18 miles upstream of the river’s mouth (Table 2-3; Figure 2-3). The facility includes a velocity barrier, an associated adult trap and raceways for temporary adult holding. Fish are spawned at the East Fork Salmon River Satellite. Green eggs collected at the satellite facility are transported to Sawtooth Fish Hatchery, located near the headwaters of the Salmon River, approximately 400 miles upstream from the mouth of the Salmon River. At Sawtooth Fish Hatchery, the eggs are incubated to the eyed stage of development. Eyed eggs are then transported to Hagerman National Fish Hatchery, where the remaining incubation and rearing to smolts occurs. Smolts are transported back to the East Fork Salmon River Satellite and released near the adult trap.

2.1.2.5 Upper Salmon River

Salmon River B-run Steelhead

The segregated Salmon River B-run Steelhead Program provides harvest mitigation for fish losses caused by the construction and operation of the four Lower Snake River Federal dams. The management goal for the program is to provide fishing opportunities in the Upper Salmon River for larger B-run type steelhead that return predominantly as age 2 ocean adults. The production goal for the entire Salmon River B-run Steelhead Program is to release approximately 1.085 million smolts annually, which includes

217,000 into the Little Salmon River, 248,000 into the Pahsimeroi River, and 620,000 into the Yankee Fork Salmon River.

Broodstock for the program would eventually be collected from only the Yankee Fork Salmon River, through a combination of angling by Shoshone-Bannock Tribes staff and collection at a temporary or permanent weir. If the permanent weir is built, it will be constructed in conjunction with the Shoshone-Bannock Tribes' Crystal Springs Hatchery Facility (construction of the hatchery or the weir are not part of the proposed action). Presently this is uncertain to occur, so until a consistent number of broodstock can be collected in Yankee Fork to achieve program goals, broodstock are collected in the Yankee Fork Salmon River via angling or at temporary weirs, the Lower Pahsimeroi weir, or sourced at Dworshak National Fish Hatchery (Table 2-3; Figure 2-2; Figure 2-3). Dworshak-origin fish are released in the Pahsimeroi River. Adults are held and spawned at the Lower Pahsimeroi Fish Hatchery, Yankee Fork Trap/Sawtooth Fish Hatchery or Dworshak. Eggs may be incubated to the eyed stage at Clearwater Fish Hatchery or at Sawtooth Fish Hatchery and then transferred to Magic Valley Fish Hatchery for final incubation and rearing. All other incubation and rearing occurs at Magic Valley Fish Hatchery. Release of yearling smolts from Magic Valley Fish Hatchery occurs in the Yankee Fork Salmon River, the Pahsimeroi River immediately downstream of the adult weir, and in the Little Salmon River.

Steelhead Streamside Incubator A-run and B-run

This program consists of eggs from both the Pahsimeroi A-run Summer Steelhead Program (subsection above, Pahsimeroi A-run Summer Steelhead) and the Salmon River B-run Steelhead Program (subsection above, Salmon River B-run Steelhead). The 2018-2027 *U.S. v. Oregon* Management Agreement includes a provision that parties agree on three locations for planting steelhead eyed-eggs in the Salmon River Subbasin, including Indian Creek, Panther Creek, and the Yankee Fork. The resulting SSI program is a conservation program designed as a supplementation program whereby returning hatchery-origin steelhead are collected at Sawtooth and Pahsimeroi fish hatcheries to produce up to 1.0 million eyed-eggs, with 500,000 coming from each hatchery.

Eggs for Indian and Panther creeks are sourced from the Pahsimeroi A-run Summer Steelhead Program. In Indian Creek, two streamside incubators are located approximately 0.6 mile upstream from the confluence with the Salmon River. Four streamside incubators are located at the confluence of Beaver Creek and Panther Creek.

Eggs from the Salmon River B-run Steelhead Program are distributed among streamside incubators in tributaries of the Yankee Fork Salmon River (Table 2-6; Figure 2-3). Eggs incubated in Yankee Fork are sourced from the Lower Pahsimeroi Fish Hatchery (Pahsimeroi A-run) and Dworshak National Fish Hatchery (Salmon River B-run). Two incubators are placed in Yankee Fork Salmon River tributaries. For both components, fry volitionally migrate from egg boxes to the stream after hatching.

Upper Salmon River Spring Chinook Salmon

The purpose of the Upper Salmon River Spring Chinook Salmon Program is to mitigate for fish losses caused by the construction and operation of the four Lower Snake River Federal dams. The program has two components (segregated and integrated) with a genetic linkage between them. A percentage of returning fish from the integrated component is released upstream of the Sawtooth Fish Hatchery to spawn naturally or used as broodstock, based on a sliding scale (Table 2-8). This program is operated as an integrated stepping-stone program, maintaining a large segregated group that continues to address harvest objectives, and an integrated group that is used to supplement spawners upstream of the adult weir.

Four abundance-based production levels are associated with increasing the size of the integrated component of the program (Table 2-9). As the number of smolts produced for the integrated component increases, the number of segregated smolts produced decreases an equivalent amount so that the total production of the program remains the same. The intent is to transition, over the long term as part of the proposed action, into a fully-integrated program, which can be completed once natural production is sufficient to provide the required number of natural-origin brood fish. This transition is likely to take multiple generations (more than 10 years) because it is unlikely that natural populations would improve to such levels quickly.

All broodstock collection, spawning, incubation, and rearing occur at the Sawtooth Fish Hatchery (Table 2-4; Figure 2-3). The program target is to release approximately 1.7 million yearling spring Chinook salmon each year into the Upper Salmon River at the Sawtooth Fish Hatchery. This target includes approximately 1.45 million smolts from the segregated harvest component and 250,000 smolts from the integrated conservation component. Smolts are released into the Salmon River immediately upstream of the hatchery weir. An additional 300,000 smolts reared at Sawtooth Fish Hatchery for release into the Yankee Fork Salmon River are included in a separate EA being drafted, as Yankee Fork Salmon River releases are part of a different program.

2.1.3 Research, Monitoring, and Evaluation

Surveying and sampling to assess program objectives and goals may increase the risk of injury and mortality to salmon and steelhead that are the focus of the actions, or that may be incidentally encountered. RM&E activities discussed in this EA are related directly to the hatchery programs described in this EA (Table 2-10; Table 2-11; Table 2-12). RM&E may include monitoring survival and growth within hatcheries and sampling outside of hatcheries, to assess the effects of hatchery fish on population, productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information may be collected from:

- Spawning ground surveys to assess abundance, distribution, and origin (hatchery or natural) of spawners through marking (i.e., passive integrated transponder (PIT) tags, coded-wire tags [CWT,] and adipose fin-clips)
- Stock composition sampling (genetics, disease) to determine population age, sex, and size distribution
- Juvenile sampling in the hatchery to determine smoltification status, size distribution, and precocial maturation
- Juvenile trapping using screw traps to determine abundance, survival, emigration timing, and size of juveniles
- PIT tagging to track downstream migration of juveniles and provide information on residualism rates of hatchery fish, and to determine emigration timing, population abundance, overwinter survival, and emigration survival of natural-origin fish

2.1.4 Operation and Maintenance

Most hatcheries used for operation of programs included in this EA divert surface water and return it to the diverted waterbody (minus any leakage and evaporation). Magic Valley, Niagara Springs, and Hagerman National fish hatcheries utilize springs or groundwater. Both surface and groundwater used at all facilities are withdrawn in accordance with state-issued water rights. All facilities are being evaluated against the NMFS (2011a) screening and passage criteria. The proposed strategy to determine compliance and prioritize needs is based on entrainment risks and specific compliance concerns.

Modifications and upgrades are based on the prioritized list and acted upon as funding becomes available.

For additional information regarding facility water sources for each program, refer to Section 3.1, Water Quantity, and Section 3.2, Water Quality, of this EA, and to the Biological Opinions recently issued for each program (NMFS 2017a, 2017b, 2017c, 2017d). Programs that rear over 20,000 pounds of fish annually operate under applicable National Pollutant Discharge Elimination System (NPDES) general permits.

Several routine (and semi-routine) maintenance activities occur in or near water that could impact fish in the area including sediment/gravel removal/relocation from intake and/or outfall structures, pond cleaning, pump maintenance, debris removal from intake and outfall structures, and maintenance and stabilization of existing bank protection. All in-water maintenance activities considered “routine” (occurring on an annual basis) or “semi-routine” (occurring with regularity, but not necessarily on an annual basis) occur within existing structures or the footprint of areas that have already been impacted. When maintenance activities occur within water, they are implemented under the following conditions:

- In-water work:
    - Is done during the allowable freshwater work times established for each location, or complies with an approved variance of the allowable freshwater work times with IDFG, NMFS, and USFWS
    - Follows a pollution and erosion control plan that addresses equipment and materials storage sites, fueling operations, staging areas, cement mortars and bonding agents, hazardous materials, spill containment and notification, and debris management
    - Ceases if fish are observed in distress at any time as a result of the activities
    - Includes notification of NMFS staff
    - Is conducted using equipment retrofitted with vegetable-based synthetic fuel oil
- Equipment:
    - Is inspected daily, and is free of leaks before leaving the vehicle staging area
    - Works above OHWM or in the dry whenever possible
    - Is sized correctly for the work to be performed and has approved oils/lubricants when working below the OHWM
    - Is staged and fueled in appropriate areas 150 feet from any waterbody
    - Is cleaned and free of vegetation before it is brought to the site and prior to removal from the project area

Table 2-2. Overview of operations for the Clearwater River Subbasin and the Hells Canyon Reach of the Snake River.

Parameter	**Clearwater River Subbasin**		**Hells Canyon Reach**	
	Clearwater Coho Salmon	**South Fork Clearwater Steelhead**	**Hells Canyon Snake River A-run Summer Steelhead**	**Hells Canyon Snake River Spring Chinook Salmon**
Adults				
Component and Purpose	Reintroduction and supplementation	Segregated harvest[1]	Segregated harvest	Segregated harvest
Broodstock number and type (HOR vs. NOR)[2]	1,200 HORs	386 HORs	750 HORs	400 HORs
Collection location[3]	Dworshak NFH; Kooskia NFH; Clear Creek Weir Lapwai Creek Weir	SF Clearwater River angling; Dworshak NFH	Hells Canyon Trap	Hells Canyon Trap; Rapid River Trap
Collection timing	Oct-Dec	Feb-Mar	Oct-Nov; Mar-Apr	Apr-Aug
Adult holding location	Dworshak NFH; Kooskia NFH	Dworshak NFH	Oxbow FH	Rapid River FH
Adult spawning location	Dworshak NFH	Dworshak NFH	Oxbow FH	Rapid River FH
Incubation, Rearing, and Release				
Incubation location	Dworshak NFH; Kooskia NFH	Dworshak NFH; Clearwater FH	Oxbow FH Niagara Springs FH	Rapid River FH (early incubation may occur at Oxbow FH)
Rearing location	Dworshak NFH; Kooskia NFH	Clearwater FH	Niagara Springs FH	Rapid River FH
Acclimation location	Kooskia NFH	None	None	None
Release locations	Clear Creek	SF Clearwater River (Red House Hole) Meadow Creek Newsome Creek	Snake River at Hells Canyon	Snake River at Hells Canyon
Release timing	April-May	April	March-April	March or April
Release number	500,000	843,000	550,000	350,000
Marks[4]	CWT = 16%-50% (range depends on funding) PBT = 100%	Adipose fin clip=60% CWT=40% PBT=100% PIT=17,000	Adipose fin clip=100% PBT=100% PIT=8,600	Adipose fin clip=100% PBT=100%

Parameter	Clearwater River Subbasin		Hells Canyon Reach	
	Clearwater Coho Salmon	South Fork Clearwater Steelhead	Hells Canyon Snake River A-run Summer Steelhead	Hells Canyon Snake River Spring Chinook Salmon
Other				
Maximum surface water (or ground/spring water if noted) use by facility (cfs)	Dworshak NFH = 182[5] Kooskia NFH = 16	Dworshak National FH = 120 Clearwater FH = 89	Oxbow FH = 15.5 Niagara Springs FH = 120[6]	Rapid River FH = 34 avg, 46.6 maximum Rapid River trap = 18 max
Adult management goal[7]	pNOB = 0	Hatchery-origin straying of known program origin to be no more than 5% of returns to a non-target population targeted for viability or high viability[8]		pHOS = 0 pNOB = 0
Method of adult management	--	Segregated, all fish marked; Excess released for harvest, provided to Tribes or food banks, or disposed	Segregated, all fish marked; Excess provided to Tribes or food banks, transported to non-anadromous waters for fisheries, or used for nutrient enhancement	Segregated, all fish marked; Continue PBT monitoring to better understand population level pHOS; Excess transported for fisheries, given to Tribes, or used for nutrient enhancement
Within basin targeted fisheries	Yes	Yes	Yes	Yes

[1]The South Fork Clearwater Steelhead program could also have some conservation benefit to natural populations because propagated fish contain what is remaining of the genetic material from the North Fork Clearwater population, which has been extirpated (Lance Hebdon, IDFG, pers. Comm.).

[2]HOR = hatchery-origin returns, NOR = natural-origin returns;

[3]NFH = National fish hatchery, FH = fish hatchery,

[4]CWT = coded-wire tag, PBT = parentage-based tagging, PIT = passive integrated transponders

[5]Up to 154 cfs is from the North Fork Clearwater River. The remainder of up to 28 cfs is sourced from Dworshak Reservoir.

[6]Niagara Springs Fish Hatchery utilizes ground/spring water

[7]pHOS = Percent hatchery-origin fish on the spawning grounds, pNOB = percent natural-origin fish in broodstock. Information on the proportion of hatchery- and natural-origin spawners on natural spawning grounds for steelhead is limited; applicants remove hatchery-origin fish from the wild to the extent possible.

[8]These goals work in conjunction with the goals of steelhead programs described in Table 2-3.

Table 2-3. Overview of operations for Salmon River steelhead programs.

Parameter	Little Salmon River A-run Summer Steelhead	Pahsimeroi A-run Summer Steelhead	Salmon River B-run Steelhead[1]	East Fork Salmon River Natural A-run Steelhead
Adults				
Component and Purpose	Segregated harvest	Segregated harvest	Segregated harvest	Integrated recovery
Broodstock number and type (HOR vs. NOR)[2]	Not Applicable	912 HORs	694 HORs	28 NORs (managed on sliding scale)
Collection location[3]	Hells Canyon Trap; Lower Pahsimeroi FH; Dworshak NFH (receives juveniles from Pahsimeroi and Hells Canyon – no additional brood collected)	Primary: Lower Pahsimeroi FH Secondary: Hells Canyon and Sawtooth FH	Lower Pahsimeroi FH; Yankee Fork Weir; Dworshak NFH	EF Salmon Satellite
Collection timing	Hells Canyon = Oct-Nov; Mar-Apr Lower Pahsimeroi = Feb-May Dworshak = Oct-Apr	Feb-May	Lower Pahsimeroi and Dworshak =Feb-Apr; Yankee Fork = Apr-May	Mar-May
Adult holding location	Oxbow FH; Lower Pahsimeroi FH Dworshak NFH	Lower Pahsimeroi FH	Lower Pahsimeroi FH; Yankee Fork Trap/Sawtooth FH[4]; Dworshak NFH	EF Salmon Satellite
Adult spawning location	Oxbow FH; Lower Pahsimeroi FH Dworshak NFH	Lower Pahsimeroi FH	Lower Pahsimeroi FH; Sawtooth FH; Dworshak NFH	EF Salmon Satellite
Incubation, Rearing, and Release				
Incubation location	Clearwater FH Oxbow FH; Sawtooth FH; Lower Pahsimeroi FH	Upper Pahsimeroi FH; Niagara Springs FH	Clearwater FH; Magic Valley FH; Sawtooth FH	Sawtooth FH; Hagerman NFH
Rearing location	Niagara Springs FH; Magic Valley FH	Niagara Springs FH	Magic Valley FH	Hagerman NFH
Acclimation location	None	None	None	None
Release locations	Little Salmon River	Lower Pahsimeroi FH	Little Salmon River Lower Pahsimeroi FH; Yankee Fork	EF Salmon Satellite

Parameter	Little Salmon River A-run Summer Steelhead	Pahsimeroi A-run Summer Steelhead	Salmon River B-run Steelhead[1]	East Fork Salmon River Natural A-run Steelhead
Release timing	April	April	April-May	Early May
Release number	636,000	800,000	1,085,000	60,000
Marks[5]	Adipose fin clip = 100% PBT=100% PIT = 7,300	Adipose fin clip = 100% PBT=100% PIT = 9,000	CWT=468,000 Adipose fin clip = 617,000 PBT = 100% PIT = 26,900	CWT=100% PBT=100% PIT = 8,600
Other				
Maximum surface water (or ground/spring water if noted) use by facility (cfs)	Lower Pahsimeroi FH = 40 Magic Valley = 87.2[6] Hells Canyon = 130 Dworshak = 182[7] Clearwater = 89	Lower Pahsimeroi FH = 40 Upper Pahsimeroi FH = 20 Sawtooth FH = 60	Lower Pahsimeroi FH = 40 Sawtooth FH = 60 Magic Valley FH = 87.2[6]	EF Salmon Satellite = 15 Sawtooth FH = 60 Hagerman NFH = 84.6[6]
Adult management goal[8]	Hatchery-origin straying of known program origin to be no more than 5% of returns to a non-target population targeted for viability or high viability[9]			Average PNI ≥ 0.4 (until 2021); ≥ 0.5 (after 2021)
Method of Adult Management	Segregated – 100% marked; Excess provided to Tribes or food banks, transported to non-anadromous waters for fisheries, or used for nutrient enhancement	Segregated – 100% marked; Excess provided to Tribes or food banks, transported to non-anadromous waters for fisheries, or used for nutrient enhancement	Segregated – some marked; Excess provided to Tribes or food banks, transported to Yankee Fork for tribal fishery, or used for nutrient enhancement	None warranted due to low estimated population abundance; Excess released upstream for natural production; strays used for nutrient enhancement
Within basin targeted fisheries	Yes	Yes	Yes	No

[1]The Salmon River B-run Steelhead program could also have some conservation benefit to natural populations because propagated fish contain what is remaining of the genetic material from the North Fork Clearwater population, which has been extirpated, and because it may also be re-introducing the B-run life history type into the Upper Salmon Basin (Lance Hebdon, IDFG, pers. Comm.).

[2]HOR = hatchery-origin returns, NOR = natural-origin returns

[3]FH = fish hatchery, NFH = National fish hatchery

[4]Adults collected at the Yankee Fork Trap are currently transported to Sawtooth FH for holding and spawning.

[5]CWT = coded-wire tag, PBT = parentage-based tagging, and PIT = passive integrated transponder; some Salmon River B-run steelhead receive both CWT and an adipose fin clip.

[6]Magic Valley and Hagerman National fish hatcheries utilize ground/spring water.

[7] Up to 154 cfs is from the North Fork Clearwater River. The remainder of up to 28 cfs is sourced from the Dworshak Reservoir.

[8]PNI = proportionate natural influence. Information on the proportion of hatchery- and natural-origin spawners on natural spawning grounds for steelhead is limited; applicants remove hatchery-origin fish from the wild to the extent possible.

[9]These goals work in conjunction with the goals of steelhead programs described in Table 2-2.

1 Table 2-4. Overview of operations for Salmon River Chinook salmon programs.

Parameter	Little Salmon/Rapid River Spring Chinook Salmon	South Fork Salmon River Summer Chinook Salmon	Johnson Creek Artificial Propagation Enhancement	Pahsimeroi Summer Chinook Salmon	Upper Salmon Spring Chinook Salmon
Adults					
Component and Purpose	Segregated harvest	Segregated – harvest, Integrated conservation	Integrated recovery	Segregated – harvest, Integrated conservation	Segregated – harvest, Integrated conservation
Broodstock number and type (HOR vs. NOR)[1]	2,096 HORs	Segregated: 678 HORs Integrated: up to 104 NORs (total brood), with balance HORs, number managed on sliding scale	Up to 104 NORs (total brood), with balance HORs, (number managed on sliding scale)	Segregated: 704 HORs Integrated: up to 42 NORs (total brood), with balance HORs, number managed on sliding scale	Segregated: 1,018 HORs Integrated: up to 80 NORs (total brood), with balance HORs, number managed on sliding scale
Collection location[2]	Rapid River FH and Hells Canyon Dam traps	South Fork Salmon Weir	Johnson Creek Weir	Lower Pahsimeroi Weir	Sawtooth Hatchery Weir
Collection timing	Late-April – August	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep
Adult holding location	Rapid River FH	South Fork Salmon Satellite	South Fork Salmon Satellite	Lower Pahsimeroi FH	Sawtooth Hatchery
Adult spawning location	Rapid River FH	South Fork Salmon Satellite	South Fork Salmon Satellite	Lower Pahsimeroi FH	Sawtooth Hatchery
Incubation, Rearing, and Release					
Incubation location	Rapid River and Oxbow FH	McCall FH	McCall FH	Upper Pahsimeroi FH	Sawtooth Hatchery
Rearing location	Rapid River FH	McCall FH	McCall FH	Upper Pahsimeroi FH	Sawtooth Hatchery
Acclimation location	Yes for Rapid River, none for Little Salmon River	None	None	Upper Pahsimeroi FH	Sawtooth Hatchery
Release locations	Rapid River and Little Salmon River	South Fork Salmon River at Knox Bridge	Johnson Creek at Moose Creek	Upper Pahsimeroi FH	Sawtooth Hatchery
Release timing	Mid-March	March-April	Late March-early April	March-April	March-April
Release number[3]	Up to 2.5 million into Rapid River and 150,000 in Hells Canyon and Little Salmon River	Segregated = 850,000 Integrated = 150,000	Up to 150,000	Segregated = 935,000 Integrated = 65,000	Segregated = 1,450,000 Integrated = 250,000

Parameter	Little Salmon/Rapid River Spring Chinook Salmon	South Fork Salmon River Summer Chinook Salmon	Johnson Creek Artificial Propagation Enhancement	Pahsimeroi Summer Chinook Salmon	Upper Salmon Spring Chinook Salmon
Marks[4, 5]	Adipose fin clip =100% PBT = 100% CWT = 120,000	Segregated: Adipose fin clip = 100% PBT = 100% CWT/PIT = some Integrated: CWT = 100% PIT = some	PBT = 100% CWT = 100% PIT = some	Segregated: Adipose fin clip =100% Integrated: CWT =100%	PBT = 100%; Segregated: Adipose fin clip = 100%CWT/PIT = some Integrated: CWT = 100% PIT = some
Other					
Maximum surface water use by facility (cfs)	Rapid River FH = 34 avg, 46.6 max (hatchery); trap = 18 max	South Fork Salmon Satellite = 9.2 avg, 20 max; McCall FH = 20	McCall FH = 20	Lower Pahsimeroi FH = 40 Upper Pahsimeroi FH = 20	Sawtooth FH = 60
Adult management goal[6]	pHOS = 0	pHOS value can range from 0 to 1.0 depending on NORs and according to the sliding scale management scheme Integrated pNOB = up to 90%	pHOS: Five year average (2011 to 2015) = 0.45 Future estimates = 0.45 pNOB goal = 100%	pHOS varies by natural-origin abundance (sliding scale management) with recent (2014-2016) values less than 0.41 Segregated pHOS and pNOB = 0 Integrated pNOB = up to 100%	pHOS varies by natural-origin abundance (sliding scale management) with recent (2014-2016) values less than 0.71 Segregated pHOS and pNOB = 0 Integrated pNOB = up to 100%

Parameter	Little Salmon/Rapid River Spring Chinook Salmon	South Fork Salmon River Summer Chinook Salmon	Johnson Creek Artificial Propagation Enhancement	Pahsimeroi Summer Chinook Salmon	Upper Salmon Spring Chinook Salmon
Method of adult management	Segregated, marked; Excess are recycled through fishery, given to tribes or charities, or used for nutrient enhancement	Continue sliding scale management of broodstock collection and passage above satellite (no immediate need to reduce pHOS) Segregated = all smolts adipose fin clipped Integrated = no external marking; Excess integrated and segregated are recycled through fishery, given to tribes or charities, transported to create fisheries, used to supplement natural spawning, or used for nutrient enhancement	PNI values are over 0.67; continue program operations (no immediate need to reduce pHOS)	Use of adult weir to implement sliding scale management of pHOS Segregated = all smolts adipose fin clipped Integrated = CWT; Excess segregated are recycled through fishery, given to tribes or charities, or used for nutrient enhancement	Use of adult weir to implement sliding scale management of pHOS Segregated = all smolts adipose fin clipped Integrated = CWT; Excess integrated and segregated are used to supplement natural production in the Yankee Fork, recycled through fishery, given to tribes or charities, or used for nutrient enhancement
Within basin targeted fisheries	Yes	Segregated = yes; Mainstem and South Fork Salmon marked-selective fisheries	No	Segregated = yes Mainstem and Upper Salmon marked-selective fisheries	Segregated = yes; Mainstem and Upper Salmon marked-selective non-tribal fisheries; Non-selective tribal fisheries

[1]HOR = hatchery-origin returns, NOR = natural-origin returns;

[2]FH = fish hatchery

[3]The size of each program component (integrated vs. segregated) varies based on the number of NORs from limited to full integration as presented in Table 2-5, and Table 2-9.

[4]CWT = coded-wire tag, PBT = parentage-based tagging, PIT = passive integrated transponder

[5] The number of smolts to be marked via adipose fin clip or CWT varies annually for each program that has both segregated and integrated components, based upon sliding scale and resulting size of integrated vs. segregated smolt program. All integrated smolts will be CWT; fish may be given adipose fin clips as integrated programs increase in size. All segregated smolts will be adipose fin clipped, but some may also be CWT when the size of the integrated program is low.

[6]pHOS = % hatchery-origin fish on the spawning grounds, pNOB = % natural-origin fish in broodstock; PNI = proportionate natural influence.

Table 2-5. Sliding scale of natural origin abundance for South Fork Salmon River summer Chinook salmon used to determine size of integrated program.

Project NOR[1] to Satellite	Size of Integrated Program
<700	150,000
700-999	250,000
1,000-1,299	500,000
>1,300	1,000,000

Source: NMFS 2017a
[1]NOR = Natural-origin returns

Table 2-6. Overview of operations for South Fork Chinook Eggbox and Steelhead Streamside Incubator A-run and B-run projects.

Parameter	South Fork Chinook Salmon Eggbox	Steelhead Streamside Incubator A-run and B-run		
		Indian Creek	Panther Creek	Yankee Fork
Adults				
Component and purpose	Segregated recovery	Conservation and supplementation		
Broodstock number[1]	NA – eggs sourced from McCall FH; (use of NOR dependent on sliding scale for South Fork Salmon Summer Chinook salmon program)	NA – eggs for Indian and Panther creeks sourced from other programs		
Collection location[2]	South Fork Salmon Satellite	Lower Pahsimeroi FH (Pahsimeroi A-run)		Lower Pahsimeroi FH; Dworshak NFH (Salmon River B-run)
Collection timing	Jun-Sep	Feb-May	Feb-May	Feb-May
Adult holding location	South Fork Salmon Satellite	Lower Pahsimeroi FH		Sawtooth FH; Pahsimeroi FH; Dworshak NFH
Adult spawning location	South Fork Salmon Satellite	Lower Pahsimeroi FH		
Incubation, Rearing, and Release				
Incubation location	McCall FH; Cabin Creek; Curtis Creek	Upper Pahsimeroi FH; Indian Creek	Upper Pahsimeroi FH; Panther Creek	Sawtooth FH; Yankee Fork Salmon River
Rearing location	Cabin Creek; Curtis Creek	Indian Creek	Panther Creek	Yankee Fork Salmon River
Acclimation location	Cabin Creek; Curtis Creek	Indian Creek	Panther Creek	Yankee Fork Salmon River
Release locations	Cabin Creek; Curtis Creek	Indian Creek	Panther Creek	Yankee Fork Salmon River
Release timing	September-October	May-July	May-July	May-July
Release number (eggs)	300,000	100,000	400,000	500,000
Marks[3]	100% PBT	100% PBT	100% PBT	100% PBT
Other				
Maximum surface water use by facility (cfs)	NA (in-river boxes)	0.042 cfs	0.084 cfs	0.105 cfs

Parameter	South Fork Chinook Salmon Eggbox	Steelhead Streamside Incubator A-run and B-run		
		Indian Creek	Panther Creek	Yankee Fork
Goal: pHOS and/or pNOB[4]	see Table 2-4 for South Fork Salmon River Summer Chinook Salmon Program	NA	NA	NA
Method of Adult Management	NA	NA	NA	NA
Within basin targeted fisheries	Selective or Non-selective tribal fisheries	Non-selective tribal fisheries	Non-selective tribal fisheries	Non-selective tribal fisheries

[1]Broodstock for South Fork Salmon Chinook Salmon Eggbox program included in the number collected for the South Fork Salmon Summer Chinook Salmon program; broodstock for Indian and Beaver creeks included in the number collected for the Pahsimeroi A-run Summer Steelhead program; broodstock for Yankee Fork included in the number collected for the Salmon River B-run Steelhead program.

[2]FH = fish hatchery

[3]PBT = parentage-based tagging

[4]pHOS = % hatchery-origin fish on the spawning grounds, pNOB = % natural-origin fish in broodstock

Table 2-7. Sliding scale broodstock and weir management for integrated program component of Pahsimeroi Summer Chinook Salmon program.

Escapement of NOR[1] to Pahsimeroi Weir	Number of NORs Released Above Weir	Number of NOR Broodstock	Maximum Percent of NOR Held for Broodstock	Minimum pNOB[1]	Maximum Percent pHOS[1] Above Weir
50-124	35-87	15-37	30	0.35	Not Applicable
125-249	88-208	38-41	30	0.90	0.70
250-499	209-458	41	30	1.00	0.30
500-999	459-958	41	20	1.00	0.25
>1000	>958	41	20	1.00	0.25

[1]NOR = Natural-origin returns, pHOS = % hatchery-origin fish on the spawning grounds, pNOB = % natural-origin fish in broodstock

Table 2-8. Sliding scale broodstock and weir management for the Upper Salmon River Spring Chinook Salmon program.

NOR[1] to Weir		NOR Released Above Weir[2]		Number of NOR Held for Brood		Maximum Percent of NOR Retained for Brood	Maximum pHOS[1] upstream of weir
Low	High	Low	High	Low	High		
50	249	30	149	20	100	40.0%	NA
250	499	150	368	100	131	40.0%	0.75
500	699	369	568	131	131	40.0%	0.45
700	999	569	868	131	131	40.0%	0.45
1,000	1,299	790	1,089	210	210	40.0%	0.35
1,300	1,599	881	1,180	419	419	40.0%	0.35
1,600	2,000	866	1266	734	734	50.0%	0.35

[1]NOR = Natural-origin return, pHOS = proportion of hatchery-origin spawners

[2]A minimum of 300 adults would be released upstream to spawn naturally. If there are insufficient natural-origin and integrated hatchery-origin adults to meet this minimum, segregated adults may be released upstream of the weir.

Table 2-9. Sliding scale of natural-origin abundance at the Sawtooth Weir used to determine the size of the Upper Salmon River Spring Chinook Salmon integrated component.

Projected NOR[1] Return to Weir (Jacks Excluded)	Size of Integrated Smolt Program	Targeted pNOB[1]	Minimum Percent of Segregated Brood composed of integrated Adults	Maximum Percent of Segregated Brood composed of integrated Adults	Mark/Tag for Integrated Smolts	Mark/Tag for Segregated Smolts
<1,000	250,000	100%	20%	30%	100% CWT, no Ad-clip	100% Ad, 120k Ad-CWT
1,000 -1,299	500,000	80%	20%	50%	100% Ad-CWT	100% Ad, no CWT
1300 -1599	1,000,000	80%	20%	60%	100% Ad, 500k Ad-CWT	100% Ad, no CWT
>1,600	1,700,000-2,000,000	70%	NA	NA	100% Ad, 120k Ad-CWT	N/A

[1]NOR = Natural-origin returns, pHOS = % hatchery-origin fish on the spawning grounds, pNOB = % natural-origin fish in broodstock

Table 2-10. RM&E activities associated with Clearwater River and Hells Canyon programs.

Program	Adult	Juvenile
All	• Measure and examine for gender, tags and marks • Recover CWTs • Collect genetic samples for PBT baseline • Monitor survival metrics for all life stages in the hatchery from spawning to release • Tissue sample collection at Lower Granite Dam to provide escapement estimates from PBT	• Monitor survival metrics for all life stages in the hatchery from spawning to release • Monitor disease occurrence in the hatchery • CWT and/or PBT tag representative groups
South Fork Clearwater Steelhead	• Run size, PBT sampling, and PIT tagging at Lower Granite Dam • Insert radio transmitters into adult steelhead	• PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns • Rotary screw trap in the South Fork Salmon River to insert PIT tags into hatchery-origin and natural-origin juveniles
Hells Canyon A-run Summer Steelhead	• Run size, PBT sampling, and PIT tagging at Lower Granite Dam.	• PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns
Hells Canyon Snake River Spring Chinook Salmon	• Trapping and tissue collection at Rapid River weir and Hells Canyon adult trap for genetic monitoring	--

Table 2-11. RM&E activities associated with Salmon River Steelhead programs.

Program	Adult	Juvenile
All	• Run size, PBT sampling, and PIT tagging at Lower Granite Dam • Trapping and tissue sampling at hatchery traps/weirs for recording: date, sex, length, origin (hatchery or natural), marks/tags, and disposition • Monitor survival metrics for all life stages in the hatchery from spawning to release	• Monitor survival metrics for all life stages in the hatchery from spawning to release • PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns
Salmon River B-run Steelhead	--	• Direct stream versus acclimated fish releases to evaluate homing efficiency between release strategies •
Steelhead Streamside Incubator Project A-run and B-run	--	• Rotary screw traps in the Yankee Fork and Panther Creek to insert PIT tags into hatchery-origin and natural-origin juveniles • Electrofishing in the Yankee Fork and Panther Creek to insert PIT tags into hatchery-origin and natural-origin juveniles • Adult trapping and tissue collection for PBT in the Yankee Fork

Table 2-12. RM&E activities associated with Salmon River Chinook Salmon programs.

Program	Adult	Juvenile
All	• Tissue sample collection at Lower Granite Dam to provide escapement estimates from PBT	• Monitor survival metrics for all life stages in the hatchery from spawning to release • CWT and/or PBT tag representative groups to estimate harvest in mixed stock fisheries • PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns
Little Salmon/Rapid River Spring Chinook Salmon	• Trapping and tissue collection at Rapid River weir and Hells Canyon adult trap for genetic monitoring	• Screw trap downstream of Rapid River weir
South Fork Salmon River Summer Chinook Salmon	• Carcass surveys, redd counts, genetic monitoring • Adult trapping and tissue collection for PBT	• Screw trap downstream of South Fork Salmon River Satellite • Most fish counted/released or anesthetized, measured, weighed, and released; smaller groups receive PIT before release • Estimate production and survival to Lower Granite Dam, and monitor migration timing
Johnson Creek Artificial Propagation Enhancement	• Temporary picket weir on Johnson Creek to monitor adult return timing, escapement, origin, age and sex of most returns, and to collect tissue for genetic monitoring • Multiple-pass spawning ground and carcass surveys to inform population-based M&E performance measures	• Screw trap on Johnson Creek is operated March to November to monitor juvenile Chinook salmon production/productivity, as well as migratory survival, and timing to Lower Granite Dam • Anesthetize, measure, weigh, mark (via clips for trap efficiency estimates) and release; PIT-tag small groups before release • Small-scale studies include mark observability, juvenile pedigree analysis, and ageing
South Fork Chinook Salmon Eggbox	• Adult trapping and tissue collection for PBT • Monitor adult recruitment back to the South Fork Satellite using PBT	• Electrofishing in the South Fork Salmon River above the weir, Cabin Creek, and Curtis Creek to assess survival at various lifestages of hatchery- and natural-origin Chinook salmon and population estimates of natural-origin population.

Program	Adult	Juvenile
Pahsimeroi Summer Chinook Salmon	• Pahsimeroi weir and fish trap operation; applying marks and collecting tissue samples for PBT • Multiple-pass spawning ground surveys, pre-spawning mortality, and carcass surveys, genetic monitoring	• Monitor survival metrics for all life stages in the hatchery from spawning to release • CWT and/or PBT tag representative groups to estimate harvest in mixed stock fisheries • PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns • Screw trap near Pahsimeroi weir • Estimate juvenile production and survival to Lower Granite Dam, and monitor migration timing • Anesthetize, measure, weigh, and release; PIT-tag small groups before release
Upper Salmon Spring Chinook Salmon	• Sawtooth Fish Hatchery weir and fish trap operation; apply marks and collect tissue samples for PBT • Multiple-pass spawning ground surveys, pre-spawning mortality, and carcass surveys, genetic monitoring	• Monitor survival metrics for all life stages in the hatchery from spawning to release • CWT and/or PBT tag representative groups to estimate harvest in mixed stock fisheries • PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns • Screw trap upstream of Sawtooth weir • Estimate juvenile production and survival to Lower Granite Dam, and monitor migration timing • Anesthetize, measure, weigh, and release; PIT-tag small groups before release

2.2 Alternative 2, Proposed Action

Under this alternative, NMFS would make ESA section 4(d) determinations for the 15 hatchery programs in the programs to operate as described in the HGMPs, as described in Section 2.1, Alternative 1, No Action (Table 2-1), including RM&E (Section 2.1.3, Research Monitoring, and Evaluation) and operations and maintenance (Section 2.1.4, Operation and Maintenance). BPA would either (1) fund the JCAPE Program or (2) not fund the JCAPE Program. Under this alternative, the 15 hatchery programs would operate as described in the HGMPs regardless of BPA’s funding decision.

2.3 Alternative 3, Reduced Production

Under this decreased production alternative, NMFS would determine that the 15 hatchery programs described for the No Action Alternative 1 and the Proposed Action Alternative 2 would be consistent with the requirements of the ESA. BPA would either (1) provide enough funding to JCAPE Program to produce 50 percent of the production levels described in the HGMP or (2) not fund JCAPE Program. Under this alternative, the hatchery production would be reduced by 50 percent of what is described in the HGMPs. Decreasing hatchery production by 50 percent would likely result in a reduction in harvest by a similar percentage. The RM&E would continue to operate at the same levels.

This alternative would not provide sufficient hatchery production identified in the HGMPs as necessary to restore coho salmon in the Clearwater River Subbasin, or contribute to the survival and recovery of the ESA-listed Chinook salmon and steelhead in the Snake River Basin.

2.4 Alternative 4, Program Termination

Under this alternative, NMFS would determine that the 15 hatchery programs described for the No Action Alternative 1 and the Proposed Action Alternative 2 do not meet the criteria for 4(d) determinations and all actions related to those programs would be terminated. BPA would not provide funding to the JCAPE Program. This termination would occur whether or not those actions may already have existing ESA authorizations. None of the 15 hatchery programs would operate under this alternative.

With the complete termination of hatchery programs, facilities would not be used for these programs, but most would continue to operate for other salmon or steelhead programs described by NMFS (2014a) and USFWS (2017a, 2017b). Facilities that may cease operations because they are dedicated to programs considered in this EA include the Hells Canyon Dam Trap, Rapid River Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, and Niagara Springs Fish Hatchery.

This alternative would not provide sufficient hatchery production identified in the HGMPs as necessary to restore coho salmon in the Clearwater River Subbasin, or contribute to the survival and recovery of the ESA-listed Chinook salmon or steelhead in the Snake river Basin.

2.5 Alternatives Considered but not Analyzed in Detail

The following alternatives were considered, but not analyzed in detail because the alternatives would not meet the Federal purpose and need.

2.5.1 Hatchery Programs with Increased Production Levels

Under this alternative, NMFS would issue an ESA 4(d) determination for increased production levels associated with the 15 hatchery programs, as compared to the level described in the HGMPs. This alternative is not analyzed in detail because substantially higher production levels would be outside the scope of current agreements and the proposed hatchery programs (NMFS 2014c; 2018), thus not meeting the NMFS's purpose and needs to evaluate the proposed hatchery programs.

2.5.2 Hatchery Programs with Other Decreased Production Levels

A version of a reduced production level alternative is analyzed in this EA as Alternative 3, and termination of all production is analyzed as Alternative 4. Alternatives that reduce production for select programs but not others are not analyzed. Reduced production level or termination of programs for select species, while maintaining other programs, would either would not provide additional insight compared to Alternative 3 and 4, and/or not meet NMFS's purpose and need to conserve and protect listed species; therefore, other reduced production alternatives will not be further analyzed in this document.

2.5.3 Increased Harvest to Reduce Hatchery Fish on Spawning Grounds

Fishery harvest could be used in the Clearwater and Salmon River subbasins to reduce the number of hatchery-origin adults on spawning grounds to reduce genetic and ecological risks of hatchery-origin fish interacting with natural-origin fish. However, this is likely not possible without also increasing impacts on ESA-listed fish in the project area that are incidentally taken while removing the hatchery-origin adults, which may require an ESA consultation. Harvest fishery is not a necessary component of the proposed programs, and other methods of reducing the number of hatchery-origin adults on the spawning ground are considered under Alternative 1 and Alternative 2.

3 Affected Environment

This subsection describes current conditions for nine resources that may be affected by implementation of the EA alternatives:

- Water quantity—Section 3.1
- Water quality—Section 3.2
- Salmon and steelhead—Section 3.3
- Fisheries—Section 3.4
- Other fish species—Section 3.5
- Wildlife—Section 3.6
- Socioeconomics—Section 3.7
- Cultural Resources—Section 3.8
- Environmental Justice—Section 3.9
- Human Health and Safety—Section 3.10

Internal scoping identified no other resources that would potentially be impacted by current operation, the Proposed Action, or other alternatives. Current conditions include the operation of hatchery programs very similar to those described in the Mitchell Act FEIS (NMFS 2014a) and the HGMPs because they were both largely developed through refinement of ongoing programs. Production and operation details are included in Table 2-2, Table 2-3, Table 2-4, and Table 2-6 of this EA. As previously noted in Section 1.2, Project Area and Study Area, the geographic scope of the study area is specific to each resource being analyzed. For some resources, the study area is limited to the area immediately surrounding the project facilities where operations could affect water quantity, wildlife, or human health and safety. For other resources, such as socioeconomics, project operations could have wider-reaching effects.

3.1 Water Quantity

Each of the 15 currently operating Snake River Basin hatchery programs included in this EA takes water from a nearby stream or lake (surface water), or wells or springs (ground or spring water) to use in the hatchery facility (Table 3-1). The use of surface water for hatchery programs may reduce instream flow, sometimes leading to substantial reduction in stream flow between the water intake and discharge structures. In particular, operations of adult holding tanks, egg incubation, juvenile fish rearing, and/or acclimation ponds affect water quantity. Surface water use is nonconsumptive because, with the exception of small amounts lost through leakage or evaporation, water that is diverted from a river or reservoir is discharged back to the river (downstream from the reservoir where applicable) after it circulates through the hatchery facility. Although groundwater is not directly replenished, it is also discharged after circulating through the facility, sometimes increasing a small amount of stream flow below the discharge point.

Most facilities are located in the Clearwater River Subbasin, the Hells Canyon Reach of the Snake River, or the Salmon River Subbasin (Figure 1-1; Figure 2-1; Figure 2-3). Additional facilities used to meet program needs are located along the Snake River upstream from Hells Canyon, and in the Payette River Subbasin. The study area for water quantity is limited to the stream reaches between intake and outfall for each facility, which range in length from 180 feet to 9,985 feet (Table 3-1). The longest diversion reaches are associated with withdrawals from reservoirs; no diversions from streams exceed 1 mile in length.

Table 3-1. Water source and use at facilities currently utilized by the hatchery programs included in this EA.

Facility	Maximum Water Use (cfs)	Maximum Ground or Spring Water Use (cfs)	Maximum Surface Water Use (cfs)	Surface Water Source	Surface Water Discharge Location	Surface Water Diversion Distance (Feet)	Average Flow (cfs)	Maximum Surface Water Use Compared to River Flow (%)
Clearwater River Subbasin								
Clearwater Fish Hatchery	89	0	89	Dworshak Reservoir	North Fork Clearwater River	9,895	64	--
Dworshak National Fish Hatchery	182	0	182	Dworshak Reservoir; North Fork Clearwater River	North Fork Clearwater River	Reservoir = 8,854; River = 902	14.5	5.3
Kooskia National Fish Hatchery	16	0	16	Clear Creek	Clear Creek; Middle Fork Clearwater River	3,696	7.7	82[1]
Snake River – Hells Canyon Reach								
Hells Canyon Trap	130	0	130	Snake River	Snake River		130	<1
Oxbow Fish Hatchery	15.5	0	15.5	Snake River	Snake River	180	15.5[2]	<0.5
Snake River – Upstream from Hells Canyon Reach								
Hagerman National Fish Hatchery	84.6	84.6	0	Unnamed springs	--	--	60	--
Niagara Springs Fish Hatchery	120	120	0	Niagara Springs	--	--	120	--
Magic Valley Fish Hatchery	87.2	87.2	0	Crystal Springs	--	--	87.2	--
Salmon River Subbasin								
Rapid River Trap	18	0	18	Rapid River	Rapid River	59	18	--
Rapid River Fish Hatchery	46.6	0	46.6	Rapid River	Rapid River	682	34	51.8[3]
South Fork Salmon River Satellite	20	0	20	South Fork Salmon River	South Fork Salmon River	2,750	9.2[2]	11
Lower Pahsimeroi Fish Hatchery	40	0	40	Pahsimeroi River	Pahsimeroi River	1,980	40[2]	26.5

Facility	Maximum Water Use (cfs)	Maximum Ground or Spring Water Use (cfs)	Maximum Surface Water Use (cfs)	Surface Water Source	Surface Water Discharge Location	Surface Water Diversion Distance (Feet)	Average Flow (cfs)	Maximum Surface Water Use Compared to River Flow (%)
Upper Pahsimeroi Fish Hatchery	34	14	20	Pahsimeroi River	Pahsimeroi River	800	20	13.2
East Fork Salmon River Satellite	15	0	15	East Fork Salmon River	East Fork Salmon River	200	15[2]	15.6
Sawtooth Fish Hatchery	54.6	11.6	43	Salmon River	Salmon River	4,850	28	18.7
Payette River Subbasin								
McCall Fish Hatchery	20	0	20	Payette Lake	North Fork Payette River	3,700	16	--

Sources: IDFG (2011a, 2011e, 2011f; 2016b); Nez Perce Tribe (2016); USFWS (2017a)

[1] Documented in January 2017. No water is diverted from Clear Creek from June through September.

[2] Surface water is diverted only from October through July at Oxbow Fish Hatchery, from June through September at the South Fork Salmon River Satellite, from February through September at Lower Pahsimeroi FH, and from March through May at the East Fork Salmon River Satellite.

[3] Information shown is for diversion of flows in the Rapid River. NMFS (2017a) reported an average diversion of 2 to 22 percent of annual Little Salmon River flows.

3.1.1 Surface Water

Surface water withdrawal for currently-operating hatchery programs often fluctuates seasonally based on propagation needs, with the highest hatchery water demand often occurring in the spring when streamflow levels are highest. Prior to release, hatcheries have more fish on hand, fish under propagation are at their largest size, and the need for rearing flows for fish health maintenance is greatest. Hatchery water withdrawal for fish rearing is often lowest in the late summer months (when river flows are also at their lowest) because fewer fish are on station after release.

Of the 11 facilities that divert water from a stream, Kooskia National and Rapid River fish hatcheries generally withdraw the highest proportion of stream flow (Table 3-1). Based on rearing levels from 2014 through 2016, the surface flow requirements for Kooskia National Fish Hatchery reach 13 cfs in March and April and approximately 9 cfs in February and May. Surface flow is not used for rearing from June through September; typical surface water demands for the remaining months range from approximately 3 to 6 cfs.

Rapid River Fish Hatchery diverts approximately 50 percent of the flow from the Rapid River during low winter flows in January and February (Table 3-1). Diversion rates decrease to as low as approximately 4 percent of Rapid River streamflow during high-flow periods in May. Actual withdrawals range from a low of about 16 cfs in May to a high of about 35 cfs in February and December.

Compared to Rapid River Fish Hatchery and Kooskia National Fish Hatchery, maximum surface water diversions for all other facilities typically comprise a relatively low percentage of streamflows (Table 3-1), and maximum reported diversion rates are short term in nature (1 to 2 months per year; USFWS 2017a, 2017b). Two facilities, Clearwater Fish Hatchery and McCall Fish Hatchery, utilize only lake water, and divert a very small percentage of the water available. Dworshak National Fish Hatchery utilizes a small amount of lake water as well, but receives most of its water from the North Fork of the Clearwater River (Table 3-1).

Sawtooth Fish Hatchery may withdraw up to 18.7 percent of Salmon River monthly flow (Table 3-1); however, the hatchery diverts an average of 10.6 percent of flow during typical low flow conditions, and less at all other times. During the lowest flow periods, the Pahsimeroi River facilities may divert up to 53.9 percent of the flow, but the average diversion is 39.7 percent during low-flow conditions. Typically, the Pahsimeroi facilities use about 26 percent of the flow based on the annual average streamflow of the Pahsimeroi River (NMFS 2017b).

In addition to surface water use at hatchery facilities, the SFCEP and SSI programs use surface water, and the incubators are utilized during summer low flow. However, the incubators use less than 1 percent of the water available and the water is almost immediately passed through the incubators and returned to the stream.

3.1.2 Ground and Spring Water

The three facilities on the Snake River upstream from the Hells Canyon Reach (Hagerman National, Niagara Springs, and Magic Valley fish hatcheries) all utilize spring water only (Table 3-1). The hatcheries receive water from springs emanating from the Eastern Snake Plain Aquifer (ESPA), which provides many spring outflows in the area. The ESPA is one of the largest confined aquifers west of the Continental Divide (occupying 10,800 square miles), and was designated as a sole source aquifer by the U.S. Environmental Protection Agency in 1991. A wide variety of uses, including drinking water, agriculture, food processing, aquaculture, and fish and wildlife habitat, are dependent on the ESPA. The ESPA is also critical to the maintenance of flows in the Snake River. The water quantity in the springs is diminishing as a result of the overall decline of the groundwater aquifer. For a detailed discussion of ESPA, see BPA et al. (2017).Two facilities, the Upper Pahsimeroi and Sawtooth fish hatcheries, utilize well water in addition to surface water (Table 3-1). Well water at both facilities is used for egg incubation and early rearing.

3.2 Water Quality

Current Snake River Basin hatcheries primarily affect water quality by discharging treated wastewater from adult holding, spawning, incubation, and juvenile rearing activities to downstream receiving waters. Adult collection and juvenile release activities may also have temporary and minor impacts to water quality through disturbance of the streambed at collection or release sites, or by anglers collecting broodstock.

Because large numbers of fish are concentrated within hatcheries, effluent with elevated water temperature, ammonia, organic nitrogen, total phosphorus, biochemical oxygen demand (BOD), pH, and solids levels is typically produced (WDE 1989; Kendra 1991; Cripps 1995; Michael 2003; USEPA 2006a). Nutrients discharged to receiving waters from hatchery effluent may cause an increase in algal growth, which may lead to increased fluctuations in dissolved oxygen and pH because of increased algal photosynthesis and respiration. Decay of senesced algae may also decrease dissolved oxygen concentrations in receiving waters.

Current water quality in downstream receiving waters from the existing hatcheries has been characterized with data as recent as 2014 (Table 3-2). Receiving waters in the Clearwater River Subbasin do not exceed federal water quality standards for anything related to hatchery effluent. Standards for total phosphorous and total suspended solids are exceeded in receiving waters for Niagara Springs, Magic Valley, and Hagerman National fish hatcheries, each of which is located along the mainstem Snake River (Figure 2-3). All receiving waters in the Salmon River Subbasin except the Pahsimeroi River attain water quality standards.

All of the hatcheries used for the Snake River programs (except for Oxbow Fish Hatchery) are permitted to discharge treated wastewater to receiving waters under the United States Environmental Protection Agency (USEPA) general NPDES permit for Cold Water Aquaculture Facilities or the USEPA’s general wasteload allocation (WLA) permit for Aquaculture Facilities (Table 3-2). The Cold Water Permit covers facilities that are not subject to specific wasteload allocations under the Total Maximum Daily Load (TMDL) process because wasteload allocations were not established at the time of permit issuance. The WLA Permit covers facilities that are subject to wasteload allocations under selected TMDLs (USEPA 2007). Both permits regulate:

- Oxygen-demanding materials, measured as BOD
- Biological wastes (e.g., dead fish)
- Floating, suspended, or submerged matter of any kind
- Nutrients, including phosphorus
- Disinfectants, including chlorine
- Disease control drugs, pesticides, and other chemicals
- Feed and nutritional supplements
- Total suspended solids
- Toxic substances

Oxbow Fish Hatchery produces less than 20,000 pounds of fish per year or distributes less than 5,000 pounds of feed at any one time and therefore is not required to have NPDES permits.

The USEPA (2006b) summarizes past compliance with general permit limits. Compliance with effluent limits during the prior permit cycle was met 100 percent of the time by about 90 percent of the facilities. The percentage of facilities exceeding the average monthly concentration limits for total suspended solids was about 2 percent and for total phosphorus about 6 percent. Maximum daily concentration limits for total suspended solids and total phosphorus were exceeded only 1 percent of the time.

Table 3-2. Current hatchery program facility NPDES permit and receiving water attributes.

Program	Facility	Permit No.	Permit Type[1]	Receiving Waters	Impairment Listings[2]
Clearwater River Coho Salmon	Kooskia National Fish Hatchery	IDG130025	Cold Water	Clear Creek	None
Clearwater River Coho Salmon	Dworshak National Fish Hatchery	IDG130012	Cold Water	North Fork Clearwater River	Dissolved Gas Supersaturation
South Fork Clearwater Steelhead	Clearwater Fish Hatchery	IDG130099	Cold Water	Clearwater River	Dissolved Gas Supersaturation
Hells Canyon Snake River A-run Summer Steelhead; Little Salmon River A-run Summer Steelhead; Pahsimeroi A-run Summer Steelhead	Niagara Springs Fish Hatchery	IDG130013	WLA	Niagara Springs Creek	Flow Alteration; Total Phosphorus; Total Suspended Solids
Hells Canyon Snake River Spring Chinook Salmon; Little Salmon/Rapid River Spring Chinook Salmon	Rapid River Fish Hatchery	IDG130037	Cold Water	Shingle Creek	None
South Fork Salmon River Summer Chinook Salmon; Johnson Creek Artificial Propagation Enhancement; South Fork Chinook Salmon Eggbox	McCall Fish Hatchery	IDG130052	Cold Water	North Fork Payette River	None
Little Salmon River A-run Summer Steelhead; Salmon River B-run Steelhead	Magic Valley Fish Hatchery	IDG130016	WLA	Snake River	Flow Alteration; Total Phosphorus; Total Suspended Solids
Pahsimeroi A-run Summer Steelhead; Pahsimeroi Summer Chinook Salmon; Steelhead Streamside Incubator Project A-run	Upper Pahsimeroi Fish Hatchery	IDG130039	Cold Water	Pahsimeroi River	Sedimentation/Siltation; Water Temperature
East Fork Salmon River Natural A-run Steelhead	Hagerman National Fish Hatchery	IDG130004	WLA	Riley Creek	Total Phosphorus; Total Suspended Solids; Fecal Coliform
East Fork Salmon River Natural A-run Steelhead; Steelhead Streamside Incubator B-run; Upper Salmon Spring Chinook Salmon	Sawtooth Fish Hatchery	IDG130074	Cold Water	Salmon River	None
Hells Canyon Snake River A-run Summer Steelhead; Little Salmon/Rapid River Spring Chinook Salmon	Oxbow Fish Hatchery	Not Required[2]	Not Required	Hells Canyon Reservoir	Water Temperature; Dissolved Gas Supersaturation

Source: Idaho Department of Environmental Quality (2017)

[1] WLA = wasteload allocation

[2] Impairments associated with those receiving waters for facilities regulated by WLA permits have established TMDLs.

[3] NPDES permits are not required because the facility produces less than 20,000 pounds of fish per year or distributes less than 5,000 pounds of feed at any one time.

3.3 Salmon and Steelhead

Adult and juvenile fish currently propagated at the 15 hatchery programs included in this EA have the potential to interact with salmon and steelhead species in the natural environment. This subsection describes the affected environment for salmon and steelhead and how ongoing hatchery operations may potentially affect salmon and steelhead species, including effects of fish ladders, weirs, traps, and surface water intakes.

NMFS has prepared four biological opinions (NMFS 2017a, 2017b, 2017c, 2017d) that consider the effects of the 15 hatchery programs included in the proposed action on ESA-listed salmon and steelhead. In each biological opinion, NMFS determined that the programs do not jeopardize listed species, nor result in destruction or adverse modification of their designated critical habitat (NMFS 2017a, 2017b, 2017c, 2017d). The opinions provide additional detail on the anticipated effects of the programs on ESA-listed salmon and steelhead, and are consistent with the pertinent portions of the analysis provided herein.

3.3.1 Study Area

Hatchery fish from the Snake River Basin hatchery programs may currently interact with salmon and steelhead during three different life phases: first, as smolts for those released from facilities; second, as juveniles rearing in streams from egg box programs; and, third, as adults upon return. The study area for salmon and steelhead includes locations where hatchery fish are captured, reared, and released, as well as areas where they are currently monitored or known to stray, including upstream of release sites.

The area within which NMFS believes the effects on anadromous salmon and steelhead could be detected includes all waterbodies downstream of hatchery release sites to Ice Harbor Dam. Given the extent of other hatchery programs above and below Ice Harbor Dam (NMFS 2014a), the relatively rapid migration rates of released hatchery smolts, and survival rates for hatchery program fish below the dam, current Snake River hatchery releases do not likely have discernible effects below Ice Harbor Dam. The study area also includes anadromous reaches adjacent to facilities used to rear program fish. Therefore, the study area for salmon and steelhead includes the Clearwater River Subbasin from the confluence of Clear Creek (Kooskia Fish Hatchery) downstream to the Snake River, the Snake River from Hells Canyon Dam downstream to Ice Harbor Dam, and the Salmon River Subbasin from Sawtooth Fish Hatchery downstream to the Snake River (Figure 1-1; Figure 2-1; Figure 2-2; Figure 2-3). Specifically, the study area includes the following waterbodies:

- Middle Fork and mainstem Clearwater River downstream of confluence with Clear Creek
    - Clear Creek downstream of Kooskia National Fish Hatchery
    - South Fork Clearwater River
        - Meadow Creek
        - Newsome Creek
- Snake River downstream of Hells Canyon Dam
- Salmon River downstream of Sawtooth Hatchery
    - Yankee Fork Salmon River
        - Ramey Creek
        - Cearly Creek

        - Jordan Creek
        - Swift Gulch Creek
        - Greylock Creek
    - East Fork Salmon River
    - Pahsimeroi River
    - Indian Creek
    - Panther Creek
        - Beaver Creek
    - South Fork Salmon River
        - East Fork of the South Fork Salmon River
            - Johnson Creek
        - Cabin Creek
        - Curtis Creek
    - Little Salmon River
        - Rapid River

The study area also includes springs or stream reaches adjacent to facilities that are used for fish rearing for several programs included in this EA:

- North Fork Clearwater River downstream of Dworshak Dam (dam is a barrier to salmon and steelhead, and therefore the reservoir is not part of study area)
- Snake River near Oxbow Fish Hatchery
- Snake River from Magic Valley Fish Hatchery downstream to Upper Salmon Falls Dam
- North Fork Payette River (McCall Hatchery)
- Tucker Springs and Riley Creek (Hagerman National Fish Hatchery)
- Niagara Springs

Available knowledge and research abilities are insufficient to discern any important role or contribution of hatchery fish in density dependent interactions (i.e., competition and predation) affecting salmon and steelhead growth and survival in the mainstem Columbia River (NMFS 2008a, 2009). Therefore, measurable effects are unlikely downstream of Ice Harbor Dam for adults from the programs included in this EA returning to the Snake River Basin. Accordingly, the analysis area for ongoing hatchery-related effects on salmon and steelhead is limited to the study area described above.

3.3.2 ESA-Listed Salmon and Steelhead Populations

The ESA-listed salmon and steelhead populations in the study area are part of major population groups (MPGs) within the Snake River Spring/Summer Chinook Salmon ESU (79 FR 20802, April 14, 2014), the Snake River Fall Chinook Salmon ESU (79 FR 20802, April 14, 2014), the Snake River Steelhead DPS (79 FR 20802, April 14, 2014), and the Snake River Sockeye Salmon ESU (79 FR 20802, April 14, 2014). Both natural-origin and hatchery-origin Snake River spring/summer Chinook salmon, fall Chinook salmon, steelhead, and sockeye salmon occur in the study area (NMFS 2017a):

- Snake River Spring/Summer Chinook Salmon ESU

- Upper Salmon River MPG
- Middle Fork Salmon River MPG
- South Fork Salmon River MPG
- Grande Ronde River/Imnaha River MPG
- Lower Snake River MPG (Tucannon River)
- 11 hatchery programs, including four covered in this EA
    - South Fork Salmon River Summer Chinook Salmon (South Fork Salmon River MPG)
    - JCAPE (South Fork Salmon River MPG)
    - Pahsimeroi Summer Chinook Salmon (Upper Salmon River MPG)
    - Upper Salmon River Spring Chinook Salmon (Upper Salmon River MPG)

- Snake River Fall Chinook Salmon ESU
    - Snake River MPG (Lower Snake River Population, including tributaries)
    - Four hatchery programs
- Snake River Steelhead DPS
    - Salmon River MPG
    - Clearwater River MPG
    - Imnaha River MPG
    - Grande Ronde River MPG
    - Lower Snake River MPG
    - 6 hatchery programs, including the East Fork Salmon River Natural A-run (Salmon River MPG)
- Snake River Sockeye Salmon ESU
    - Sawtooth Valley MPG
    - One hatchery program

3.3.3 Critical Habitat and Essential Fish Habitat

Critical habitat has been designated in the Snake River Basin for the Snake River Spring/Summer Chinook Salmon ESU, Snake River Fall Chinook Salmon ESU, Snake River Sockeye Salmon ESU, and Snake River Basin Steelhead DPS. Within designated critical habitat, NMFS identifies physical and biological features, also called primary constituent elements, such as freshwater spawning and rearing sites, as well as freshwater estuarine migration corridors. NMFS (2017a, 2017b, 2017c, 2017d) provide an analysis of hatchery program effects on essential fish habitat (EFH), defined under the Magnuson-Stevens Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Chinook salmon and coho salmon have designated EFH, and NMFS recognizes the need to consider EFH in terms of the need to minimize risks from hatchery water withdrawals, and genetic and ecological interactions of hatchery-origin fish with natural-origin fish (NMFS 2016a). EFH is designated for both Chinook and coho salmon throughout the study area.

3.3.4 Non-ESA-listed Salmon Populations

Native spring/summer Chinook and coho salmon were extirpated from the Clearwater River Subbasin in 1927 by the construction of Lewiston Dam (also known as the Washington Water Power Diversion Dam) at the mouth of the Clearwater River. Lewiston Dam was removed in 1973. Spring Chinook salmon were reintroduced in 1961, and coho salmon in 1994. More recent efforts to reestablish summer Chinook salmon in the Clearwater Subbasin were initiated in 2009.

The non-ESA-listed salmon populations in the study area include both natural- and hatchery-origin coho salmon that are reintroduced into the Clearwater River Subbasin through the Clearwater River Coho Restoration Program. Similarly, natural- and hatchery-origin populations of spring/summer Chinook salmon in the Clearwater River Subbasin are not listed, and are not part of the Snake River Spring/Summer Chinook Salmon ESU.

3.3.5 Ongoing Effects of Hatchery Programs

Hatchery programs can affect natural-origin salmon and steelhead and their habitat in a variety of ways (Table 3-3). The extent of effects (adverse or beneficial) on salmon and steelhead and their habitat depends on the design of hatchery programs, the condition of the habitat, and the status of the species, among other factors. The following subsections describe each hatchery effect pathway in more detail as they pertain to the 15 Snake River Basin hatchery programs included in this EA, as they currently operate.

Table 3-3. General effects of hatchery programs on natural-origin salmon and steelhead resources.

Pathway	Description of Pathway
Genetics	• Interbreeding with hatchery-origin fish can change the genetic character of the local populations. • Interbreeding with hatchery-origin fish may reduce the reproductive performance of the local populations.
Masking	• Hatchery-origin fish can increase the difficulty in determining the status of the natural-origin component of a salmon population.
Competition and Predation	• Hatchery-origin fish can increase competition for food and space. • Hatchery-origin fish can prey on natural-origin fish.
Prey Enhancement	• Hatchery-origin fish can increase the number of prey for natural-origin salmonids.
Disease	• Concentrating salmon for rearing in a hatchery facility can lead to an increased risk of carrying pathogens and outbreaks. When hatchery-origin fish are released from hatchery facilities, they may increase the disease risk to natural-origin salmon and steelhead through pathogen transmission.
Population Viability	• Abundance: Preserve, increase, or decrease the abundance of a natural-origin fish population • Spatial Structure: Preserve, expand, or reduce the spatial structure of a natural-origin fish population • Genetic Diversity: Increase, retain or homogenize within-population genetic diversity of a natural-origin fish population • Productivity: Maintain, increase, or decrease the productivity of a natural-origin fish population
Nutrient Cycling	• Returning hatchery-origin adults can increase the amount of marine-derived nutrients in freshwater systems.

Pathway	Description of Pathway
Facility Operations	• Hatchery facilities can reduce water quantity or quality in adjacent streams through water withdrawal and discharge. • Weirs for broodstock collection or to control the number of hatchery-origin fish on the spawning grounds can have the following unintentional consequences: o Isolation of formerly connected populations o Limiting or slowing movement of migrating fish species, which may enable poaching or increase predation or prespawn mortality o Alteration of streamflow o Alteration of streambed and riparian habitat o Alteration of the distribution of spawning within a population o Increased mortality or stress due to capture and handling o Impingement of downstream migrating fish o Forced downstream spawning by fish that do not pass through the weir • Increased straying due to either trapping adults that were not intending to spawn above the weir, or displacing adults into other tributaries
Research, Monitoring, and Evaluation (RM&E)	• Surveying and sampling to assess program objectives and goals may increase the risk of injury and mortality to salmon that are the focus of the actions, or that may be incidentally encountered. • RM&E will also provide information on the status of the natural population.

3.3.5.1 Genetics

Ongoing hatchery operations currently affect salmon and steelhead in the study area. Genetic effects may depend on the type of hatchery program being operated. Most hatchery programs included in this EA are segregated[5]; however, some are wholly integrated or have integrated components.

Segregated programs use only hatchery-origin fish for broodstock, which may result in greater domestication compared to integrated programs that use natural-origin broodstock to maintain genetic similarities with wild fish; therefore, a potential for negative effects exists if hatchery fish from segregated programs interbreed with natural fish on spawning grounds. Integrated programs are designed to supplement natural populations by using natural-origin broodstock to increase production. NMFS considers three major areas of genetic effects of hatchery programs: within-population diversity, outbreeding effects, and hatchery-influenced selection.

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 and is lost primarily due to genetic drift (i.e., a random loss of diversity, usually only exacerbated at low population size). For a population to maintain its genetic diversity reasonably well, the effective population size should at least be in the hundreds (Lande and Barrowclough 1987).

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, 1997). Natural straying serves a valuable function in preserving diversity that would otherwise be lost through genetic drift and in recolonizing vacant habitat. Straying is considered a risk only when it occurs at unnatural levels or from unnatural sources. Gene flow from straying populations can have two effects, it can increase genetic diversity (Ayllon et al. 2006), but it can also alter established allele frequencies along with coadapted gene complexes and reduce the population's level of adaptation (i.e., outbreeding depression) (Edmands

[5] It should be noted that both Pahsimeroi and Sawtooth programs could use integrated returns in segregated programs if abundance is sufficient to do so. This would slighty lessen the domestication risk due to the addition of a partially wild compenent. The use of integreated fish in these programs will likely be very small within the next 10 years.

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 the potential for outbreeding depression.

Hatchery-influenced selection occurs when hatchery spawning and rearing allows for selection different than that imposed by the natural environment. For example, fish being reared in hatcheries can have different age-at-length, age at maturity, fecundity, life stage-specific mortality, and run timing compared to fish of the same species from natural parents reared naturally. This difference causes genetic change that is passed on to natural populations through interbreeding with hatchery-origin fish. These selection pressures can be a result of differences in environments (i.e., fish reared in hatchery vs. natural) or a consequence of protocols and practices used by a hatchery program that affects the fish in a way that would not occur in nature (e.g., no allowance for mate selection). Hatchery selection can range from relaxation of natural selection that would normally occur in nature to intentional selection for desired characteristics (Waples 1999).

The typical metrics used to describe the influence of hatchery-origin spawners on the natural population are called proportionate natural influence (PNI) and the proportion of hatchery-origin fish on the spawning grounds (pHOS). A PNI exceeding 0.5 indicates that natural selection outweighs hatchery-influenced selection (i.e., the use of natural-origin broodstock contributes to higher PNI). In other words, the use of more natural-origin broodstock equates to less genetic effects on natural-origin populations. The Hatchery Scientific Review Group (HSRG) has developed guidelines for allowable pHOS levels in populations, scaled by the population's conservation importance, recommending a maximum of 5 percent in "primary" populations, 10 percent for "contributing" populations, and at a level required to maintain "sustaining" populations (HSRG 2014). NMFS has not adopted the HSRG guidelines per se; however, the HSRG guidelines are the only acknowledged quantitative standards available, so NMFS considers them a useful screening tool. NMFS evaluates each hatchery program specifically, but generally, if a program meets HSRG standards, NMFS will typically consider the risk levels to be acceptable. Listed salmonid populations in the Snake River Basin are classified by recovery expectation (ICTRT 2007) rather than by the HSRG classification scheme, but "viable" and "highly viable" equate to "primary" and "maintain" equates to "contributing" and "sustaining." Highly viable populations are those with less than 1 percent risk of extinction over 100 years, viable populations are those with negligible (less than 5 percent) risk of extinction over 100 years, and maintained populations are those with less than 25 percent risk of extinction over 100 years (McElhany et al. 2000; NWFSC 2015).

The 15 existing hatchery programs included in this EA currently support artificial production of three salmonid species: spring/summer Chinook salmon, coho salmon, and steelhead. Because no fall Chinook or sockeye salmon are produced under any of these hatchery programs, they are not genetically affected through interbreeding. Therefore, only individuals from the Snake River Spring/Summer Chinook Salmon ESU, Snake River Steelhead DPS, and introduced Clearwater River coho salmon have the potential to be affected.

Spring/Summer Chinook Salmon Programs

Existing hatchery programs have influenced the current genetic condition of salmon and steelhead in the study area. Natural-origin salmon and steelhead genetics have been affected by hatchery fish from the seven spring/summer Chinook salmon hatchery programs presented in this section:

- Little Salmon/Rapid River Spring Chinook Salmon (segregated)
- Hells Canyon Snake River Spring Chinook (segregated)
- South Fork Salmon River Summer Chinook Salmon (portions segregated and integrated)
- SFCEP (segregated with integrated option)

- JCAPE (integrated)
- Pahsimeroi Summer Chinook Salmon (portions segregated and integrated)
- Upper Salmon Spring Chinook Salmon (portions segregated and integrated)

Segregated Little Salmon/Rapid River and Hells Canyon Programs

Combined, the segregated Little Salmon/Rapid River Spring Chinook Salmon and Hells Canyon Snake River Spring Chinook Salmon programs release nearly 3 million hatchery-origin spring/summer Chinook salmon into the Rapid River, Little Salmon River, and Snake River (Table 2-1). Hatchery spring/summer Chinook salmon from the segregated programs have the greatest hatchery-influenced selection over the natural-origin Snake River spring/summer Chinook salmon in the Salmon River Subbasin because of overlap in time and space.

<u>Diversity and Outbreeding</u>

All spring/summer Chinook salmon populations that receive hatchery-origin spawners from these hatchery programs are within the South Fork Salmon River MPG. Currently, although the Little Salmon/Rapid River and Hells Canyon programs may contribute hatchery-origin returns (HORs) to the Little Salmon River population, historical outbreeding effects of spring/summer Chinook salmon released from the hatchery programs appear to be low. According to tagging data from IDFG from 2011 to 2015, a 5-year mean of 16.8 fish from the Little Salmon/Rapid River program strayed into the Lower Salmon River area, and a mean of 0.2 adult fish from the program strayed into the Sawtooth Fish Trap (NMFS 2017a). Currently, strays into the Hells Canyon reach do not affect the Snake River Spring/Summer Chinook Salmon ESU because Hells Canyon is not within the geographic boundaries of the Snake River Spring/Summer Chinook Salmon ESU.

<u>Hatchery-Influenced Selection Effects</u>

NMFS assesses the genetic effects of the segregated Little Salmon/Rapid River and Hells Canyon programs by considering how many fish from each program might spawn in the natural environment. Because supplementation of the natural population is not an objective for either program, the number/proportion of hatchery-origin spawners should ideally be zero. However, the HSRG recommends a maximum pHOS of 5 percent for receiving populations that are targeted as viable or highly viable, and 10 percent for those receiving populations that are maintained. Viable populations are those that are critical for recovery of a listed ESU whereas maintained populations are those that do not meet the criteria for a viable population, but do support ecological functions and preserve options for recovery (NMFS 2017f). The Little Salmon River population is considered maintained.

The proportion of hatchery-origin fish on spawning grounds from the segregated Little Salmon/Rapid River and Hells Canyon programs is currently unknown. Natural and hatchery-origin spawning in the Little Salmon River population is not well documented; therefore, it is difficult to estimate pHOS levels. However, because the Little Salmon River population plays only a maintained role in viability scenarios (NMFS 2017b), PNI and pHOS calculations are not a concern under current hatchery operations.

Segregated and Integrated South Fork Salmon River, South Fork Chinook Eggboxes, and JCAPE Programs

The South Fork Salmon River Summer Chinook Salmon, SFCEP, and JCAPE programs use varying proportions of natural-origin spring/summer Chinook salmon for broodstock (Table 2-4). Currently, NMFS believes that the removal of broodstock for these programs would not result in more than a minimal effect on abundance and that the genetic impacts to the populations are not considered a substantial risk

(NMFS 2017a). Because the integrated components of the JCAPE and South Fork Salmon River programs are designed to supplement natural populations by using natural-origin broodstock to increase production, they provide some benefit to natural Chinook salmon populations in the South Fork Salmon River and Johnson Creek (NMFS 2017a).

Diversity and Outbreeding

Current outbreeding effects of spring/summer Chinook salmon released from these hatchery programs appear to be low. A 5-year mean of 0.8 adult fish (from CWT data) and 2.8 fish (PBT data) from the South Fork Salmon River Summer Chinook Salmon program was detected at the Rapid River Fish Trap from 2011 through 2015. A 5-year average of 0.2 fish from the program was detected at Red River (South Fork of the Clearwater River), and a mean of 3.4 (CWT) and 0.2 (PBT) fish from various hatchery programs strayed to the South Fork Salmon River.

The Nez Perce Tribe uses 100 percent natural-origin brood for the JCAPE program. Therefore, outbreeding depression from straying from this program is likely minimal. From 2011 through 2015, an annual mean of 0.2 adult fish (CWT) from the JCAPE program was detected at the South Fork Salmon River Trap. All adipose fin clipped hatchery fish captured at the JCAPE weir are removed from the population.

The outbreeding effects of the SFCEP are unknown, as fish from these programs are not marked and cannot be distinguished from natural-origin spring/summer Chinook salmon. However, NMFS does not expect current effects from the SFCEP to differ greatly from those of the South Fork program, which has low straying, as discussed above, because the South Fork program is the source of the eggs for the SFCEP.

Hatchery-Influenced Selection Effects

Because of the overlap in time and space with their natural counterparts, hatchery spring/summer Chinook salmon from these programs likely have the greatest hatchery-influenced selection over the natural-origin Snake River spring/summer Chinook salmon in the Salmon River Subbasin.

Hatchery-influenced selection is minimized by using as many natural-origin fish for broodstock as possible for the integrated components of the South Fork Salmon River Summer Chinook Salmon, SFCEP, and JCAPE programs. Both the South Fork Salmon River Summer Chinook Salmon and SFCEP programs use natural-origin fish on a sliding-scale approach, whereas JCAPE uses 100 percent natural-origin broodstock (Section 2.1.2.2, South Fork Salmon River). Operation of these programs using the sliding scale for integrated and segregated programs currently poses considerably less risk of hatchery-influenced selection than segregated programs because of the genetic relationship between the programs (Busack 2015). In this case, the presence of returning segregated hatchery-origin adults on the South Fork Salmon River spawning grounds poses little additional risk over returning integrated hatchery-origin adults.

As discussed in the introduction to Section 3.3.5.1, Genetics, NMFS generally evaluates PNI and pHOS values to estimate hatchery-influenced selection effects. A PNI exceeding 0.5 indicates that natural selection outweighs hatchery-influenced selection (i.e., the use of natural-origin broodstock contributes to higher PNI). Both programs currently operate on a sliding scale (Table 2-7 and Table 2-8) and remove natural-origin fish for broodstock

Program-specific modeling (NMFS 2017a) indicates that the recent transitioning of the South Fork Salmon River Summer Chinook Salmon program into a program with both integrated and segregated components has increased the South Fork Salmon River population PNI in recent years. From 2010 through 2014, the PNI ranged from 0.19 (2013) to 0.63 (2014). Over that same period, the pHOS ranged from 0.18 (2014) to 0.28 (2013). When the SFCEP program is included in the 2010 through 2014 data, the mean PNI is 0.40, with a mean pHOS of 0.33 (NMFS 2017a). From 2011 through 2015, the PNI for the JCAPE program at a release level of 100,000 smolts ranged from 0.69 to 0.79, and the integrated pHOS ranged from 0.27 to 0.45. These values indicate that natural selective forces are currently dominant in the JCAPE integrated program.

Overall, NMFS believes that the population level pHOS values observed from 2010 through 2014 for these programs did not constitute a serious threat to the Snake River Spring/Summer Chinook Salmon ESU.

Segregated and Integrated Pahsimeroi and Upper Salmon Programs

The Pahsimeroi Summer Chinook Salmon and the Upper Salmon Spring Chinook Salmon programs use varying proportions of natural-origin spring/summer Chinook salmon for broodstock (Table 2-4). The removal of broodstock for these programs is not believed to have resulted in more than a minimal effect on the populations, and the genetic impacts to the populations are not currently considered a substantial risk (NMFS 2017a). Because the integrated components are designed to supplement natural populations by using natural-origin broodstock to increase production, they provide some benefit to natural Chinook salmon populations in the Pahsimeroi River and in the upper Salmon River (NMFS 2017a).

<u>Diversity and Outbreeding</u>

Outbreeding effects of spring/summer Chinook salmon released from the Pahsimeroi Summer Chinook and Upper Salmon Spring Chinook salmon programs appear to be low. According to IDFG data from 2011 through 2015, a 5-year mean of 0.8 fish from the Pahsimeroi Summer Chinook Salmon program strayed into the Upper Salmon River area during spawning ground surveys. No strays from any Salmon River hatchery programs were detected at the Pahsimeroi trap. The average population level pHOS from 2011 through 2015 was estimated at 0.07. Because no strays were detected at the Pahsimeroi trap, NMFS believes that the 0.07 pHOS is likely fish from the Pahsimeroi Summer Chinook Salmon program (NMFS 2017b).

Recent data indicate a low number of strays from the Upper Salmon Spring Chinook Salmon program. From 2011 through 2015, a mean of 2.4 adult fish from the program was detected in the Upper Salmon River during spawning ground surveys. The average population level pHOS from 2010 through 2014 was estimated at 0.30, and stray levels from the Upper Salmon River mainstem hatchery program are low (NMFS 2017b).

<u>Hatchery-Influenced Selection Effects</u>

NMFS believes a PNI exceeding 0.5 puts the Pahsimeroi River population on a trajectory to achieve viability. Data from 2014 through 2016 indicates that PNI ranged from 0.44 to 0.62 for this population (NMFS 2017b). For the Upper Salmon River mainstem population, data from 2014 through 2016 indicate that PNI ranged from 0.12 to 0.35 based on the multipopulation component model analysis tool developed by Busack (2015).

Steelhead Programs

With the exception of the East Fork Salmon River Natural A-run Steelhead Program, all of the steelhead hatchery programs included in this EA are segregated programs (Table 2-1; Table 2-2; Table 2-3). The segregated programs include the South Fork Clearwater Steelhead, Hells Canyon Snake River A-run Summer Steelhead, Little Salmon River A-run Summer Steelhead, Pahsimeroi A-run Summer Steelhead, Salmon River B-run Steelhead (including Little Salmon River B-run, Pahsimeroi River B-run, and Yankee

Fork B-run), and the SSI programs (receives eggs from Salmon River B-Run and Pahsimeroi A-run programs). The hatchery programs pose both genetic and ecological risks, although there is some benefit to the species from the integrated program designed to supplement the East Fork Salmon River population. Steelhead from these programs appear to exhibit low to no straying.

Segregated Programs

<u>Diversity and Outbreeding</u>

Available information suggests that very few fish from Idaho steelhead programs return to a place from which they were not released. NMFS compared adults detected at Lower Granite Dam to detections further upstream, and determined that the percent of detections that classify as straysranged from 0.3 percent for fish released from the Little Salmon River to 3 percent for fish released from the South Fork Clearwater River and Red River satellite facility in the South Fork Clearwater River watershed (a previous acclimation site that is no longer used). Stray rates for the Pahsimeroi A-run and from Upper Salmon B-run releases in the Yankee Fork were 0.5 and 0.4 percent, respectively (Leth 2017a, as cited in NMFS 2017c).

Because the majority of the steelhead hatchery programs included in this EA have been ongoing for quite some time, and the effects of any hatchery-origin fish spawning naturally are likely reflected to some degree in the status review data, NMFS (2017c) has previously concluded that the hatchery steelhead strays do not negatively impact steelhead population recovery.

<u>Hatchery-Influenced Selection Effects</u>

For the segregated programs, genetic effects are assessed by considering how many fish from each program spawn naturally. Information for steelhead is not adequate to estimate pHOS with confidence, but applicants remove hatchery-origin fish from the wild to the extent possible. Hatchery steelhead from the segregated programs are most likely to have the greatest hatchery-influenced selection over the natural-origin Snake River steelhead in the Salmon and Clearwater river subbasins, compared to all other natural-origin steelhead populations because of overlap in time and space.

Integrated Program - East Fork Salmon River Natural A-run program

<u>Diversity and Outbreeding</u>

NMFS (2017c) assessed stray rates of adults from the East Fork Salmon River Natural A-run Program by comparing adult PIT tag detection at Lower Granite Dam to subsequent detections outside the natal hatchery reach. Stray rates were low; about 1.3 percent of adults from the integrated East Fork Salmon River Natural A-run program strayed (NMFS 2017c).

<u>Hatchery-Influenced Selection Effects</u>

The East Fork Salmon River Natural A-run Steelhead Program’s genetic evaluation is different from evaluation of the segregated programs because of the use of natural-origin broodstock. Data from 2013 through 2016 indicate that PNI ranged from 0.39 to 0.52, despite very low natural-origin returns. In addition, smolt releases were reduced in 2013 from 170,000 to 60,000 steelhead. Although 2016 would have been the first year with returns from this reduction, NMFS applied the proportional decrease in smolt releases to the observed PNI from 2013 through 2016. This allowed for estimation of what pHOS and proportion of natural-origin spawners (pNOS) would have been for 2013 through 2015 if only 60,000 smolts had been released, assuming natural-origin returns were the same. Using this approach, the PNI would have ranged from 0.44 to 0.52. PNIs within this range are likely to reflect a balance between natural selective forces and hatchery selective forces.

Clearwater River Coho Salmon

Native Clearwater River coho salmon were extirpated from the Clearwater River Subbasin in 1927 by the construction of Lewiston Dam, and all coho salmon that currently exist in the subbasin originate from recent reintroduction efforts initiated in 1994. Therefore, because all coho salmon in the study area exist because of the reintroduction efforts, they are linked genetically throughout the study area. Despite this, hatchery broodstock sources have changed over the years, and as a result, the genetic profile of the natural-origin population likely differs from hatchery-origin genetics at some level. That level, however, is currently unknown.

3.3.5.2 Masking

Masking occurs when unmarked hatchery-origin salmon and/or their offspring are included when making population estimates (e.g., abundance, productivity) of natural-origin fish because hatchery-origin salmon cannot be distinguished from the natural-origin fish. This inclusion of hatchery-origin fish results in an overestimation of the count of natural-origin fish. To minimize masking effects, hatchery-origin fish are often marked (e.g., adipose fin clips, PIT-tags, CWT). This allows hatchery-origin fish to be distinguished from natural-origin fish. PBT is another marking method that may be used to alleviate masking effects. It uses genotyping of hatchery broodstock to identify the progeny of hatchery-origin fish. Tissue samples are typically collected at hatchery traps, during spawning ground surveys, or sampling at Lower Granite Dam. With this information, parentage assignments are used to identify the origin and brood year of their progeny. PBT is used widely among hatchery programs in the Snake River Basin, and is the only method by which to identify juveniles from the egg box programs. Although PBT can be used to alleviate masking effects, it is only effective if sampled fish are matched back to parents and if that information is integrated into the abundance estimates.

Most of the spring/summer Chinook salmon and steelhead from the hatchery programs included in this EA are adipose-fin clipped (Table 2-2; Table 2-3; Table 2-4; Table 2-6) to differentiate program fish from natural-origin fish as juveniles, in fisheries, and upon adult return. Mass-marking allows for monitoring of hatchery fish stray rates to natural spawning areas, and where applicable, natural spawning population objectives. This, in turn, decreases potential masking effects from the ongoing hatchery releases.

Because no fall Chinook or sockeye salmon are produced under any of the hatchery programs included in this EA, masking of these populations is not a concern. Further, native Clearwater River coho salmon were extirpated from the Clearwater River in 1927. Coho salmon abundance is not currently estimated, but all coho salmon that currently exist in the subbasin originated from reintroduction efforts initiated in 1994. Although some level of genetic divergence between natural-origin coho and hatchery coho has likely occurred since the initiation of reintroduction efforts, particularly with changes in hatchery broodstock sources, natural- and hatchery-origin coho in the study area are genetically linked. Therefore, individuals currently released from the Clearwater Coho Salmon program (16 to 50 percent CWT) are unlikely to mask natural-origin fish in the study area.

3.3.5.3 Competition and Predation

Under current operations, ecological interactions between natural- and hatchery-origin fish may occur during both the adult and juvenile life-history stages. Hatchery smolts released into habitats where natural-origin juvenile salmon and steelhead rear may compete with or prey on natural-origin fish.

Hatchery adults may also compete with natural-origin salmon and steelhead for spawning sites and resources.

Spring/Summer Chinook Salmon Programs

Interactions Between Hatchery- and Natural-Origin Juveniles

The likelihood of competition or predation between natural- and hatchery-origin fish under current operations is influenced by a variety of factors including the size of predators and prey, spatial and temporal overlap, and the number of fish released at any time.

Hatchery Releases

In the study area, all hatchery spring/summer Chinook salmon smolts are released in March or April, and outmigrate from March through September. Eggs from the SFCEP are placed in October so that fish may hatch and rear in the natural environment and outmigrate volitionally in spring. Despite these release periods, some natural-origin salmon and steelhead juveniles are lost to competition and predation from the release of hatchery-origin juveniles, particularly when there is overlap in time and space (Table 3-4; NMFS 2017a, 2017b. All releases could overlap with natural-origin Chinook and sockeye salmon and steelhead in the Snake River Basin.

Predation on some species by hatchery-origin smolts is less likely than competition because of fish size. Some reports suggest that hatchery-origin fish can prey on fish that are one-half their length (Pearsons and Fritts 1999; HSRG 2004), but other studies have concluded that hatchery-origin predators prefer fish one-third or less their length (Hillman and Mullan 1989; Beauchamp 1990; Cannamela 1992; CBFWA 1996). Thus, past predation by spring Chinook salmon hatchery smolts has been limited to fish that are less than 2.8 inches, given the typical length of smolts released from programs under current operations (NMFS 2017a, 2017b). The average size of most natural-origin fish that may be encountered by juvenile hatchery fish is larger than 2.8 inches (Table 3-4).

NMFS (2017a, 2017b) determined that the current levels of competition and predation from spring/summer Chinook salmon hatchery programs in this EA are minimal. Hatchery-origin Chinook salmon likely have the largest effect on natural-origin Chinook salmon, followed by steelhead and sockeye salmon (NMFS 2017a, 2017b). Using return data from 2007 through 2016, the maximum number of fish lost from competition and predation during the juvenile life stage attributed to spring/summer Chinook salmon hatchery programs from the Little Salmon/Rapid River Spring Chinook Salmon, Hells Canyon Snake River Spring Chinook Salmon, South Fork Salmon River Summer Chinook Salmon, and JCAPE programs equates to about 2.1 to 2.2, 1.5 to 1.6, and 2.0 percent (respectively) of the potential adult returns for Chinook salmon (all races), steelhead, and sockeye salmon (NMFS 2017a). NMFS (2017a) acknowledges that these percentages of adult return losses are likely overestimated because models assumed 100 percent overlap of all populations.

Using data from 2007 through 2016, the maximum number of fish lost from competition and predation from the Pahsimeroi Summer Chinook Salmon and Upper Salmon Spring Chinook Salmon programs equates to about 0.8, 0.7, and 0.5 percent of the potential adult return for Chinook salmon (all races), steelhead, and sockeye salmon, respectively (NMFS 2017b). The past effects from all programs are spread out over the various populations that comprise the Snake River ESUs/DPSs, and also include the unlisted spring/summer Chinook salmon originating from the Clearwater Subbasin. It should be noted that models could not account for all the variables that could influence competition and predation of hatchery juveniles on natural juveniles. The predation model provides worst-case estimates on natural-origin fish loss. However, the model likely overestimates predation because in fresh water, hatchery-origin juveniles consume a wide variety of invertebrates, other fish species, and other hatchery-origin fish in addition to natural-origin smolts (NMFS 2017a).

Past Chinook salmon hatchery smolts releases are unlikely to have affected age-0 steelhead. Steelhead spawn from March to June, with a peak from April to May in the study area (Busby et al. 1996). Thus, it is unlikely that any age-0 steelhead emerge in time to interact with the hatchery Chinook smolts that are released in mid-late spring. A lack of geographic overlap prevents current Chinook hatchery releases from interacting with age-0 sockeye in Redfish, Pettit, and Alturas Lakes. Natural-origin coho juveniles are also likely to be subject to some level of competition or predation from all Chinook hatchery releases; however, because coho are not listed in the study area, NMFS has not estimated historic losses and adult equivalents.

Despite the number of smolts released into the study area, negative ecological effects from residual hatchery Chinook salmon preying on or competing with natural-origin salmonids have likely been minimal. Although residualism has not been studied in Chinook salmon as extensively as for steelhead, recent data suggests that residualism may occur as result of hatchery rearing and has been measured in some Upper Columbia River hatchery programs (NMFS 2017a).

Table 3-4. General information on size and freshwater occurrence/release for natural and hatchery-origin juvenile salmonids in the Snake River Basin.

Species, Race (Origin)	Life Stage	Estimated size (inches)	Occurrence/Release Timing
Chinook Salmon			
Spring/Summer (natural)	Fry	<2.5	January to April
	Pre-smolts	2.5 to 4.0	April to February
	Smolts	4.0 to 6.0	March to June
Spring/Summer (hatchery)	Smolts	5.7 to 6.7	March to April
Fall (natural)	Fry	<1.8	April to June
	Pre-smolts	1.8 to 2.5	May to June
	Smolts	>2.5	May to August
Fall (hatchery)	Smolts	5.9 to 7.0	April
Steelhead			
Natural	Fry	<2.5	June to October
	Pre-Smolts	2.5 to 6.0	October to May
	Smolts	6.0 to 8.0	March to June
Hatchery	Smolts	6.0 to 8.0	Mid-March to May
Coho Salmon			
Natural	Fry	<2.5	March to May
	Pre-Smolts	2.5 to 4.5	May to April
	Smolts	4.5 to 5.5	late April to May
Hatchery	Smolts	4.5 to 5.5	April to May
Sockeye Salmon			
Natural	Fry	<2.5	January to June
	Pre-smolts	2.5 to 4.0	April to March
	Smolts	4.0 to 7.0	April to May
Hatchery	Pre-smolts	3.0 to 3.5	October
	Smolts	4.7 to 7.0	May

Sources: Connor et al. (2002), Nez Perce Tribe (2016), NMFS (2017a, 2017b), WDFW et al. (2017).

Naturally Produced Progeny Competition

The progeny of naturally-spawning hatchery-origin Chinook salmon likely compose a sizable portion of the juvenile fish population for those areas where hatchery fish are allowed to spawn naturally. This is a desired result of the integrated recovery programs.

NMFS does not have any data suggesting that offspring of naturally spawning hatchery-origin adults behave differently from the offspring of natural-origin parents (NMFS 2017c). Therefore, ongoing competition and predation is similar among juveniles, regardless of origin. The only expected effect of natural production by hatchery fish spawning naturally is a density-dependent response of decreasing growth and potential exceedance of habitat capacity. Because various species of salmonids historically coexisted in substantial numbers with spring/summer Chinook salmon, it follows that passage and habitat were adequate to allow all species to be productive and abundant (NMFS 2017c).

Competition Between Hatchery- and Natural-Origin Adults

If hatchery- and natural-origin fish overlap in spawning areas, hatchery-origin fish (as well as natural-origin fish) may spawn over (superimpose) redds of natural-origin fish. Run and spawn timing between hatchery-origin and natural-origin Snake River spring/summer Chinook salmon is very similar (NMFS 2017a), and redd superimposition may currently occur. Therefore, hatchery-origin fish that make it onto spawning grounds currently may compete with natural-origin spring/summer Chinook salmon for spawning habitat.

The ongoing JCAPE program and portions of the South Fork Salmon River Summer Chinook Salmon, Pahsimeroi Summer Chinook Salmon, and Upper Salmon Spring Chinook Salmon programs produce hatchery-origin fish that are intended to spawn with natural-origin fish to supplement the natural-origin population. Target pHOS for each integrated program are generally below 0.51, depending on sliding scale management of natural-origin brood (see Table 2-4). For all other programs, hatchery staff currently attempt to reduce the number of hatchery-origin spawners on natural-origin spawning grounds.

Spawning site competition or redd superimposition is unlikely between spring/summer Chinook salmon hatchery fish and Snake River fall Chinook salmon, sockeye salmon, steelhead, or coho (Table 3-5). Spawn timings largely do not overlap; therefore, opportunity for these potential ecological interactions to occur has been limited. It is possible that hatchery-origin spring/summer Chinook salmon may have competed with natural-origin fall Chinook salmon because of a slight overlap in spawn timings in late September. However, the Snake River Fall Chinook Salmon ESU boundary overlaps only with a portion of the Snake River Spring/Summer Chinook Salmon ESU.

Table 3-5. Run and spawn timing of Snake River Spring/Summer Chinook salmon, steelhead, fall Chinook salmon, sockeye salmon, and coho salmon.

Species		Run Timing	Holding	Spawning
Spring/summer Chinook Salmon (natural or hatchery-origin)		March-August	April-July	Late July to October
Fall Chinook Salmon		July-October	August to October	Late-September to October
Steelhead		May-November	October-April	March to June
Sockeye Salmon[1]	Resident life history 1 - residual	NA	NA	Late fall
	Resident life history 2: kokanee	NA	NA	Late summer to early fall
	Anadromous	June to September	August to October	Late fall
Coho Salmon		September to December	October to December	Mid-October to mid-December

Source: NMFS 2017a, 2017b; IDFG website, http://fishandgame.idaho.gov

[1]Sockeye have two resident life forms in the Snake River Basin: 1) more closely resembles sockeye salmon life history traits in that it spawns in lakes in late fall with most juveniles remaining in the lake, maturing and spawning without rearing in the ocean; 2) the more common resident form known as kokanee, spawns in tributary streams to the lake during late summer\early fall (IDFG 2005).

Steelhead Programs

Interactions Between Hatchery- and Natural-Origin Juveniles

Hatchery Releases

Steelhead smolts from the ongoing hatchery programs in this EA are released from mid-March to May. These smolts may overlap with natural-origin Chinook salmon, sockeye salmon, steelhead, and coho salmon in the study area (Table 3-4).

Based on historic travel and residence time, an average size at release of 7.9 inches, and the corresponding size of natural-origin salmon and steelhead juveniles in the study area (NMFS 2017c), currently-released hatchery steelhead likely affect natural-origin steelhead most, followed by sockeye and Chinook salmon. Steelhead likely prey on or compete with natural-origin coho salmon juveniles at some level; however, because coho salmon are not listed in the study area, NMFS has not estimated juvenile losses and adult equivalents.

Using the average number of each species that passed over Lower Granite Dam from 2011 through 2016, the maximum number of fish lost due to current competition and predation during the juvenile life stage from steelhead hatchery programs equates to about 1.8, 4.6, and 2.6 percent of the potential adult return for Chinook salmon, steelhead, and sockeye salmon, respectively (NMFS 2017c). These ongoing losses are spread out over the various populations that comprise the Snake River ESUs/DPSs, and also include the unlisted spring/summer Chinook salmon from the Clearwater River. Residual hatchery steelhead are not accounted for in these estimates.

Residual hatchery steelhead are those fish that do not immigrate to the ocean after release from the hatchery. These fish have the potential to compete with and prey on natural-origin fish for a longer period relative to fish actively outmigrating, and could impart some genetic effects when they spawn naturally. Although residualism is a natural life history and may occur at rates around 5 percent naturally (Melnychuk 2011), hatchery programs have the potential to increase residualism rates through hatchery rearing.

Similar to Chinook and coho salmon hatchery programs, steelhead smolts currently released from the subject hatchery programs are unlikely to affect age-0 steelhead because steelhead spawn from March to June, with a peak from April to May in the study area (Busby et al. 1996). Thus, it is unlikely that any age-0 steelhead emerge from the gravel in time to interact with the hatchery steelhead smolts as they migrate downstream. A lack of geographic overlap prevents steelhead hatchery releases from interacting with age-0 sockeye salmon in Redfish, Pettit, and Alturas Lakes.

<u>Naturally Produced Progeny Competition</u>

As presented above for Chinook salmon, offspring of naturally spawning hatchery-origin steelhead compose a portion of the juvenile fish population for those areas where hatchery-origin steelhead are allowed to spawn naturally. This is a desired result of the integrated recovery programs (e.g., East Fork Salmon River Natural A-run). Further, juveniles produced from outplanted eggs from the SSI program may also compete with natural-origin salmon and steelhead. From 1995 through 2009, about 82.3 percent of the eggs outplanted into the Yankee Fork have survived to the fry stage (NMFS 2017c). NMFS currently has no data suggesting that offspring of naturally spawning hatchery-origin adults behave differently from the offspring of natural-origin parents (NMFS 2017c). Therefore, ongoing competition and predation is similar among juveniles, regardless of origin.

Competition Between Hatchery- and Natural-Origin Adults

Natural-origin and naturally spawning hatchery-origin steelhead likely overlap in their selection of spawning sites due to similar spring spawn times and habitat requirements. Because straying appears to be low (Section 3.3.5.1, Genetics), although some hatchery fish may spawn naturally, this primarily occurs within populations that are not targeted as viable or highly viable populations in the DPS. Thus, competition with natural-origin steelhead may occur, but has had little effect on the recovery of the Snake River steelhead population.

Competition between adult hatchery-origin steelhead and other salmonids is unlikely due to differences in run timing, holding, and spawn timing. Steelhead begin their entry into freshwater during the last portion of the spring/summer Chinook salmon migration and reach the study area after spring/summer Chinook salmon have held over the summer and spawned. Although sockeye and fall Chinook salmon overlap with the steelhead run, Snake River sockeye salmon spawn only in lakes in the Upper Salmon River Subbasin, and both complete their spawning before steelhead spawning begins. Therefore, competition between steelhead adults and other salmon species is unlikely (NMFS 2017c).

Coho Salmon Program

Hatchery-released juveniles and returning adult Coho compete with their natural-origin counterparts for resources in the study area. Under past operations, released hatchery smolts may have preyed upon other species of natural-origin salmon and steelhead.

Interactions Between Hatchery-origin Coho and Natural-Origin Salmonids

NMFS estimates that 6,500 hatchery-origin coho adults currently return to the study area from the 500,000 coho smolt releases considered in this EA (NMFS 2017d). Juveniles are released from April through May into Clear Creek, and may overlap with natural-origin coho salmon, Chinook salmon, sockeye salmon, and steelhead in the study area. Based on data from 2010 through 2016, hatchery coho salmon survival to Lower Granite Dam is estimated at 58 percent; individuals take 30 days, on average, to reach Lower Granite Dam, with an additional nine days of travel time to Ice Harbor Dam (NMFS 2017d). Based on travel and residence time, an average size at release of 5.2 inches (NMFS 2017d), and the corresponding size of natural-origin salmon and steelhead juveniles in the study area (Table 3-4), current hatchery coho salmon releases likely affect natural-origin Chinook salmon the most (NMFS 2017d), followed by natural-origin coho. Based on release timing and size (Table 3-4), coho salmon smolts do not overlap with age-0 steelhead, and are highly unlikely to overlap geographically with sockeye. Therefore, coho release do not likely prey on other salmon and steelhead (NMFS 2017d).

Based on ecological interaction models using 2008 through 2015 data, the maximum annual numbers of salmon and steelhead currently lost from competition with and predation by hatchery-origin Clearwater River coho salmon equates to 51 to 53 adult Chinook salmon, 50 to 51 adult steelhead, and 2 adult sockeye salmon (NMFS 2017d). These ongoing adult-equivalent losses from predation and competition provide worst-case estimates. In fresh water, hatchery-origin fish juveniles consume a wide variety of invertebrates, other fish species, and other hatchery-origin fish, in addition to natural-origin smolts (NMFS 2017a). In their freshwater stage, coho primarily feed on plankton and insects (NMFS 2016b), and terrestrial drift and benthic aquatic invertebrates (Dill et al. 1981; Gonzales 2006). NMFS has not estimated natural coho salmon losses because they are not listed in the study area.

Similar to Chinook salmon and steelhead programs, current coho salmon hatchery releases do not likely affect age-0 steelhead because steelhead spawn from March to June with a peak from April to May in the study area (Busby et al. 1996). Thus, it is unlikely that any age-0 steelhead emerge in time to interact with the hatchery coho smolts as they migrate downstream. A lack of geographic overlap also prevents current coho salmon releases from interacting with age-0 sockeye in Redfish, Pettit, and Alturas Lakes. Considering the low number of coho salmon currently released into the study area, if coho releases residualize, ongoing predation and competition is likely minimal.

Competition Between Hatchery- and Natural-Origin Adults

Naturally spawning hatchery-origin coho salmon spawn from October to early December and prefer small gravel substrates in tributaries. Therefore, potential temporal or geographic overlap with other salmon or steelhead is limited, including fall Chinook salmon that may spawn through early October. Ongoing Coho salmon redd superimposition on other salmon and steelhead redds in the study area is likely minimal. Considering the low number of hatchery-origin coho that currently return to the study area (6,500; NMFS 2017d), redd superimposition on natural-origin coho, though possible, is likely low. Because they are not ESA-listed, NMFS has not estimated current hatchery-origin coho redd superimposition on natural-origin coho in the study area.

3.3.5.4 Prey Enhancement

Upon release into the natural environment, hatchery-origin juveniles may become prey items for natural-origin salmon and steelhead and provide an additional food source.

Spring/Summer Chinook Salmon Programs

On average, almost 7 million hatchery-origin juvenile spring/summer Chinook salmon have been released annually since 2012 into the Snake River Basin from hatchery programs included in this EA (Table 3-6). Any resident adult fish[6] can prey on hatchery-origin juveniles. Similarly, larger natural-origin juvenile fish can prey on hatchery-origin juveniles. Though the occurrence of predation by some species on hatchery-origin smolts is likely to be low because of fish size (Section 3.3.5.3, Competition and Predation), prey enhancement can nonetheless occur for any fish species that are larger than the hatchery-origin juveniles (e.g., fish that residualize).

[6] Rainbow trout is the resident form of steelhead, and is discussed in Section 3.4, Other Fish Species.

Steelhead Programs

On average, about 5 million hatchery-origin juvenile steelhead have been released annually into the Snake River Basin from hatchery programs included in this EA (Table 3-7). Similar to spring/summer Chinook salmon releases discussed above, these hatchery smolts provide prey for adults that may be present (e.g., steelhead) as well as any fish that are larger than the hatchery-origin juvenile steelhead.

Clearwater River Coho Salmon Program

For the portion of the coho salmon restoration program included in this EA, the average number of coho salmon smolts released into Clear Creek from 2007 through 2015 was about 575,000 (USFWS 2017b). Though predation by some species on hatchery-origin coho salmon smolts is likely to be low because of smolt size at release, prey enhancement can be realized for any fish that are larger than the hatchery-origin juvenile coho salmon.

Table 3-6. Approximate 10-year average juvenile releases from Spring/Summer Chinook Salmon programs included in this EA.

Program	Release site or Program	Release Years Used for Average	Average Juvenile Releases[1]
Hells Canyon Snake River Spring Chinook Salmon	Hells Canyon Dam	2003 to 2014	414,447
Little Salmon/Rapid River Spring Chinook Salmon	Rapid River Hatchery	2003 to 2014	2,529,489
	Little Salmon River	2003 to 2014	204,925
South Fork Salmon River Summer Chinook Salmon[2]	Segregated	2003 to 2014	990,832
	Integrated	2012 to 2014	243,042
Johnson Creek Artificial Propagation Enhancement	Johnson Creek	2003 to 2014	100,485
South Fork Chinook Eggbox	Cabin and Curtis creeks	2007 to 2014	310,505
Pahsimeroi Summer Chinook Salmon	Segregated	2003 to 2013	975,002
	Integrated	2012 to 2013	173,239
Upper Salmon Spring Chinook Salmon	Segregated	2004 to 2013	828,182
	Integrated	2012 to 2013	156,577

Source: USFWS (2017a)

[1] Historical release numbers may vary from those under the Proposed Action, but are still representative of conditions expected under Alternatives 1 and 2 of this EA

[2] In 2012, the South Fork Salmon River fully segregated program was changed to a segregated and integrated program, and average releases for the segregated program consider both fully segregated and segregated + integrated years.

Table 3-7. Average juvenile releases from steelhead hatchery programs included in this EA.

Program	Release sites	Release Years Used for Average	Average Juvenile Releases[1]
South Fork Clearwater	Red House Hole	2007 to 2016	228,480
	Meadow Creek	2012 to 2016	526,078
	Newsome Creek	2012 to 2016	129,719
Hells Canyon Snake River A-run	Hells Canyon Dam	2003 to 2014	536,905
Little Salmon River A-run	Little Salmon River	2003 to 2014	931,741
Pahsimeroi A-run	Pahsimeroi River	2003 to 2013	823,918
East Fork Salmon River Natural A-run	East Fork Salmon River	2004 to 2016	84,508
Steelhead Streamside Incubator Project	Confluence of Beaver and Panther creeks	2006 to 2013	335,661
	Indian Creek	2006 to 2013	138,242
	Yankee Fork tributaries	2006 to 2013	446,302
Salmon River B-run	Little Salmon River	2011 to 2017	193,000
	Pahsimeroi River	2010 to 2013	148,142
	Yankee Fork	2004 to 2013	629,856

Sources: USFWS (2017a, 2017b); Brian Leth, IDFG, email sent to Dave Ward, HDR, February 26, 2018a, regarding hatchery releases

[1] Historic release numbers may vary from those under the Proposed Action, but are still representative of conditions expected under Alternative 1 and Alternative 2 of this EA. Facility operators typically produce a 10 percent buffer to account for losses throughout the rearing period; therefore, actual releases may exceed Proposed Action release targets by up to 10 percent.

3.3.5.5 Diseases

Ongoing hatchery programs may introduce exotic pathogens into the natural environment. When a hatchery fish is infected in a hatchery facility, the pathogen can be amplified in the water column and among the other fish because hatchery fish are reared at higher densities and closer proximity than in the natural environment. Transmission of pathogens between infected hatchery fish and natural fish can occur indirectly through hatchery water effluent or directly if infected hatchery fish contact natural-origin fish after the hatchery fish are released into the natural environment.

Currently, major diseases identified in salmonids from the Snake River Basin include Bacterial Kidney Disease (BKD) and Infectious Hematopoietic Necrosis (IHN), both of which are caused by pathogens endemic to the basin (bacterium *Renibacterium salmoninarum* and IHN virus, respectively).

Under current operations, hatchery operators monitor the health status of hatchery-produced salmon and steelhead from the time they are ponded at rearing facilities until their release. Prior to release, a pre-release fish health inspection is completed, and all fish production is conducted according to the USFWS National Fish Health Policy, and policies and guidelines of the Integrated Hatcheries Operations Team.

Spring/Summer Chinook Salmon Programs

From 2014 to 2016, several pathogens endemic to the Snake River Basin were detected in rearing hatchery spring/summer Chinook salmon for programs included in this EA, but only one of these detections resulted in a disease outbreak (Table 3-8). An outbreak is defined as an infectious disease that results in a higher than normal mortality within a specific rearing unit for five consecutive days (NWIFC and WDFW 2006).

For all programs, fish health staff monitor hatchery fish from all programs throughout their rearing cycle for signs of disease. Fish are checked, and any mortalities are removed daily. A subset of live fish are tested monthly. Fish are also tested prior to transfer to acclimation sites. Prior to release, the Eagle Fish Health Laboratory conducts a final prerelease fish health inspection. These fish health practices minimize the risk of pathogen transfer to salmon and steelhead and in the natural environment.

Table 3-8. Pathogen detections in hatchery Spring/Summer Chinook salmon juveniles reared and/or acclimated as part of programs included in this EA.

Facility	Program	Year	Pathogen-caused Disease	Outbreak
Oxbow Fish Hatchery	Hells Canyon Snake River Spring Chinook; Little Salmon/Rapid River Spring Chinook	2014	Bacterial kidney disease	No
		2015	Bacterial kidney disease	No
		2016	Bacterial kidney disease	No
Rapid River Fish Hatchery[1]	Hells Canyon Snake River Spring Chinook; Little Salmon/Rapid River Spring Chinook	2014	Bacterial kidney disease	No
		2015	Bacterial kidney disease	No
		2016	Bacterial kidney disease	No
McCall Fish Hatchery[2]	South Fork Salmon River Summer Chinook	2014	Fungal disease	No
		2015	Fungal disease	No
		2016	Fungal disease	No
Pahsimeroi Fish Hatchery	Pahsimeroi Summer Chinook	2014	Bacterial kidney disease; white spot	No
		2015	Bacterial kidney disease; white spot[3]	Yes
		2016	Bacterial kidney disease; white spot	NA
Sawtooth Fish Hatchery	Upper Salmon Spring Chinook	2014	Bacterial kidney disease; Cotton mould; cotton mouth; white spot	No
		2015	Cotton mould; cotton mouth; white spot	Unknown
		2016	Cotton mould; Bacterial kidney disease	No

Source: Hebdon (2017a, 2017b as cited in NMFS 2017a, 2017b)

[1]Pathogen information for Rapid River Fish Hatchery is identical to pathogen information for Oxbow Fish Hatchery.

[2]Includes fish reared for the JCAPE. South Fork Chinook Eggbox Program fish are reared in the natural environment from eggboxes, and no pathogens have been detected for this program.

[3]This infection resulted in an outbreak in November 2015 and was treated with erthyromycin medicated feed.

Steelhead Programs

From 2014 through 2016, a variety of pathogens endemic to the Snake River Basin were detected in facilities used to rear juvenile steelhead for programs included in this EA (Table 3-9). Juvenile rearing for all steelhead programs in the Salmon River Subbasin occurs on spring or well water, with minimal, if any, exposure to pathogens through the water source. In addition, most of the rearing facilities for steelhead released in the Salmon River Subbasin are out of anadromous areas. Thus, even though detections and outbreaks with endemic pathogens do occur (Table 3-9), it is currently very unlikely that salmon or steelhead in the natural environment are exposed to pathogens shed from hatchery fish during rearing. In addition, treatments for the pathogens responsible for outbreaks usually are effective within 3 to 10 days after treatment begins. Thus, the amount of time available over which shedding of pathogens occurs is limited. Ongoing implementation of fish health protocols prevent, minimize and control outbreaks.

Table 3-9. Pathogen detections and disease outbreaks in hatchery steelhead juveniles included in this EA.

Facility	Program	Years	Pathogen-caused Disease	Outbreak
Clearwater Fish Hatchery	South Fork Clearwater	2014	No data	No data
		2015	Bacterial gill disease	Yes
		2016	IHNV[1]	No
Oxbow Fish Hatchery	Hells Canyon Snake River A-run	2014	None	No
		2015	IHNV	No
		2016	None	No
Pahsimeroi Fish Hatchery	Pahsimeroi A-run	2014	None	No
		2015	IHNV	No
		2016	Whirling disease	No
	Salmon River B-run	2014	IHNV; Bacterial kidney disease	No
		2015	Bacterial kidney disease	No
		2016	Bacterial kidney disease; whirling disease	No
Sawtooth Fish Hatchery	East Fork Salmon River Natural A-run	2014	Bacterial kidney disease	No
		2015	None	No
		2016	Bacterial kidney disease; whirling disease	No
Magic Valley Fish Hatchery	Pahsimeroi A-run	2014	None	No
		2015	None	No
		2016	Bacterial gill disease (x2)	No
	Salmon River B-Run	2014	Bacterial gill disease	No
		2015	Bacterial gill disease	Yes
		2016	Bacterial gill disease (x2)	No
Niagara Springs Fish Hatchery	Hells Canyon Snake River A-run	2014	Bacterial gill disease; ulcer disease	Yes
		2015	IHNV, Bacterial gill disease	Yes
		2016	Ulcer disease; Bacterial gill disease	Yes
	Pahsimeroi A-run	2014	Ulcer disease	Yes
		2015	Bacterial gill disease	Yes
		2016	Ulcer disease	No
Hagerman National Fish Hatchery	East Fork Salmon River Natural A-run	2014	Infectious gill disease; Bacterial kidney disease; ulcer disease; fluke	No
		2015	Infectious gill disease; Bacterial gill disease; white spot	Yes
		2016	Infectious gill disease; Bacterial gill disease; white spot	Yes

Source: NMFS (2017c)
[1]IHNV = infectious hematopoietic necrosis virus

Coho Salmon Programs

NMFS (2017d) assessed the ongoing risk of pathogen transmission to natural-origin salmon and steelhead for that portion of the Clearwater Coho Salmon program included in this EA. From 2014 through 2016, coho salmon from the Clearwater program were infected with IHNV, *R. salmoninarum* (causes BKD), and *Aeromonas salmonicida* (causes furunculosis). Both of these pathogens are endemic to the Snake River Basin, and can be transmitted to natural-origin salmon and steelhead that occupy rivers near existing coho rearing facilities.

3.3.5.6 Population Viability

Salmon and steelhead population viability is determined through a combination of four parameters including abundance, productivity, spatial structure, and diversity. As part of status reviews and recovery planning for threatened and endangered populations, NMFS defines population performance measures for these key parameters and then estimates the effects of hatchery programs at the population scale on the survival and recovery of an entire ESU or DPS. NMFS has established population viability criteria for the Snake River Spring/Summer Chinook Salmon ESU, Snake River Fall Chinook Salmon ESU, Snake River Steelhead DPS, and Snake River Sockeye Salmon ESU. Appendix A presents a detailed summary of current population viability trends for these salmon ESUs and the Snake River Steelhead DPS, including estimates of abundance, productivity, spatial structure, and genetic diversity for all MPGs. Spring/summer Chinook and coho salmon populations in the Clearwater River Subbasin are not ESA-listed; therefore, NMFS has not developed population viability criteria.

The effects of hatchery programs 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). Although ongoing hatchery production for programs considered in this EA currently affect each of the four population viability parameters in different ways, overall, hatchery programs have a minimal, negative effect on natural-origin fish from the Snake River Spring/Summer Chinook Salmon ESU and Snake River Steelhead DPS. Ongoing hatchery production has little to no effect on population viability for natural-origin individuals from the Snake River Fall Chinook Salmon and Snake River Sockeye Salmon ESUs.

One potential effect on population viability for integrated programs stems from broodstock collection, where the maximum number of natural-origin fish proposed for collection and the proportion of the donor population tapped to provide hatchery broodstock are considered. When natural-origin fish are removed from the natural population to be used as broodstock, a “mining” effect could be caused, where the broodstock collection contributes to reducing population abundance and spatial structure, though it would decrease genetic risks by incorporating more natural-origin brood.

3.3.5.7 Nutrient Cycling

Salmon are important transporters of marine-derived nutrients into the freshwater and terrestrial systems through the decomposition of adult carcasses (Cederholm et al. 2000). Naturally spawning hatchery-origin fish, or carcass placement of hatchery fish, contributes to increased nutrient cycling in the natural environment.

Phosphorous is one example of a marine-derived nutrient that is added to natural systems from salmonid carcasses. Estimating the quantity of phosphorous added to the natural environment from hatchery programs is one method to estimate nutrient transport. Increased phosphorus can benefit salmonids because phosphorus is typically a limiting nutrient for the growth of prey sources (e.g., *Daphnia* spp., a prey item for juvenile salmonids).

Spring/Summer Chinook Salmon Programs

NMFS (2017a, 2017b) estimates that hatchery-origin fish and eggs from the seven Salmon River Subbasin spring/summer Chinook hatchery programs included in this EA currently add about 766 kg of phosphorus annually into the environment, in addition to what is typically added to the system by natural-origin fish. This is likely an overestimation of nutrients added to the system, because hatchery-origin returns are subjected to removal from harvest, broodstock collection, and gene flow management. With the use of mark selective fisheries and fish collected for broodstock, the true contribution is likely less than this value, perhaps about 50 percent (NMFS 2017b). Regardless, hatchery-origin fish increase phosphorous concentrations, which likely compensates for some marine-derived nutrients lost from declining numbers of natural-origin fish.

Steelhead Programs

NMFS (2017c) estimates that, if all returning fish spawn naturally, hatchery steelhead from programs included in this EA currently contribute about 373 kg of phosphorous to the study area annually. With the use of mark selective fisheries, the iteroparous (i.e., repeat-spawning) life history of steelhead, and fish collected for broodstock, the true contribution is likely less than this value, perhaps by about 30 percent (NMFS 2017c), so approximately 261 kg.

Coho Salmon Program

NMFS (2017d) estimates that hatchery-origin fish and eggs from that portion of the Clearwater Coho Salmon program included in this EA currently adds about 136 kg of phosphorus annually into the environment, in addition to what is typically added to the system by natural-origin fish. As discussed above, this is likely an overestimation of nutrients added to the system, and the actual value is perhaps 30 percent less (or about 95 kg).

3.3.5.8 Facility Operations

Because water quantity and water quality are assessed as separate resources in Sections 3.1, Water Quantity, and 3.2, Water Quality, the discussion of current facility operations in this subsection is restricted to operation of weirs and traps for adult collection, water diversions, intake structures, and facility maintenance activities relative to their operations resultant direct impacts on salmon and steelhead. The facilities (or related activities) that may currently affect salmon and steelhead species include:

- Dworshak National Fish Hatchery Ladder and North Fork Clearwater Intake (ladder downstream of Dworshak Dam)
- Kooskia National Fish Hatchery
- Hells Canyon Dam Trap
- Rapid River Hatchery Trap and Intake
- South Fork Salmon River Satellite and Intake
- Johnson Creek Weir
- Pahsimeroi Fish Hatchery Trap and Intakes (lower and upper)
- East Fork Salmon River Satellite and Intake
- Yankee Fork Weir
- Sawtooth Fish Hatchery Trap and Intake

Niagara Springs, Magic Valley, and Hagerman National fish hatcheries are all located in nonanadromous waters. No surface water is diverted, no adults are collected at, and no juveniles are released from these facilities. Therefore, operation of these facilities for steelhead incubation and rearing does not modify salmon or steelhead habitat use or decrease availability of water in rearing or spawning areas. Similarly, Oxbow Fish Hatchery is located upstream of Hells Canyon Dam, which is impassible to anadromous salmon and steelhead. Therefore, operation of these facilities has no effect on salmon and steelhead in the study area, and they are not discussed further in this subsection.

Adult Collection

The current operation of adult collection facilities, particularly seasonal, channel-spanning weirs, affects salmon and steelhead species via migratory delay, and may lead to changes in spawning distribution. Though adult passage is delayed slightly, current weir operation guidelines and monitoring minimizes delays to and impacts on fish. Traps are checked daily at all collection facilities. All nontarget fish are handled and released in accordance with current standard operating procedures (SOPs) for *Salmon and Steelhead Production Programs in the Salmon and Snake River Basins* (IDFG et al. 2017).

Spring/Summer Chinook Salmon Programs

As presented in Section 2.1.1, Clearwater Subbasin and Hells Canyon Programs (Table 2-2), and Section 2.1.2, Salmon River Programs (Table 2-4), spring/summer Chinook salmon are collected for broodstock for programs at Hells Canyon Dam, the Rapid River Hatchery Trap, South Fork Salmon Satellite, Johnson Creek Weir, Lower Pahsimeroi Hatchery Weir, and Sawtooth Hatchery Ladder. Natural-origin adults are collected for broodstock as part of integrated program components but can also be encountered at traps collecting brood for segregated programs. Natural-origin spring/summer Chinook salmon are the primary nontarget species encountered during broodstock collection for spring/summer Chinook salmon programs (Table 3-10). Such encounters may delay migration and cause stress or mortality from sorting, holding, and handling. Collected nontarget species are typically returned upstream of collection sites on the same day they are captured, with the exception of fish collected at Hells Canyon Dam (fish are returned to the Snake River below the dam the same day as they are captured).

Hatchery spring/summer Chinook salmon collection periods do not overlap with typical run timing of natural-origin steelhead, and therefore, steelhead are rarely captured at facilities. Sockeye and fall Chinook salmon are separated spatially and/or temporally from spring/summer Chinook salmon broodstock collection periods, and have not been encountered previously at program weirs (NMFS 2017a, 2017b).

Table 3-10. Average annual number of natural-origin Spring/Summer Chinook salmon trapped during broodstock collection at facilities under the Proposed Action.

Facility (type)	Collection Period	Average Number Handled (percent mortality of fish actually trapped)
Hells Canyon Dam Weir (fixed)	Late April to early September	14[1] (0)
Rapid River Fish Hatchery weir (seasonal velocity barrier)	Late April to early September	145[1] (0.08%)
South Fork Salmon Satellite (seasonal picket weir)	Mid-June to mid-September	749[2] (4.9%)
Johnson Creek Weir	May to September	466[3] (4.8%)
Lower Pahsimeroi Fish Hatchery Weir	June to September	271[4] (1-6%)
Sawtooth Fish Hatchery Weir (seasonal picket weir)	June to September	493[5] (0-1.6%)

[1] 12-year average from 2001-2012 (NMFS 2017a)
[2] 14-year average from 2001-2014 (NMFS 2017a)
[3] 17-year average from 1998-2015, excluding 1999 (NMFS 2017a)
[4] NMFS 2017b
[5] NMFS 2017b

Steelhead Programs

As discussed in Section 2.1.1, Clearwater Subbasin and Hells Canyon Programs(Table 2-2), and Section 2.1.2, Salmon River Programs (Table 2-4), steelhead are collected for broodstock at the Dworshak National Fish Hatchery Ladder, Hells Canyon Dam Trap, and seasonal weirs at the Lower Pahsimeroi Hatchery, East Fork Salmon River Satellite, and Yankee Fork Weir. In addition to these facilities, steelhead broodstock are also collected via angling in South Fork Clearwater River and, if needed, on the Yankee Fork in the Salmon River Subbasin. Only the East Fork Salmon River Natural A-run Steelhead program removes fish from the local natural population for broodstock, leading to an effect on steelhead return numbers. However, the removal of natural-origin broodstock is limited by abundance-based sliding scales (Section 2.1.2.4, East Fork Salmon River) to reduce risk to the naturally spawning population.

Annually these programs likely encounter natural-origin steelhead and fall Chinook salmon, with little if any incidental mortality (Table 3-11). The effects of angling are subsumed in the overall Snake River Basin fishery, which is not a part of this EA, though angling effects are considered generally as part of the current conditions for salmon and steelhead (NMFS 2017c).

Table 3-11. Annual number of natural-origin steelhead and fall Chinook salmon handled during collection of adult hatchery steelhead.

Facility	Collection Period	Number Handled (Mortalities)	
		Steelhead	Fall Chinook Salmon
Dworshak National Fish Hatchery Ladder[1]	October to April	31 (2)	0
Hells Canyon Weir[2]	October to November	63 (1)	14 (0)
Pahsimeroi Fish Hatchery Weir[3]	February to May	125 (0)	0
East Fork Salmon River Weir[3]	March to May	30 (0)	0
Yankee Fork Weir and hook-and-line angling[4]	April to May	Not available	0
Sawtooth Fish Hatchery Weir[3]	February to May	48 (0)	0

Source: (Izbicki 2017; Leth 2017b, as cited in NMFS 2017c)

[1]Broodstock collection for the Salmon River B-run Steelhead program currently occurs primarily at Pahsimeroi Fish Hatchery with a portion provided by Dworshak National Fish Hatchery and with some collection in Yankee Fork using a picket weir as needed. Dworshak NFH ladder is not open continuously, but rather 10 times for less than one week over collection period to collect representative fish throughout the run. Average handling, and min and max mortalities information for Dworshak Hatchery based on actual values for the most recent three years (2015-2017).

[2]Hells Canyon Dam trap operated three days per week, eight hours per day

[3] Pahsimeroi, Sawtooth and East Fork traps are operated 24-hours a day, 7 days per week;

[4]Yankee Fork picket weir operated and checked daily; angling is conducted by Shoshone-Bannock Tribal staff to supplement brood collections at the weir

Coho Salmon Program

For the portion of the Clearwater Coho Salmon Program included in this EA, broodstock are collected from October through December at Lapwai Creek, Dworshak National Fish Hatchery, and Kooskia National Fish Hatchery (Section 2.1.1, Clearwater Subbasin and Hells Canyon Programs, Table 2-2). A seasonal picket weir is installed annually on Lapwai Creek. The Dworshak National Fish Hatchery Ladder is a fixed facility located on the right bank of the North Fork Clearwater River downstream of Dworshak Dam. At Kooskia National Fish Hatchery, broodstock enter a trap after encountering a velocity barrier and finger weir on Clear Creek.

Although unlikely considering the timing of adult coho salmon collection, salmon and steelhead are occasionally trapped at Kooskia National Fish Hatchery and Lapwai Creek. Captured individuals are temporarily delayed in their migrations and returned to the stream within 24 hours of collection. To date, no incidental captures of natural-origin steelhead or fall Chinook salmon have been reported at either facility; however, hatchery-origin steelhead and fall Chinook salmon have been occasionally collected (Nez Perce Tribe 2016).

USFWS and the Nez Perce Tribe operate the Dworshak National Fish Hatchery Trap from October through April to collect returning adult steelhead, and any coho salmon trapped are opportunistically collected from October through December. All salmon and steelhead trapped are returned to the Clearwater River if not targeted for hatchery broodstock (Nez Perce Tribe 2016).

Water Diversions

As described in Section 3.1, Water Quantity, the diversion of surface water for hatchery programs reduces instream flow between the water intake and discharge structures. Flow reductions and dewatering may affect salmon and steelhead if migration is impeded or if it leads to increased water temperatures. A relatively low percentage of streamflow is used in most cases, the distance of most diversions is relatively short, and the water use is non-consumptive; however, water is still removed from the system as a result of current hatchery operations. Dewatering of redds or prevention of natural-origin fish movement has not been observed historically at any facility when water flow could be limited by hatchery operations during low-flow months (NMFS 2017a). During low flow periods, habitat complexity may be reduced in some areas, but the diversion reaches are not completely disconnected from flow, and fish in the area are still able to either use the remaining habitat or migrate up or downstream.

Although surface water diversion for Kooskia National Fish Hatchery took up to 82 percent of Clear Creek flow in January 2017 (Table 3-1), measurable effects on salmon and steelhead have not been observed. Steelhead do not enter Clear Creek until spring, and Kooskia National Fish Hatchery does not use Clear Creek water from June through September because of high water temperatures (Johnson 2017, as cited in NMFS 2017d).

Intake Screening

Each facility with intakes, pumps, or screens has the potential to impact salmon and steelhead via impingement or entrainment during water intake. Facilities are routinely observed for any signs that screens are not effectively excluding fish from intakes. Although all intake facilities were designed to meet NMFS screening criteria applicable at the time of construction, not all facilities have been upgraded or retrofitted to meet the current (NMFS 2011a) screening criteria. Those that have not been upgraded may pose a greater risk of entrainment and impingement potential. Assessments of LSRCP facilities have been completed, and coordination with NMFS is underway to develop an implementation and prioritization strategy.

Because the intake screen at Dworshak National Fish Hatchery was installed in 1968, it does not adhere to the most recent NMFS screening criteria (NMFS 2011a). While this alone may not be a problem, occurrences of natural-origin juvenile salmonids within the hatchery water system have been documented, including some mortalities. Mortalities are usually newly emerged fry (fewer than 200 per year), but occasionally larger juveniles are found. The hatchery has not kept a record of mortalities, and species identification has been hampered by the small size and deteriorated condition of the specimens (Nemeth 2017). Therefore, operation of this intake is likely to result in some salmon and steelhead mortalities.

Effluent Discharge

All of the current hatchery facilities considered in this EA are either operated under NPDES permits, or do not need a NPDES permit because rearing levels are below permit minimums (Section 3.2, Water Quality). Eggbox programs produce less than 20,000 pounds of fish per year and distribute less than 5,000 pounds of feed at any one time; therefore, no NPDES wastewater permit is required. For those facilities that operate under NPDES permits, facility effluent is monitored to ensure compliance with permit requirements. Though compliance with NPDES permit conditions is not an assurance that effects on salmon and steelhead do not currently occur, the facilities use the water specifically for the purposes of rearing salmon and steelhead, which have a low mortality during hatchery residence compared to survival in the natural-environment (~55 percent compared to 7 percent [Bradford 1995]). Because the same water used for rearing (where survival is high compared to the natural environment) is then discharged into the surrounding habitat and then further diluted once it is combined with the river water, NMFS believes effluent currently has a negligible impact on salmon and steelhead in the study area (NMFS 2017c).

Facilities discharge proportionally small volumes of water with waste (predominantly biological waste) into a larger waterbody, which results in temporary, very low or undetectable levels of contaminants. General effects of biological waste in hatchery effluent are summarized in NMFS (2004), though the biological waste is not likely to have a detectable effect on salmon and steelhead because of pollution abatement practices that reduce the biological waste at each facility, as well as the relatively small volume of effluent compared to the streamflow.

Therapeutic chemicals used to control or eliminate pathogens (i.e., formaldehyde, sodium chloride, iodine, potassium permanganate, hydrogen peroxide, antibiotics), can also be present in hatchery effluent. However, these chemicals are not likely to be problematic for salmon and steelhead because they are quickly diluted beyond manufacturer’s instructions when added to the total effluent and again after discharge into the recipient waterbody. Therapeutants are also used periodically, and not constantly during hatchery rearing. Many therapeutants break down quickly in the water and/or are not likely to bioaccumulate in the environment. For example, formaldehyde readily biodegrades within 30 to 40 hours in stagnant waters. Similarly, potassium permanganate would be reduced to compounds of low toxicity within minutes. Aquatic organisms are also capable of transforming formaldehyde through various metabolic pathways into nontoxic substances, preventing bioaccumulation in organisms (USEPA 2015).

Facility Maintenance Activities

HGMPs referenced in Section 2.2, Alternative 2, Proposed Action (NMFS 2017a, 2017b, 2017c, 2017d) prepared for each hatchery program describe facility-specific maintenance activities that currently occur at each location, which are incorporated herein by reference. NMFS also references details on maintenance activities provided in two Biological Opinions recently prepared for the effects of ongoing hatchery operation and maintenance on bull trout (*Salvelinus confluentus*; USFWS 2017a, 2017b). Routine preventative maintenance of hatchery facility structures is necessary for proper functionality.

For most facilities in anadromous waters, hatchery-related infrastructure (e.g., weirs and water source intakes) are located within migration and/or spawning habitat of salmon and steelhead. Therefore, individual fish are temporarily displaced from occupied habitats when personnel or heavy equipment are working in or near the river channel. Hatchery maintenance activities may displace juvenile fish through noise and instream activity or expose them to brief pulses of sediment as activities occur instream.

During debris removal activities at intakes and weirs, noise or sediment likely currently displaces juvenile fish. To prevent exposure of embryonic and age-0 juvenile life stages during in-water maintenance activities, all work is currently completed within agency-approved summer in-water work windows unless site-specific variances are authorized by state and Federal resource agencies. When maintenance activities occur within water, they are currently implemented using BMPs described in Section 2.1.4, Operation and Maintenance.

3.3.5.9 Research, Monitoring, and Evaluation

Although some hatchery programs have program-specific RM&E activities (Table 2-9; Table 2-10; Table 2-11), RM&E activities associated with other research programs are currently conducted independent of hatchery operations. NMFS (2017a, 2017b, 2017c, and 2017d) determined that the effects of ongoing program RM&Es on natural-origin salmon and steelhead populations are unlikely to contribute to a decrease in the abundance, productivity, diversity, or spatial structure of the populations. RM&E activities that are directly related to hatchery programs are currently implemented using well-established (e.g., Galbreath et al 2008) methods and protocols. Because the intent of RM&E for all programs is to improve the understanding of salmon and steelhead populations, the information gained outweighs the risks to the populations, based on the small proportion of fish encountered. Incidental effects may result from tagging, such as injury to salmon and steelhead.

Collection of adults at traps delays individuals in their upstream migration and could alter spawning behaviors upon release. Individuals may also suffer stress or mortality during tagging or tissue sampling. Mortality from tagging is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment).

NMFS has developed general guidelines to reduce impacts when collecting listed adult and juvenile salmonids (NMFS 2000, 2008b). Currently, hatchery operators and staff must abide by these guidelines, which are incorporated as terms and conditions into current ESA Section 7 opinions and Section 10 permits for research and enhancement. Additional monitoring principles for supplementation programs have been developed (Galbreath et al. 2008).

Ongoing spawning ground surveys are likely to temporarily harass salmon and steelhead in surveyed reaches of the study area. At times, the research involves observing adult fish, which are more sensitive to disturbance than juveniles. These avoidance behaviors are likely in the range of normal predator and disturbance behaviors.

Individual salmon and steelhead are currently captured at rotary screw traps associated with juvenile outmigration monitoring for several hatchery programs. These ongoing collections temporarily delay downstream migration, and stress fish during handling (if required).

Electrofishing is also used to collect natural- and hatchery-origin steelhead in Panther Creek and the Yankee Fork for PIT tagging. Steelhead in these streams are therefore likely exposed to potential stress from handling and tagging.

In addition, electrofishing is used in the South Fork Salmon River above the weir, Cabin Creek, and Curtis Creek to assess survival at various lifestages of hatchery- and natural-origin Chinook salmon and population estimates of natural-origin population. Summer Chinook salmon in these streams are also likely exposed to potential stress from handling.

3.3.5.10 Critical Habitat and Essential Fish Habitat

As discussed in Section 3.3.3, Critical Habitat and Essential Fish Habitat, critical habitat has been designated in the study area for the Snake River Spring/Summer-run Chinook Salmon ESU, Snake River Fall-run Chinook Salmon ESU, Snake River Sockeye Salmon ESU, and Snake River Basin Steelhead DPS. In addition, with the exception of hatchery programs that operate in nonanadromous waters (Niagara Springs, Magic Valley, and Hagerman National fish hatcheries), all facilities that support hatchery programs included in this EA currently operate and/or release juvenile hatchery fish into EFH for Chinook salmon and historic EFH for extirpated natural coho salmon. Further, those programs that operate or release hatchery fish into the Clearwater River Subbasin also overlap with EFH for reintroduced coho salmon.

Ongoing direct effects on critical habitat and EFH result from facility operation (e.g., water diversion and effluent discharge), maintenance, and the presence of hatchery program-related weirs and water withdrawal structures. Genetic and ecological interactions between hatchery-reared fish and fish in the natural environment also contribute to minor degradation of critical habitat and EFH, particularly as related to rearing habitat.

As described in Section 3.3.5.8, Facility Operations, ongoing water withdrawals for hatchery operations can affect critical habitat and EFH by reducing streamflow, impeding migration, or limiting the amount of stream-dwelling organisms that could provide 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. All hatchery programs are currently operated to minimize each of these effects. In general, water withdrawals are small enough in scale that changes in flow are low, and measurable impacts on critical habitat and EFH do not occur. Minor modifications to channel habitat by construction and operation of weirs or maintenance actions results in short-term water quality impairments. However, impacts on water quality are typically short-lived, and do not currently alter the function or usability of critical habitat and EFH once turbidity subsides.

Currently, hatchery fish returning to the Snake River Basin largely spawn and rear near the hatchery of origin, and do not generally enter areas that are identified as critical habitat and/or EFH for other species outside of the study area. Some spring/summer Chinook salmon, coho salmon, and steelhead from ongoing programs might stray into other rivers. However, because straying is low from these programs (NMFS 2017a, 2017b, 2017c, 2017d), these few strays do not exceed the carrying capacities of natural production areas, or increase disease or predation in these habitats.

3.4 Fisheries

The ongoing operation of hatchery programs increases the number of hatchery-origin fish that are available for fisheries. Abundance of natural-origin salmon and steelhead can limit tribal and recreational fisheries. However, hatchery production and fishery management strategies such as selective recreational fisheries (fisheries that target ad-clipped hatchery-origin fish) may allow fishing effort to be focused on hatchery-origin fish rather than natural-origin fish. Careful monitoring and analysis of fisheries practices can determine how specific fisheries may benefit or maintain populations.

Salmon and steelhead from the 15 hatchery programs included in this EA may be exposed to fisheries in the Pacific Ocean, the Columbia River, and in the Snake River Basin; however, as described in Section 3.3.1, Study Area, effects on fisheries downstream of Ice Harbor Dam are not likely to be discernable. Very few spring/summer Chinook salmon and steelhead are caught in ocean fisheries (NMFS 2014b). Substantial numbers of coho salmon are caught in ocean fisheries (PFMC 2016); however, the Clearwater River Coho Salmon Program contributes an extremely small proportion of the total number of coho salmon smolts released into the Columbia River Basin, and therefore, an extremely small contribution to fisheries. Although spring/summer Chinook salmon, steelhead, and coho salmon may all be harvested by commercial, tribal, and recreational fisheries in the Columbia River through plans developed by parties to the *U.S. v Oregon* process, the likelihood of detecting specific effects of the programs included in this EA on these fisheries is low. Therefore, the subsections below focus on fisheries in the Snake River Basin, specifically in the Clearwater River Subbasin, the Hells Canyon Reach of the Snake River, and the Salmon River Subbasin.

Discussion is limited to fisheries for spring/summer Chinook salmon, steelhead, and coho salmon within the study area. One exception is the spring/summer Chinook salmon fishery in the Clearwater River subbasin because no Clearwater River spring/summer Chinook salmon hatchery programs are included in this EA; therefore, only steelhead and coho salmon fisheries are discussed for the Clearwater River subbasin. Although Snake River fall Chinook salmon may be harvested during fall fisheries, the hatchery programs included in this EA have little or no effect on this fishery. Furthermore, harvest of fall Chinook is very low relative to that of spring/summer Chinook salmon, and is limited to the Snake and Clearwater rivers.

IDFG regulates and manages recreational fisheries in the Clearwater and Salmon River subbasins, comanages recreational fisheries in the Hells Canyon Reach of the Snake River with ODFW, and comanages recreational fisheries in the Snake River along the Washington border with WDFW. WDFW manages recreational fisheries in the Snake River from the Idaho border downstream to Ice Harbor Dam.

Tribal fisheries in the study area are managed by either the Nez Perce Tribe or the Shoshone-Bannock Tribes (see Section 3.8. Cultural Resources). The most recent *U.S. v. Oregon* Management Agreement (NMFS 2018) provides a framework for managing some of the fisheries from Ice Harbor Dam to Lower Granite Dam for the spring/summer Chinook fisheries. The agreement includes a list of tribal and non-tribal salmonid fisheries in the Columbia River Basin that are intended to ensure fair sharing of harvestable fish between tribal and non-tribal fisheries in accordance with Treaty fishing rights standards and *U.S. v. Oregon*. Other fisheries not in the *U.S. v. Oregon* Management Agreement include steelhead, fall Chiook salmon, and coho fisheries in the analysis area, as well as spring/summer Chinook salmon fisheries above Lower Granite Dam.

3.4.1 Spring/Summer Chinook Salmon

Timing and duration of recreational fisheries for spring/summer Chinook salmon are highly variable each year and depends on run size and allocation (Brian Leth, IDFG, email sent to Dave Ward, HDR, February 23, 2018b, regarding recreational fisheries). The recreational fishery in the Salmon River Subbasin includes both spring and summer seasons, and is limited to portions of the Salmon, Little Salmon, and South Fork Salmon rivers (IDFG 2018a). Fishing is generally allowed in a short section of the lower Salmon River and in most of the Little Salmon River in spring. Fishing is generally allowed in the upper Salmon River (downstream from Sawtooth Fish Hatchery) and in the South Fork Salmon River in summer (NMFS 2011b). Fishing is also authorized in the Grande Ronde and Imnaha Subbasins (NMFS 2013). Recreational fisheries are selective; only fish with clipped adipose fins may be retained.

Recreational harvest has varied widely among recent years, but catch in the Salmon River Subbasin is usually at least 15 times greater than that in the Hells Canyon Reach. Catch and subsequent release of fish without clipped adipose fins has also been highest in the Salmon River Subbasin.

The Nez Perce Tribe harvests Snake River spring/summer Chinook salmon throughout its treaty territory and at usual and accustomed locations. Harvest occurs primarily in the Rapid River within the Salmon River Subbasin; however, harvest also occurs in the South Fork Salmon River and other locations throughout the Salmon River and Clearwater River subbasins. Harvest by the Shoshone-Bannock Tribes also occurs within the Salmon River Subbasin. Also in the Grande Ronde and Imnaha Subbasins, both the Nez Perce Tribe and the Shoshone-Bannock Tribes, as well as the Confederated Tribes of the Umatilla Indian Reservation fish for spring/summer Chinook salmon. Tribal fisheries may be selective or non-selective; fish with intact adipose fins may often be kept. Fisheries are open until specifically closed.

3.4.2 Steelhead

Recreational fisheries for steelhead are generally managed by changes in daily and possession limits, rather than by season duration (Brian Leth, IDFG, email sent to Dave Ward, HDR, February 23, 2018b, regarding recreational fisheries). Although fishing seasons vary among and within subbasins, fisheries generally have a spring component, open from January 1 through April or May, a closed season during portions of spring and/or summer, and a fall component for the remainder of the year. The early portion of the fall component (1 to 3 months) is designated as catch and release only in most areas. The recreational fisheries are selective; only fish with clipped adipose fins may be retained.

The recreational fishery in the Clearwater River Subbasin occurs in the mainstem, North Fork, Middle Fork, and South Fork of the Clearwater River. Fish are also harvested in the Hells Canyon Reach of the Snake River. Harvest in the Salmon River Subbasin is limited to the Salmon River downstream from

Sawtooth Fish Hatchery, and most of the Little Salmon River (IDFG 2018b). Harvest is generally higher in the fall than in spring, especially in the Hells Canyon Reach of the Snake River. Harvest has varied widely among recent years, but is generally highest in the Salmon River Subbasin. Catch and subsequent release of fish without clipped adipose fins has also been highest in the Salmon River Subbasin.

The Nez Perce Tribe harvests Snake River steelhead throughout its treaty territory and at usual and accustomed locations. Tribal members fish throughout the Salmon River and Clearwater River subbasins, but most current steelhead harvest occurs in the North Fork Clearwater River. Harvest by the Shoshone-Bannock Tribes occurs within the Salmon River Subbasin. Tribal fisheries may be selective or non-selective; fish with intact adipose fins may often be kept. Fisheries are open until specifically closed.

Currently, all steelhead fisheries in the analysis area are managed together in a framework that sets limits on lethal impacts rates for each MPG (NMFS 2019a). Furthermore, in years of critically low abundance, additional conservation measures will be implemented to reduce lethal impact rates by MPG. For example, when the returns were critically low for 2018-2019 fishing season, managers decided to reduce the bag limit for Idaho's recreational fishery as a conservation measure. Recently, NMFS determined that this framework is not likely to jeopardize the continued existence or recovery of any of the ESUs and DPSs listed in the Snake River (NMFS 2019a).

3.4.3 Coho Salmon

A recreational fishery for coho salmon has recently begun on the mainstem Clearwater, Middle Fork Clearwater, and North Fork Clearwater rivers, as well as the mainstem Snake River above Lower Granite Dam. Because Clearwater River coho salmon from the proposed hatchery production do not have clipped adipose fins, recreational anglers can keep fish with an intact adipose fin. Similar to spring/summer Chinook salmon, duration of the season each year depends on run size. To date, recreational fisheries in Idaho have occurred only in 2014, 2015, and 2017, generally from late summer through the middle of fall (Christine Kozfkay, IDFG, email sent to Emi Kondo, NMFS, April 10, 2019, regarding recreational coho salmon fisheries).

The Nez Perce Tribe harvests coho salmon in the Clearwater River Subbasin, as well as at usual and accustomed locations. The Tribal fishery is non-selective because Clearwater River coho salmon from the proposed hatchery production do not have clipped adipose fins. Fisheries for the Tribe are open until specifically closed.

3.5 Other Fish Species

Adult and juvenile fish propagated at the 15 hatchery programs included in this EA have the potential to interact with fish species other than salmon and steelhead in the natural environment. Approximately 100 fish species have been documented in the Columbia River Basin, many of which are introduced (Ward and Ward 2004). Many of these species are also found in the Snake River Basin, including hatchery-origin salmon and steelhead. As described in Section 3.3.1, Study Area, the area within which the effects of the hatchery programs can be detected on fish species includes all waterbodies downstream of hatchery release sites to Ice Harbor Dam on the Snake River. The study area also includes stream reaches adjacent to facilities used to rear program fish. As noted in Section 3.3.5.8, Facility Operations, facilities that may potentially affect other fish species include:

- Dworshak National Fish Hatchery Ladder and North Fork Clearwater Intake (ladder downstream of Dworshak Dam)
- Kooskia National Fish Hatchery

- Hells Canyon Dam Trap
- Rapid River Fish Hatchery Trap and Intake
- South Fork Salmon River Satellite and Intake
- Johnson Creek Weir
- Pahsimeroi Fish Hatchery Trap and intakes (lower and upper)
- East Fork Salmon River Satellite and Intake
- Yankee Fork Weir
- Sawtooth Fish Hatchery Trap and Intake

No program-related broodstock collection or release of hatchery fish occurs at or near Oxbow, Niagara Springs, Magic Valley, or Hagerman National fish hatcheries. Because these facilities follow NPDES criteria and monitor effluent, it is not likely that ongoing hatchery operations, including water diversion, effluent discharge, or maintenance activities, affect other fish species.

The fish from the current programs can potentially interact with other fish species during two different life phases, first as smolts upon release, and second as adults upon return. As discussed in Section 3.3, Salmon and Steelhead, smolts are not likely to have a discernible effect downstream of Ice Harbor Dam. Adults returning to the Clearwater River Subbasin, Hells Canyon Reach, and Salmon River Subbasin are also not likely to have a discernible effect downstream of Ice Harbor Dam because the fish from these programs are likely to have similar density-dependent interactions (e.g., competitive or predator/prey relationships) with other fish species, comparable to that discussed in Section 3.3, Salmon and Steelhead.

Of the native and introduced fish species in the Columbia River Basin, 14 native and 3 introduced species have been identified as the most likely to have potential interactions with fish from the current programs (Table 3-12). Bull trout, listed under the ESA as threatened (64 FR 58909, November 1, 1999), may be locally common in much of the habitat occupied by anadromous fish in the Upper Snake River Basin. The primary interaction between bull trout and salmon and steelhead is predation of salmon and steelhead by subadult and adult bull trout. Further details about ecological interactions between bull trout and fish from the current programs are provided by USFWS (2017a, 2017b).

Pacific lamprey (*Entosphenus tridentatus*) and river lamprey (*Lampetra ayresii*) are considered culturally important to many tribes, and have declined to a remnant of their numbers prior to human development. Anadromous lamprey are vulnerable to similar threats as salmonids, including barriers to passage, reduced access to spawning habitat, degradation of habitat and water quality, and presence of introduced predators (Luzier et al. 2011). Hatchery fish may act as a buffer against marine mammal predation on lamprey.

Additional fish species are considered Federal species of concern, or are listed by individual or multiple states as endangered, sensitive, species of concern, or candidate species (Table 3-12). Hatchery fish may compete for spawning sites or have redd superimposition with other salmonid species such as westslope cutthroat trout (*Oncorynchus clarki lewisi*) and rainbow trout. Further details about these species' life history, current status and trends, limiting factors and threats, and interaction with salmon and steelhead are provided by NMFS (2014a).

Table 3-12. Species other than salmon or steelhead that may interact with hatchery-origin salmon and steelhead in the Study Area.

Species	Range	Federal/State Listing Status	Relationship		
			Prey	Competitor	Predator
Native					
Bull trout (*Salvelinus confluentus*)	Throughout the Columbia River Basin	Federally threatened (64 FR 58909, November 1, 1999) Oregon State sensitive Washington State species of concern	✓	✓	✓
Pacific lamprey (*Entosphenus tridentatus*)	Accessible reaches of the Columbia River Basin	Federal species of concern Idaho State endangered Oregon State sensitive	✓	✓	✓
River lamprey (*Lampetra ayresii*)	Accessible reaches of the Columbia River Basin	Federal species of concern Washington State candidate	✓	✓	✓
Brook lamprey (*L. richardsoni*)	Throughout the Columbia River Basin	Oregon State sensitive	✓	✓	
Westslope cutthroat trout (*Oncorhynchus clarki lewisi*)	Upper Columbia River Basin and Snake River	Federal species of concern Oregon State sensitive	✓	✓	✓
Rainbow trout (*O. mykiss*)	Throughout the Columbia River Basin	Not listed	✓	✓	✓
Leopard dace (*Rhinichthys falcatus*)	Throughout the Columbia River Basin	Washington State candidate	✓		
Umatilla dace (*R. umatilla*)	Columbia, Kootenay, Slocan, and Snake Rivers	Washington State candidate	✓	✓	
Margined sculpin (*Cottus marginatus*)	Tucannon, Walla Walla and Umatilla River subbasins	Federal species of concern Washington State sensitive	✓	✓	✓
Mountain sucker (*Catostomus platyrhynchus*)	Middle-Columbia and Upper Columbia River watersheds	Washington State candidate		✓	
Northern pikeminnow (*Ptychocheilus oregonensis*)	Throughout the Columbia River Basin	Not listed	✓	✓	✓
Three-spine stickleback (*Gasterosteus aculeatus*)	Throughout the Columbia River Basin	Not listed	✓	✓	
White sturgeon (*Acipenser transmontanus*)	Accessible reaches of the Columbia River Basin	Not listed			✓
Mountain whitefish (*Prosopium williamsoni*)	Columbia River Basin	Not listed	✓	✓	✓

Species	Range	Federal/State Listing Status	Relationship		
			Prey	Competitor	Predator
Introduced					
Brook trout (*Salvelinus fontinalis*)	Upper reaches of watersheds throughout the Columbia River Basin	Not listed	✓	✓	✓
Smallmouth bass (*Micropterus dolomieu*)	Columbia River Basin	Not listed		✓	✓
Largemouth Bass (*Micropterus salmoides*)	Columbia River Basin	Not listed		✓	✓

Source: Ecovista et al. (2003); Ecovista (2004); Ward and Ward (2004); NMFS (2014a)

Other species may prey heavily on salmonid eggs or juveniles. Hatchery fish may act as a buffer against predation on wild fish. Conversely, releases of hatchery fish may attract additional predators that may then prey on wild fish.

Current disease and nutrient effects on salmonid species (e.g., bull trout) are likely to be similar to the effects discussed in Sections 3.3.5.5, Diseases, and 3.3.5.7, Nutrient Cycling. Diseases that pose particular risk to hatchery-origin salmonids (i.e., BKD and IHN) only affect salmonid species. Other diseases that are endemic to many fish species (e.g., freshwater ich, *Ichthyophthirius multifiliis*) may also be amplified in a hatchery to affect nonsalmonid species.

Other salmonid species, such as bull trout and westslope cutthroat trout, may occur near existing hatchery facilities and release sites; however, several factors currently reduce the likelihood of disease and pathogen transmission. The proportion of facility surface water withdrawal and subsequent discharge at most sites comprises only a portion of the total streamflow (Table 3-1), which reduces, via dilution, the likelihood for transmission of pathogens from effluent. Smolt release strategies promote distribution of hatchery fish throughout the system and rapid outmigration, which reduces the concentration of hatchery-released fish in the river, and therefore, the likelihood for a diseased hatchery fish to encounter other salmonids. Fish health protocols currently in place to address pathogens also minimize the likelihood for disease and pathogen effects on salmonids. More details about disease effects on bull trout are discussed by USFWS (2017a, 2017b).

Fish species other than salmon or steelhead may also be affected by operation of hatchery facilities, similar to the effects discussed in Section 3.3.5.8, Facility Operations. Flow reductions and dewatering may affect fish species other than salmon or steelhead if migration is impeded, or if such reduction in flow leads to increased water temperatures. During low-flow periods, habitat complexity may be reduced in some areas.

Each facility with intakes, pumps, or screens has the potential to affect fish via impingement or entrainment during water intake. Although all intake facilities were designed to meet NMFS screening criteria applicable at the time of construction, not all facilities have been upgraded or retrofit to meet the current (NMFS 2011a) screening criteria. Those that have not been upgraded may pose a greater risk of entrainment and impingement potential.

The spatial distribution of fish species other than salmon or steelhead are generally not affected by weir operations because weirs are designed to allow juvenile passage, and adults are passed upstream when captured. The operation of adult collection facilities, particularly seasonal, channel-spanning weirs, can affect migratory species (e.g., Pacific lamprey and bull trout) via migratory delay. If captured, fish may be harmed during handling at the collection facility. Although adult passage may be delayed slightly, weir operation guidelines and monitoring of weirs minimize delays and impacts on fish. All nontarget fish are handled and released in accordance with SOPs (IDFG et al. 2017). Effects of facility operations on bull trout are further discussed by USFWS (2017a, 2017b).

Fish species other than salmon or steelhead may also be affected by effluent discharge from hatchery facilities, similar to the effects discussed in Section 3.3.5.8, Facility Operations. However, facilities currently discharge proportionally small volumes of water with waste (predominantly biological waste) into a larger waterbody, which results in temporary, very low or undetectable levels of contaminants.

Although many fish species may be incidentally collected during RM&E activities described in Section 3.3.5.9, Research, Monitoring, and Evaluation, general guidelines to reduce impacts on salmon and steelhead (NMFS 2000, 2008b) also reduce effects on other species. In addition, BMPs in place for ESA-listed salmon and steelhead (NMFS 2017a, 2017b, 2017c, 2017d) and for bull trout (USFWS 2017a, 2017b) further reduce effects.

3.6 Wildlife

The hatchery facilities and hatchery-origin salmon and steelhead propagated for the 15 hatchery programs included in this EA have the potential to affect wildlife by acting as either predators or prey, enhancing nutrient availability, transferring pathogens or toxic contaminants outside the hatchery environment, or impeding wildlife movement. The study area for wildlife is limited to the project area as described in Section 1.2, Project Area and Study Area; therefore, marine mammals are not considered here because marine mammals are not present within the study area.

Numerous species of birds, mammals, and invertebrates may potentially interact with salmon and steelhead associated with the hatchery programs included in this EA, or may be otherwise affected by hatchery operations (Table 3-13). Hatchery fish may act as a buffer against predation on wild fish. Conversely, releases of hatchery fish may attract additional predators that may then prey on wild fish.

Birds that occur in the study area may consume salmon and steelhead, or may be affected by hatchery operations through noise of hatcheries using heavy equipment. Salmon and steelhead predators include the bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), osprey (*Pandion haliaetus*), and great blue heron (*Ardea Herodias*). One bald eagle's nest, a mature eagle, and a fledgling have been observed near Kooskia National Fish Hatchery. Also, only a vacant nest for a golden eagle was observed near Niagara Springs Fish Hatchery, indicating that there is no golden eagle within a close proximity to the Niagara Springs Fish Hatchery.

Mammals that occur in the study area may consume salmon and steelhead, or may encounter and be affected by hatchery operations, broodstock collection activities, or juvenile release activities. Canada lynx (*Lynx canadensis*) maintain large home ranges and are highly mobile, and may occasionally travel through the area near Hells Canyon and Salmon River hatchery programs (USFWS 2017a). Wolverines (*Gulo gulo luscus*) are also highly mobile and may travel through higher elevation areas associated with some hatchery programs. McCall Hatchery is located within the range of the northern Idaho ground squirrel (*Urocitellus brunneus*), and is approximately 2.5 miles from the nearest documented population (USFWS 2003 in USFWS 2017a). River otters (*Lontra canadensis*) and mink (*Neovison vison*) occur throughout the Study Area and may consume salmon and steelhead (Cederholm 2000; Melquist 1997 in NMFS 2014a).

The Bliss Rapids snail (*Taylorconcha serpenticola*) and the Snake River physa snail (*Physa natricina*) both occur in the vicinity of Hagerman National, Niagara Springs, and Magic Valley fish hatcheries (USFWS 2017a). Snails can be affected by changes in water quantity and water quality near hatcheries. Maintenance activities in springs at Hagerman National and Niagara Springs fish hatcheries can also disturb Bliss Rapids snails.

Table 3-13. Primary wildlife species that may interact with hatchery-origin salmon and steelhead or be affected by hatchery operations in the Study Area.

Species[1]	Range in relationship to study area	Federal/State Listing Status	Relationship		
			Prey	Predator	Otherwise Affected by Operations
Birds					
Bald Eagle (*Haliaeetus leucocephalus)*	Throughout the Columbia River Basin	Federally protected under Bald Eagle and Golden Eagle Protection Act		✓	✓
Golden Eagle (*Aquila chrysaetos)*	Throughout the Columbia River Basin	Federally protected under Bald Eagle and Golden Eagle Protection Act Washington State candidate		✓	
Osprey (*Pandion haliaetus*)	Throughout the Columbia River Basin	Federally protected under Migratory Bird Treaty Act		✓	✓
Great Blue Heron (*Ardea herodias*)	Throughout the Columbia River Basin	Federally protected under Migratory Bird Treaty Act		✓	
Mammals					
Canada Lynx (*Lynx canadensis*)	Subalpine forests in study area	Federally threatened (65 FR 16053 16086) Idaho State threatened Washington State endangered		✓	✓
North American Wolverine (*Gulo gulo luscus*)	Subalpine forests in study area	Federally proposed threatened Oregon State threatened Washington State candidate		✓	✓
Northern Idaho Ground Squirrel (*Urocitellus brunneus*)	Dry meadows surrounded by coniferous forests; near McCall Fish Hatchery	Federally threatened (65 FR 17780) Idaho State threatened			✓
River Otter (*Lontra canadensis*)	Throughout the Columbia River Basin	Not listed		✓	✓
Mink (*Neovison vison*)	Throughout the Columbia River Basin	Not listed		✓	✓
Invertebrates					
Bliss Rapids Snail (*Taylorconcha serpenticola*)	Middle Snake River	Federally threatened (57 FR 59244)	✓		✓
Snake River Physa Snail (*Physa natricina*)	Middle Snake River	Federally endangered (57 FR 59244)	✓		✓

Source: NMFS (2014a); USFWS (2017a, 2017b).

[1] Additional species are provided by NMFS (2014a); the various non-sensitive bird species that may potentially be affected by temporarily elevated noise are listed in BPA EGIS (2018).

Additional bird and mammal species may at times consume juvenile hatchery salmon and steelhead, and some invertebrates may serve as prey for hatchery salmon and steelhead. A comprehensive list of wildlife species and potential effects is provided in Section 3.5 of the Mitchell Act FEIS (NMFS 2014a). Three program hatcheries in the Upper Snake River Basin - Magic Valley Fish Hatchery, Niagara Springs Fish Hatchery, and Hagerman National Fish Hatchery – were not in the Mitchell Act FEIS project area. However, based on review of Information, Planning, and Consultation System (IPAC System) (USFWS 2017c) and available literature, federally listed and non-listed species identified in the Mitchell Act FEIS encompass those species expected to occur in the vicinity of the three hatcheries in the Upper Snake River Basin that may be affected.

Similar to the discussion in Section 3.3, Salmon and Steelhead, the transfer of toxic contaminants and/or pathogens to wildlife associated with the ongoing hatchery programs is unlikely to contribute to their current presence/load in wildlife due to the regulation of hatchery operations through NPDES Aquaculture Facilities permits and the applicants' fish health policies (USFWS 2004; NWIFC and WDFW 2006; NMFS 2014a; USFWS 2017a). The presence of hatchery-origin salmon and steelhead carcasses likely provides a benefit to local wildlife as a nutrient source. Weirs and traps used for collection of fish may impede wildlife movement and/or benefit wildlife by restricting fish migration and subsequently enhancing predation efficiency. The 15 programs currently utilize passive methods of predator control (i.e., netting around facilities).

3.7 Socioeconomics

The existing hatchery programs affect socioeconomic conditions by providing fish for commercial and recreational fishing opportunities, employment, and economic opportunities through hatchery operations. Hatchery-related spending affects the economy in the community surrounding the hatchery, and those economic impacts can extend outward, having a wider regional effect. As described in Section 3.3.1, Study Area, the study area for socioeconomics is limited to the Snake River Basin upstream from Ice Harbor Dam, with the focus on economic impacts of current hatchery operations.

One important impact hatchery programs can have on social economics is through tribal and nontribal commercial and recreational fisheries that target hatchery fish. Changes in hatchery production levels can create beneficial or adverse effects on harvests, which would affect the industries and communities that depend on them. The hatchery programs assessed in this EA are part of the larger Lower Snake River economic impact region analyzed in the Mitchell Act FEIS (NMFS 2014a, Figure 3-1). According to the Mitchell Act FEIS, the total hatchery-generated activity in the Lower Snake River economic impact region creates about 934 jobs, generates about $24.5 million in personal income and results in about $29.3 million to $35.0 million in recreational expenditures (NMFS 2014a, Table 3-23 and Table 4-109).

Section 3.4, Fisheries, describes salmon and steelhead in the Snake River Basin. IDFG regulates and manages recreational fisheries in the Clearwater and Salmon River subbasins, comanages recreational fisheries in the Hells Canyon Reach of the Snake River with ODFW, and comanages recreational fisheries in the Snake River along the Washington border with WDFW. WDFW manages recreational fisheries in the Snake River from the Idaho border downstream to Ice Harbor Dam. Recreational fisheries for Spring/Summer Chinook salmon and steelhead are selective; only fish with clipped adipose fins may be kept. Because Clearwater River coho salmon from the hatchery production included in this EA do not have clipped adipose fins, recreational anglers can keep fish with an intact adipose fin.

The Nez Perce Tribe and Shoshone-Bannock Tribes are fisheries comanagers in their designated areas with IDFG, WDFW, and ODFW. Tribes regulate and manage their own fisheries. Tribes have both selective and non-selective fisheries that can potentially harvest hatchery-origin fish. The degree to which hatchery-origin fish wander (i.e., swim to a nonnative tributary first, but return to their native tributary during spawning season) is unknown and is not likely affecting Nez Perce Tribe or Shoshone-Bannock Tribes fisheries.

The current operating budgets of hatchery facilities associated with the 15 hatchery programs analyzed in this EA range from $21,000 to $3.4 million per year (Table 3-14). Operating budgets vary widely among facilities because some are used for most life stages of one or more programs, and others are used for as few as one life stage for one program. Many of the hatcheries are also used for programs not included in this EA. Hatchery facilities are funded by IPC, USFWS, LSRCP, Pacific Coastal Salmon Recovery Fund, or the U.S. Army Corps of Engineers (USACE).

The 15 hatchery programs included in this EA currently provide about 358 to 514 of the 934 hatchery-related jobs, $9.4 million to $13.5 million of the $24.5 million in hatchery-related personal income, and $13.4 to $16.9 million of the $29.3 to $35.0 million in recreational expenditures in the Lower Snake River economic impact region (Table 3-15). Of note, the economic impact of hatchery spending on jobs is broader than employment at the hatcheries because these jobs include indirect employment opportunities in the community that provide goods and services related to hatchery operations and personnel.

Table 3-14. Funding source and operating budgets for programs included in this EA.

Program	Funding Source	Hatchery Staffing Level	Annual Operating Budget	Research, Monitoring & Evaluation Budget
Clearwater River Subbasin				
Clearwater Coho	PCSRF[1]; USACE; USFWS-LSRCP	4.5 FTE	$310,200	--
South Fork Clearwater Steelhead	PCSRF; USACE; USFWS – LSRCP	2.83 FTE, 62.7 seasonal months	$1,059,600	--
Hells Canyon Reach				
Hells Canyon Snake River A-run Summer Steelhead)	Idaho Power Company	1.3 FTE, 27.2 seasonal months	$510,700	$99,800
Hells Canyon Snake River Spring Chinook Salmon	Idaho Power Company	0.4 FTE, 7.0 seasonal months	$180,500	$18,700
Salmon River Subbasin				
Little Salmon River A-run Summer Steelhead	USFWS - LSRCP; Idaho Power Company	2.0 FTE, 28.5 seasonal months	$817,800	$119,000
Little Salmon/Rapid River Spring Chinook Salmon	Idaho Power Company	3.1 FTE, 58.8 seasonal months	$1,456,000	$183,000
South Fork Salmon River Summer Chinook Salmon	USFWS - LSRCP	2.7 FTE, 35.6 seasonal months	$932,300	$125,400
Johnson Creek Artificial Propagation Enhancement	BPA	3.5 FTE	$504,300	$1,069,484
South Fork Chinook Salmon Eggbox	USFWS - LSRCP	0.4 seasonal months	$7,400	--
Pahsimeroi A-run Summer Steelhead	Idaho Power Company	1.7 FTE, 32.7 seasonal months	$667,000	$128,600
Pahsimeroi Summer Chinook Salmon	Idaho Power Company	2.0 FTE, 16.9 seasonal months	$666,500	$116,700
East Fork Salmon River Natural A-run Steelhead	USFWS - LSRCP	0.2 FTE, 2.4 seasonal months	$37,300	$21,000

Program	Funding Source	Hatchery Staffing Level	Annual Operating Budget	Research, Monitoring & Evaluation Budget
Steelhead Streamside Incubator Project A-run and B-run	Idaho Power Company; USFWS - LSRCP	0.8 FTE, 12.7 seasonal months	$131,500	--
Salmon River B-run Steelhead	USFWS - LSRCP; Idaho Power Company	1.1 FTE, 10.2 seasonal months	$423,800	$119,500
Upper Salmon Spring Chinook Salmon	USFWS - LSRCP	4.2 FTE, 67.9 seasonal months	$1,470,500	$148,500

Source: Gary Byrne, IDFG, email sent to David Ward, HDR on January 22, 2018, regarding Socioeconomic Information Request
[1] PCSRF = Pacific Coast Salmon Restoration Fund

Table 3-15. Economic impacts of current program operations.

Program	Number of Jobs Impacted[1]	Economic Impacts on Personal Income[1]	Effects on Recreational Expenses[1]
Clearwater River Subbasin			
Clearwater Coho	15 – 24	$392,500 - 632,000	$560,500 - 755,700
South Fork Clearwater Steelhead	25 – 41	$661,800 – 1,065,500	$945,100 – 1,274,200
Hells Canyon Reach			
Hells Canyon Snake River A-run Summer Steelhead)	16 – 26	$431,800 – 695,200	$616,600 – 831,300
Hells Canyon Snake River Spring Chinook Salmon	10 – 17	$274,800 - 442,400	$392,400 – 529,000
Salmon River Subbasin			
Little Salmon River A-run Summer Steelhead	19 – 31	$499,300 – 803,900	$713,000 – 961,300
Little Salmon/Rapid River Spring Chinook Salmon	79 – 128	$2,080,300 – 3,349,500	$2,970,900 – 4,005,400
South Fork Salmon River Summer Chinook Salmon	30 – 48	$785,000 – 1,264,000	$1,121,100 – 1,511,500
Johnson Creek Artificial Propagation Enhancement	4 – 7	$117,800 – 189,600	$168,200 – 226,700
South Fork Chinook Salmon Eggbox[2]	--	--	--
Pahsimeroi A-run Summer Steelhead	24 – 39	$628,000 – 1,011,200	$896,900 – 1,209,200
Pahsimeroi Summer Chinook Salmon	30 – 39	$785,000 – 1,033,700	$1,121,100 – 1,428,500
East Fork Salmon River Natural A-run Steelhead	2 – 3	$47,100 – 75,800	$67,300 – 90,700
Steelhead Streamside Incubator Project A-run and B-run[3]	--	--	--
Salmon River B-run Steelhead	32 – 43	$851,700 – 1,121,600	$1,216,400 – 1,549,900
Upper Salmon Spring Chinook Salmon	60 – 79	$1,570,000 – 2,067,500	$2,242,200 – 2,857,000
Total	**358 – 514**	**$9,394,900 – 13,482,000**	**$13,365,100 – 16,900,000**

Program	Number of Jobs Impacted[1]	Economic Impacts on Personal Income[1]	Effects on Recreational Expenses[1]

Source: Gary Byrne, IDFG sent to David Ward, HDR on January 22, 2018, regarding Socioeconomic Information Request

[1] The estimated ranges of number of jobs, personal income, and recreational fisheries expenditures were calculated by applying the proportion of smolt releases from each program relative to the smolt releases in the Snake River Basin for the relevant Mitchell Act FEIS alternatives per Table 2-1(NMFS 2014a).

[2]Impacts of the South fork Chinook Salmon Eggbox Program on jobs and income are included in estimates for the South Fork Salmon River Summer Chinook Salmon Program.

[3]Impacts of the Steelhead Streamside Incubator Program on jobs and income are included in estimates for the Pahsimeroi A-run Summer Steelhead and Salmon river B-run Steelhead programs.

3.8 Cultural Resources

Salmon fishing has been central to existence of Indian tribes in the Pacific Northwest for thousands of years. Beyond the generation of jobs and income for contemporary commercial Indian tribal fishers, salmon are regularly eaten by individuals and families, and are served at gatherings of tribal communities. As with other Pacific Northwest tribes, tribes of the Columbia River Basin have historically depended on salmon for subsistence purposes and attach great cultural importance to salmon for ceremonial purposes. Tribes of the Columbia River Basin share a passionate concern for the future of salmon runs in the region because of their importance to tribal culture, history, and economic sustenance. As described in Section 2.1, Alternative 1, No Action, excess or surplus adult salmon and steelhead from many of the hatchery programs included in this EA are provided to tribes for direct consumption or for tribal fisheries (Table 2-2; Table 2-3; Table 2-4) .The Mitchell Act FEIS provides more details about the importance of salmon to Indian culture (NMFS 2014a, Subsection 3.4.4.1.1, Fish Harvests and Tribal Values and Subsection 3.4.4.1.2, Ceremonial and Subsistence Harvests).

The following Indian tribes are located within the study area and/or may rely on salmon fisheries in the Snake River Basin upstream from Ice Harbor Dam for cultural and subsistence purposes:

- Nez Perce Tribe
- Shoshone-Bannock Tribes
- Confederated Tribes of the Yakama Nation
- Confederated Tribes of the Umatilla Indian Reservation

Present day tribal reservations may encompass a fraction of a tribe’s previously occupied territory; therefore, tribes have the exclusive right of taking fish at all usual and accustomed places in accordance with applicable treaties. For example, the combined amount of tribal reservation land for the Nez Perce, Umatilla, Yakama, and Warm Springs reservations consists of 2.5 million acres, but the tribes’ aboriginal lands and ceded areas encompass 41 million acres (CRITFC 1994). The tribes are committed to rebuilding salmon and steelhead populations to healthy, harvestable levels, and fairly sharing the conservation burden so that they may fully exercise their right to take fish at all usual and accustomed fishing locations.

3.8.1 Nez Perce Tribe

The Nez Perce Indian Reservation contains 770,000 acres in north-central Idaho (Figure 3-1). The Nez Perce Tribe, in its 1855 Treaty with the United States, reserved "[t]he exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at a usual and accustomed places in common with citizens of the Territory..." 12 Stat. 957. Salmon and steelhead are central to the tribe's culture, spiritual beliefs, economics, and way of life. The tribe is committed to rebuilding salmon and steelhead to healthy, harvestable levels and fairly sharing the conservation burden so that they may fully exercise their right to take fish at all usual and accustomed fishing places. The tribe currently conducts ceremonial, subsistence, and commercial fisheries in the mainstem Columbia "Zone 6" fishery and at its usual and accustomed fishing places throughout most of the Columbia and Snake River Basin, including locations within the study area.

3.8.2 Shoshone-Bannock Tribes

The Shoshone-Bannock Tribes consist of numerous bands of the Northern Shoshone and Bannock peoples who harvested anadromous fish resources from locations within the study area from time immemorial. Decades after contact with European-Americans the Fort Hall Reservation was established in 1867 by executive order and during negotiations for the Treaty with the Eastern Shoshone and Bannocks July 3, 1868 (commonly referred to as the Fort Bridger Treaty), the Shoshone and Bannock peoples specifically reserved almost 1.8 million acres in southeastern Idaho; the following year an executive order reaffirmed this reservation for the northern Shoshone and Bannock present at Fort Bridger. After the relocation of numerous bands of Shoshone, including the Lemhi Shoshone, the Fort Hall Reservation is home to almost 6,000 members with the current land base of 544,000 acres owned by the Tribes or individual members. The Reservation is situated between the cities of Pocatello, American Falls, and Blackfoot and comprises land in Bingham, Power, Bannock, and Caribou counties. The Shoshone-Bannock Tribes historically fished for salmon across the Snake and Columbia River basins, with significant fisheries below Shoshone Falls on the Snake River and throughout the upper Salmon River Subbasin; presently the hydrosystem has confined significant fisheries to the Salmon River subbasin or other tributaries of the Snake River basin below the Hells Canyon Complex.

Article IV of the Fort Bridger Treaty expressly reserved the right to ‘hunt on unoccupied lands of the United States, so long as game may be found thereon’, and the governing body for the Shoshone-Bannock Tribes extends those fishing rights to members in annual regulations and fishing guidelines. Currently, most members of the Shoshone-Bannock Tribes fish in the Salmon and Snake Rivers in Idaho and Northeast Oregon. In response to low returns of Snake River Sockeye salmon, Tribes petitioned to list Snake River sockeye salmon as endangered and supported efforts to list remaining anadromous stocks in the following years. In 2008, the Shoshone Bannock Tribes signed an accord with the action agencies, tribes, and states to collaboratively fund and implement ongoing projects that would ultimately benefit Snake River fisheries. The Shoshone-Bannock Tribes are active co-managers of fish resources within portions of the study area.

3.8.3 Confederated Tribes and Bands of the Yakama Nation

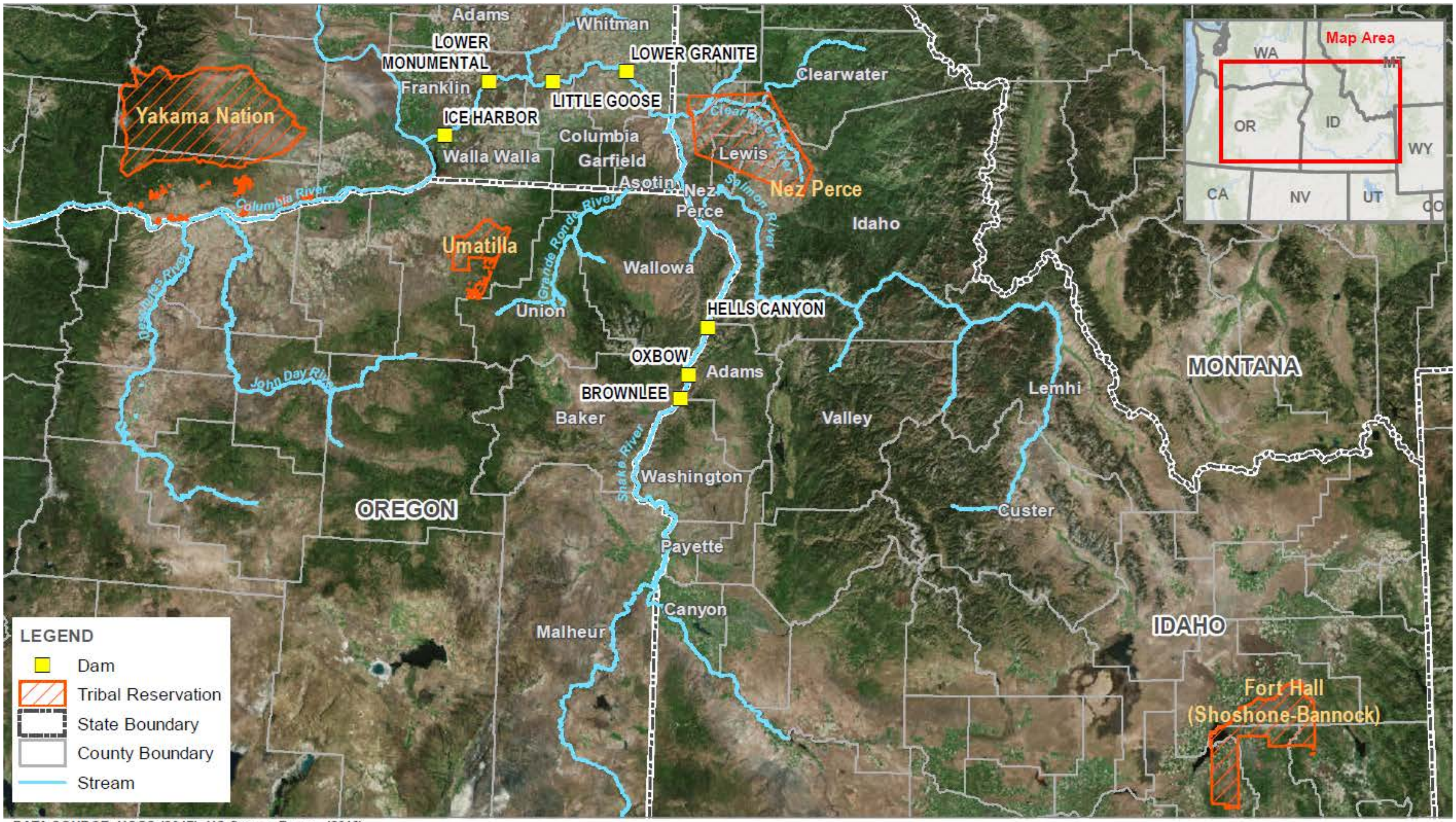
The Confederated Tribes and Bands of the Yakama Nation includes 14 tribes (CRITFC 2018b). The Yakama Indian Reservation is located at the base of Mount Adams in central Washington (Figure 3-1). The Yakama Nation has historically depended on the Columbia River and salmon for subsistence. The Yakama Nation has primarily harvested fish in the Columbia River between Bonneville and McNary Dams, Columbia River tributaries including the Yakima and Klickitat rivers, and in Icicle Creek (a tributary of the Wenatchee River). Although ceded lands of the 1855 Treaty encompassed 12 million acres, tribal elders have stated that historically their tribes have traveled as far north as Canada and south to present-day California. The Yakama Nation may have usual and accustomed places within the study area.

3.8.4 Confederated Tribes of Umatilla Indian Reservation

The Confederated Tribes of the Umatilla Indian Reservation includes the Umatilla, Walla Walla, and Cayuse tribes (CRITFC 2018c). These tribes have long depended on the abundant fisheries in the Columbia Plateau, historically living around the confluence of the Yakima, Snake, and Walla Walla rivers.

The Cayuse lived "...south of and between the Nez Perces and Wallah-Wallahs, extending from the Des Chutes or Wawanui river to the eastern side of the Blue Mountains. It [their country] is almost entirely in Oregon, a small part only, upon the upper Wallah-Wallah river, lying within Washington Territory" (CTUIR 2018). The Umatilla tribes traveled over vast areas to take advantage of salmon and steelhead runs, traditionally fishing the Columbia and Snake rivers, and the Imnaha, Tucannon, Walla Walla, Grande Ronde, Umatilla, John Day, Burnt, and Powder rivers of northeastern Oregon and southeastern Washington (USBR 1986).

Tribal members typically harvest spring, summer, and fall Chinook salmon and steelhead in the Columbia River and its tributaries located in southeastern Washington and northeastern Oregon. The confederation has comanagement responsibilities of fishery activities within the Columbia, Snake, Walla Walla, Tucannon, and Grande Ronde rivers, including operation of hatcheries in tributaries to the Snake River in northeastern Oregon. Because of the close historical relationship and geographic proximity the Confederated Tribes of Umatilla Indian Reservation to the project area (Figure 3-1), the Confederated Tribes may have usual and accustomed places within the study area.



DATA SOURCE: USGS (2017), US Census Bureau (2016)

0 20 40 60
Miles

Figure 3-1. Map of Study Area for cultural resources and environmental justice showing counties and Tribal reservations.

3.9 Environmental Justice

In 1994, the President issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. Environmental justice is defined as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” The objectives of the Executive Order include developing Federal agency implementation strategies, identifying minority and low-income populations where proposed Federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process. Environmental justice analysis leads to a determination of whether high and adverse human health or environment effects of a program would be disproportionately borne by minority populations and low-income populations, often referred to as the environmental justice communities of concern. Minority and low-income populations that has the potential to be affected by a change in hatchery programs are those that harvest fish for subsistence and economic purposes.

For the environmental justice analysis for the current operation of the15 hatchery programs, minority and low-income communities of concern were identified by comparing demographic data for counties in which physical hatchery facilities are located with a statewide reference area. The three environmental justice metrics used to determine if a county is considered a minority community of concern are (1) percentage of county residents that are nonwhite, (2) percentage that are Indian, and (3) percentage that are Hispanic. The metric for determining if a county is a low-income community of concern is based on the poverty rate and per capita income. Counties were determined to be minority or low-income communities of concern if the level in any category (percent minority, poverty rate, or income) exceeded the applicable data in the statewide reference area.

Seven counties in the study area qualify as communities of concern; six qualify based on minority population and low-income thresholds and one qualifies as low-income only (Table 3-16). Twin Falls, Gooding, Lemhi, Clearwater, and Idaho counties in Idaho, and Baker County in Oregon met both minority population and low-income thresholds. Custer County, Idaho met only the low-income threshold. Only Valley County, Idaho did not meet any criteria to be considered a community of concern. Of the 15 hatchery programs addressed in this EA, only the facilities in Valley County, Idaho, McCall Fish Hatchery and Johnson Creek Weir, are not in environmental justice communities of concern.

Through treaties, the United States made commitments to protect tribes’ rights to take fish. These rights are of enormous cultural and societal importance to the tribes; thus, impacts to commercial, subsistence, and recreational harvest opportunities are examined for any effect on tribal and low-income harvest. All tribes identified in Section 3.8, Cultural Resources are considered an environmental justice group of concern and, accordingly, tribal effects are a specific focus of the environmental justice analysis. Although individual tribes may not meet traditional environmental justice analysis thresholds for minority or low-income populations, they are regarded as affected groups for environmental justice purposes, as defined by USEPA guidance; guidance regarding environmental justice extends beyond statistical threshold analyses to consider explicit environmental effects on Indian tribes (USEPA 1998). The natural or physical environment of a tribe may include resources reserved and protected under the National Historic Preservation Act or the Native American Graves Protection and Repatriation Act.

Table 3-16. Summary of environmental justice communities of concern analysis.

State, County	Total Population (2016 estimates)	Percent Non White	Percent Indian	Percent Hispanic	Poverty Rate Percent	Per Capita Income $ (2016)
Idaho						
Statewide Reference Area	1,635,483	17.2	1.1	12	18.0	$24,280.00
Twin Falls County	80,955	19.0	0.7	15.1	18.5	$21,682.00
Gooding County	15,157	31.9	1.3	29.0	18.5	$20,418.00
Custer County	4,185	4.3	0.4	3.2	25.9	$23,624.00
Valley County	9,897	2.2	0.1	1.1	16.3	$28,133.00
Lehmi County	7,743	6.5	0.8	3.0	20.3	$21,953.00
Clearwater County	8,528	8.8	1.9	3.9	15.0	$21,316.00
Idaho County	16,251	8.4	2.5	3.1	19.3	$19,524.00
Oregon						
Statewide Reference Area	3,982,267	23.1	0.9	12.4	18.66	$28,822.00
Baker County	16,030	8.6	1.1	3.3	17.8	$24,776.00

Source: U.S. Census Bureau (2017), 2012-2016 American Community Survey, Table B17001: Poverty Status in the Past 12 Months by Sex and Age; Table B19301: Per Capita Income in the Past 12 Months (in 2016 Inflation Adjusted Dollars).

3.10 Human Health and Safety

Potential risks to human health from hatchery facility operations include common chemical usage and handling, potential toxic contaminants in hatchery-origin fish, and potential pathogens transmitted from handling hatchery-origin fish. In addition, hatchery operators may get injured through various incidents, such as slipping, getting cuts, and getting electrocuted, though such risks are minimized by following state and federal safety standards. Risks, such as falling, hypothermia, and drowning, are also present when weirs are operated, though such risks are also minimized by following safety protocols.

Another risk to human health is contaminant exposure through consumption. Food from aquatic environments provides an important contribution to human nutrition and health. Risk is associated with the frequency of consuming fish, regardless of whether fish are of hatchery or natural origin. Risk is minimal when fish and fish products are harvested, handled, processed, stored, sold, and prepared properly in accordance to the Food and Drug Administration’s “Procedures for the Safe and Sanitary Processing and Importing of Fish and Fishery Products” (USFDA 2018).

The minimal use of therapeutics in the United States and application of therapeutics in compliance with manufacturers’ directions further limits the risk hatcheries pose to human health and the environment. However, locally high concentrations of therapeutics could occur depending on the nature of the receiving environment, if therapeutics are needed to control or prevent a disease outbreak.

Compliance with safety programs, rules, and regulations, and the use of personal protective equipment limits the spread of pathogens and the potential risk to human health. Accidental skin contact and needle-stick injuries involving infected fish are potential human health risks to hatchery personnel. Chemicals in the environment, including pesticides, heavy metals, and persistent organic pollutants, can accumulate in fish and pose a public health issue to people who consume it. Proper monitoring techniques, as well as control measures and risk-based surveillance, have been shown to be critical to the protection of public health.

4 Environmental Consequences

This chapter describes the analysis of the direct and indirect environmental effects associated with the alternatives on the nine resource categories. The effects of Alternative 1, No Action, are described in terms of how current conditions (Section 3, Affected Environment) are likely to appear into the future under implementation of the 15 hatchery programs as described in the HGMPS that are the subject of this EA. The effects of the other alternatives are described relative to Alternative 1. The relative magnitude of impacts are described using the following terms:

- Undetectable – The impact would not be detectable.
- Negligible – The impact would be at the lower levels of detection.
- Low – The impact would be slight, but detectable.
- Medium – The impact would be readily apparent.
- High – The impact would be severe.

The aspects of critical habitat as defined by the ESA that may be affected include (1) adequate water quantity and quality, and (2) freedom from excessive predation. Potential effects on critical habitat as defined by the ESA are analyzed in this EA in the broader discussion of impacts on habitat in Sections 4.1, Water Quantity; 4.2, Water Quality; 4.3, Salmon and Steelhead; 4.4, Fisheries; 4.5, Other Fish Species; and 4.6, Wildlife.

4.1 Water Quantity

The overall effect on water quantity from operation of the 15 hatchery programs as described in the HGMPs would be low-adverse under Alternative 1, Alternative 2, and Alternative 3 (Table 4-1). Relative to Alternative 1, effects would be negligible-beneficial under Alternative 4.

Table 4-1. Summary of effects on water quantity.

Resource	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Water Quantity	Low-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.1.1 Alternative 1

Under Alternative 1, the hatchery programs would be operated as described in the HGMPs[7]. The 15 hatchery programs would continue to use surface water, spring water, and groundwater as previously described (Table 3-1). Kooskia National Fish Hatchery would continue to divert up to 82 percent of Clear Creek under winter low flow conditions; however, the hatchery would not divert water from June through September. Effects on salmon and steelhead would be low because steelhead do not enter Clear Creek until spring, and because no water is diverted in summer. Rapid River Fish Hatchery would continue to divert over 50 percent of the flow from the Rapid River during low winter flows. Surface water diversions

[7] Although JCAPE would increase broodstock collection numbers and juvenile releases from 100,000 to 150,000 under a future operational scenario, no increase in surface water use is proposed.

would continue for other facilities, with all diversions from streams under 1 mile in length. Clearwater and McCall fish hatcheries would continue to draw water from reservoirs, having a relatively small effect on water sources before water is returned to rivers below the reservoirs. Hagerman National, Niagara Springs, and Magic Valley fish hatcheries would continue to utilize spring water and potentially affect the groundwater aquifer contribution to decline of the groundwater would be an adverse effect. Overall, the continued operation of the hatchery programs under Alternative 1 would likely have a low-adverse effect on water quantity.

4.1.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in the quantity of water used. Therefore, this alternative would also have the same low-adverse effect as Alternative 1.

4.1.3 Alternative 3

Under Alternative 3, the effect on water quantity would be similar to that under Alternative 1 even though the production levels of the hatchery programs would be reduced by 50 percent. Many facilities would continue to be operated for other programs as described by NMFS (2014a) and USFWS (2017a, 2017b), precluding substantial reductions in surface water withdrawals. Facilities that may reduce surface water diversion because they are dedicated solely to programs considered in this EA include Rapid River, McCall, and Niagara Springs fish hatcheries, and the Hells Canyon Trap, South Fork Salmon River Satellite, and East Fork Salmon River Satellite. Withdrawals from the Rapid River may decrease slightly with decreased production. Reduction in the amount of surface water from Payette Lake diverted to McCall Fish Hatchery would have a relatively small benefit, but would have little effect on streamflows downstream from the lake. Reductions in hatchery production would likely not affect the amount of water diverted at the Hells Canyon Trap, South Fork Salmon River Satellite, and East Fork Salmon River Satellite for adult collection facilities. It is possible that reducing the East Fork Salmon River Natural A-run Steelhead program by 50 percent would render the program too small to be viable and therefore result in terminating operations at the East Fork Salmon River Satellite. However, the assumption for this EA is that the program would continue at a 50 percent reduction from the current level.

Although dedicated to programs considered in this EA, Niagara Springs Fish Hatchery uses spring water. Reductions in production would have little effect on the amount of water used, or on the aquifer from which it is derived. Overall, Alternative 3 would have a similar low-adverse effect on water quantity as Alternative 1.

4.1.4 Alternative 4

Even with immediate termination of all 15 hatchery programs under Alternative 4, many facilities would remain in operation for different programs described by NMFS (2014a) and USFWS (2017a, 2017b). Facilities that would continue operation include Clearwater, Dworshak National, Kooskia National, Hagerman National, Magic Valley, , and Sawtooth fish hatcheries, although all Chinook Salmon rearing would cease at Sawtooth Fish Hatchery. Reduced production at these facilities may result in slightly reduced surface and ground water withdrawals. Reductions in production would have little effect on spring water aquifers.

Facilities that divert water that may cease to operate because they are dedicated to programs considered in this EA would include the Hells Canyon Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon River Satellite, McCall Fish Hatchery, East Fork Salmon River Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries. The diversion of up to

51.8 percent of the flow from the Rapid River during winter would cease if hatchery operations were terminated. Termination of water diversion to McCall Fish Hatchery would have a relatively small benefit to Payett Lake but would have little effect on streamflows downstream of the lake. Hells Canyon Trap, South Fork Salmon River Satellite, and East Fork Salmon River Satellite either divert a very small percentage of the streamflow or have a relatively short diversion distance (Table 3-1). Niagara Springs Fish Hatchery uses spring water, so termination of hatchery operations may have a negligible-beneficial effect on the aquifer. Overall, Alternative 4 would have a negligible-beneficial effect on water quantity compared to Alternative 1.

4.2 Water Quality

The overall effect on water quality from operation of the 15 hatchery programs would be low-adverse under Alternative 1, Alternative 2, and Alternative 3 (Table 4-2). Relative to Alternative 1, effects would be negligible-beneficial under Alternative 4.

Table 4-2. Summary of effects on water quality.

Resource	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Water Quality	Low-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.2.1 Alternative 1

Under Alternative 1, the 15 hatchery programs would be operated the same as under current conditions, so no change in the discharge of water temperature, ammonia, organic nitrogen, total phosphorus, BOD, pH, and solids in receiving waters would be expected. Temporary and minor effects on sedimentation and dissolved gas supersaturation from adult collection and juvenile release activities would also be expected to remain similar to current conditions. All hatchery discharges are allowed, and most facilities are managed under NPDES permits (other than Oxbow Fish Hatchery, which does not require a permit) administered by the USEPA (Table 3-2). The pollutant loads associated with each respective hatchery (where applicable) have been permitted with conditions and wasteload allocations that protect the water quality of receiving waters. Currently, all 15 hatchery programs are in compliance with their NPDES discharge permits, although periodic effluence limit exceedances occur (Section 3.2, Water Quality).

Under Alternative 1, effluent discharged by hatchery facilities would be expected to continue contributing similar levels of pollutants to receiving waters, and periodic effluent permit-limit exceedances would be expected to occur at a similar frequency. However, water quality may improve in watersheds with TMDLs that are currently in place or will be developed or revised in the future. As NPDES permits are renewed, hatchery facilities in these watersheds would be required to comply with effluent limits that reflect current technologies and watershed conditions, likely resulting in lower pollutant discharge limits. Overall, Alternative 1 is expected to have a low-adverse effect on water quality.

4.2.2 Alternative 2

Under Alternative 2, the hatchery programs would be the same as under Alternative 1, with no change in effluent discharge, adult collection and juvenile release activities, and water quality. Therefore, this alternative would have the same low-adverse effect as Alternative 1.

4.2.3 Alternative 3

Under Alternative 3, the 15 hatchery programs would operate at half the capacity of Alternative 1 and Alternative 2. Reducing hatchery production may improve water quality in receiving waters downstream of wastewater discharge. The effect of hatchery effluent on the water quality of receiving waters is, in part, a function of fish production levels. Decreasing fish production in the 15 hatchery programs would decrease the quantity of heat, nutrients, BOD, sediment, therapeutics (e.g., antibiotics), fungicides, disinfectants, steroid hormones, anesthetics, pesticides, herbicides, and pathogens discharged to receiving waters. Although the pollutant loading would be less than for Alternative 1 and Alternative 2, there would still be a pollutant load to receiving waters. For those watersheds with TMDLs that are currently in place or will be developed or revised in the future, compliance with the NPDES permit would help improve the water quality; a reduction in production level may further help improve the water quality if these facilities discharge effluent at a level much lower than the limit provided in the permit.

Reduced broodstock collection may reduce in-stream disturbance, although disturbance would still occur because of broodstock collection for other programs. Fish release would also be reduced; however, fish release would still occur and would potentially disturb the streambed and shoreline at release locations and temporarily affect dissolved gas levels. Because broodstock collection, holding, incubation and rearing, and release would still occur, Alternative 3 would have a similar low-adverse effect as Alternative 1 and Alternative 2.

4.2.4 Alternative 4

As described in Section 4.1, Water Quantity, even with immediate termination of all 15 hatchery programs under Alternative 4, many facilities would remain in operation for different programs described by NMFS (2014a) and USFWS (2017a, 2017b). Facilities that would still be operating to support other programs would have a reduced pollutant load to their respective receiving waters that would result in a small and incremental improvement in water quality.

Facilities that may cease to operate because they are dedicated to programs considered in this EA would include the Hells Canyon Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon River Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon River Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries. Closing Rapid River, McCall, and Niagara Springs fish hatcheries would result in a small reduction in heat, nutrients, BOD, sediment, therapeutics (e.g., antibiotics), fungicides, disinfectants, steroid hormones, anesthetics, pesticides, herbicides, and pathogens discharged to receiving waters because these hatcheries hold large numbers of fish for a longer period of time than the other facilities. Therefore, closing these hatcheries would result in a small improvement in water quality, while closing other traps, satellites, and weirs is not likely to have a detectable effect.

Niagara Springs Fish Hatchery currently discharges to Niagara Springs Creek and a reach of the Snake River that are currently impaired for flow alteration, total phosphorus, and total suspended solids. An approved TMDL is in place that addresses these impairments and provides wasteload allocations to Niagara Springs Fish Hatchery for total phosphorus and total suspended solids. These wasteload allocations are intended to bring these parameters into compliance with water quality standards. However, closing Niagara Springs Fish Hatchery would further reduce the cumulative total phosphorus and total suspended solids wasteload to Niagara Springs Creek and the Snake River.

Discontinuing broodstock collection and juvenile releases may eliminate temporary stream bottom and shoreline disturbances and effects on dissolved gas. Among the broodstock collection facilities and juvenile release sites that would no longer be in use, the South Fork Salmon River Satellite is located on a waterbody that is impaired for sedimentation. However, the temporary and small-scale nature of sediment disturbance from broodstock collection and juvenile releases would likely result in a very small difference in sediment loading to the South Fork Salmon River. Overall, Alternative 4 would have a negligible-beneficial effect on water quality compared to Alternative 1.

4.3 Salmon and Steelhead

Natural-origin salmon and steelhead populations in the Snake River Basin could be affected by hatchery programs through various effect pathways (Table 3-3). In this subsection, the hatchery program effects on natural salmon and steelhead populations in the study area are described for each alternative. Effects of each alternative vary among the pathways considered, and even among species for some pathways; therefore, it is difficult to postulate an overall effect of the alternatives on salmon and steelhead. In general, slightly more pathways would be adversely affected than beneficially affected under Alternative 1 and Alternative 2. Under Alternative 3 and Alternative 4, more pathways would be beneficially affected than adversely affected.

4.3.1 Genetics

As discussed in Section 3.3.5.1, Genetics, natural-origin fish from the Snake River Spring/Summer Chinook Salmon ESU and Snake River Steelhead DPS would likely be genetically affected by the No Action and Proposed Action alternatives (Table 4-3). In addition, although native coho salmon are extirpated from the study area, natural-origin coho salmon from reintroduction efforts in the Clearwater River Subbasin may be genetically affected in the natural environment through interbreeding with hatchery-origin counterparts.

Table 4-3. Summary of effects on salmon and steelhead genetics.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Snake River Spring/Summer Chinook Salmon ESU	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Snake River Steelhead DPS	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Clearwater River Coho (Reintroduced)	Negligible-adverse	Same as Alternative 1	Low-adverse	Moderate-adverse

4.3.1.1 Spring/Summer Chinook Salmon

Alternative 1

Under Alternative 1, all proposed hatchery programs pose genetic risks to natural-origin Chinook salmon from the Snake River Spring/Summer Chinook Salmon ESU. For all programs, the net effect on the Snake River Spring/Summer Chinook Salmon ESU would be low-adverse because PNI levels for most of the programs are designed to have natural selection be equal to or dominant over hatchery selection.

Little Salmon/Rapid River and Hells Canyon Programs

Under Alternative 1, these segregated programs are operated to limit stray rates of hatchery spring/summer Chinook salmon escapement. The proportion of hatchery-origin fish on spawning grounds from the segregated Little Salmon/Rapid River Spring Chinook Salmon and Hells Canyon Snake River Spring Chinook Salmon programs is currently unknown. Natural- and hatchery-origin spawning in the

Little Salmon River population is not well documented; therefore, it is difficult to estimate pHOS levels. However, because the Little Salmon River population only plays a maintained role in current recovery scenarios (NMFS 2017a), as well as proposed recovery scenarios under the final recovery plan (NMFS 2017g), PNI and pHOS calculations are not anticipated to be a concern under Alternative 1.

South Fork Salmon River, South Fork Chinook Eggboxes, and Johnson Creek Programs

Under Alternative 1, hatchery operators intend to phase into having higher levels of integration, which would result in higher PNI values using the sliding-scale approach for future broodstock management. If the natural population size increases, the total pHOS level would be reduced to maintain the basin-wide PNI of 0.5 or higher, meaning that natural selection would be equal to or prevalent over hatchery selection. Using the sliding-scale management approach, the South Fork Salmon River summer Chinook salmon population is projected to have future PNI values that approach or exceed 0.67 (NMFS 2017a). These PNI values are acceptable because they indicate that the natural environment is driving selection of the population, which minimizes adverse genetic effects of operating hatchery programs, particularly in populations considered viable for recovery of the ESU (e.g., South Fork Salmon River). Further, the JCAPE program produces Chinook salmon that are genetically similar enough to the natural population to be listed within the same ESU (i.e., Snake River spring/summer Chinook salmon ESU). Although PNI values for the South Fork Salmon River Chinook Salmon and SFCEP programs might fall below a value of 0.54 in years when natural-origin returns are poor, this lower PNI value would have negligibly negative affect on genetics, because on balance, at this minimal level of natural-origin returns, meeting a minimum level population abundance is more critical than the potential adverse hatchery-influenced selection effects (NMFS 2017a).

Pahsimeroi and Upper Salmon Programs

For the Upper Salmon River Spring Chinook Salmon program, hatchery operators intend to phase into having higher levels of integration in the future, which would result in higher PNI values using the sliding scale approach for future broodstock management. Applying the sliding scale to the natural-origin returns from 2014 through 2016 would result in PNI levels ranging from 0.51 to 0.56 (Pahsimeroi), and 0.45 to 0.62 (Upper Salmon River). NMFS believes that the steps in the sliding scale proposed by hatchery operators would continue to improve the PNI into the future as long as natural-origin returns increase (NMFS 2017b).

In general, NMFS believes a PNI of 0.5 is adequate for maintaining the population's genetic structure and productivity because the natural-origin influence is not dominated by hatchery influence. However, a PNI slightly less than 0.5 may be acceptable (despite the prevalence of hatchery-influenced selection), on balance, when natural-origin abundance is low to ensure enough fish are available to spawn regardless of fish origin. The Pahsimeroi program would be operated to achieve a PNI exceeding 0.5, whereas the Upper Salmon program would be operated to achieve a PNI exceeding 0.67 (NMFS 2017b). Although a PNI exceeding 0.5 indicates that natural selection outweighs hatchery-influenced selection, the current recovery scenario (NMFS 2017g) for the Salmon River spring/summer Chinook salmon MPG calls for high viability of the Upper Salmon River Mainstem population. Therefore, NMFS believes a more aggressive PNI than that considered for the Pahsimeroi River population (which is targeted to achieve viability) puts the Upper Salmon River population on a trajectory to achieve high viability under the current recovery approach. NMFS believes a PNI of at least 0.67 is a reasonable metric for a highly viable population when natural-origin returns are high (i.e., >1,000). Recent data suggests that the Upper Salmon River Mainstem population is likely to obtain a PNI exceeding 0.67 when the abundance exceeds 1,000 natural-origin fish, and PNI exceeding 0.6 when natural-origin returns exceed 350 fish.

Finally, the Pahsimeroi Summer Chinook Salmon and Upper Salmon Spring Chinook Salmon programs produce Chinook salmon that are genetically similar enough to the natural population to be listed within the same ESU (i.e., Snake River Spring/Summer Chinook Salmon ESU).

Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in effects on natural spring/summer Chinook salmon genetics. Therefore, this alternative would also have the same, low-adverse effect as Alternative 1.

Alternative 3

Reduction of hatchery programs by 50 percent under Alternative 3 would reduce the hatchery-influenced selection from all programs, resulting in no more than a negligible-beneficial genetic effect compared to Alternative 1. Although several integrated programs are part of the Snake River Spring/Summer Chinook Salmon ESU (JCAPE, Pahsimeroi Summer Chinook Salmon, and Upper Salmon Spring Chinook Salmon), these programs are not intended to maintain or contribute to genetic diversity of natural-origin fish. Although integrated programs can contribute to genetic diversity if NORs are low, hatchery-origin production in the natural environment is generally considered adverse.

Alternative 4

With immediate termination of the hatchery programs under Alternative 4, hatchery-origin fish that have already been released would return to the Snake River Basin for 4 or 5 years and would continue to be removed if encountered through another program, but the removal would not take place at the levels described in the HGMPs. Therefore, hatchery-influenced selection may temporarily increase, but would decrease as the hatchery-origin adults cease to return.

Elimination of all hatchery programs would have a low-beneficial effect on Snake River Spring/Summer Chinook Salmon ESU genetics within the Snake River Basin compared to Alternative 1. Similar to Alternative 3, although several integrated programs are part of the Snake River Spring/Summer Chinook Salmon ESU (JCAPE, Pahsimeroi Summer Chinook Salmon, and Upper Salmon Spring Chinook Salmon), these programs are not intended to maintain or contribute to genetic diversity of natural-origin fish. Thus, hatchery-origin production in the natural environment is considered adverse.

4.3.1.2 Steelhead

Alternative 1

Under Alternative 1, the proposed hatchery programs pose genetic risks to natural-origin steelhead from the Snake River DPS, although there is some benefit to the species from the integrated program designed to supplement the East Fork Salmon River population. Considering the relatively small size of the East Fork Salmon River Natural A-run program compared to the overall genetic risks, the net effect on steelhead under Alternative 1 would be low-adverse.

With the exception of the East Fork Salmon River Natural A-run Steelhead program, all of the steelhead hatchery programs under Alternative 1 are operated as segregated programs. As discussed in Section 3.3.5.1, Genetics, segregated hatchery programs under the Proposed Action pose a risk of genetic impacts to the receiving South Fork Salmon River, Little Salmon River, Pahsimeroi River, and Upper Salmon River populations, all of which are designated as maintained (NMFS 2017g).

Despite the indication that straying is low for hatchery fish from these segregated programs (Section 3.3.5.1, Genetics), Alternative 1 includes ongoing coordination with the Steelhead Workgroup to address uncertainties in the future that are related to the broader workgroup objectives of determining (1) appropriate methodologies for assessing hatchery-origin steelhead composition in receiving populations throughout the study area, and (2) target levels at which hatchery program modifications might be triggered (NMFS 2017c).

Under Alternative 1, the integrated East Fork Salmon River Natural A-run Steelhead Program would continue to use natural-origin broodstock, and would be operated to obtain a PNI exceeding 0.5, meaning that natural selection would be equal to or prevalent over hatchery selection and the net genetic effect on natural populations would be minimal. Best available data suggests that the East Fork Salmon River Natural program is likely to obtain a PNI of > 0.5 (NMFS 2017c). NMFS (2017c) anticipates that the PNI would continue to increase in the future as long as returns of natural-origin fish increase. Therefore, under Alternative 1, NMFS anticipates that going forward, natural selection would be equal to or prevalent over hatchery selection. In addition, this program produces steelhead that are genetically similar enough to the natural population to be listed within the same DPS (i.e., Snake River Steelhead DPS). In addition, in the current recovery scenario, this population is not targeted for viability or high viability, but for maintained status (NMFS 2017c, 2017g). Thus, NMFS believes a PNI of 0.5 is adequate for maintaining the population, and a PNI less than 0.5 is acceptable when natural-origin abundance is low (i.e. < 250 fish), to ensure enough fish are available to spawn regardless of fish origin (NMFS 2017c).

Alternative 2

Under Alternative 2, the operation of all steelhead hatchery programs would be the same as under Alternative 1, with no change in effects on natural steelhead genetics. Therefore, this alternative would also have the same, low-adverse effect on genetics as Alternative 1.

Alternative 3

Reduction of hatchery programs by 50 percent under Alternative 3 would reduce hatchery-influenced selection from those hatchery programs intended to support recreational and tribal harvest, resulting in no more than a negligible-beneficial effect compared to Alternative 1, which has a low-adverse genetic impact. Genetic diversity would still be maintained through reduced operation of the East Fork Salmon River Natural A-run Program, whose purpose is to supplement natural populations through integrated recovery. The negative effects of using fewer broodstock under this alternative for the East Fork Salmon River Natural A-run program would not outweigh the beneficial effect of reducing the genetic risk of hatchery selection from the remainder of the steelhead programs under Alternative 3.

Alternative 4

With immediate termination of the hatchery programs under Alternative 4, hatchery-origin fish that have already been released would return to the Snake River Basin for 4 or 5 years and would continue to be removed if encountered through another program, but the removal would not take place at the levels described in the HGMPs. Therefore, hatchery-influenced selection may temporarily increase, but would decrease over time as the hatchery-origin adults from both programs cease to return. The East Fork Salmon River Program is included in the Snake River Steelhead DPS and serves to maintain some genetic diversity. Therefore, termination of this integrated program may reduce the support for genetic diversity within the DPS. Still, if hatchery-origin fish from any of the programs spawn in the natural environment, hatchery-influenced selection is considered an adverse effect on natural-origin steelhead genetics. Under this alternative, fewer segregated steelhead hatchery programs would exist in the Snake River Basin to affect natural steelhead genetics, and therefore, elimination of all programs would have a low-beneficial effect on Snake River Steelhead DPS genetics compared to Alternative 1.

4.3.1.3 Coho Salmon

Alternative 1

Although natural and hatchery-origin coho are genetically linked through the reintroduction program, hatchery broodstock sources have changed over the years, and as a result, the genetic profile of the natural-origin population likely differs from hatchery-origin genetics at some level. The genetic effect of hatchery-influenced selection on natural-origin coho is likely minimal considering that these fish share a genetic lineage. Under Alternative 1, the effect on natural-origin coho salmon genetics would be negligible adverse.

Alternative 2

Under Alternative 2, the operation of the Clearwater River coho hatchery program would be the same as under Alternative 1, with no change in effects on natural-origin coho genetics. Therefore, this alternative would also have the same, negligible-adverse effect on genetics as Alternative 1.

Alternative 3

Reduction of hatchery programs by 50 percent under Alternative 3 would decrease hatchery-influenced selection from harvest programs; however, reduction of the hatchery program could increase harvest pressure on the natural-origin population. This program is intended to reintroduce and restore coho salmon to the Clearwater River Subbasin at levels of abundance and productivity sufficient to support sustainable runs and annual harvest. All natural-origin coho in the study area are genetically linked to hatchery counterparts through the reintroduction program. Although a reduction of the hatchery program would reduce hatchery-influence selection, it would also increase harvest pressure on the recently-reintroduced natural population. Because the program is intended to supplement the natural population as well as provide harvest opportunities, and because hatchery- and natural-origin fish are genetically linked through the reintroduction program, this alternative would result in a low-adverse effect on genetic diversity in the natural population.

Based on results from the Clearwater River Subbasin coho reintroduction program to date and experience in managing anadromous fish populations in the Snake River Basin, the Nez Perce Tribe believes this program will require a substantial hatchery production component and the establishment of highly productive naturally spawning coho salmon aggregates (Nez Perce Tribe 2016).

Alternative 4

Native Clearwater coho salmon are extirpated from the study area. Natural production of coho salmon is the result of re-introduction; they are not ESA-listed. Therefore, with immediate termination of the hatchery program under Alternative 4, although genetic risks associated with hatchery-origin selection would decrease, harvest pressure would increase on natural-origin coho. As discussed for Alternative 3, because the Clearwater River coho program is intended to supplement the recently-reintroduced natural population as well as provide harvest opportunities, and because hatchery fish and natural-origin fish are genetically linked through the reintroduction program, complete elimination of this program would result in a moderate-adverse effect on genetic diversity in the natural population. Until there exists a viable, self-sustaining population of coho salmon in the Clearwater River Basin, genetic effects from hatchery-influenced selection are outweighed by population rebuilding efforts.

4.3.2 Masking

Most smolts from spring/summer Chinook salmon, steelhead, and coho hatchery programs would continue to be marked (Table 2-2; Table 2-3; Table 2-4; Table 2-6); therefore, masking is unlikely to occur under any alternative for natural spring Chinook salmon, steelhead, or coho. Retention rate of CWT generally exceeds 97 percent (Hand et al. 2007; Nandor et al. 2009). The 3 percent of fish that are mismarked or lose tags is not likely to have a discernible effect on assessing the status of the natural population, especially because PBT is an effective tool to alleviate the effects of masking even for non-externally marked fish and gives NMFS significant confidence in the estimates for these programs Similarly, although the steelhead and Chinook salmon eggbox programs use only PBT marking, the relatively limited contribution of fish from eggbox programs compared to overall hatchery program production in the study area is not likely to result in detectable effects on assessing the status of natural populations.

4.3.3 Competition and Predation

The overall competition and predation effects from hatchery-origin Chinook salmon, coho salmon, and steelhead on natural-origin salmon and steelhead would range from negligible-adverse to low-adverse under Alternative 1 and Alternative 2 (Table 4-4). Relative to Alternative 1, effects would range from negligible-beneficial to low-beneficial under Alternative 3 and Alternative 4.

Table 4-4. Summary of effects on natural-origin salmon and steelhead from competition and predation with hatchery-origin fish.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/summer Chinook salmon	Low-adverse	Same as Alternative 1	Low-beneficial	Low-beneficial
Steelhead	Low-adverse	Same as Alternative 1	Low-beneficial	Low-beneficial
Fall Chinook salmon	Negligible-adverse	Same as Alternative 1	Low-beneficial	Negligible-beneficial
Sockeye salmon	Negligible-adverse	Same as Alternative 1	Low-beneficial	Negligible-beneficial
Coho salmon	Negligible-adverse	Same as Alternative 1	Low-beneficial	Negligible-beneficial

4.3.3.1 Alternative 1

Under Alternative 1, with the exception of the JCAPE program, all hatchery programs would be operated the same as under current conditions. As such, there would be no expected change in the competition and predation effects from Chinook salmon, coho salmon, and steelhead smolts released from the programs compared to those described in Section 3.3.5.3, Competition and Predation. The JCAPE currently releases 100,000 smolts under the 2008-2017 *U.S. v Oregon* Management Agreement, but proposes a release of 150,000 smolts moving forward. This is a relatively minor increase in the total number of spring/summer Chinook salmon smolts released into the study area under current conditions because of other smolts released in the Salmon River subbasin (Table 2-1), and additive effects would be negligible.

Spring/Summer Chinook Salmon

Competition and predation effects from all programs would be low-adverse for the Snake River Spring/Summer Chinook Salmon ESU. Chinook salmon smolts from the programs may outcompete or prey on up to 2.2 percent of the natural-origin spring Chinook salmon population (NMFS 2017a, 2017b). Hatchery spring Chinook salmon smolts migrate out of the study area soon after release, with median travel times to Ice Harbor Dam ranging from 29 total days for Pahsimeroi Summer Chinook salmon releases, to 61 days for Johnson Creek releases (NMFS 2017a, 2017b). Steelhead smolts from the programs may outcompete or prey on up to 1.8 percent of the natural-origin Chinook salmon population. Hatchery steelhead smolts migrate out of the study area soon after release, with median travel times to Lower Granite Dam ranging from 12 days for steelhead from several programs, to 35 days for the Hells Canyon Snake River A-run summer steelhead (NMFS 2017c). Travel to Ice Harbor Dam requires an additional 3 days. The maximum estimated numbers of Chinook salmon lost from competition and predation with Clearwater River coho salmon equates to 51-53 adult Chinook salmon (all runs) (NMFS 2017d), which equates to less than 0.2 percent of the natural-origin Chinook populations (Reynolds 2017). The total number of Chinook salmon lost to competition and predation with all hatchery species would be very small.

Adults from the spring/summer Chinook salmon hatchery programs may compete for spawning sites and potentially superimpose natural-origin spring Chinook salmon redds in the study area. The likelihood is low; however, because the proportion of hatchery-origin fish on spawning grounds would continue to be reduced under Alternative 1 as part of ongoing monitoring of pHOS levels to determine if they are in line with recommendations by HSRG (NMFS 2017a). Because adults from the JCAPE program and portions of the South Fork Salmon River Summer Chinook Salmon, Pahsimeroi Summer Chinook Salmon, and Upper Salmon Spring Chinook Salmon programs produce hatchery-origin fish that are intended to spawn with natural-origin fish to supplement the natural-origin population, competition for spawning sites and redd superimposition would continue to occur at levels similar to current conditions. Competition between natural-origin Chinook salmon and adult steelhead and coho salmon from hatchery programs under Alternative 1 would be negligible due to differences in run timing, holding, and spawn timing.

Steelhead

Competition and predation effects from all programs would also be low-adverse for the Snake River Steelhead DPS. Chinook salmon smolts from the programs may prey on up to 1.6 percent of the natural-origin steelhead population (NMFS 2017a, 2017b). Steelhead smolts from the programs may compete with or prey on up to 4.6 percent of the natural-origin steelhead population (2017c). The maximum estimated number of steelhead lost from competition and predation with Clearwater River coho equates to 51 adult steelhead (NMFS 2017d), which is about 0.2 percent of the natural-origin steelhead population (Reynolds 2017). None of the hatchery smolt releases (spring/summer Chinook salmon, steelhead, or coho salmon) should affect age-0 steelhead because of lack of temporal overlap with spring smolt releases.

Naturally spawning hatchery-origin steelhead may compete with natural-origin steelhead adults for spawning sites due to similar spring spawn times and habitat requirements; however, considering low stray rates, this would primarily occur within populations that are not targeted as viable or highly viable populations in the DPS. Thus, competition with natural-origin steelhead may occur, but is likely to have a negligible effect on the recovery of the Snake River steelhead populations. Spawning site competition or redd superimposition is unlikely between spring/summer Chinook salmon and coho salmon hatchery program adults and Snake River steelhead because of the difference in spawning time.

Fall Chinook Salmon

Competition and predation effects from all programs would be negligible-adverse for the Snake River Fall Chinook Salmon ESU. Spring/summer Chinook salmon smolts released from the programs under Alternative 1 have the potential to prey on, and to compete with, natural-origin fall Chinook salmon fry and parr, though the likelihood is less than the 0.8 to 2.2 percent range presented for spring Chinook salmon, because natural-origin fall Chinook salmon smolts would have less geographic and temporal overlap with the hatchery-origin fish. Steelhead smolts from the programs may compete with or prey on up to 1.8 percent of the natural-origin Chinook salmon population (NMFS 2017c). The maximum estimated numbers of fall Chinook salmon lost from competition and predation with Clearwater River coho salmon equates to 51 to 53 adult Chinook salmon (all runs) (NMFS 2017d), which equates to less than 0.2 percent of the natural-origin Chinook populations (Reynolds 2017).

Spawning site competition or redd superimposition is unlikely between steelhead and coho salmon hatchery smolts and Snake River fall Chinook salmon because of the difference in spawn timing and location. As described in Section 3.3.5.3, Competition and Predation, it is possible that hatchery-origin spring/summer Chinook salmon adults might compete with natural-origin fall Chinook salmon because of a slight overlap in spawn timings in late-September. However, NMFS expects these effects are negligible because the overlap is geographically small and temporally short (NMFS 2017a, 2017b).

Sockeye Salmon

Competition and predation effects from all programs would also be negligible-adverse for the Snake River Sockeye Salmon ESU. Chinook salmon smolts from the programs may prey on up to 2.0 percent of the natural-origin sockeye population (NMFS 2017a, 2017b), and steelhead smolts from the programs may compete with or prey on up to 2.6 percent (NMFS 2017c). The maximum estimated number of sockeye salmon lost from competition and predation with Clearwater River coho salmon from Lower Granite Dam upstream to the confluence of the Clearwater and Snake rivers equates to two adults (NMFS 2017d), which is less than 0.3 percent of the natural-origin sockeye salmon population. A lack of geographic overlap prevents Chinook salmon, steelhead, and coho salmon hatchery releases from interacting with age-0 sockeye in Redfish, Pettit, and Alturas lakes. Adult competition for spawning grounds and redd superimpositions would not occur because of differences in spawn timing and location.

Coho Salmon

Competition and predation effects from all programs would also be negligible-adverse for coho salmon. Chinook salmon, steelhead, and coho salmon smolts from all hatchery programs have the potential to prey on, and to compete with, coho salmon juveniles in the study area. However, because native coho salmon are extirpated from the Snake River Basin, and any natural-origin coho in the study area originated from reintroduction efforts using hatchery broodstock, NMFS has not modeled the equivalent adult loss of coho salmon from competition and predation with any of the hatchery program smolt releases. The potential for hatchery program smolts to compete with or prey upon coho salmon would be limited to reintroduced populations in the Clearwater River Subbasin and the mainstem of the Snake River downstream of the confluence with the Clearwater River. Considering the low number of hatchery-origin coho returning to the study area (6,500; NMFS 2017d), redd superimposition on natural-origin coho, though possible, is likely minimal.

4.3.3.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in competition and predation effects on other salmon and steelhead species. Therefore, this alternative would have the same effects as Alternative 1.

4.3.3.3 Alternative 3

The 50-percent reduction in hatchery production under Alternative 3 would theoretically result in similar reductions to harvest and a corresponding reduction in the number of hatchery-origin spring/summer Chinook salmon, steelhead, or coho salmon adults returning to the Snake River Basin. Therefore, the competitive and predatory effects of hatchery-origin smolts and returning adults would be reduced compared to Alternative 1.

The competition and predation effects would be low-beneficial relative to Alternative 1 for the Snake River Spring/Summer Chinook Salmon ESU. Reductions in smolt numbers from all spring/summer Chinook salmon, steelhead, and coho salmon hatchery programs would reduce the potential for competition with or predation on natural-origin parr, and competition with juvenile spring Chinook salmon compared to Alternative 1. Similarly, reduced numbers of adults from the spring/summer Chinook salmon hatchery programs under Alternative 1 would compete for spawning grounds, resulting in less redd superimposition.

The competition and predation effects would also be low-beneficial relative to Alternative 1 for the Snake River Steelhead DPS. Reductions in smolt numbers from all spring/summer Chinook salmon, steelhead, and coho salmon hatchery programs would reduce the potential for competition with or predation on natural-origin parr, and competition with juvenile steelhead compared to Alternative 1. Similarly, reduced numbers of adults from the steelhead hatchery programs under Alternative 1 would compete for spawning grounds, resulting in less redd superimposition.

The competition and predation effects would be negligible-beneficial relative to Alternative 1 for the Snake River Fall Chinook Salmon ESU. Reductions in smolt number from all spring/summer Chinook salmon, steelhead, and coho salmon hatchery programs would reduce potential predation on natural-origin fry and parr, and competition with juvenile summer/fall Chinook salmon compared to Alternative 1. Subsequent reductions in the number of spring/summer Chinook salmon hatchery program adults would decrease the already limited potential for spawning ground competition and redd superimpositions with fall Chinook salmon.

The competition and predation effects would also be negligible-beneficial relative to Alternative 1 for sockeye salmon. Reduction in smolt numbers from all spring/summer Chinook salmon, steelhead, and coho salmon hatchery programs would reduce the potential predation on natural-origin parr, and competition with juvenile sockeye salmon in the Snake River Basin compared to Alternative 1. Due to a lack of temporal and geographic overlap, no adult competition for spawning grounds and redd superimpositions would occur between sockeye salmon and hatchery program adults in the study area.

The competition and predation effects would also be negligible-beneficial relative to Alternative 1 for coho salmon. Reductions in the number of smolts from all spring/summer Chinook salmon, steelhead, and Coho salmon programs would decrease the potential for competition and predation effects on natural-origin juvenile coho salmon compared to Alternative 1. Due to limited temporal, geographic, and spawning habitat overlap, no adult competition for spawning grounds and redd superimpositions would occur between coho salmon and hatchery program adults in the study area.

4.3.3.4 Alternative 4

As described in Section 4.1, Water Quantity, with the complete termination of hatchery programs under Alternative 4, facilities would not be used for these programs, but many would continue to operate for other salmon or steelhead programs described by NMFS (2014a) and USFWS (2017a, 2017b). Facilities that may cease to operate because they are dedicated to programs considered in this EA would include the Hells Canyon Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon River

Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon River Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries.

Because there would be a reduction in the overall spring/summer Chinook salmon, steelhead, and coho salmon hatchery-origin smolts (and eggs), and a subsequent reduction in returning adults in the study area over time, the hatchery programs' competitive and predatory effects would eventually subside. Therefore, the effects would be low-beneficial to all species relative to Alternative 1. Ecological effects of program termination would be most substantial in the Hells Canyon Reach of the Snake River, the Little Salmon River, and the South Fork Salmon River. Effects may be less in the East Fork Salmon River because the East Fork Salmon River Natural A-run Steelhead Program is integrated and uses only natural-origin broodstock. No fish are collected at or released from Niagara Springs Fish Hatchery; therefore no additional effects would be realized.

4.3.4 Prey Enhancement

Because adult spring/summer Chinook salmon do not typically eat after entering freshwater (Quinn 2005) and steelhead are the only species likely to be present and feeding as adults when hatchery subyearlings and yearlings are released from all programs in the spring (Section 3.3.5.4, Prey Enhancement), or when fish from eggbox programs are rearing in the natural environment, the effects of prey enhancement are analyzed only for steelhead (Table 4-5).

Table 4-5. Summary of prey enhancement effect on steelhead.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Steelhead	Low-beneficial	Same as Alternative 1	Negligible-adverse	Negligible-adverse

4.3.4.1 Alternative 1

Under Alternative 1, with the exception of the JCAPE program, all hatchery programs would be operated the same as under current conditions. As such, no change would be expected in the prey enhancement effects from Chinook salmon, coho salmon, and steelhead smolts or eggs released from the programs compared to those described in Section 3.3.5.4, Prey Enhancement. The JCAPE Program currently releases 100,000 smolts under the 2008-2017 *U.S. v Oregon* Management Agreement, but proposes a release of 150,000 smolts moving forward. This is a relatively minor increase in the total number of spring/summer Chinook salmon smolts released into the study area under current conditions, and additive effects on prey enhancement would be undetectable on top of the low-beneficial effect of prey enhancement under Alternative 1. Similarly, negligible additive effects would be realized if steelhead adults preyed upon age-0 spring Chinook salmon or steelhead fry or parr from the eggbox programs.

4.3.4.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in prey enhancement effects on steelhead. Therefore, this alternative would also have the same, low-beneficial effect as Alternative 1.

4.3.4.3 Alternative 3

Under Alternative 3, the total number of smolts released would be reduced to 3.5 million spring/summer Chinook salmon, 2.5 million steelhead, and 250,000 coho salmon. Steelhead would have a smaller number of smolts to prey on compared to Alternative 1, and the difference in effects would likely be negligible-adverse, especially because steelhead do not rely on the smolts from the programs and would find other sources of food.

4.3.4.4 Alternative 4

Under Alternative 4, no program-related smolts would be available as a prey source for adult steelhead, though these fish are likely to find other sources of food. Therefore, this alternative would have a negligible-adverse effect compared to Alternative 1. A reduction in prey enhancement would be most substantial in reaches adjacent to and downstream of facilities that would likely cease to operate completely under Alternative 4, as described in Section 4.1, Water Quantity.

4.3.5 Diseases

The overall disease effects from hatchery-origin Chinook salmon, coho salmon, and steelhead on natural-origin salmon and steelhead would be negligible-adverse under Alternative 1 and Alternative 2. Relative to Alternative 1, effects would be negligible-beneficial under Alternative 3 and Alternative 4 (Table 4-6). NMFS (2017a, b) determined that the risk of pathogen transmission to natural-origin salmon and steelhead is negligible for programs under the Proposed Action.

Table 4-6. Summary of disease effects on salmon and steelhead.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/Summer Chinook salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Steelhead	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Fall Chinook salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Sockeye salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Coho salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial

4.3.5.1 Alternative 1

Under Alternative 1, the hatchery programs would be operated with the same disease management protocols as under current conditions, so no change in disease effects on other salmon and steelhead species would be expected. Although pathogens can be passed to natural-origin salmon and steelhead species that occupy rivers near hatchery facilities, several factors reduce the likelihood of disease and pathogen transmission between hatchery and natural fish. First, the proportion of facility surface water withdrawal and subsequent discharge at most sites represents only a portion of the total streamflow (Section 3.1, Water Quantity). This reduces, via dilution, the potential for transmission of pathogens from effluent (Section 3.2, Water Quality). Second, smolt release strategies typically promote distribution of hatchery fish throughout the system and rapid outmigration, which reduces the concentration of hatchery-released fish, and therefore, the potential for a diseased hatchery fish to encounter natural-origin salmon and steelhead. Finally, standard fish health protocols minimize the potential for disease and pathogen effects on natural-origin salmon and steelhead (USFWS 2017a). In Idaho, recommendations for treating specific disease agents comes from the Idaho Department of Fish and Game Fish Health Laboratory in Eagle, ID (IDFG 2016b) and from USFWS's Pacific Region Fish Health Program office located at Kooskia National Fish Hatchery.

Because few major outbreaks have occurred for any of the programs and management protocols have limited the extent and duration of any outbreaks, production of all salmon and steelhead species discussed here would have a negligible-adverse effect.

4.3.5.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in disease effects on other salmon and steelhead species. Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1.

4.3.5.3 Alternative 3

The 50 -percent reduction in total quantity of smolts under Alternative 3 would result in a negligible-beneficial effect on the potential for pathogen transmission to natural-origin fish associated with the hatchery programs compared to Alternative 1 because the reduction would reduce the number of hatchery fish that can potentially transfer diseases to natural-origin fish. Although a slight beneficial effect might be realized, most facilities that propagate fish from these programs would continue to operate for other nonproject programs that would have similar disease effects on natural salmon and steelhead species. This minimizes any beneficial effect compared to Alternative 1.

4.3.5.4 Alternative 4

Similar to Alternative 3, given the quantity of smolts that would be eliminated from the Snake River Basin, terminated production under Alternative 4 would result in a negligible-beneficial effect on the potential for pathogen transmission to natural-origin fish associated with the hatchery programs compared to Alternative 1. Although a slight beneficial effect might be realized, as discussed in Section 2.4, Alternative 4, with the exception of the Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries, facilities that propagate fish from these programs would continue to operate for other nonproject programs that would have similar disease effects on natural salmon and steelhead species. This minimizes any beneficial effect compared to Alternative 1. Relative disease effects of program termination may, be most substantial in the Rapid River, Little Salmon River, and South Fork Salmon River.

4.3.6 Population Viability

As discussed in Section 3.3.5.6, Population Viability, and in Appendix A, the discussion herein is limited to the Snake River Spring/Summer Chinook Salmon ESU and the Snake River Steelhead DPS because these are the only species that have negatively affected population viability in addition to effects discussed in Section 3.3.5.3.. Spring/summer Chinook salmon and coho salmon hatchery programs considered in this EA would have no effect on population viability for the Snake River Steelhead DPS. Similarly, coho salmon and steelhead hatchery programs considered in this EA would have no effects on population viability of the Snake River Spring/Summer Chinook Salmon ESU. Effects on population viability consider abundance, productivity, spatial structure and diversity. Effects from same-species hatchery programs (i.e., conspecifics) on the Snake River Spring/Summer Chinook Salmon ESU and Snake River Steelhead DPS are summarized below (Table 4-7).

Table 4-7. Summary of population viability effects of Chinook salmon hatchery programs on natural-origin Chinook salmon and steelhead hatchery programs on natural-origin steelhead.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Snake River Spring/Summer Chinook Salmon ESU	Low adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Snake River Steelhead DPS	Low adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial

4.3.6.1 Spring/Summer Chinook Salmon Programs

Alternative 1

Under Alternative 1, hatchery programs would release the number of smolts and eggs as proposed in the HGMPs.

Hatchery programs contribute differently to abundance based on the program's intent for the returning adults. Fish from segregated hatchery programs (Table 2-2, Table 2-3, Table 2-4, Table 2-6) are not intended to contribute to natural population abundance. However, under this alternative, hatchery programs that are designed to have hatchery-origin fish spawn naturally would increase abundance and provide a benefit to population viability via that parameter; for those programs, moreover, the spatial structure would potentially be maintained or enhanced through the use of various acclimation sites that encourage hatchery-origin adults to return to rivers into which they are released. The program also minimizes the impacts of broodstock mining through the use of abundance based scales for broodstock selection.

Regardless of whether hatchery fish are intended to spawn naturally or not, hatchery programs would increase risks to natural-origin fish diversity from hatchery-influenced selection. Further, if hatchery and natural-origin fish interbreed in the natural environment, productivity could be negatively affected compared to production by two natural origin parents[8].

Because the genetic risks are present for all programs, while the benefit of supplementing abundance is present for integrated programs, the overall effect of hatchery programs on natural-origin fish from the Snake River Spring/Summer Chinook Salmon ESU would be low-adverse.

Alternative 2

Under Alternative 2, the operation of all spring/summer Chinook salmon hatchery programs would be the same as under Alternative 1, with no change in population viability of the Snake River Spring/Summer Chinook Salmon ESU and the Snake River Steelhead DPS compared to Alternative 1. Therefore, this alternative would also have the same effect as Alternative 1 for both species.

Alternative 3

Although the 50 percent reduction in hatchery production under Alternative 3 would reduce the small benefits to abundance relative to Alternative 1, it would decrease risks to genetics (diversity) and productivity from hatchery-influenced selection. For those programs that are part of the Snake River Spring/Summer Chinook Salmon ESU (JCAPE, Pahsimeroi Summer Chinook Salmon, Upper Salmon Spring Chinook Salmon), benefits to abundance may outweigh the genetic risks to ensure spatial structure throughout the ESU, so a reduction in production for those programs may be a slight negative effect relative to Alternative 1. Overall, however, effects on population viability under Alternative 3 would be negligible-beneficial for the Snake River Spring/Summer Chinook Salmon ESU relative to Alternative 1 because genetic risks are reduced for all programs by the reduction in production.

Alternative 4

With immediate termination of all hatchery programs under Alternative 4, hatchery-origin fish that have already been released would continue to be removed if encountered through another program, but the removal would not take place at the levels described in the HGMPs because adult removal would not occur as described in the HGMP. Returning adults from previous releases for the integrated program

[8] This statement is regarding all hatchery programs, combined. However, it does not apply equally to all programs in the proposed action. For example, JCAPE uses 100% natural-origin broodstock and only releases 150,000 yearlings into Johnson Creek, thus the impacts to diversity and productivity are likely to be minimal from this program. Moreover, there is some benefit to species population viability from the integrated JCAPE program, which is designed to supplement the natural population. Even though JCAPE uses exclusively native natural-origin broodstock, we still expect there to be some fitness effects from the program to the natural-origin population from naturally spawning hatchery program returnees.

would contribute to abundance for a short period, but the integrated programs will not contribute to abundance thereafter. Hatchery productions will not contribute to genetic diversity risks for all programs. Relative to Alternative 1, effects on population viability effects would be low-beneficial for the Snake River Spring/Summer Chinook Salmon ESU because genetic risks are eliminated for all programs by the termination of all hatchery programs[8].

4.3.6.2 Steelhead Programs

Alternative 1

Under Alternative 1, steelhead hatchery programs would release the same number of smolts as under current conditions, and the same number of eggs would be placed into streamside incubators.

Effects on population viability would be low-adverse for the Snake River Steelhead DPS. The East Fork Salmon River Natural A-run Steelhead program, would continue to produce fish that are intended to spawn naturally and may increase abundance and productivity. The increases in abundance from the East Fork Salmon River Natural A-run Steelhead program may provide a benefit to population viability in this respect. Regarding effects to species diversity, best available data suggests that the East Fork Salmon River Natural program is likely to obtain a PNI exceeding 0.5 (NMFS 2017c). The program also reduces the likelihood of broodstock mining through the use of abundance based scales for broodstock selection. The East Fork Salmon River Natural A-run Steelhead program may contribute to spatial structure for the overall MPG by ensuring the existence of the East Fork Salmon population. Most other programs in the study area currently have infrastructure in place to remove hatchery steelhead from the natural environment, and NMFS expects no more than five percent of hatchery-origin steelhead straying to a non-target population, measured as a 5-year rolling average beginning in 2018. In addition, some hatchery fish may be removed through fisheries in the area, and NMFS (2019a) concluded that current and proposed fisheries are not likely to reduce the likelihood of surivial and recovery of the DPS. Limited straying and hatchery-fish removal will minimize genetic risks from programs that are not intended for natural population supplementation because fish that have some hatchery influence may be less fit than natural-origin fish and could reduce the productivity of natural-origin fish if they spawn in the wild. In addition, the spatial structure would be maintained or enhanced through the use of various acclimation sites that encourage hatchery-origin adults to return to rivers into which they are released. Over time, other viability factors, such as genetic diversity and spatial structure, would increase as natural-origin returns increase.

Alternative 2

Under Alternative 2, the operation of all steelhead hatchery programs would be the same as under Alternative 1, with no change in population viability of the Snake River Spring/Summer Chinook Salmon ESU and the Snake River Steelhead DPS compared to Alternative 1. Therefore, this alternative would also have the same effect as Alternative 1.

Alternative 3

The 50 percent reduction under Alternative 3, would reduce abundance relative to Alternative 1. The effects on population viability of the Snake River Steelhead DPS would be negligible-beneficial compared to Alternative 1. Although Alternative 3 would reduce abundance slightly, it would decrease the genetic risks to natural-origin population diversity, despite inclusion of the East Fork Salmon River Natural A-run Program as part of the Snake River Steelhead DPS. Overall, the reduced production under this alternative would reduce the risks to productivity and spatial structure of natural-origin fish compared to Alternative 1. However, East Fork Salmon River Natural A-run Program reducing its production by 50 percent is likely to increase risks to genetic diversity, productivity, spatial structure, and abudandance of the East Fork Salmon population compared to Alternative 1 because the benefits from this program described in Alternative 1 would be decreased.

Alternative 4

With termination of all hatchery programs under Alternative 4, hatchery-origin fish that have already been released would continue to be removed if encountered through another program, but removal would not take place at the levels described in the HGMPs. Under this alternative, the East Fork Salmon River Natural A-run Steelhead program would no longer contribute to abundance, productivity, spatial structure, and genetic diversity. However, the risks from all other programs would be reduced and possibly eliminated, which would benefit diversity and productivity of the listed species. Therefore, relative to Alternative 1, the population viability effects would be low-beneficial for the Snake River Steelhead DPS.

4.3.7 Nutrient Cycling

The overall effects of nutrient contribution in the form of marine-derived nutrients on natural-origin salmon and steelhead would be low-beneficial for Alternative 1 and Alternative 2 (Table 4-8). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and low-adverse under Alternative 4.

Table 4-8. Summary of nutrient cycling effects on salmon and steelhead.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/summer Chinook salmon	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Steelhead	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Fall Chinook salmon	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Sockeye salmon	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Coho salmon	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse

4.3.7.1 Alternative 1

Under Alternative 1, NMFS expects undetectable change in nutrient cycling effects on other salmon and steelhead species while all hatchery programs operate as described in the HGMPs[9]. All the salmon and steelhead species discussed here benefit equally from additional nutrients provided by hatchery fish carcasses. Because some hatchery-origin fish from all programs die in the Snake River Basin, the programs would provide a low-beneficial effect on salmon and steelhead species that exist in the basin through nutrient cycling. The number of hatchery-origin fish that would be allowed to spawn naturally is undetermined because the number would depend on how many natural-origin fish are on the spawning ground. However, a portion of hatchery-origin adult returns would be expected to spawn naturally and

[9] Although JCAPE would increase broodstock collection numbers and juvenile releases from 100,000 to 150,000 under a future operational scenario, this increase is not likely to amount to a detectable change in localized effect because an increase in 50,000 smolts is a small fraction compared to all of the other smolts released in the Salmon River Subbasin (Table 2-1).

thereby contribute nutrients to the environment. Further, nutrients would be contributed in Johnson Creek through the placement of spawned adults as part of the nutrient enhancement actions. Under this alternative, the estimated number of hatchery-origin Chinook salmon adult returns from all programs would range from 168 from the SFCEP program to 15,900 from the Little Salmon/Rapid River Spring Chinook program (NMFS 2017a, 2017b). The estimated number of hatchery-origin steelhead adult returns would range from four for the SSI programs to 7,360 for the Pahsimeroi A-run Summer Steelhead program (NMFS 2017c). The estimated number of coho salmon adult returns from that portion of the Clearwater River program included under the Proposed Action would be 6,500 (NMFS 2017d). Over time, returning hatchery fish that spawn naturally would contribute to marine-derived nutrients in the Snake River Basin, increasing the overall benefit to the system.

4.3.7.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in nutrient cycling effects on other salmon and steelhead species. Therefore, this alternative would also have the same low-beneficial effect as Alternative 1.

4.3.7.3 Alternative 3

With the 50 percent reduction in hatchery programs under Alternative 3, the total quantity of smolts released in the Snake River Basin would be 3.5 million spring/summer Chinook salmon, 2.5 million steelhead, and 250,000 coho salmon. Program hatchery-origin adults would still return to the Snake River Basin, a portion of those adults would spawn in the natural environment and carcasses would subsequently contribute to nutrient cycling. Therefore, with regard to nutrient cycling, this alternative would have no more than a negligible-adverse effect compared to Alternative 1.

4.3.7.4 Alternative 4

Cessation of all program smolt releases (currently 7 million spring/summer Chinook salmon, 5 million steelhead, and 500,000 coho salmon) under Alternative 4 would reduce the quantity of adult returns. Hatchery-origin smolts released prior to program termination would return to the Snake River Basin for 4 or 5 years, and would continue to contribute to nutrient cycling at reduced levels. Over time, hatchery-origin adults from the project programs would no longer return to the Snake River Basin, and marine-based nutrient contribution attributed to program adults would cease. Therefore, with regard to nutrient cycling, this alternative would have a low-adverse effect compared to Alternative 1.

4.3.8 Facility Operations

The overall effects of facility operations on natural-origin salmon and steelhead would range from low-adverse to negligible-adverse under Alternative 1 and Alternative 2. Relative to Alternative 1, effects would be negligible-beneficial under Alternative 3 and Alternative 4 (Table 4-9).

Table 4-9. Summary of facility effects on salmon and steelhead.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/summer Chinook salmon	Low-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial

Steelhead	Low-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Fall Chinook salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Sockeye salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Coho salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial

4.3.8.1 Alternative 1

Under Alternative 1, the hatchery programs would be operated the same as under current conditions[10], so no change in effects on salmon and steelhead species from facility operations would be expected, including adult collection, surface water diversion, effluent discharge, and routine instream maintenance activities.

The intake facilities are likely to affect all the salmon and steelhead species discussed here in the same manner. Facility operations would have negligible-adverse effects on salmon and steelhead in the study area because the program facilities minimize any impediment of fish movement as discussed in Section 3.3.5.8, Facility Operations. Further, facility funders and/or operators have or would review all facilities for compliance with the current anadromous salmonid passage facility design criteria and guidelines (NMFS 2011a, or most current). These criteria ensure that the mesh or slot size in the screening material, and the approach velocity of water toward the intake screening, meet standards that reduce the risk of both entrainment and impingement of listed juvenile salmonids. Upon review of hatchery facilities, funders and operators would prioritize repairs and upgrades into the future. Moreover, facilities are routinely observed for any signs that screens are not effectively excluding fish from intakes.

Surface water withdrawals would not change from current operations; therefore, effects of water withdrawals and associated habitat degradation in diversion reaches assessed in Section 3.3.5.8, Facility Operations, are assumed into the future under Alternative 1. Note that because future climate change trends (Section 5.1, Past, Present, and Reasonably Foreseeable Actions) indicate that juveniles may outmigrate earlier, the risk of dewatering juvenile rearing habitat when flows are at their lowest would be reduced even further (Dittmer 2013).

With the exception of the JCAPE program, all program broodstock collection would be identical to current operations. For the JCAPE program, NMFS assumes that the increase in broodstock needed to achieve a smolt release of 150,000 (up from 100,000 currently) would not change the average number of nontarget salmon and steelhead mortalities in the future.

Thus, weirs, ladders, and traps operated for spring/summer Chinook salmon, steelhead, and coho salmon broodstock collection would continue to operate as they currently do, and would, therefore, have the potential to capture both natural- and hatchery-origin salmon and steelhead. Broodstock collection timing, including angling for steelhead, would be the same under Alternative 1 as under current operations, and broodstock collection for each facility would have the greatest effect on species that overlap in run timing (i.e., spring/summer Chinook salmon run and some of the fall Chinook salmon and steelhead runs). Effects would range from migratory delay to mortality through stress from handling; expected handling mortality rates are provided for each species in Section 3.3.5.8, Facility Operations.

The spatial distribution of juvenile and adult salmon and steelhead is not expected to be affected by weir operation because weirs are designed to allow juvenile passage, and natural-origin adults are passed

[10] Although JCAPE would increase broodstock collection numbers and juvenile releases from 100,000 to 150,000 under a future operational scenario, no increase in surface water use is proposed.

upstream when not required for broodstock. At fixed volitional traps/ladders (i.e., not channel spanning) the intent is to collect broodstock via olfactory attraction to natal waters. These volitional traps are located along riverbanks and use attraction flow. Therefore, any fish, including nontarget fish, may enter the trapping facility. If nontarget fish enter the trap, staff would remove them from holding ponds within 24 hours of capture, which could delay to short delays in upstream migration. Though fish that are not collected are passed upstream to spawn naturally, there is a slight risk that weir delay or avoidance could impact spawning disrubution, though the impact would be small.

Broodstock collection currently has a low-adverse effect on Chinook salmon and steelhead, and a negligible-adverse effect on other salmon and steelhead. Similar effects would occur under Alternative 1. Sockeye and fall Chinook salmon are separated spatially and/or temporally from spring/summer Chinook salmon broodstock collection periods, and have not been encountered previously at program weirs (NMFS 2017a, 2017b). Similarly, Snake River sockeye salmon are and would continue to be rarely encountered during any steelhead broodstock collection facility (NMFS 2017c), and would not be encountered during coho salmon collection at Kooskia National Fish Hatchery (NMFS 2017d).

Operations would continue to include BMPs that limit the type, timing, and magnitude of allowable instream activities. In general, the measures would limit effects to short-term, sublethal effects such as fish displacement, and/or startling of fish, and would not result in any deviation beyond normal fish behavioral responses to environmental disturbances. Therefore, routine maintenance activities would not result in harm, harassment, or mortality of salmon and steelhead.

4.3.8.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in effects described above on salmon and steelhead species. Therefore, this alternative would also have the same, low-adverse effect as Alternative 1 for Chinook salmon and steelhead, and a negligible-adverse effect on other species.

4.3.8.3 Alternative 3

The 50-percent reduction in hatchery production under Alternative 3 would reduce the required broodstock for collection and perhaps the duration of the collection period; however, many facilities would continue to operate for other nonproject programs. Similarly, although lower program production would likely require less surface water for operations, nonproject operations would likely continue to divert surface water from adjacent waterbodies at most facilities. Therefore, this alternative would have no more than a negligible-beneficial effect compared to Alternative 1.

4.3.8.4 Alternative 4

With the complete termination of hatchery programs under Alternative 4, existing facilities would no longer be used to support these programs. As described in Section 4.1, Water Quantity, with the exception of the Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries, facilities would continue to operate for other nonproject programs that would have similar operational effects on natural salmon and steelhead species. This minimizes any beneficial effect compared to Alternative 1 because, although the frequency at which salmon and steelhead species are encountered would be less and the likelihood of migratory delay, mortality, or changes to spawning distribution would be reduced, ongoing facility operations would continue at many sites, resulting in a negligible-beneficial effect on salmon and steelhead compared to Alternative 1.

4.3.9 Research, Monitoring, and Evaluation

The overall effects of RM&E on natural-origin salmon and steelhead would be negligible-adverse under Alternative 1, Alternative 2, and Alternative 3. Relative to Alternative 1, effects would range from negligible-adverse to negligible-beneficial under Alternative 4, depending on the species considered (Table 4-10).

Table 4-10. Summary of RM&E effects on salmon and steelhead.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/summer Chinook salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Steelhead	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Fall Chinook salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Sockeye salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Coho salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.3.9.1 Alternative 1

Under Alternative 1, RM&E activities that are currently part of the hatchery programs would be operated the same as under current conditions, so no change in effects on salmon and steelhead would be expected. Spawning ground surveys would continue to be performed during spring Chinook salmon spawning seasons (Table 2-9; Table 2-10; Table 2-11), screw traps in the South Fork Clearwater River, Johnson Creek, Sesech River, Rapid River, Panther Creek, and Yankee Fork Salmon River would continue to be operated the same as under current conditions (Table 2-9; Table 2-10; Table 2-11), and juvenile fish sampling and tagging would be performed the same way as under current conditions (Section 3.3.5.9, Research, Monitoring, and Evaluation). The effects of juvenile fish sampling would be minimized because smolt traps would have a negligible effect on migration, angling would be performed following sport fishing equipment rules for selective fisheries, and methods of electrofishing would be performed to minimize fish injury (Snow et al. 2014). All salmon and steelhead species are likely to be affected in a similar fashion, with the effects ranging from migratory delay to stress from handling (Section 3.3.5.9, Research, Monitoring, and Evaluation), leading to a negligible-adverse effect. Because smolt traps are checked daily, nontarget fish can be removed on a daily basis, though handling may cause stress or injury to the fish. Considering the low number of sockeye salmon, and limited occurrence in the study area, the potential for effects on sockeye salmon would be less than for other salmon and steelhead, though still negligible-adverse.

4.3.9.2 Alternative 2

Under Alternative 2, the operation of hatchery programs would be the same as under Alternative 1, with no change in effects on salmon and steelhead species. Therefore, this alternative would have the same negligible-adverse effect as Alternative 1.

4.3.9.3 Alternative 3

Under Alternative 3, the RM&E for both hatchery programs would be the same as under Alternative 1; however, lower production would reduce the level of effort required for RM&E, and therefore, reduce the presence of researchers in the natural environment. Regardless, Alternative 3 would result in no detectable change in effects on salmon and steelhead species compared to Alternative 1. Therefore, this alternative would also have the same negligible-adverse effect as Alternative 1.

4.3.9.4 Alternative 4

With the termination of hatchery programs under Alternative 4, surveys would presumably continue until all adults from terminated programs have returned. Future surveys and smolt trapping would be reduced in duration and frequency until all program-related RM&E is discontinued. RM&E used to inform non-project hatchery and natural monitoring objectives would continue to operate. Effects on salmon and steelhead related to such RM&E would continue as under Alternative 1. Thus, in those waterbodies, RM&E effects would be negligible-beneficial for salmon and steelhead in the study area because of reduced effort associated with program-related RM&E.

As described in Section 4.1, Water Quantity, facilities that may cease operations because they are dedicated to programs considered in this EA include Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries. If these facilities cease to operate entirely, hatchery-related RM&E effects on salmon and steelhead would be reduced, and could be terminated in the South Fork Salmon River and East Fork Salmon River subbasins because hatchery programs in these subbasins would be terminated.

4.3.10 Critical Habitat and Essential Fish Habitat

The overall effects of the alternatives on critical habitat and EFH for Chinook and coho salmon in the study area would be low-adverse for Alternative 1 and Alternative 2 (Table 4-11). Relative to Alternative 1, effects would be negligible-beneficial under Alternative 3, and low-beneficial under Alternative 4.

Table 4-11. Summary of program effects on critical habitat and EFH for Chinook and coho salmon.

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/summer Chinook salmon	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Fall Chinook salmon	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Coho salmon	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial

4.3.10.1 Alternative 1

Under Alternative 1, with the exception of the JCAPE program, all hatchery programs would be operated the same as under current conditions, with no change in water use or juvenile release strategies. Although JCAPE would increase broodstock collection numbers and juvenile releases from 100,000 to 150,000 under a future operational scenario, no increase in surface water use is proposed. Therefore, NMFS expects no change in effects on critical habitat or Chinook or coho salmon EFH compared to current conditions.

NMFS has determined that Alternative 1 would result in a low-adverse effect on critical habitat and EFH for Chinook and coho salmon, specifically through production of hatchery fish that may provide forage, through operation and existence of associated structures (e.g., weirs, water withdrawal structures, effluent, and maintenance and construction) and genetic and ecological interactions of the hatchery-reared fish with natural fish in the natural environment, affecting complex channels and floodplain habitat, thermal refugia, and spawning habitat.

4.3.10.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in effects on critical habitat and EFH for Chinook or coho salmon. Therefore, this alternative would have the same low-adverse effect as Alternative 1.

4.3.10.3 Alternative 3

The 50 percent reduction in hatchery production under Alternative 3 would reduce the required broodstock for collection; however, many facilities would continue to operate for other nonproject programs. Similarly, although lower program production would likely require less surface water for operations, nonprogram operations would likely continue to divert surface water from adjacent waterbodies at most facilities. Therefore, this alternative would have no more than a negligible-beneficial effect on critical habitat and EFH compared to Alternative 1.

4.3.10.4 Alternative 4

With the complete termination of hatchery programs under Alternative 4, existing facilities would no longer be used to support these programs. As described in Section 4.1, Water Quantity, with the exception of the Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries, facilities would continue to operate for other programs that would have similar operational effects on critical habitat and EFH for Chinook and coho salmon. This would minimize any beneficial effect compared to Alternative 1 because, although the frequency at which salmon and steelhead species are encountered would be less and the likelihood of migratory delay or mortality would be reduced, ongoing facility operations would continue at many sites, resulting in a low-beneficial effect on critical habitat and EFH compared to Alternative 1.

4.4 Fisheries

The overall effects of the hatchery programs on salmon and steelhead fisheries in the study area would range from negligible-beneficial to low-beneficial for Alternative 1 and Alternative 2 (Table 4-12). Relative to Alternative 1, effects would range from undetectable to negligible-adverse under Alternative 3 and range from negligible-adverse to low-adverse under Alternative 4.

Table 4-12. Summary of effects on fisheries for Spring/Summer Chinook salmon, coho salmon, and steelhead.

Fishery	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Spring/summer Chinook salmon	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Steelhead	Low-beneficial	Same as Alternative 1	Negligible-adverse	Medium-adverse

Fishery	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Coho salmon	Negligible-beneficial	Same as Alternative 1	Undetectable	Negligible-adverse

4.4.1 Alternative 1

Returning hatchery-origin adult salmon and steelhead provide both recreational and tribal fisheries opportunities. Selective fisheries, in which only hatchery-origin spring/summer Chinook salmon and steelhead with clipped adipose fins may be kept, are intended to increase fishing opportunities while also protecting natural-origin fish. All coho salmon may be kept because fish do not receive adipose fin clips. Because the hatchery programs play an important role in the implementation and management of fisheries, the programs would provide a low-beneficial effect on recreational and tribal fisheries for spring/summer Chinook salmon and steelhead. The Clearwater River Coho program included under the proposed action contributes to about half of the overall coho salmon production in the Clearwater River subbasin. Because coho salmon fisheries are so new and harvest is low relative to Chinook salmon and steelhead, the effect of the Clearwater River Coho Program on coho salmon fisheries would be negligible-beneficial.

4.4.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in effects on fisheries. Therefore, this alternative would also have the same low-beneficial effects on spring/summer Chinook salmon and steelhead fisheries, and the same negligible-beneficial effect on coho salmon fisheries as Alternative 1.

4.4.3 Alternative 3

The 50 percent reduction in hatchery production under Alternative 3 would reduce abundance relative to Alternative 1, and would therefore reduce both recreational and tribal fishing opportunities. Although fishing opportunities from the programs included in this EA would be reduced, other programs would continue operating and provide fishing opportunities. Further reductions in harvest to protect natural-origin fish would therefore not be needed, with the possible exception of coho salmon. A small number of coho salmon are currently harvested; therefore the effect of a 50 percent reduction in the portion of the Clearwater Coho Salmon program included in this EA would be undetectable. The effect of reductions in production of spring/summer Chinook salmon and steelhead would be negligible-adverse, because the fisheries are larger and have a larger geographic scope than the coho salmon fishery.

4.4.4 Alternative 4

Termination of hatchery programs would decrease recreational and tribal fishing opportunities in the study area because the number of hatchery-origin fish would decrease substantially. Recreational fisheries would likely be further reduced to protect natural-origin spring/summer Chinook salmon and steelhead. Production resulting from operation of the Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries would cease entirely; therefore, recreational fishing for spring/summer Chinook salmon in at least the Snake River, Little Salmon River, and South Fork Salmon River would probably cease entirely. Elimination of Chinook salmon rearing at Sawtooth Fish Hatchery would probably also result in cessation of Chinook salmon fishing in the upper Salmon River. Tribal fisheries may continue because those fisheries are non-selective, though the opportunities would also be reduced because hatchery-origin adults would no longer contribute to the fisheries. Although other facilities would continue to operate for other programs, recreational fishing for steelhead would be reduced throughout the study area, especially in the South Fork Clearwater River, Little Salmon River, and the Yankee Fork Salmon River. Fishing for coho salmon in the Clearwater River Subbasin would also be reduced until natural production and production from the component of the Coho Salmon program not included in this EA combine to replace lost production. Therefore, with regard to fisheries, this alternative would have low-adverse effects for spring/summer Chinook salmon, medium-adverse effects for steelhead, and negligible-adverse effects for coho salmon compared to Alternative 1.

4.5 Other Fish Species

The overall effect on fish species other than salmon and steelhead would range from negligible-adverse to low-beneficial under Alternative 1 and Alternative 2 (Table 4-13). Relative to Alternative 1, effects would be generally negligible-beneficial or negligible-adverse under Alternative 3, and would range from low-beneficial to low-adverse under Alternative 4.

Table 4-13. Summary of effects on fish species other than salmon or steelhead.

Metric	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Competition and Predation	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Prey Enhancement	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Diseases	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Nutrient Cycling	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Facility Operations	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Research Monitoring and Evaluation	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.5.1 Alternative 1

Because production of salmon and steelhead smolts and/or eggs and the estimated number of adult recruits under Alternative 1 would not change compared to current conditions, undetectable change in effects on other fish species is expected[11]. Competition and predation effects would continue to be negligible-adverse for many fish species in the study area, especially for salmonid species such as bull trout and westslope cutthroat trout that may compete for spawning grounds or experience redd superimposition with hatchery-origin salmonids. Effects would likely be less than those on natural-origin salmon and steelhead (Section 4.3.3, Competition and Predation) because of differences in spawn timing,

[11] Although JCAPE would increase broodstock collection numbers and juvenile releases from 100,000 to 150,000 under a future operational scenario, this increase is not likely to amount to a detectable change in localized effect because an increase in 50,000 smolts is a small fraction compared to all of the other smolts released in the Salmon River Subbasin (Table 2-1).

location, and habitat preference. Predation by hatchery fish on native species, such as leopard dace and Umatilla dace, would also remain similar to current levels.

Prey enhancement related to hatchery production of salmon and steelhead would continue to have a low-beneficial effect on fish species in the study area that could prey on smolts and/or eggs from the hatchery programs, though no fish species relies solely on salmon smolts and/or eggs. Available juvenile salmon and steelhead prey would remain similar to current numbers, and predation on hatchery-origin juvenile salmon and steelhead by bull trout would remain similar to current levels. Predation on hatchery-origin salmon and steelhead by Pacific lamprey and river lamprey would also likely be similar to current conditions, as would the potential for hatchery salmon and steelhead to buffer Pacific lamprey from predation by marine mammals.

Diseases that are endemic to many fish species would continue to have a negligible-adverse effect on fish species in the study area, though such incidences are not likely to occur with current ongoing hatchery programs. Diseases that pose particular risk to hatchery-origin salmonids (i.e., BKD and IHN) only affect salmonid species. Although other salmonid species such as bull trout, resident rainbow trout, and westslope cutthroat trout have the potential to occur near existing hatchery facilities and release sites, several factors such as the relatively low volume of discharge, smolt release strategies, and fish health protocols would continue to reduce the likelihood of disease and pathogen transmission between hatchery fish and other salmonids.

Most fish species in the study area would continue to indirectly benefit from nutrient cycling of carcasses from hatchery-origin fish through having enhanced nutrients available to their prey sources. Naturally spawning fish of hatchery origin or nutrient enhancement derived from fish spawned in hatcheries would continue to contribute to increased nutrient cycling in the natural environment.

Facility operations would continue to have negligible-adverse effects because the program facilities minimize any impediment to fish movement as discussed in Section 3.5, Other Fish Species. Upstream migration may be delayed slightly for fish trapped at collection facilities. Handling levels and potential for injury would remain unchanged from current conditions. Weirs may act as barriers that cause population subdivision if other fish species (e.g., small, non-game fish) are consistently not passed upstream. Effects of water diversions, intakes, effluent discharge, and maintenance activities would also remain unchanged.

RM&E activities would continue to have a negligible-adverse effect on fish species other than salmon and steelhead. Individuals would continue to be incidentally collected in traps and during surveys, and may suffer increased stress and minimal mortality. However, guidelines in place to reduce impacts on salmon and steelhead (NMFS 2008b) would continue to reduce effects on other species. In addition, BMPs in place for salmon, steelhead, and bull trout (USFWS 2017a, 2017b) would also continue to reduce these effects.

4.5.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in effects on other fish species. Therefore, this alternative would have the same effects as Alternative 1 (Table 4-13).

4.5.3 Alternative 3

Under Alternative 3, the 50 percent decrease in hatchery-origin salmon and steelhead smolt production would reduce competition and predation effects relative to Alternative 1. The change would be negligible-beneficial under Alternative 3 (Table 4-13) because fewer juvenile salmon and steelhead would compete with juvenile bull trout and other fish species for prey, and fewer salmon and steelhead smolts would compete with bull trout and other salmonids for habitat space.

The decrease in hatchery-origin salmon and steelhead smolt production would also reduce the availability of an important prey resource of bull trout, and to a lesser extent of Pacific lamprey and river lamprey. Other food sources would remain available (e.g., insects, other fish species, frogs, snake, mice, waterfowl), because hatchery production and activities would not affect these resources. Therefore, the effect on prey enhancement on fish species other than salmon and steelhead would be negligible-adverse relative to Alternative 1.

Current rearing and release strategies and fish health protocols reduce the likelihood of disease and pathogen transmission between hatchery fish and other salmonids; however, reduction of hatchery production may further reduce the risk of disease amplification to salmonids other than salmon and steelhead. Reduction of hatchery production under Alternative 3 may, therefore, result in a negligible-beneficial effect on other fish species relative to Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 would result in fewer hatchery-origin salmon and steelhead contributing to nutrient cycling in the study area. The corresponding reduced intake of nutrients through prey sources would contribute to a negligible-adverse effect on other fish species relative to Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 would reduce the effort required to collect hatchery broodstock, which would in turn reduce the number of nontarget fish collected; however, all facilities would continue to operate for the 15 programs and for other programs described by NMFS (2014a) and USFWS (2017a, 2017b). Because all facilities would continue to operate similar to current conditions, though likely for shorter durations to meet reduced broodstock collection goals, the effect on fish species relative to Alternative 1 would be negligible-beneficial.

RM&E activities would also continue even with the 50 percent reduction in production under Alternative 3. Because all RM&E activities would continue similar to current conditions, the effect on fish species would be similar to Alternative 1.

4.5.4 Alternative 4

With the complete termination of hatchery programs under Alternative 4, facilities would not be used for these programs, but many would continue to operate for other salmon or steelhead programs described by NMFS (2014a) and USFWS (2017a, 2017b). As described in Section 4.1, Water Quantity, facilities that may cease operations because they are dedicated to programs considered in this EA Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries. Relative effects of program termination, such as reduced incidental handling and migration delays at the traps, may, therefore, be most substantial in the Hells Canyon Reach of the Snake River, the Little Salmon River, and the South Fork Salmon River. No fish are collected at or released from Niagara Springs Fish Hatchery; therefore, any effects would be limited to elimination of effluent, which may result in negligible but beneficial effects on resident fish relative to Alternative 1.

Termination of the hatchery programs would reduce competition with and predation on other fish species, leading to an overall low-beneficial effect on other fish species relative to Alternative 1. Relative reductions would be negligible for many of the 15 programs, but would be more substantial in the Little Salmon River and in the South Fork Salmon River, where all hatchery production would cease.

The programs would not release smolts or eggs, eliminating one source of prey for some fish (especially bull trout) in the study area. This could result in a low-adverse effect on other fish species relative to Alternative 1. Relative effects would again be negligible for many of the 15 programs, but would be more substantial in the Little Salmon River and in the South Fork Salmon River, where all hatchery production would cease. Bull trout would be affected because they occur throughout the South Fork Salmon River watershed (USFWS 2017a) and a large population of bull trout inhabits the Rapid River (USFWS 2005).

Termination of hatchery programs would eliminate the risk of hatchery-related disease amplification to salmonids other than salmon and steelhead. Complete cessation of hatchery production in some watersheds would contribute to a negligible-beneficial effect on other fish species relative to Alternative 1.

Over time, as salmon and steelhead from terminated programs no longer return to the study area, hatchery-origin adults from the 15 programs would no longer contribute to nutrient cycling. Some hatchery-origin fish would successfully spawn in the natural environment, and therefore, add to future generations that would contribute to nutrient cycling. However, complete cessation of hatchery production in some watersheds, and corresponding reduced intake of nutrients through prey sources, would contribute to a low-adverse effect on other fish species relative to Alternative 1.

As previously noted, facilities would not be used for the 15 programs considered in this EA, but many would continue to operate for other salmon or steelhead programs. These facilities may operate with reduced intake and effluent discharge because of reduced production. Some facilities may cease operations because they are dedicated to programs considered in this EA. Reduced operation of some hatcheries and complete cessation of operations at other facilities would contribute to a negligible-beneficial effect on other fish species relative to Alternative 1.

RM&E would eventually terminate for these programs, but for the most part would likely continue to operate for other programs. The exception may be for programs in the Little Salmon River and the South Fork Salmon River, where all hatchery production facility operations would cease. Complete cessation of hatchery-related RM&E activities in these watersheds would contribute to a negligible-beneficial effect on other fish species relative to Alternative 1.

4.6 Wildlife

The overall effect on wildlife would range from negligible-adverse to low-beneficial under Alternative 1 and Alternative 2 (Table 4-14). Relative to Alternative 1, effects would be generally negligible-beneficial or negligible-adverse under Alternative 3, and range from negligible-beneficial to low-adverse under Alternative 4.

Table 4-14. Summary of effects on wildlife.

Metric	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Prey Enhancement	Low-beneficial	Same as Alternative 1	Negligible-adverse	Negligible-adverse
Diseases	Negligible-adverse	Same as Alternative 1	Undetectable	Negligible-beneficial
Nutrient Cycling	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Facility Operations	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial

4.6.1 Alternative 1

Because production of salmon and steelhead smolts and/or eggs, and the estimated number of adult recruits under Alternative 1 would not change compared to current conditions, undetectable change in effects on wildlife would be expected.

Prey enhancement related to hatchery production of salmon and steelhead would continue to have a low-beneficial effect on wildlife species in the study area that could prey on smolts and/or eggs from the hatchery programs, though no wildlife species relies solely on hatchery-origin salmon smolts, eggs, or adults.

Toxic contaminants and/or diseases that are found in hatchery-origin salmon and steelhead are unlikely to affect other wildlife species and would continue to have a negligible-adverse effect on wildlife species in the study area.

Most wildlife species in the study area (e.g., stream invertebrates, mammals, and birds) would continue to benefit from nutrient cycling of carcasses from hatchery-origin fish, either directly or indirectly. Naturally spawning fish of hatchery origin, or carcass placement of fish spawned in hatcheries, would continue to contribute to increased nutrient cycling in the natural environment.

Program facilities would continue to have negligible-adverse effects because only passive methods (i.e., netting and fencing around facilities) are used to deter predators such as great blue herons, and river otters at facilities. Program facilities minimize impediments to wildlife movement, and staff members who can remove nontarget species would be present at weirs and traps during trapping operations and routine maintenance activities. Handling levels and potential for injury would remain unchanged from current conditions.

Operation and maintenance at the hatchery, weir, and release location may cause temporary effects on wildlife, including various species of birds (BPA EGIS 2018), disturbance due to human presence and temporary elevated noise. The noise-sensitive wildlife are anticipated to temporarily relocate to adjacent habitats, which are abundant near the sites. Effects on bald eagles and osprey from elevated noise is also likely to be negligible because the number of sightings have been small (a few bald eagles around Kooskia National Fish Hatchery, and ospreys around Hagerman and Kooskia National fish hatcheries, and Sawtooth Fish Hatchery), and those sightings are in areas where human activity and disturbance is common (e.g., near highways). Effects from temporarily elevated noises are anticipated to remain unchanged from current conditions because no change in operation is proposed that would change the level of noise.

Operation and maintenance at Hagerman National, Niagara Springs, and Magic Valley fish hatcheries may have effects on Bliss Rapids snails and Snake River physa snails. Effects are likely to be negligible because management practices are in place to prevent impacts, and all effluent water is monitored regularly for compliance with NPDES standards.

4.6.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in effects on wildlife. Therefore, this alternative would have the same effects as Alternative 1 (Table 4-14).

4.6.3 Alternative 3

Under Alternative 3, the geographic extent of effects of the hatchery programs on wildlife would be the same compared to Alternative 1.

The 50 percent decrease in hatchery-origin salmon and steelhead smolt production would reduce the availability of prey compared to Alternative 1, though no wildlife species relies solely on salmon smolts, eggs, or adults. Therefore, the effect on prey enhancement on wildlife would be negligible-adverse relative to Alternative 1.

Current rearing and release strategies and fish health protocols reduce the likelihood of toxic contaminants and pathogen transmission between hatchery fish and wildlife; however, reduction of hatchery programs may further reduce the risk of disease transmission to wildlife. Reduction of hatchery production under Alternative 3 may, therefore, result in an undetectable but beneficial effect on wildlife relative to Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 would result in fewer hatchery-origin and natural-origin salmon and steelhead contributing to nutrient cycling in the study area. The corresponding reduced intake of nutrients through prey sources would contribute to a negligible-adverse effect on wildlife species relative to Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 would further minimize the number of nontarget wildlife species collected, and potentially, the duration of the collection period; however, all facilities would continue to operate for the 15 programs and for other programs described by NMFS (2014a) and USFWS (2017a, 2017b). Because all facilities would continue to operate similar to current conditions, though likely for shorter durations to meet reduced broodstock collection goals, the effect of facility operations on wildlife relative to Alternative 1 would be negligible-beneficial.

4.6.4 Alternative 4

With the complete termination of hatchery programs under Alternative 4, facilities would not be used for these programs, but many would continue to operate for other salmon or steelhead programs described by NMFS (2014a) and USFWS (2017a, 2017b). As described in Section 4.1, Water Quantity, facilities that may cease operations because they are dedicated to programs considered in this EA include Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries. Relative effects of program termination may, therefore, be most substantial in the Hells Canyon Reach of the Snake River, the Little Salmon River, and the South Fork Salmon River. Relative effects may be less in the East Fork Salmon River because the East Fork Salmon River Natural A-run Steelhead Program is integrated and uses only natural-origin broodstock. No fish are collected at or released from Niagara Springs Fish Hatchery; therefore, any effects would likely be undetectable.

Termination of the hatchery programs would further reduce the availability of prey, which could increase competition among wildlife species with shared food preferences (e.g., among piscivorous avian species). This may shift predation pressure to other wildlife species to compensate for the loss in salmon, leading to a negligible-adverse effect on prey enhancement relative to Alternative 1. Relative reductions would be negligible for many of the 15 programs, but would be more substantial in the Little Salmon River and in the South Fork Salmon River, where all hatchery production would cease.

The programs would not release smolts or eggs, eliminating one source of prey for some wildlife species in the study area. This could result in a negligible-adverse effect to wildlife species relative to Alternative 1. Relative effects would again be undetectable for many of the 15 programs, but would be more substantial in the Little Salmon River and in the South Fork Salmon River, where all hatchery production would cease.

Termination of hatchery programs would eliminate the risk of the limited types of hatchery-related toxins and pathogens that can be transferred to wildlife species. Complete cessation of hatchery production in some watersheds would contribute to a negligible-beneficial effect on wildlife relative to Alternative 1.

Over time, as salmon and steelhead from terminated programs no longer return to the study area, hatchery-origin adults from the 15 programs would no longer contribute to nutrient cycling. Some hatchery-origin fish would successfully spawn in the natural environment, and therefore, contribute to future generations that would contribute to nutrient cycling. However, complete cessation of hatchery production in some watersheds, and corresponding reduced intake of nutrients through prey sources would contribute to a low-adverse effect on wildlife species relative to Alternative 1.

As previously noted, facilities would not be used for the 15 programs considered in this EA, but many would continue to operate for other salmon or steelhead programs. Some facilities may cease operations because they are dedicated to programs considered in this EA. Complete cessation of these facility operations, including the elimination of some weirs and traps that may impede wildlife movement, would contribute to a negligible-beneficial effect on wildlife species relative to Alternative 1.

4.7 Socioeconomics

The overall effect on socioeconomics would be medium-beneficial under Alternative 1 and Alternative 2 (Table 4-15). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and low-adverse for Alternative 4.

Table 4-15. Summary of effects on socioeconomics.

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Socioeconomics	Medium-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse

4.7.1 Alternative 1

Under Alternative 1, the hatchery programs would be operated in a similar manner as under current conditions[12], so recreational expenditures, employment opportunities, and the local procurement of goods and services related to hatchery operations would remain the same. Thus, the contribution of over $13.4 million in recreational expenditures, $9.4 million in personal income, and 358 jobs to the regional economy would lead to a medium-beneficial effect of these hatchery programs, as seen under current conditions.

4.7.2 Alternative 2

Under Alternative 2, the operation of hatchery programs would be the same as under Alternative 1, with no change in recreational expenditures, employment opportunities, or the local procurement of goods and services related to hatchery operations. Therefore, this alternative would also have the same medium-beneficial effect as Alternative 1.

[12] Although JCAPE would increase broodstock collection numbers and juvenile releases from 100,000 to 150,000 under a future operational scenario, this increase is not likely to amount to a meaningful change in the operation of the program to affect socioeconomics.

4.7.3 Alternative 3

Under Alternative 3, all hatchery production would be reduced by 50 percent compared to Alternative 1. Some hatchery facilities would be operated at a reduced level. Decreasing hatchery production by 50 percent under Alternative 3 could result in a reduction of harvest and associated recreational expenditures within the study area, though recreational fisheries targeting fish from other productions would continue. However, many facilities would continue to operate at essentially the same levels because of other programs. Although possible, it is unclear whether staff reduction and impacts on personal income would occur. Therefore, this alternative would have no more than a negligible-adverse effect compared to Alternative 1.

4.7.4 Alternative 4

Under Alternative 4, operations of the hatchery programs described in the Proposed Action would no longer themselves contribute to recreational expenditures, jobs, or operational expenses for the regional economy, though recreational fisheries targeting fish from other productions would continue. As described in Section 4.1, Water Quantity, facilities that may cease operations and reduce the number of hatchery-related jobs available because they are dedicated specifically to the programs considered in the Proposed Action include the Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries However, other facilities such as Clearwater, Dworshak National and Kooskia National fish hatcheries would continue to operate at essentially current levels because of other programs. This alternative would have a low-adverse effect compared to Alternative 1 because of reduced expenditures, jobs, and operational expenses.

4.8 Cultural Resources

The overall effect on cultural resources would be low-beneficial under Alternative 1 and Alternative 2 (Table 4-16). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and medium-adverse under Alternative 4.

Table 4-16. Summary of effects on cultural resources.

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Cultural Resources	Medium-beneficial	Same as Alternative 1	Low-adverse	Medium--adverse

4.8.1 Alternative 1

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, and the health and survival of fish would be the same relative to current conditions. Because the conservation programs currently in place would be expected to increase Chinook salmon, coho salmon, and steelhead abundance and productivity, the tribes would continue to receive the surplus of adult fish collected. In addition, the tribes would continue to harvest hatchery-origin fish, as well as benefit from increase in natural production through the non-selective fisheries. The tribes would benefit through the long-term potential for salmon and steelhead to continue existing and for their populations to increase in size in the Clearwater River Subbasin, the Hells Reach of the Snake River, and the Salmon River Subbasin, resulting in a medium-beneficial effect.

4.8.2 Alternative 2

Under Alternative 2, the operation of both hatchery programs would be the same as under Alternative 1, with no change in the survival and abundance of salmon and steelhead. Therefore, this alternative would have the same low-beneficial effect as Alternative 1.

4.8.3 Alternative 3

Under Alternative 3, the effects of the hatchery programs on cultural resources would be similar to those as under Alternative 1, but harvests would be reduced in the study area (see Section 4.7, Socioeconomics). Reduced returns of hatchery fish could reduce harvest opportunities and surplus fish received by tribes, though some opportunities would remain through the reduced hatchery production relative to Alternative 1. Therefore, this alternative would have a low-adverse effect compared to Alternative 1.

4.8.4 Alternative 4

Under Alternative 4, the hatchery programs would no longer contribute to tribal fisheries nor the tribes receiving surplus fish or to the abundance and productivity of salmon and steelhead in the Clearwater River Subbasin, the Hells Reach of the Snake River, and the Salmon River Subbasin, although natural-origin salmon and steelhead would continue to return to these areas. While the tribes may be able to continue their non-selective fisheries, a large portion of their harvest would be reduced because the hatchery productions would no longer contribute to returning fishable adults. As described in Section 4.1, Water Quantity, facilities that may cease operations because they are dedicated specifically to the programs considered in the Proposed Action include the Hells Canyon Dam Trap, Rapid River Fish Hatchery, Oxbow Fish Hatchery, South Fork Salmon Satellite, Johnson Creek Weir, McCall Fish Hatchery, East Fork Salmon Satellite, Niagara Springs Fish Hatchery, and both Lower Pahsimeroi and Upper Pahsimeroi fish hatcheries All hatchery production in the Little Salmon River and South Fork Salmon River watersheds would cease, so the hatchery programs would no longer contribute to tribes receiving surplus fish or to tribal fisheries at any usual and accustomed places. However, other facilities such as Clearwater, Dworshak National and Kooskia National fish hatcheries would likely continue to operate at essentially current levels because of other hatchery programs being implemented. Because the tribes would lose a large portion of harvest and surplus fish, this alternative would have a medium-adverse effect compared to Alternative 1.

4.9 Environmental Justice

The overall effect on environmental justice would be medium-beneficial under Alternative 1 and Alternative 2 (Table 4-17). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and low-adverse under Alternative 4.

Table 4-17. Summary of effects on environmental justice.

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Environmental Justice	Medium-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse

4.9.1 Alternative 1

Under Alternative 1, the hatchery programs would continue to distribute fish collected for adult management to public entities (e.g., local food banks) and to local tribes for ceremonial and subsistence purposes. The environmental justice communities of concern (Section 3.9, Environmental Justice) would benefit from the distribution of fish to local food banks to the extent that these communities rely on these food banks. The programs would also continue to provide economic opportunities (Section 4.7, Socioeconomics) and fish of cultural importance to the tribes (Section 4.8, Cultural Resources). Therefore, this alternative would have a medium-beneficial effect.

4.9.2 Alternative 2

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in socioeconomics, tribal cultural resources, or fish distribution affecting the environmental justice communities of concern. Therefore, this alternative would have the same medium-beneficial effect as under Alternative 1.

4.9.3 Alternative 3

Decreasing hatchery production under Alternative 3 could result in a reduction of charitable harvest donations. However, tribes, food banks, and nontribal organizations would continue to benefit from receiving surplus fish for consumption and ceremonial purposes. It is likely that the 50 percent reduction in production of these programs under Alternative 3 would result in a negligible-adverse effect compared to Alternative 1.

4.9.4 Alternative 4

As previously described, termination of the hatchery programs under Alternative 4 would have a socioeconomic effect of negligible-adverse (Section 4.7, Socioeconomics) and a cultural resources effect of medium-adverse (Section 4.8, Cultural Resources). Fishing for subsistence purposes may be affected in the Little Salmon River and South Fork Salmon River, as all hatchery production would cease to exist with the termination of the programs. However, the Clearwater, Dworshak National and Kooskia National fish hatchery facilities are used for programs beyond those analyzed in this EA. These hatchery facilities would continue to operate and provide charitable harvest donations to tribes, food bank, and nontribal organizations for consumption, ceremonial, or subsistence purposes. Therefore, this alternative would have a low-adverse effect compared to Alternative 1.

4.10 Human Health and Safety

The overall effect on human health and safety would be low-adverse under Alternative 1, Alternative 2, and Alternative 3 (Table 4-18). Relative to Alternative 1, effects would be low-beneficial under Alternative 4.

Table 4-18. Summary of effects on human health and safety.

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Human Health and Safety	Low-adverse	Same as Alternative 1	Same as Alternative 1	Low-beneficial

4.10.1 Alternative 1

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so the level of risks to hatchery facility and weir operators remain the same. However, the continued use and discharge of chemicals from the hatchery programs may lead to increased accumulation of these chemicals in the environment. Although consumption of hatchery fish may increase health risks for consumers, hatchery fish are likely to continue to serve as a source of food for humans. Risks associated with handling infected fish would continue to be a potential human health risk among hatchery personnel. However, continued best safety practices and use of personal protective equipment will minimize this potential risk. Therefore, this alternative is likely to have a low-adverse effect.

4.10.2 Alternative 2

Under Alternative 2, the operation of the hatchery programs would be the same as under Alternative 1, resulting in no change in effects on human health and safety. Therefore, this alternative would have the same low-adverse effect as Alternative 1.

4.10.3 Alternative 3

Under Alternative 3, the effects of the hatchery programs would be the same as under Alternative 1. It is unlikely that the 50 percent reduction in production of these programs would result in much, if any, change to human health and safety. Decreasing hatchery production under Alternative 3 could result in a reduction of harvest in the study area, which could result in reduced consumption. However, hatchery facilities would continue to operate for other programs, having the same level of hatchery operation effects on hatchery facility and weir operators and human health. Risks associated with handling infected fish would continue to be a potential human health risk among hatchery personnel. However, continued best safety practices and use of personal protective equipment will minimize this potential risk. Therefore, this alternative would likely have the same effect as Alternative 1.

4.10.4 Alternative 4

Under Alternative 4, the termination of hatchery programs would reduce any potentially harmful effects associated with hatchery operations on hatchery facility and weir operators and human health and safety after the last adults return. The number of fish available for consumption could decrease, and the effects of hatchery operations on health risks (e.g., effects of chemicals in effluent) would also be reduced because only the facilities used for other programs would continue to operate. Risks associated with handling infected fish would continue to be a potential human health risk among remaining hatchery personnel. However, continued best safety practices and use of personal protective equipment will minimize this potential risk. Therefore, this alternative would have a low-beneficial effect relative to Alternative 1.

5 Cumulative Impacts

Cumulative impacts were assessed by combining the effects of each alternative with the effects of other past, present, and reasonably foreseeable future actions that are impacting or will impact the same resources potentially affected by each alternative. Actions are included only if they are tangible and specific, and if effects overlap temporally and geographically with the Proposed Action.

The temporal boundary for this cumulative impacts analysis extends from the construction of the Hells Canyon Complex of dams (opened from 1959 through1967) and the four lower Snake River dams (opened from 1962 through -1975) until the ESA section 4(d) determinations are no longer in effect. The ESA section 4(d) determinations have no expiration date, but would be subject to agency verification if the hatchery programs are changed such that HGMPs need to be revised. The programs would be periodically reviewed by NMFS and the operators to assess success in meeting purpose and needs as described in Section 1.1, Purpose and Need.

The geographic area for the cumulative impacts analysis related to physical resources, such as water quantity and water quality, is limited to stream reaches directly affected by water withdrawals and other disturbances, such as effluent discharge. The geographic area for the cumulative impacts analysis related to fish and wildlife includes locations where hatchery fish are captured, reared, and released, areas that are accessible from release sites such as migration corridors and rearing habitats downstream to Ice Harbor Dam, and areas where they may be monitored or stray downstream to Ice Harbor Dam (i.e., Ice Harbor Dam is the downstream limit because effects of the Proposed Action would not detectable or measurable downstream of Ice Harbor Dam). The cumulative impacts for socioeconomics, cultural resources, environmental justice, and human health and safety were assessed over a large geographic area to account for the contribution of project effects on communities and regions.

Finally, the cumulative impacts associated with the proposed action were largely addressed by previous environmental impact statements, including NMFS (2014a, 2017e), as well as the recent environmental assessment for the Idaho steelhead fisheries (NMFS 2019b). These reviews looked primarily at the impacts to the human environment from a broader set of fishery or hatchery operations, as described in section 5.2 below. Consequently, this assessment focuses on looking at any changes to those impacts or new information within the project area, particularly (in many cases) the extent to which it modifies the information presented in the Mitchell Act FEIS.

5.1 Past, Present, and Reasonably Foreseeable Future Actions

The effects of past and present actions on resources potentially affected by the Proposed Action are recognized as current conditions described in Chapter 3, Affected Environment. Historical development of the Columbia and Snake River basins for electrical power, flood control, navigation, and agricultural needs has influenced the existing condition of the resources in the study area. This development, along with other factors such as historic harvest, has led to the implementation of management and recovery actions, including numerous hatchery programs.

The expected impacts of the alternatives on all of the resources are described in Chapter 4. Reasonably foreseeable future actions with the potential to have cumulative impacts with the alternatives described in this EA include operation of hatchery programs as described in the Mitchell Act FEIS (NMFS 2014a). Climate change may also contribute to effects of the alternatives and is considered a reasonably foreseeable future condition[13] for purposes of this cumulative impacts analysis. The project area is in the Pacific Northwest where the effects of climate change are affecting hydrologic patterns and water temperatures. Climate change impacts to the regional hydrologic cycle and ESA-listed salmon and steelhead populations, as well as their habitats, have been evaluated extensively across the Columbia River Basin (Mote 2003; ISAB 2007; Karl et al. 2009, Dittmer 2013; USBR 2016). Evidence of climate change includes increased average annual air temperatures and water temperatures over the past century. Recently researchers examined data from 1990 through 2009 and found that temperatures in the Snake River Basin are increasing, while average streamflows are slightly decreasing (NMFS 2017a, 2017b, 2017c, 2017d).

According to the Independent Scientific Advisory Board (ISAB), average annual temperatures in the Northwest have increased by approximately 1.8°F since 1900, or about 50 percent more than the global average evaluated over the same period of time (ISAB 2007). Earlier climate investigations have estimated that the mean annual temperature in the Columbia River Basin has increased by approximately 3.6°F since the late 1800s (USBR 2016). The latest climate models project a warming of 0.2°F to 1.1°F per decade over the next century (NMFS 2017a, 2017b, 2017c, 2017d).

In general, warming air temperature in winter and spring will lead to more precipitation falling as rain, rather than snow. At elevations within the Snake River Basin along the transient snow zone, even a small amount of warming in winter may cause substantial shifts in the accumulated rainfall versus snowfall during the cool months (October through March); alternatively, locations at higher elevations typically experience winter temperatures far below freezing, so a slight increase in temperature may not initiate a shift from snow to rain (ISAB 2007). In watersheds that historically develop a seasonal snow pack, warmer temperatures will likely lead to a reduced snowpack depth and cause a temporal shift in snowmelt runoff.

Reduction in snowpack depth is attributed to both warming surface air temperatures and reduction of precipitation falling as snow (ISAB 2007). Annual snowpack measurements taken throughout the region on April 1 are considered a prime indicator of natural water storage available as runoff during the warmer months of the year. These measurements indicate a substantial snowpack reduction across the Northwest (Karl et al. 2009). For example, the average snowpack decline in the Cascade Mountains was about 25 percent over the past 40 to 70 years, and is projected to decline by as much as 40 percent by the 2040s (Karl et al. 2009). In general, declines in the Northwest snowpack are projected to continue over this century, varying with latitude, elevation, and proximity to the coastal regions.

Flow timing has shifted over the past 50 years, with the peak of spring runoff shifting from a few days earlier in some places to as much as 25 to 30 days earlier in others (Karl et al. 2009). Throughout the region, shifts in the timing and magnitude of snowmelt runoff increase the winter flood risk and summer drought risk in more sensitive watersheds. Increased winter temperatures and reduced snowpack would likely increase winter runoff, causing peak flows along rivers and large streams to increase and causing diminished runoff earlier in the season (ISAB 2007). Reductions in warm season (April through September) runoff in the region are expected to reach approximately 10 percent by mid-century (Karl et al. 2009). Impacts caused by shifts in flow timing range from lower streamflows to drought in the warmer months (June through September; ISAB 2007).

[13] Climate change is not an "action" but a condition which affects both the proposed action and the past, present, and future actions discussed here.

5.2 Cumulative Impacts Analysis

This subsection will discuss the cumulative impacts for all of the resources analyzed in Chapter 4. Of note, analysis from Mitchell Act FEIS is used, where relevant, because the effects of the 15 programs included in this EA were included in the Mitchell Act FEIS (NMFS 2014a) as part of a broader analysis of 49 hatchery programs in the Snake River Basin and 117 hatchery programs in the Columbia River Basin. That is, the cumulative impacts of these programs with other hatchery programs in the Columbia River Basin was analyzed in the Mitchell Act FEIS. As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs (Table 2-1), but hatchery salmon and steelhead production for programs under the Proposed Action in this EA (Alternative 2) fall generally in the range between various Mitchell Act FEIS alternatives.

5.2.1 Water Quantity

Successful operation of hatcheries depends on reliable supplies of surface, spring, or groundwater that is subsequently discharged to receiving waterbodies (Section 3.1, Water Quantity). Changes in production levels have the potential to affect water quantity by changing the amount of water withdrawn from a surface water body or groundwater for hatchery operations.

As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1). NMFS (2014a, Section 4.6.4, Water Quantity) determined that use of surface, spring, and groundwater would remain similar to current conditions for Mitchell Act FEIS Alternative 1, but that reduced production could result in decreased water use for Mitchell Act FEIS Alternative 2 through Alternative 6. Production (and presumably water use) would be lowest under Mitchell Act FEIS Alternative 2, and the smallest decrease in water use would be under Mitchell Act FEIS Alternative 6. For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, water use in those programs are not likely to be different than that analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small.

Continued use of surface and groundwater through other development, such as irrigation, in the area has been contributing to reduced water availability. Of note, the aquifer water levels of ESPA could drop 15 feet over the next 20 years from decreased recharge incidental to irrigation conveyance and application, increased use of groundwater for irrigation and domestic use, and conversion of land from irrigated agriculture to urban and suburban uses (SPF Water Engineering, 2010).

Climate change may affect water quantity by changing seasonal river flows. Some areas may experience reduced flows, increased flows, or a change in flow timing. Shifts in the timing and magnitude of snowmelt runoff may increase winter flows and increase the risk of summer drought. Increased winter temperatures and reduced snowpack could cause peak flows to increase and result in diminished runoff earlier in the season than under current conditions (ISAB 2007).

Under Alternatives 1 and 2 of this EA, the 15 hatchery programs are expected to have measurable, but low-adverse effects on water quantity. The effects on water quantity are due primarily to a small number of facilities diverting a relatively large proportion of streamflow over relatively short diversion reaches for a limited time during low-flow periods (Section 4.1, Water Quantity). Hatchery needs are likely to remain somewhat stable; therefore any reductions in water quantity because of climate change would have greater effects than considered in Section 4.1, Water Quantity. Effects under Alternative 3 would be similar to those under Alternative 1 and Alternative 2 because even with reduced production, all facilities would continue operating. Under Alternative 4, a number of the hatcheries would cease operations entirely; therefore, cumulative impacts would be similar to the effects considered in Section 4.1, Water Quantity.

5.2.2 Water Quality

Successful operation of hatcheries requires water of consistently high quality. As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1). NMFS (2014a, Section 4.6.3, Water Quality) determined that reductions in hatchery production for Mitchell Act FEIS Alternative 2 through Alternative 6 could improve water quality compared to current conditions (Mitchell Act FEIS Alternative 1) through reductions in temperature, ammonia, nutrients (e.g., nitrogen), BOD, pH, sediment levels, antibiotics, fungicides, disinfectants, steroid hormones, and pathogens. Improvements to water quality would be greatest under Mitchell Act FEIS Alternative 2, and minimal under Mitchell Act FEIS Alternative 6. For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, water quality effects from those programs are not likely to be different than the closest alternative analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small. Therefore, the programs analyzed in this EA are likely to continue improving water quality, along with the other hatchery programs in the Columbia River Basin.

Continued discharge of effluent through other development, such as agriculture, is likely to continue affecting water quality. For those watersheds with established TMDLs, the water quality is expected to improve because the effluent should meet federal standards designed to improve water quality.

Given the close correspondence between surface air temperature and surface water temperature for many streams, climate change may affect water quality by increasing water temperatures and changing seasonal river flows. As a result, water quality may be degraded further relative to current conditions.

Under Alternatives 1 and 2 of this EA, the 15 hatchery programs are expected to have measurable, but low-adverse effects on water quality. The effects on water quality are due primarily to minor changes in water temperature, BOD, pH, and various nutrients and pollutants in receiving waters (Section 4.1, Water Quantity). Hatchery needs are likely to remain somewhat stable; therefore any reductions in water quality because of climate change would have greater effects than considered in Section 4.2, Water Quality. Although decreased fish production in the 15 hatchery programs would slightly decrease the pollutant load discharged to receiving waters, all facilities would remain in operation. Pollutants would still be discharged to receiving waters; therefore, effects under Alternative 3 would be similar to those under Alternative 1 and Alternative 2. Under Alternative 4, a number of the hatcheries would cease operations entirely; therefore, cumulative impacts would be similar to the effects considered in Section 4.2, Water Quality.

5.2.3 Salmon and Steelhead

Cumulative impacts of hatchery production in the Snake River Basin may benefit salmon and steelhead but can also pose risks (Section 4.3, Salmon and Steelhead). As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1).

In the Mitchell Act FEIS, NMFS (2014a) concluded that hatchery programs would:

- Affect natural-origin abundance where hatchery broodstock is collected from the natural-origin population
- Pose genetic risks to salmon and steelhead, affecting productivity and diversity at numerous hatcheries across the basin
- Employ weirs, which can impede spatial structure
- Pose risks of effects related to operation of hatchery facilities, such as blocked passage, reduced habitat, entrainment, and diminished water quality

- Pose competition and predation risks to natural-origin salmon and steelhead
- Pose a risk of masking hatchery effects without adequate marking and sampling
- Pose a risk of disease transfer to natural-origin populations

NMFS (2014a, Section 4.2.3, Effects on Salmon and Steelhead) determined that natural-origin abundance of Snake River salmon and steelhead would generally increase under all programs covered by the Mitchell Act FEIS alternatives relative to current conditions (Alternative 1), with the largest increase occurring under Alternative 5 and the smallest under Alternative 2 and Alternative 3. Genetic diversity would also likely increase under all alternatives relative to current conditions, with changes being similar under all alternatives compared to current conditions. New weirs would be installed only under Alternative 3 through Alternative 5. Hatchery facility risks would be decreased equally from current conditions under Alternative 2 through Alternative 6. Competition with and predation on natural-origin juvenile salmonids would be reduced with decreases in hatchery production; therefore, Alternative 2 would result in the largest decreases in competition and predation, and Alternative 6 would result in the smallest decreases. Risks of masking and disease transfer may also be reduced through reduced hatchery production, therefore relative effects would be similar to those for competition and predation. For those programs in this EA that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, the effects on salmon and steelhead from those programs are not likely to be different than the closest alternative analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small.

Climate change, particularly changes in streamflow and water temperatures, would likely impact natural-origin salmon and steelhead life stages in various ways. The effects of climate change on salmon and steelhead would vary among species and among life history stages (ISAB 2007). Effects of climate change may affect every species and life history in every type of salmon and steelhead in the cumulative impacts study area (Glick et al. 2007; Mantua et al. 2009) (Table 5-1).

It is likely that, as climate change affects ocean conditions, abundances of salmon and steelhead would change accordingly, resulting in changes in abundance of adults returning to freshwater to spawn. Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, whereas cooler ocean periods have coincided with relatively high abundances (Karl et al. 2009).

If climate change reduces the water volumes and increases the water temperatures in the analysis area, it will likely reduce the suitable habitat for spring and summer Chinook salmon, coho salmon, and steelhead rearing, potentially decreasing their abundance. Effects would likely be less on fish that migrate as subyearlings, and therefore do not rear during summer low flows. Lower summer flows and increased water temperatures may lead to an increase in the abundance of nonnative warm water species that can compete and prey on listed salmon and steelhead. Warmer water temperatures may also increase the incidence of disease outbreaks and pathogen virulence in both the natural population and hatchery-produced juveniles. On the other hand, warmer water temperature may also shift pathogen composition through increase in pathogens that thrive in warmer waters and decrease in pathogens that are susceptible to warmer waters.

Although climate change may well have impacts on the abundance and/or distribution of salmonids and steelhead populations that are considered under all of the alternatives in this EA, the proposed hatchery management described in the HGMPs and the associated monitoring provides the ability to evaluate hatchery program impacts as abundances change, making appropriate adjustments feasible and timely.

Table 5-1. Examples of potential impacts of climate change by salmon and steelhead life stage under all alternatives.

Life Stage	Effects
Egg	Increased water temperatures and decreased flows during spawning migrations would increase pre-spawn mortality and reduce egg deposition for some species. Increased maintenance metabolism would lead to smaller fry. Faster embryonic development would lead to earlier hatching. Increased mortality for some species because of more frequent winter flood flows. Lower flows would decrease access to or availability of spawning areas.
Spring and Summer Rearing	Faster yolk utilization may lead to early emergence. Smaller fry are expected to have lower survival rates. Growth rates would be slower if food is limited or temperature increases exceed optimal levels. Growth could increase where food is available, and temperatures are below stressful levels. Lower flows would decrease habitat capacity. Sea level rise would eliminate or diminish the tidal wetland capacity.
Overwinter Rearing	Smaller size at start of winter is expected to result in lower winter survival. Mortality would increase because of more frequent floods. Warmer winter temperatures would lead to higher metabolic demands, which may decrease winter survival if food is limited, or increase winter survival if growth and size are enhanced. Warmer winters may increase predator activity/hunger, which can decrease winter survival.
Out-Migration	Earlier snowmelt and warmer temperatures may cause earlier emigration to the estuary and ocean either during favorable upwelling conditions, or prior to the period of favorable ocean upwelling. Increased predation risk in the mainstem because of higher consumption rates by predators at the elevated spring water temperatures.
Adult	Increased water temperatures may delay fish migration. Increased water temperature may also lead to more frequent disease outbreaks as fish become stressed and crowded.

Although climate change will likely have impacts on the abundance and/or distribution of salmon and steelhead, proposed hatchery management actions and associated monitoring provide the ability to make appropriate adjustments. However, the cumulative impacts on salmon and steelhead under Alternative 1 and Alternative 2 of this EA may extend beyond that considered in Section 4.3, Salmon and Steelhead, because of the potential changes in natural production and distribution, and changes in hatchery production and operations that may be required. Moreover, climate change may exacerbate some effects from hatchery programs under Alternatives 1 and 2, as described in the eight bullet points above from the Mitchell Act FEIS. For example, as previously noted, warmer water temperatures caused by climate change may increase the incidence of disease outbreaks and pathogen virulence in both the natural population and hatchery-produced juveniles. Thus we would expect these effects from Alternatives 1 and 2 to compound with those described in the Mitchell Act FEIS.

Under Alternative 3 and Alternative 4 of this EA, the number of smolts released would decrease; effects on salmon and steelhead would range from low-beneficial to low-adverse (Section 4.3, Salmon and Steelhead). However, similar to Alternative 1 and Alternative 2 of this EA, the cumulative impacts on salmon and steelhead when including climate change may extend beyond that considered in Section 4.3, Salmon and Steelhead, though to a lesser degree because of the reduction or termination of these programs analyzed in this EA.

5.2.4 Fisheries

As described above, climate change will likely have impacts on the abundance and/or distribution of salmon and steelhead. These impacts would likely result in changes to management actions such as regulation of fisheries to make appropriate adjustments. The cumulative impacts on fisheries under all alternatives of this EA may extend beyond that considered in Section 4.4, Fisheries, because of the potential changes in natural production and distribution, and changes in hatchery production and operations.

5.2.5 Other Fish Species

As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1). NMFS (2014a, Section 4.2.4, Effects on Other Fish Species that Have a Relationship to Salmon and Steelhead) determined that reductions in hatchery production for Mitchell Act FEIS Alternative 2 through Alternative 6 would likely result in a reduction in competition and predation for bull trout, Pacific lamprey, and other fish species, but also a reduction in prey resources compared to current conditions (Alternative 1). The greatest effect would be under Alternative 2, with Alternative 6 having the least change compared to current conditions. For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, effects on other fish species from those programs are not likely to be different than the closest alternative analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small.

Other fish species would likely respond to climate change in similar ways as salmon and steelhead. Habitat may be affected by future changes in water temperatures, precipitation, and extreme events, which can occur from climate changes. Fish that are more adaptable to warmer aquatic conditions could ultimately replace cold-water fish as the dominant species as previously noted, the mitigated benefits from habitat restoration actions are difficult to predict.

Under Alternative 1 and Alternative 2 of this EA, hatchery juveniles and adults would continue to either be prey for other fish species, prey upon other fish species, and/or compete for resources with the other fish species. However, because climate change may favor introduced warmer water fish over native cold-water fish, the cumulative impacts on other fish species may be greater than those described in Section 4.5, Other Fish Species.

Under Alternative 3 and Alternative 4 of this EA, the number of smolts released would decrease; effects on other fish species would range from negligible-beneficial to negligible-adverse (Section 4.5, Other Fish Species). However, because climate change may favor introduced warmer water fish over native cold-water fish, the cumulative impacts on other fish species may be greater than those described in Section 4.5, Other Fish Species.

5.2.6 Wildlife

As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1). NMFS (2014a, Section 4.5.4, Wildlife Species Effects) determined that reductions in hatchery production for Mitchell Act FEIS Alternative 2 and Alternative 3 could result in potential reductions in wildlife abundance, distribution and fitness compared to current conditions (Alternative 1). Wildlife populations would be expected to increase under Alternative 1 and Alternative 4 through Alternative 6. For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, effects on wildlife from those programs are not likely to be different than the closest analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small.

The effects of climate change on wildlife could include decreased distribution because of warmer summer temperatures and loss of insulating snow cover for mammals in winter, or reductions in food availability through effects on prey species such as salmon and steelhead. Reduction in salmon and steelhead carcasses would decrease nutrients available to wildlife, and reduction in the number of live fish could affect predators such as bald eagles and golden eagles.

Under Alternative 1 and Alternative 2 of this EA, hatchery juveniles and adults would continue to either be prey for wildlife or provide nutrients. Although climate change may have negative effects on salmon and steelhead, hatchery production would continue; therefore, the cumulative impacts on wildlife would likely be similar to those described in Section 4.6, Wildlife.

Under Alternative 3 and Alternative 4 of this EA, the cumulative impacts on wildlife may differ from those under Alternatives 1 and 2 because the number of smolts released would decrease; however, effects on wildlife would range from negligible-beneficial to low-adverse (Section 4.6, Wildlife). The cumulative impacts on wildlife would likely be similar to those described in Section 4.6, Wildlife.

5.2.7 Socioeconomics

Socioeconomic conditions represent effects from many years of development and attempts to mitigate for that development through hatchery programs and other restoration actions. As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1). NMFS (2014a, Section 4.3.4, Harvest and Economic Values) determined that economic benefits of hatchery programs, including income, number of jobs, and recreational expenditures, would be reduced under Mitchell Act FEIS Alternative 2 through Alternative 5 compared to current conditions (Alternative 1). Reductions would be greatest under Alternative 2. Only under Alternative 6 would economic benefits be increased. Climate change could possibly have indirect effects through potential changes in hatchery operations in response to changes in water quantity and quality. For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, socioeconomic effects from those programs are not likely to be different than the closest alternative analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small.

Although the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1), under Alternative 1 and Alternative 2 of this EA, the total number of juvenile salmon and steelhead released would fall between releases for Mitchell Act FEIS Alternative 5 and Alternative 6 for the 15 hatchery programs and would have similar contributions to or reductions in total harvest, total economic benefit to income, jobs, and recreational expenditures. The cumulative impacts on socioeconomics would likely be similar to those described in Section 4.7, Socioeconomics.

Under Alternative 3 and Alternative 4 of this EA, the cumulative impacts on socioeconomics may differ than those under Alternatives 1 and 2 because the number of smolts released and returning adults would decrease; however, any decreases in total harvest, total economic benefit to income, jobs, and recreational expenditures would be negligible to low (Section 4.7, Socioeconomics). The cumulative impacts under Alternative 3 and Alternative 4 would not be measurable beyond that analyzed in the Mitchell Act FEIS. The cumulative impacts on socioeconomics would likely be similar to those described in Section 4.7, Socioeconomics.

5.2.8 Cultural Resources

Tribal harvest conditions also represent effects from many years of development and attempts to mitigate for that development through hatchery programs and other restoration actions. However, future climate change could possibly reduce the number of salmon and steelhead available for harvest.

As noted above, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1); however, under Alternative 1 and Alternative 2 of this EA, the number of juvenile salmon released, and therefore the number of adult salmon available for tribal harvest would fall between those for Mitchell Act FEIS Alternative 5 and Alternative 6. Cumulative impacts are therefore unlikely to change substantially from those considered in Section 4.8, Cultural Resources.

Under Alternative 3 and Alternative 4 of this EA, the number of juvenile salmon released, and therefore the number of adult salmon available for tribal harvest or as surplus (Section 4.7, Socioeconomics) could be less than under Alternative 1 and Alternative 2. However, the cumulative impacts under Alternative 3 and Alternative 4 would not be measurable beyond that analyzed in the Mitchel Act FEIS. The cumulative impacts on cultural resources would likely be similar to those described in Section 4.8, Cultural Resources.

For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, cultural resources effects from those programs are not likely to be different than the closest alternative analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small.

5.2.9 Environmental Justice

Distribution of surplus fish from hatchery programs is dependent on availability of fish, and therefore at least indirectly affected by levels of hatchery production and harvest policies. As previously noted, the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1). NMFS (2014a, Section 4.4.4, Analysis of Environmental Justice Effects) determined that tribal harvests would be reduced under Mitchell Act FEIS Alternative 2 through Alternative 5 compared to current conditions (Alternative 1). Reductions would be greatest under Alternative 2. Only under Alternative 6 would harvest increase. For those programs that have production numbers slightly higher than what was analyzed in the Mitchell Act FEIS alternatives, environmental justice effects from those programs are not likely to be different than the closest alternative analyzed in the Mitchell Act FEIS because the differences in smolt production levels are small. Future climate change could possibly reduce the number of hatchery-origin salmon and steelhead available for harvest and distribution.

Although the relationship to specific Mitchell Act FEIS alternatives varies among the 15 programs assessed in this EA (Table 2-1), under Alternative 1 and Alternative 2 of this EA, the number of adult salmon available for distribution would fall between those for Mitchell Act FEIS Alternative 5 and Alternative 6. Reductions in the number of fish available because of climate change may result in cumulative impacts being greater than those considered in Section 4.8, Environmental Justice.

Under Alternative 3 and Alternative 4 of this EA, the number of adult salmon available for harvest or distribution may be less than under Alternative 1 or Alternative 2 (Section 4.9, Environmental Justice). Further reductions in the number of fish available because of climate change may result in cumulative impacts being greater than those considered in Section 4.9, Environmental Justice.

5.2.10 Human Health and Safety

Future hatchery operations and climate change could affect the use of chemicals in hatchery facilities, discharge of chemicals into the environment, and consumption of hatchery-produced fish. Changes in chemical use at hatcheries could be made in response to changing environmental conditions or new management protocols based on new techniques or chemical products to support fish health. Hatchery operation may also change to reduce injured through various incidents, such as slipping, getting cuts, and getting electrocuted. Such changes are difficult to predict; however, hatcheries would continue to implement safe handling and storage procedures to support human health and safety.

The 15 hatchery programs under Alternative 1 and Alternative 2 of this EA would not contribute to a measurable cumulative impact beyond that analyzed in the Mitchell Act FEIS on human health and safety within the Snake River Basin because the hatchery operations minimize risks through compliance with safety programs, rules, and regulations, as well as through the use of protective equipment (Section 4.10, Human Health and Safety). Also, the risk to human health through consumption is directly associated with frequency of consuming fish, regardless of whether the fish are natural- or hatchery-origin, and the risk to human health through consumption is not measurable beyond that considered in the Mitchell Act FEIS. Therefore no cumulative impacts would be expected beyond those already discussed in Section 4.10, Human Health and Safety.

Similar to Alternative 1 and Alternative 2, operation of the 15 hatchery programs under Alternative 3, and termination of the programs under Alternative 4 of this EA would not contribute to a measurable cumulative impact beyond that analyzed in the Mitchell Act FEIS on human health and safety within the Snake River Basin. The risk to human health through consumption is not measurable beyond that considered in the Mitchell Act FEIS. Therefore no cumulative impacts would be expected beyond those already discussed in Section 4.10, Human Health and Safety.

6 Agencies Consulted

Katey Grange, Environmental Protection Specialist, Bonneville Power Administration
Sarah Biegel, NEPA Compliance Officer, Bonneville Power Administration
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7 References Cited

Ayllon, F., J. L. Martinez, and E. Garcia-Vazquez. 2006. Loss of regional population structure in Atlantic salmon, *Salmo salar*, following stocking. ICES Journal of Marine Science. Volume 63, pages 1269 to 1273.

Beauchamp, D. A. 1990. Seasonal and diet food habit of rainbow trout stocked as juveniles im Lake Washington. Transactions of the American Fisheries Society. Volume 119, pages 475 to 485.

Bonneville Power Administration (BPA). 2003. Fish and Wildlife Implementation Plan Final Environmental Impact Statement DOE/EIS-0312.

BPA, Shoshone-Bannock Tribes, U.S. Forest Service, and National Marine Fisheries Service. 2017. Crystal Springs Hatchery Program Draft Environmental Impact Statement DOE/EIS-0500.

Bradford, M. J. 1995. Comparative review of Pacific salmon survival rates. Canadian Journal of Fisheries and Aquatic Sciences. Volume 52, pages 1327 to 1338.

Busack, C. 2015. Extending the Ford model to three or more populations. August 31, 2015. Sustainable Fisheries Division, West Coast Region, National Marine Fisheries Service. 5p.

Busack, C. and K. P. Currens. 1995. Genetic risks and hazards in hatchery operations: Fundamental concepts and issues. AFS Symposium 15:71-80.

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Lagomarsino. 1996. Status review of West Coast steelhead from Washington, Idaho, Oregon, and California. August 1996. U.S. Dept. Commerce. NOAA Technical. Memo., NMFS-NWFSC-27. NMFS, Seattle, Washington. 275p.

Byrne, Gary, Idaho Department of Fish and Game, email sent to David Ward, HDR on January 22, 2018, regarding Socioeconomic Information Request for Snake River Basin Hatcheries.

Cannamela, D. A. 1992. Potential impacts of releases of hatchery steelhead trout "smolts" on wild and natural juvenile Chinook and sockeye salmon, Appendix A. A White Paper. March 1992. Idaho Department of Fish and Game, Boise, Idaho. 26p.

Cederholm, C. J., D. H. Johnson, R. E. Bilby, L. G. Dominguez, A. M. Garrett, W. H. Graeber, E. L. Greda, M. D. Kunze, B. G. Marcot, J. F. Palmisano, R. W. Plotnikoff, W. G. Pearch, C. A. Simenstad, and P. C. Trotter. 2000. Pacific salmon and wildlife - Ecological contexts, relationships, and implications for management. Special edition technical report. Prepared for D.H. Johnson and T.A. O'Neil (managing directors), Wildlife-habitat relationships, and implications for management. WDFW, Olympia, Washington.

Columbia Basin Fish and Wildlife Authority (CBFWA). 1996. Draft programmatic environmental Impact statement. Impacts of artificial salmon and steelhead production strategies in the Columbia River Basin. December 10, 1996. Prepared by the Columbia Basin Fish and Wildlife Authority, Portland, Oregon. 475p.

Columbia River Inter-Tribal Fish Commission (CRITFC). 1994. A fish consumption survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin. Technical Report 94-3, October 1994. Portland, OR.

CRITFC. 2018a. https://www.critfc.org/member_tribes_overview/nez-perce-tribe/. Accessed January 25, 2018.

CRITFC. 2018b. https://www.critfc.org/member_tribes_overview/the-confederated-tribes-and-bands-of-the-yakama-nation/. Accessed January 25, 2018.

CRITFC. 2018c. https://www.critfc.org/member_tribes_overview/the-confederated-tribes-of-the-umatilla-indian-reservation/. Accessed January 25, 2018.

Confederated Tribes of the Umatilla Indian Reservation (CTUIR). 2018. http://ctuir.org/history-culture/history-ctuir. Accessed January 25, 2018.

Connor, W. P., H. L. Burge, and R. Waitt. 2002. Juvenile life history of wild fall Chinook salmon in the Snake and Clearwater rivers. North American Journal of Fisheries Management. Volume 22, pages 703 to 712.

Cripps, S. J. 1995. Serial particle size fractionation and characterization of an aquacultural effluent. Aquaculture. Volume 133, pages 323 to 339.

Dill, L.M., R.C. Ydenberg, and A.H.G. Fraser. 1981. Food abundance and territory size in juvenile coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Zoology. Volume 59, pages 1801 to 1809.

Dittmer, K. 2013. Changing streamflow on Columbia Basin tribal lands—climate change and salmon. Climatic Change. Volume 120, pages 627 to 641.

Ecovista. 2004. Salmon Subbasin Management Plan. Prepared for Northwest Power and Conservation Council https://www.nwcouncil.org/fw/subbasinplanning/salmon/plan.

Ecovista, Nez Perce Tribe Wildlife Division, and Washington State University for Environmental Education. 2003. Draft Clearwater Subbasin Assessment. Prepared for Nez Perce Tribe Watershed Division and Idaho Soil Conservation Commission. https://www.nwcouncil.org/media/19880/a01_03.pd.

Edmands, S. 2007. Between a rock and a hard place: Evaluating the relative risks of inbreeding and outbreeding for conservation and management. Molecular Ecology. Volume 16, pages 463 to 475.

Galbreath, P. F., C. A. Beasley, B. A. Berejikian, R. W. Carmichael, D. E. Fast, M. J. Ford, J. A. Hesse, L. L. McDonald, A. R. Murdoch , C. M. Peven, and D. A. Venditti. 2008. Recommendations for broad scale monitoring to evaluate the effects of hatchery supplementation on the fitness of natural salmon and steelhead populations. October 9, 2008. Final report of the Ad Hoc Supplementation Monitoring and Evaluation Workgroup (AHSWG). 87p.

Garcia, Terry. U.S. Department of Commerce, Assistant Secretary for Oceans and Atmosphere. July 21, 1998. Letter to Ted Strong, Columbia River Inter-Tribal Fish Commission.

Glick, P., J. Clough, and B. Nunley. 2007. Sea-level rise and coastal habitats in the Pacific Northwest: An analysis for Puget Sound, Southwestern Washington, and Northwestern Oregon. National Wildlife Federation. 106p.

Gonzales, E. J. 2006. Diet and prey consumption of juvenile coho salmon (*Oncorhynchus kisutch*) in three Northern California streams. MS Thesis, Humboldt State University.

Hand, D. M., W. R. Brignon, J. Rivera, and D. E. Olson. 2007. Comparative tag retention, clip quality, and injuries of juvenile spring Chinook salmon marked by an automated marking trailer and manual marking trailer at Warm Springs NFH. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.

Hatchery Scientific Review Group (HSRG). 2004. Hatchery reform: Principles and recommendations of the Hatchery Scientific Review Group. April 2004. 329p.

HSRG. 2014. On the science of hatcheries: An updated perspective on the role of hatcheries in salmon and steelhead management in the Pacific Northwest. June 2014. 160p.

Hebdon, L. 2017a. Letter to Allyson Purcell (NMFS) from Lance Hebdon (IDFG). August 17, 2017. Idaho steelhead programs request for consultation. IDFG, Boise, Idaho. 2p.

Hebdon, L. 2017b. Pedigree of hatchery steelhead broodstocks BY12-15_IDFG_2017 excel report.

Hillman, T. W., and J. W. Mullan. 1989. Effect of hatchery releases on the abundance of wild juvenile salmonids. Chapter 8 *in* Summer and winter ecology of juvenile Chinook salmon and steelhead trout in the Wenatchee River, Washington. Report to Chelan County PUD by D.W. Chapman Consultants, Inc. Boise, Idaho. 22p.

Idaho Department of Environmental Quality. 2017. Idaho's 2014 S 305(b) Integrated Report Interactive Map. Accessed December 20, 2017. https://mapcase.deq.idaho.gov/wq2014/.

Idaho Department of Fish and Game (IDFG). 2005. Snake River Sockeye Salmon. https://fishandgame.idaho.gov/ifwis/cwcs/pdf/Sockeye%20Salmon%20(Snake%20River).pdf Accessed January 8, 2018.

IDFG. 2011a. Hatchery and Genetic Management Plan: South Fork Clearwater B-run steelhead (Clearwater Fish Hatchery). November 2011.

IDFG. 2011b. Hatchery and Genetic Management Plan for Hells Canyon Snake River Summer Steelhead Program. September 2011.

IDFG. 2011c. Hatchery and Genetic Management Plan for Little Salmon River Summer Steelhead Program. September 2011.

IDFG. 2011d. Hatchery and Genetic Management Plan for East Fork Salmon River Steelhead Program. December 2011.

IDFG. 2011e. Hatchery and Genetic Management Plan for Salmon River Basin Summer Steelhead Program. September 2011.

IDFG. 2011f. Hatchery and Genetic Management Plan for Upper Salmon River B-run Steelhead. November.

IDFG. 2015a. Hatchery and Genetic Management Plan for Salmon River Basin Spring Chinook Salmon Program. December 2015.

IDFG. 2015b. Hatchery and Genetic Management Plan for Little Salmon River Basin, Spring Chinook Salmon Program. Draft September 2011, updated November 2015.

IDFG. 2016a. Hatchery and Genetic Management Plan for Hells Canyon Snake River Spring Chinook Salmon Program. Draft September 2011, updated December 2015.

IDFG. 2016b. Hatchery and Genetic Management Plan -South Fork Salmon River Summer Chinook Program. Updated January, 2016.

IDFG. 2016c. Hatchery and Genetic Management Plan for Pahsimeroi River Summer Chinook Salmon Program. November 2011, updated March 2016.

IDFG. 2018a. Chinook salmon seasons and rules. https://idfg.idaho.gov/fish/chinook/rules. Accessed February 23, 2018.

IDFG. 2018b. Steelhead fishing rules. https://idfg.idaho.gov/fish/steelhead/rules. Accessed February 23, 2018.

IDFG, Nez Perce Tribe, Shoshone-Bannock Tribes, U.S. Fish and Wildlife Service, and Idaho Power Company. 2017. Standard operating procedures for salmon and steelhead production programs in the Salmon and Snake River basins.

Independent Scientific Advisory Board (ISAB). 2007. Climate change Impacts on Columbia River Basin fish and wildlife. ISAB Climate Change Report: ISAB 2007-2. May 11, 2007.

Interior Columbia Technical Recovery Team (ICTRT). 2007. Viability criteria for application to Interior Columbia Basin Salmonid ESUs. Review draft. March 2007. 93p.

Izbicki, A. 2017. Adult collection data needs for Dworshak National Fish Hatchery. 2p.

Johnson, B. 2017. Email to Emily Reynolds (NMFS) from Becky Johnson (NPT). August 23, 2017. Clear Creek Temperatures. 1p.

Jones Jr., R. P. 2015. Memorandum to Chris Yates from Rob Jones 2015 5-Year Review - Listing status under the Endangered Species Act for hatchery programs associated with 28 salmon evolutionarily significant units and steelhead distinct population segments. September 28, 2015. NMFS West Coast Region, Sustainable Fisheries Division, Portland, Oregon. 54p.

Jones, R. 2016. Memo to File. Mitchell Act Hatchery FEIS. August 30, 2016. 10p.

Karl, T. R., J. M. Melillo, and T. C. Peterson. 2009. Global Climate Change Impacts in the United States. T. R. Karl, J. M. Melillo, and T. C. Peterson, (eds.). 25 Cambridge University Press, 2009. 196p.

Kendra, W. 1991. Quality of salmonid hatchery effluents during a summer low-flow season. Transactions of the American Fisheries Society. Volume 120, pages 43 to 51.

Kozfkay, C., IDFG, April 1000, 2019. Personal communication, email sent to Emi Kondo, regarding recreational coho salmon fisheries.

Lande, R., and G. F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. Pages 87-123 in M. E. Soule, editor. Viable Populations for Conservation. Cambridge University Press, Cambridge and New York.

Leth, B. 2017a. Idaho Steelhead stray summary for spawn years 2011-2016_IDFG_August 16, 2017 excel report.

Leth, B. 2017b. Steelhead take at traps 7-14-17 excel report.

Leth, B., IDFG, February 26, 2018a. Personal communication, email sent to Dave Ward, regarding hatchery releases.

Leth, B., IDFG, February 23, 2018b. Personal communication, email sent to Dave Ward, regarding recreational fisheries.

Luzier, C. W., H. A. Schaller, J. K. Brostrom, C. Cook-Tabor, D. H. Goodman, R. D. Nelle, K. Ostrand, and B. Streif. 2011. Pacific lamprey (*Entosphenus tridentatus*) assessment and template for conservation measures. U. S. Fish and Wildlife Service, Portland, OR.

Mantua, N., I. Tohver, and A. Hamlet. 2009. Impacts of climate change on key aspects of freshwater salmon habitat in Washington State. Pages 217 to 253 (Chapter 6) in: Washington Climate Change Impacts Assessment: Evaluating Washington’s Future in a Changing Climate. Climate Impacts Group, University of Washington, Seattle, Washington.

McClelland, E. K., and K. A. Naish. 2007. What is the fitness outcome of crossing unrelated fish populations? A meta-analysis and an evaluation of future research directions. Conservation Genetics. Volume 8, pages 397 to 416.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-42. 174p.

Melnychuck, M. C., and S. J. Hausch. 2011. Method for Estimating Detection Probabilities of Nonmigrant Tagged Fish: Applications for Quantifying Residualization Rates, Transactions of the American Fisheries Society, Volumne 140, Issue 6, pages 1613-1628.

Melquist, W. 1997. Aquatic mustelids: mink and river otter. Pages 35 to 42 *in* Harris, J. E. and 5 C. V. Ogan, editors. Mesocarnivores of northern California: biology, management & survey 6 techniques;

August 12 to 15, 1997, Humboldt State University, Arcata, CA. 127 pages. The 7 Wildlife Society, California North Coast Chapter, Arcata, CA.

Michael, Jr, J. H. 2003. Nutrients in salmon hatchery wastewater and its removal through the use of wetland constructed to treat off-line settling pond effluent. Aquaculture. Volume 226, pages 213 to 225.

Mote, P. W. 2003. Trends in temperature and precipitation in the Pacific Northwest during the twentieth century. Northwest Science. Volume 77, pages 271 to 282.

Nandor, G. F., J. R. Longwill, and D. L. Webb. 2009. Overview of the coded wire tag program in the greater Pacific region of North America.

National Marine Fisheries Service (NMFS). 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. June 2000.

NMFS. 2004. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery and Conservation Management Act Essential Fish Habitat Consultation on the Effects of the Northeast Oregon Hatchery Project: Imnaha, Upper Grande Ronde, and Wallowa Subbasins, Wallowa and Union Counties, Oregon. October 7, 2004. National Marine Fisheries Service, Habitat Conservation Division. Portland, Oregon. NMFS Consultation No.: NWR-2004-00615. 63p.

NMFS. 2008a. Supplemental comprehensive analysis of the Federal Columbia River Power System and mainstem effects of the Upper Snake and other tributary actions. May 5, 2008. NMFS, Portland, Oregon. 1230p.

NMFS. 2008b. Assessing benefits and risks & recommendations for operating hatchery programs consistent with conservation and sustainable fisheries mandates. Appendix C of supplementary comprehensive analysis of the Federal Columbia River Power System and mainstem effects of the Upper Snake and other tributary actions. May 5, 2008. NMFS, Portland, Oregon.

NMFS. 2009. FCRPS adaptive management implementation plan. 2008-2018 Federal Columbia River Power System Biological Opinion. September 11, 2009. 42p.

NMFS. 2011a. Anadromous salmonid passage facility design. National Marine Fisheries Service, Northwest Region. July 2011. 140p.

NMFS. 2011b. Endangered Species Act Section 7 Consultation Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation: Approval of two Fishery Management and Evaluation Plans (FMEP) describing Recreational Fisheries proposed by the Idaho Department of Fish and Game. April 19, 2011.

NMFS. 2011c. 5-Year Review: Summary & evaluation of Snake River sockeye, Snake River spring/summer Chinook, Snake River fall-run Chinook, Snake River Basin steelhead. NMFS, Portland, Oregon. 65p.

NMFS. 2012. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. Snake River Fall Chinook Salmon Hatchery Programs, ESA section 10(a)(l)(A) permits, numbers 16607 and 16615. October 9, 2012. NMFS, Portland, Oregon. NMFS Consultation No.: NWR-2011-03947 and NWR-2011-03948. 175p.

NMFS. 2013. Endangered Species Act Section 7 Consultation Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation-Biological Opinion on the Effects of the three Tribal Resource Management Plans and two Fishery Management and Evaluation Plans on Snake River Chinook Salmon and Steelhead Species Listed Under the Endangered Species Act. June 25, 2013. NMFS, Seattle, Washington. 58p.

NMFS. 2014a. Final environmental impact statement to inform Columbia River Basin hatchery operations and the funding of Mitchell Act hatchery programs. West Coast Region. National Marine Fisheries Service. Portland, Oregon.

NMFS. 2014b. Snake River harvest module. Prepared by the National Marine Fisheries Service West Coast Region, Portland, Oregon. June 2014.

NMFS. 2015a. Proposed ESA recovery plan for Snake River Fall Chinook salmon *(Oncorhynchus tshawytscha*). October 2015. NMFS, West Coast Region, Portland, Oregon. 326p.

NMFS. 2015b. ESA recovery plan for Snake River sockeye salmon (*Oncorhynchus nerka*). June 8, 2015. NMFS, West Coast Region. 431p.

NMFS. 2016. Proposed ESA recovery plan for Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha*) and Snake River steelhead (*Oncorhynchus mykiss*).

NMFS. 2016a. Environmental assessment for issuance of Endangered Species Act Section 10(a)(1)(A) permits for spring Chinook salmon hatchery programs in the Methow Basin.

NMFS. 2016b. Coho salmon (*Oncorhynchus kisutch*). http://www.fisheries.noaa.gov/pr/species/fish/coho-salmon.html; accessed June 6, 2016.

NMFS. 2017a. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. Five Snake River Basin Spring/Summer Chinook Salmon Hatchery Programs. NMFS Consultation Number: WCR-2017-7319.

NMFS 2017b. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. Four Salmon River Basin Spring/Summer Chinook Salmon Hatchery Programs in the Upper Salmon River Basin. NMFS Consultation Number: WCR-2017-7042.

NMFS 2017c. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. Nine Snake River Steelhead Hatchery Programs and one Kelt Reconditioning Program in Idaho. NMFS Consultation Number: WCR-2017-7286.

NMFS. 2017d. Endangered Species Act (ESA) Section 7(a)(2) and 4(d) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. Five Clearwater River Basin Spring/Summer Chinook Salmon and Coho Salmon Hatchery Programs. NMFS Consultation Number: WCR-2017-7303.

NMFS. 2017e. Final Environmental Impact Statement and record of decision for *U.S. v. Oregon.* November 6, 2017.

NMFS. 2017f. Recovery Glossary. http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/recovery_glossary.html Accessed November 10, 2017.

NMFS. 2017g. Final Snake River spring/summer Chinook Salmon and Snake River Basin steelhead Recovery Plan. November 2017.

NMFS. 2018. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Response. Consultation on effects of the 2018-2027 *U.S. v. Oregon* Management Agreement. NMFS Consultation Number: WCR-2017-7164.

NMFS. 2019a. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. Recreational and Tribal Treaty Steelhead Fisheries in the Snake River Basin. NMFS Consultation No.: WCR-2018-10283. 131p.

NMFS. 2019b. Environmental assessment for Snake River Basin Steelhead Fisheries.

Nemeth, D. Personal communication (email) between Doug Nemeth, USFWS, and Becky Holloway, HDR Engineering, March 21, 2017.

Nez Perce Tribe. 2016. Hatchery and Genetic Management Plan: Clearwater River Coho Restoration Project.

Nez Perce Tribe. 2017. Hatchery and Genetic Management Plan - Johnson Creek Artificial Propagation Enhancement (JCAPE) Project. Updated February 10, 2017.

Northwest Fisheries Science Center (NWFSC). 2015. Status review update for Pacific salmon and steelheadlListed under the Endangered Species Act: Pacific Northwest.

Northwest Indian Fish Commission (NWIFC) and Washington Department of Fish and Wildlife (WDFW). 2006. The salmonid disease control policy of the fisheries co-managers of Washington state, version 3. 38p.

Pacific Fisheries Management Council (PFMC). 2016. Pacific coast salmon fishery management plan for commercial and recreational salmonids fisheries off the coasts of Washington, Oregon, and California as revised through Amendment 19 (Effective March 2016). Portland, OR.

Pearsons, T. N., and A. L. Fritts. 1999. Maximum size of Chinook salmon consumed by juvenile coho salmon. North American Journal of Fisheries Management. Volume 19, pages 165 to 170.

Quinn, T. P. 1993. A review of homing and straying of wild and hatchery-produced salmon. Fisheries Research. Volume 18, pages 29 to 44.

Quinn, T. P. 1997. Homing, straying, and colonization. Genetic effects of straying of non-native hatchery fish into natural populations. NOAA Tech. Memo., NMFS43 NWFSC-30. 13p.

Quinn, T. P. 2005. The Behavior and Ecology of Pacific Salmon and Trout. University of Washington Press, Bethesda, Maryland. 391p.

Reynolds, E. 2017. Clearwater sp_su Ch and coho PCDrisk_Reynolds_9_19_17 excel report.

Shoshone-Bannock Tribes. 2016. Hatchery and Genetic Management Plan for Yankee Fork Chinook Salmon Project.

Shoshone-Bannock Tribes and IDFG. 2010a. Hatchery and Genetic Management Plan for Dollar Creek Eggbox Project. June 3, 2010.

Shoshone-Bannock Tribes and IDFG. 2010b. Hatchery and Genetic Management Plan for Streamside Incubator Supplementation Project. June 1, 2010.

Snow, C., C. Frady, A. Repp, B. Goodman, and A. Murdoch. 2014. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2013 annual report. November 3, 2014. Report to Douglas PUD, Grant PUD, and the Wells HCP Hatchery Committee, East Wenatchee, Washington. 207p.

SPF Water Engineering. 2010. Water Supply Assessment for the Shoshone-Bannock Tribes's Crystal Springs Fish Hatchery. Appendix E of the Crystal Springs Hatchery and Programs for Snake River

Chinook Salmon and Yellowstone Cutthroat Trout Master Plan (2010), prepared by the Shoshone-Bannock Tribes. Fort Hall, Idaho.

U.S. Bureau of Reclamation (USBR). 1986. Planning report/draft environmental impact statement, Umatilla Project, Oregon.

USBR. 2016. West-wide climate risk assessment: Columbia River Basin climate impact assessment. final report. US Department of the Interior, Bureau of Reclamation, Pacific Northwest Regional Office. March 2016.

U.S Census Bureau. (2017). 2012-2016 American community survey. https://www.census.gov/acs/www/data/data-tables-and-tools/. Accessed January 25, 2018.

U.S. Environmental Protection Agency (USEPA). 1998. Reviewing for environmental justice: EIS and permitting resource guide. EPA 16 Review. Region 10 – Environmental Justice Office.

USEPA. 2006a. Compliance guide for the concentrated aquatic animal production point source category. Engineering and Analysis Division Office of Science and Technology. EPA-821-B-05-001. 292 p.

USEPA. 2006b. EPA fact sheet for NPDES permit numbers IDG-130000, IDG-131000, IDG-132000, ID002826-6.

USEPA. 2007. Authorization to discharge under the National Pollutant Discharge Elimination System, Permit No.: IDG-130000. Aquaculture facilities in Idaho, subject to wasteload allocations under selected total maximum daily loads.

USEPA. 2015. Federal aquaculture facilities and aquaculture facilities located in Indian country within the boundaries of Washington State. Biological Evaluation for Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. NPDES General Permit WAG130000. December 23, 2015. 191p.

USEPA. 2016. A fish consumption survey of the Shoshone-Bannock Tribes. Final Report, Contract Number EP W14 020 and EP W09 011. December 31, 2016.

U.S. Fish and Wildlife Service (USFWS). 2003. Recovery Plan for the Northern Idaho Ground Squirrel (Spermophilus brunneus brunneus). Portland, Oregon. 68 p.

USFWS. 2004. U.S. Fish & Wildlife Service handbook of aquatic animal health procedures and protocols. https://www.fws.gov/policy/AquaticHB.html.

USFWS. 2005. Bull trout core area templates – Complete core area by core area analysis.

USFWS. 2017a. Biological opinion for the authorizations and funding of the continued operation, maintenance, monitoring, and evaluation of the Hells Canyon and Salmon River steelhead and spring/summer Chinook salmon hatchery programs. USFWS, Idaho Fish and Wildlife Office, Boise, Idaho. 01EIFW00-2017-F-1079.

USFWS. 2017b. Biological opinion for the authorizations and funding of the continued operation, maintenance, monitoring, and evaluation of the Clearwater hatchery programs. USFWS, Idaho Fish and Wildlife Office, Boise, Idaho. 01EIFW00-2017-F-1143.

USFWS. 2017c. Information, Planning, and Consultation System (IPAC System). Project-specific ESA species and critical habitat data for all counties in project action area. https://ecos.fws.gov/ipac/. Accessed November 2017.

USFWS and NMFS. 1997. Secretarial Order 3206. 14p.

U.S Food and Drug Administration (USFDA). 2018. Guidance for industry: HACCP regulation for fish and fishery products; questions and answers for guidance to facilitate the implementation of a HACCP system in seafood processing.

https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Seafood/ucm176892.htm. Accessed January 25, 2018.

U.S. Geological Survey (USGS). 2012. Current water data for the Nation online search page. http://waterdata.usgs.gov/nwis/rt.

Waples, R. S. 1999. Dispelling some myths about hatcheries. Fisheries. Volume 24, pages 12 to 21.

Ward, N. E., and D. L. Ward. 2004. Resident fish in the Columbia River Basin: Restoration, enhancement, and mitigation for losses associated with hydroelectric development and operations. Fisheries. Volume 29, pages 10 to 18.

Washington Department of Ecology (WDE). 1989. Quality and fate of fish hatchery effluents during the summer low flow season. Publication No. 89-17. Washington Department of Ecology, Olympia, WA. May 1989.

Washington Department of Fish and Wildlife (WDFW). 2014. Washington Department of Fish and Wildlife: species of concern. https://wdfw.wa.gov/conservation/endangered/.

WFDW, Nez Perce Tribe, Idaho Power Company, Confederated Tribes of the Umatilla Indian Reservation, and Oregon Department of Fish and Wildlife. 2017. Lyons Ferry Complex annual operations plan, October 1, 2017 – September 30, 2018. https://www.fws.gov/lsnakecomplan/Reports/AOP/2017-2018%20Lyons%20Ferry%20Complex%20AOP%20FINAL.pdf

Appendix A. Population Viability of Salmon and Steelhead in the Study Area

Snake River Spring/Summer Chinook Salmon ESU

Snake River spring/summer Chinook salmon are listed as threatened under the ESA. The ESU consists of five MPGs composed of twenty-eight historical populations, of which four are extirpated (Table A-1).

Within the study area, populations from two MPGs have the potential to be genetically affected by hatchery programs included in this EA. Three populations in the South Fork Salmon River MPG and two populations in the Upper Salmon River MPG are likely to receive hatchery-origin spawners (NMFS 2017a; Table A-2). Other populations in the ESU may be subject to ecological (predation/competition) effects along migratory corridors, or genetically via straying.

Adult returns have increased dramatically within the ESU since 2000; however, increases are due primarily to hatchery returns. In 2001, only 10 percent of the returns were fish of natural-origin (NMFS 2012). Natural-origin abundance in most populations in the ESU has increased in recent years, but the increases have not been substantial enough to change current viability ratings (NMFS 2017f). Data from 2005 to 2014 indicate that most populations affected by programs included in this EA have indeed increased in abundance; however, all affected populations remain at high viability risk and returns are below minimum spawner thresholds. The productivity value for four of the five populations receiving hatchery fish is greater than the replacement value of 1.0 (Table A-2). Abundance and productivity data for the Little Salmon River are insufficient to estimate abundance and productivity trends. Spatial structure ratings indicate low or moderate risk for all populations except the Pahsimeroi River, which has a high risk.

For those integrated programs that collect natural-origin Chinook salmon for broodstock, NMFS expects that diversity and abundance impacts are minimal. This is because many of the natural-origin returns may be offspring from hatchery programs. For those populations that currently meet abundance thresholds for a “large” population (Table A-2), it is unlikely that broodstock collection of natural-origin adults has a negative impact on abundance.

Table A-1. Snake River Spring/Summer Chinook salmon ESU components.

ESU Components	
Natural Production	
Major Population Group	**Populations**
Lower Snake River	Tucannon River
Grande Ronde/Imnaha	Wenaha, Lostine/Wallowa, Minam, Catherine Creek, Upper Grande Ronde, Imnaha
South Fork Salmon River	Secesh, East Fork/Johnson Creek, South Fork Salmon River Mainstem, Little Salmon River
Middle Fork Salmon River	Bear Valley, Marsh Creek, Sulphur Creek, Loon Creek, Camas Creek, Big Creek, Chamberlain Creek, Lower Middle Fork (MF) Salmon, Upper MF Salmon
Upper Salmon River	Lower Salmon Mainstem, Lemhi River, Pahsimeroi River, Upper Salmon Mainstem, East Fork Salmon, Valley Creek, Yankee Fork, North Fork Salmon
Artificial Production	
Hatchery programs included in ESU (11)	Tucannon River Spr/Sum, Lostine River Spr/Sum, Catherine Creek Spr/Sum, Looking glass Hatchery Reintroduction Spr/Sum, Upper Grande Ronde Spr/Sum, Imnaha River Spr/Sum, Big Sheep Creek-Adult Spr/Sum out planting from Imnaha program, McCall Hatchery summer, Johnson Creek Artificial Propagation Enhancement summer, Pahsimeroi Hatchery summer, Sawtooth Hatchery spring.

Source: Jones Jr. (2015); NWFSC (2015)

Table A-2. Measures of viability and overall viability rating for Snake River Spring/Summer Chinook salmon populations.

Major Population Group, Population	Abundance and Productivity1				Spatial Structure and Diversity			Overall Viability Rating2	Proposed Recovery Status3 (NMFS 2017f)
	ICTRT Minimum Spawner Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
Lower Snake River									
Tucannon River	750	↑267 (.19)	↓.69	High	Low	Moderate	Moderate	High Risk	Highly Viable[4]
Asotin Creek	500	--	--	--	--	--	--	Extirpated	
Grande Ronde/Imnaha									
Wenaha River	750	↓399 (.12)	↑.93	High	Low	Moderate	Moderate	High Risk	Viable or Highly Viable
Lostine/Wallowa	1,000	↑332 (.24)	↑.98	High	Low	Moderate	Moderate	High Risk	Viable or Highly Viable
Lookingglass Creek.	500	--	--	--	--	--	--	Extirpated	
Minam River	750	↑475 (.12)	↑.94	High	Low	Moderate	Moderate	HighRisk	Viable or Highly Viable
Catherine Creek	1,000	↑110 (.31)	↑.95	High	High	Moderate	High	High Risk	Viable or Highly Viable
Upper Grande Ronde River	1,000	↑43 (.26)	↑.59	High	High	Moderate	High	High Risk	Viable or maintained
Imnaha River	750	↑328 (.21)	↑1.20	High	Low	Moderate	Moderate	High Risk	Viable or Highly Viable
South Fork Salmon River									
South Fork Mainstem4	**1,000**	**↑791 (.18)**	**↓1.21**	**High**	**Low**	**Moderate**	**Moderate**	**High Risk**	**Viable**
Secesh River	750	↑472 (.18)	1.25	High	Low	Low	Low	High Risk	Highly Viable
East Fork/Johnson Creek	**1,000**	**↑208 (.24)**	**↓1.15**	**High**	**Low**	**Low**	**Low**	**High Risk**	**Maintained**
Little Salmon River	**750**	**Insufficient data**			**Low**	**Low**	**Low**	**High Risk**	**Maintained**
Middle Fork Salmon River									
Chamberlain Creek	750	↑641 (.17)	↓2.26	Moderate	Low	Low	Low	Maintained	Viable
Big Creek	1,000	↑164 (.23)	↓1.10	**High**	Very low	Moderate	Moderate	High Risk	Highly viable

Major Population Group, Population	Abundance and Productivity1				Spatial Structure and Diversity			Overall Viability Rating2	Proposed Recovery Status3 (NMFS 2017f)
	ICTRT Minimum Spawner Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
Loon Creek	500	54 (.10)	↓.98	High	Low	Moderate	Moderate	High Risk	Viable
Camas Creek	500	↑38 (.20)	↓.80	High	Low	Moderate	Moderate	High Risk	Maintained
Lower Middle Fork	500	Insufficient data	Insufficient data	--	Moderate	Moderate	Moderate	High Risk	Maintained
Upper Middle Fork	750	↑71 (.18)	↓0.50	High	Low	Moderate	Moderate	High Risk	Maintained
Sulpher Creek	500	↑67 (.99)	↑.92	High	Low	Moderate	Moderate	High Risk	Maintained
Marsh Creek	500	↑253 (.27)	↓1.21	High	Low	Moderate	Moderate	High Risk	Viable
Bear Valley Creek	750	↑474 (.27)	↓1.37	High	Very low	Moderate	Moderate	High Risk	Viable
Upper Salmon River									
Salmon Lower Mainstem	2,000	↓108 (.18)	↑1.18	High	Low	Low	Low	High Risk	Maintained
Salmon Upper Mainstem4	**1,000**	**↑411 (.14)**	**↑1.22**	**High**	**Low**	**Low**	**Low**	**High Risk**	**Viable or highly viable**
Pahsimeroi River	**1,000**	**↑267 (.16)**	**↑1.37**	**High**	**Moderate**	**High**	**High**	**High Risk**	**Viable**
Lemhi River	2,000	↑143 (.23)	↑1.30	High	High	High	High	High Risk	Viable
Valley Creek	500	↑121 (.20)	↑1.45	High	Low	Moderate	Moderate	High Risk	Viable
East Fork Salmon River	1,000	↑347 (.22)	↑1.08	High	Low	High	High	High Risk	Viable
Yankee Fork	500	↑44 (.45)	↓.72	High	Moderate	High	High	High Risk	Maintained
North Fork Salmon River	500	Insufficient data	Insufficient data	--	Low	Low	Low	High Risk	Maintained
Panther Creek	750	Insufficient data	Insufficient data	--	--	--	--	Extirpated	

Source: NWFSC (2015), NMFS (2017f)

1Upwards arrow=improved since prior review. Downwards arrow=decreased since prior review. Current abundance and productivity estimates are expressed as geometric means with (standard error) for abundance.

2Highly viable/Very Low risk = less than 1 percent risk of extinction over 100 years; Viable/Low risk = less than 5 percent risk of extinction over 100 years.

3Maintained/Moderate = 6 to 25 percent risk of extinction over 100 years; High Risk = does not meet viability criteria, greater than 25 percent risk of extinction over 100 years.

4Bolded cells indicate populations whose viability may be affected by hatchery programs

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Snake River Fall Chinook Salmon ESU

The Snake River Fall Chinook Salmon ESU includes naturally spawned fish in the lower mainstem of the Snake River and the lower reaches of several of the associated major tributaries below Hells Canyon Dam, including the Tucannon, Grande Ronde, Clearwater, Salmon, and Imnaha Rivers, along with four artificial propagation programs (Jones Jr. 2015; NWFSC 2015). A single extant population spawns and rears in the mainstem Snake River and its tributaries below Hells Canyon Dam.

This ESU has been reduced to the Lower Mainstem Snake River fall Chinook salmon population that is viable, but has a narrow range of available habitat. The Draft Snake River Fall Chinook Recovery Plan (NMFS 2015a) reports that a single population viability scenario could be possible given the unique spatial complexity of the population. All of the hatchery programs are included in the ESU along with the natural-origin population that is at moderate risk, with a low risk for abundance/productivity and a moderate risk for spatial structure and diversity (NMFS 2017c). Best available information indicates that the ESU remains threatened, which is based on the low risk for abundance/productivity and moderate risk for spatial structure/diversity (NWFSC 2015; NMFS 2017f).

Snake River Steelhead DPS

The Snake River Basin Steelhead DPS includes all naturally spawned anadromous O. mykiss originating below natural and man-made impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho (NWFSC 2015). The Interior Columbia Technical Recovery Team (ICTRT) identified six MPGs in the Snake River Steelhead DPS: Clearwater River, Salmon River, Grande Ronde River, Imnaha River, Lower Snake River, and Hells Canyon Tributaries (ICTRT 2007). The Hells Canyon Tributaries MPG is extirpated, leaving five extant MPGs. Nine hatchery steelhead programs are included in the DPS (Table A-3). This DPS consists of A-run steelhead, which primarily return to spawning areas in the summer, and B-run steelhead, which exhibit a larger body size and begin their migration in the fall (NMFS 2011c).

The Snake River Steelhead DPS has a moderate to high risk of extinction and remains threatened. Four of the five extant MPGs are not meeting recovery objectives in the draft recovery plan, and the status of many individual populations remains uncertain. Still, the most recent status review suggests that populations in the Salmon and Clearwater subbasins are doing relatively well (Table A-4). For example, the minimum abundance threshold for the lower mainstem Clearwater population is 1,500, and abundance was most recently estimated at 2,099. In addition, the productivity value for a number of populations is greater than the replacement value of 1.0 (NMFS 2017d).

Within the study area hatchery programs included in this EA directly affect the South Fork Clearwater River population in the Clearwater River MPG and the Little Salmon River, Pahsimeroi River, East Fork Salmon River, and Upper Salmon River populations in the Salmon River MPG (Table A-4). Because the Hells Canyon Tributaries MPG is extirpated, fish released from the Hells Canyon Snake River A-run Summer Steelhead Program do not affect that population. Other populations in the DPS may be subject to ecological (predation/competition) effects along migratory corridors, or genetically via straying.

Table A-3. Snake River Basin steelhead DPS components.

DPS Components[1]	
Natural Production	
Major Population Group	**Populations**
Grande Ronde River	Joseph Creek, Upper Mainstem, Lower Mainstem, Wallowa River
Imnaha River	Imnaha River
Clearwater River	Lower Mainstem River, North Fork Clearwater, Lolo Creek, Lochsa River, Selway River, South Fork Clearwater
Salmon River	Little Salmon/Rapid, Chamberlain Creek, Secesh River, South Fork Salmon, Panther Creek, Lower MF, Upper MF, North Fork, Lemhi River, Pahsimeroi River, East Fork Salmon, Upper Mainstem
Lower Snake	Tucannon River, Asotin Creek
Hells Canyon Tributaries	Extirpated
Artificial Production	
Hatchery programs included in DPS (7)	Tucannon River summer, Little Sheep Creek summer, EF Salmon River A, Dworshak NFH B, Lolo Creek B, Clearwater Hatchery B, SF Clearwater (localized) B

Source: 79 FR 20802; NMFS (2012); Jones Jr. (2015); NWFSC (2015)

1 Note: The DPS listing is updated in the FR every five years and the last update was on April 14, 2014. NMFS is currently developing an updated DPS listing.

Table A-4. Measures of viability and overall viability rating for Snake River steelhead MPGs.

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]	Proposed Recovery Status[3] (NMFS 2017f)
	ICTRT Minimum Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
Lower Snake River									
Tucannon River	1,000	NA	NA	High (?)	Low	Moderate	Moderate	High Risk	Viable or Highly Viable
Asotin Creek	500		NA	Moderate (?)	Low	Moderate	Moderate	Maintained (?)	Viable or Highly Viable
Grande Ronde River									
Lower Grande Ronde	1,000	NA	NA		Low	Moderate Moderate	Moderate	Maintained	Viable or highly Viable
Joseph Creek	500	1,839	1.86	Very low	Very low	Low	Low	Highly Viable	Highly Viable
Upper Grande Ronde	1,500	1,649 (.21)	3.15	Viable (moderate)	Very low	Moderate	Moderate	Viable	Viable or Highly Viable
Wallowa River	1,000	NA	NA	High	Very low	Low	Low	Moderate?	Viable or Highly Viable
Imnaha River									
Imnaha River	1,000	NA	NA	Moderate	Very low	Moderate	Moderate	Moderate	Highly Viable
Clearwater River									
Lower Mainstem Clearwater River	1,500	2,099 (.15)	2.36	Moderate	Very low	Low	Low	Maintained (?)	Viable
South Fork Clearwater River4	**1,000**	**NA**	**NA**	**High**	**Low**	**Moderate**	**Moderate**	**Maintained or High Risk (?)**	**Maintained**
Lolo Creek	500	NA	NA	High	Low	Moderate	Moderate	Maintained (?)	Maintained
Selway River	1,000	1,650 (.17)	2.33	Moderate (?)	Very low	Low	Low	Maintained (?)	Viable
Lochsa River	1,000			Moderate (?)	Very low	Low	Low	Maintained (?)	Highly Viable
North Fork Clearwater River	--	--	--	--	--	--	--	Extirpated	

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]	Proposed Recovery Status[3] (NMFS 2017f)
	ICTRT Minimum Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
Salmon River									
Little Salmon River	**500**	**NA**	**NA**	**Moderate (?)**	**Low**	**Moderate**	**Moderate**	**Maintained (?)**	**Maintained**
South Fork Salmon River.	1,000	1,028 (.17)	1.80	Moderate (?)	Very low	Low	Low	Maintained (?)	Viable
Secesh River	500			Moderate (?)	Low	Low	Low	Maintained (?)	Maintained
Chamberlain Creek	500	2,213 (.16)	2.38	Moderate (?)	Low	Low	Low	Maintained (?)	Viable
Lower Middle Fork Salmon River	1,000			Moderate (?)	Very low	Low	Low	Maintained (?)	Highly Viable
Upper Middle Fork Salmon River	1,000			Moderate (?)	Very low	Low	Low	Maintained (?)	Viable
Panther Creek	500	NA	NA	Moderate	High	Moderate	High	High Risk	Viable
North Fork Salmon River	500	NA	NA	Moderate	Low	Moderate	Moderate	Maintained (?)	Maintained
Lemhi River	1,000	Insufficient data	Insufficient data	Moderate	Insufficient data	Insufficient data	Moderate	Maintained (?)	Viable
Pahsimeroi River	**1,000**	**NA**	**NA**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Maintained (?)**	**Maintained**
East Fork Salmon River	**1,000**	**NA**	**NA**	**Moderate**	**Very low**	**Moderate**	**Moderate**	**Maintained (?)**	**Maintained**
Upper Salmon River	**1,000**	**NA**	**NA**	**Moderate**	**Very low**	**Moderate**	**Moderate**	**Maintained (?)**	**Maintained**
Hells Canyon Tributaries									
Lower Hells Canyon Tributaries	--	--	--	--	--	--	--	Extirpated	

Source: NWFSC (2015); NMFS (2017f)

1 Current abundance and productivity estimates are expressed as geometric means with (standard error) for abundance.

2 Highly viable/Very Low risk = less than 1 percent risk of extinction over 100 years; Viable/Low risk = less than 5 percent risk of extinction over 100 years; ratings with (?) are based on imitated or provisional data.

3 Maintained/Moderate = 6 to 25 percent risk of extinction over 100 years; High Risk = does not meet viability criteria, greater than 25 percent risk of extinction over 100 years.

4 Bolded cells indicate populations whose viability may be affected by hatchery programs.

Snake River Sockeye Salmon ESU

The Snake River Sockeye Salmon ESU includes naturally spawned anadromous and residual sockeye salmon originating from the Snake River Basin in Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive propagation program (Jones Jr. 2015). The ICTRT treats Sawtooth Valley sockeye salmon as the single MPG within the ESU. The MPG contains one extant population (Redfish Lake) (NMFS 2015b).

The Snake River Sockeye Salmon ESU does not meet biological viability criteria (i.e., indication that the ESU is self-sustaining and naturally producing, and no longer qualifies as an endangered species), and likely will not for some time. However, annual returns of sockeye salmon through 2013 show that more fish are returning to the basin than before initiation of the captive broodstock program, which began after listing of the ESU. The ongoing reintroduction program is still in the phase of building sufficient returns to allow for large-scale reintroduction into Redfish Lake, the initial target for restoration (NMFS 2015b). In the 2015 status update, NMFS determined that the ESU remains at high risk for spatial structure, diversity, abundance, and productivity (NWFSC 2015). At present, anadromous returns are dominated by production from the captive spawning component.