Environmental Assessment for Endangered Species Act Section 4(d) Approval and Section 10(a)(1)(A) Permit Issuance for Steelhead Hatchery Programs and Section 10(a)(1)(B) Permits Issuance for Summer/Fall and Fall Chinook Salmon Hatchery Programs in Upper Columbia River Basin

Final Environmental Assessment

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Acronym List

AF	Acclimation Facility
DPS	Distinct population segment
EA	Environmental assessment
EIS	Environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FH	Fish Hatchery
FTE	Full-time equivalent
HCP	Habitat Conservation Plan
HGMP	Hatchery and genetic management plan
HOR	Hatchery-origin returns
HSRG	Hatchery Scientific Review Group
IHOT	Integrated Hatchery Operations Team
M&E	Monitoring and Evaluation
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act (also called Magnuson-Stevens Act)
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (also called NOAA Fisheries Service)
NOR	Natural-origin returns
NPDES	National Pollutant Discharge Elimination System
pHOS	Proportion of hatchery-origin spawners on spawning grounds
PNI	Proportionate Natural Influence (pNOB/(pNOB+pHOS))
pNOB	Proportion of natural-origin fish in the broodstock
PUD	Public Utillity District
RM&E	Research, Monitoring, and Evaluation
ROD	Record of Decision
SSSA	Salmon and Steelhead Settlement Agreement
UCR	Upper Columbia River Basin
USBOR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

WDOE	Washington Department of Ecology
WNFH	Winthrop National Fish Hatchery

1. INTRODUCTION

The National Marine Fisheries Service (NMFS) has received the following Endangered Species Act (ESA) applications for summer steelhead hatchery programs in the Upper Columbia River (UCR), located in Washington State (Figure 1-1): Section 10(a)(1)(A) permit request for Wells Complex Summer Steelhead program (DPUD and WDFW 2011), and Section 4(d) limit 5 approval for Winthrop National Fish Hatchery (WNFH) Summer Steelhead program (USFWS 2012b).

NMFS has also received ESA section 10(a)(1)(B) permit applications for the following hatchery programs that produce summer/fall and fall Chinook salmon in the Upper Columbia River, located in Washington State (Figure 1-1):

- Chelan Falls summer/fall Chinook salmon Program (Chelan PUD 2014; CPUD 2010)
- Wenatchee summer/fall Chinook salmon Program (Chelan PUD and Grant PUD 2014; GPUD 2009b)
- Methow summer/fall Chinook salmon Program (GPUD 2009a; Grant PUD 2014a)
- Wells Hatchery summer/fall Chinook salmon Program (DPUD and WDFW 2013)
- Priest Rapids fall Chinook salmon Program 4451(Grant PUD 2014b; WDFW and GPUD 2005)

The applications include Hatchery and Genetic Management Plans (HGMPs) [1] that outline the supportive breeding, rearing, releasing, and associated monitoring and evaluation actions that occur in the Upper Columbia River Basin for summer steelhead and summer/fall and fall Chinook salmon. To respond to these applications, NMFS is proposing issuing ESA section 10(a)(1)(A) permit to Douglas County Public Utility District (PUD) and Washington Department of Fish and Wildlife (WDFW), the section 4(d) limit 5 approval to U.S. Fish and Wildlife Service (USFWS) and U.S. Bureau of Reclamation (USBOR), and section 10(a)(1)(B) permits to Douglas PUD, Chelan PUD, Grant PUD, and WDFW.

[1] These HGMPs serve as the conservation plans for ESA 10(a)(1)(B) permits as required by 50 CFR 222.102.

The release of fish from the steelhead releases in the Methow River basin are intended to aid in recovery efforts of UCR steelhead, and the other programs analyzed here are intended to improve the viability status of the species, and/or reduce the species extinction risk, and/or increase harvest opportunities.

If the programs meet the criteria of ESA section 10(a)(1)(A), 10(a)(1)(B), and Section 4(d), NMFS can issue the permits. NMFS' issuance of permits to the applicants constitutes the 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).

The ESA sections 10(a)(1)(A) and 10(a)(1)(B) permits would be issued for 10 years from the date of issuance. The Section 4(d) determination would be made for an unlimited amount of time. NMFS would review the annual reports provided by the applicants, and the permits would be modified when warranted by NMFS as specified in the permits.

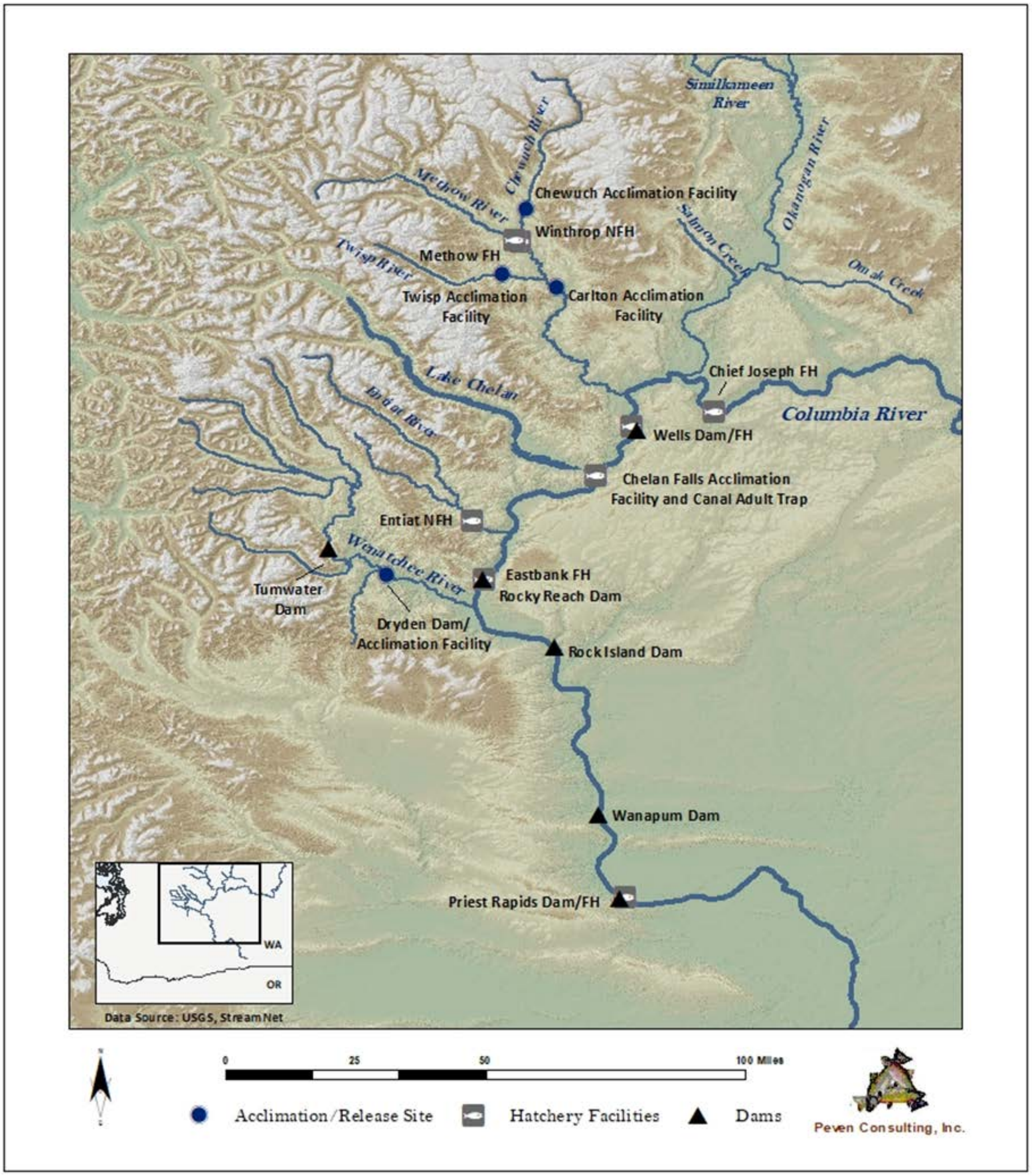

Figure 1-1. Map of the Project Area and facilities associated with the seven hatchery programs evaluated in this environmental assessment.

The following activities are included in the HGMPs, and are further described in more detail in Chapter 2:

- Broodstock collection, including collection methods and facility operations
- Holding, identification, and spawning of adult fish
- Egg incubation and rearing
- Marking of hatchery-origin juveniles
- Juvenile releases
- Adult management
- Monitoring and evaluation to assess program performance

1.1. Purpose and Need

NMFS proposes to issue ESA section 10(a)(1)(A) and 10(a)(1)(B) permits to, and to make a determination under ESA section 4(d) for, the above-mentioned salmon and steelhead hatchery programs in the Upper Columbia River basin after evaluation and approval of the programs. NMFS' purpose is two fold: 1) aim to ensure the sustainability of UCR salmon and steelhead by conserving the productivity, abundance, diversity, and distribution of listed species of salmon and steelhead in the Upper Columbia River; and 2) aim to meet the applicants' need for ESA coverage in order to continue operating their programs.

1.2. Project Area and Analysis Area

The Project Area is the geographic area where the Proposed Action would take place. It includes the areas immediately adjoining the hatchery facilities, acclimation sites, and weir locations, as described in the HGMPs. For this EA, the Project Area includes the Columbia River from the Chief Joseph Hatchery to the Priest Rapids Fish Hatchery (Figure 1-1). Within this reach and included in the Project Area are the Methow, Chelan, and Wenatchee Sub-basins.

The Analysis Area is the geographic area that is being evaluated for a particular resource. Direct and indirect impacts for each resource (e.g., water quality and quantity, wildlife) are analyzed in Chapter 4, Environmental Consequences. The mainstem Columbia River from the Chief Joseph Hatchery downstream to the confluence with the Snake River, including the Wenatchee, Methow, Chelan River sub-basins, encompasses the total Analysis Area for this EA. However, while the broad Analysis Area is large due to the amount of habitat for the species being analyzed, impacts from the operation of the hatchery programs tend to be localized to areas immediately adjoining the hatchery facilities. For some resources, the Analysis Area may be different (e.g., larger or smaller) from the Project Area depending on where the effects of the alternatives occur. The Analysis Area for each resource is described in Chapter 3. In addition, a larger Analysis Area was defined to consider actions with effects that are potentially cumulative with the Proposed Action and thus, require evaluation of effects that may occur outside the Project Area. The evaluation of this larger Analysis Area for cumulative effects is described in Chapter 5.

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

In addition to NEPA and the ESA, other plans, regulations, agreements, treaties, laws, and Secretarial and Executive Orders also affect hatchery operations in the action area.

1.3.1. U.S. v. Oregon

The court in *U.S. v. Oregon* (302 F.Supp. 899, 1978) 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 are governed through the 2018-2027 *United States v. Oregon* Management Agreement (Management Agreement) (*U.S. v. Oregon* 2009), negotiated by the Federal and state governments and the involved treaty Indian tribes; the current Management Agreement was adopted in 2018 and expires in 2027. For more details about the history and details of the Management Agreement, see the Mitchell Act Mitchell Act FEIS (Mitchell Act FEIS) Subsection 1.7.4, *U.S. v. Oregon*.

The parties to the Management Agreement use the information on releases from the programs being evaluated in this EA as part of their management actions and evaluations, which ensure that the requirements of the Management Agreement are met. Fisheries (both Tribal and non-tribal) are managed through the Management Agreement.

1.3.2. Federal-Tribal Trust Responsibilities and 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 3206, *American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the ESA* (Secretarial Order), clarifies the responsibilities of the agencies when actions 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, and
- Assist tribes in developing and expanding tribal programs so that healthy ecosystems are promoted and conservation restrictions are unnecessary.

NMFS considers the responsibilities described above when taking ESA actions, such as issuing a section 10 permit and 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.

1.3.3. No Net Impact Mitigation Goals

The hatchery programs evaluated in this EA are designed to meet the "no net impact" mitigation goals established in the Wells (Douglas County Public Utility District 2002), Rocky Reach (Chelan County Public Utility District 2002b), and Rock Island Habitat Conservation Plans (HCPs) (Chelan County Public Utility District 2002a) and the Priest Rapids Salmon and Steelhead Settlement Agreement (SSSA) (GPUD 2005) in a manner consistent with overall objectives for rebuilding natural populations. No Net Impact as defined in the HCPs refers to a virtual impact of zero mortality as fish pass the dams. It is composed of two components: 91 percent combined adult and juvenile survival achieved by measures implemented within the geographic area of the dam, and 9 percent compensation for unavoidable project mortality, which is mitigated through hatchery (7%) and habitat enhancement (2%) programs.

1.4. Public Involvement

A public commenting period for this EA took place from April 2, 2019 through May 2, 2019. NMFS received two comments, though neither comments had specific information or supporting documentations to warrant a change in the proposed action or the analysis contained in this EA.

2. Description of Alternatives

There are four alternatives being considered in this EA:

- **Alternative 1**: No Action Alternative assumes that NMFS would not make ESA section 4(d) determinations, nor issue and the section 10(a)(1)(A) and 10 (a)(1)(B) permits, but the programs would continue as currently operated.
- **Alternative 2**: Proposed Action Alternative (Preferred Alternative) would mean NMFS issued the section 10(a)(1)(A) and 10 (a)(1)(B) permits, as well as made the section 4(d) determination, allowing for continued operation of the current programs with ESA coverage.
- **Alternative 3**: Reduced Production Alternative assumes NMFS issued the section 10(a)(1)(A) and 10 (a)(1)(B) permits, as well as made the section 4(d) determination, but an ESA coverage for 50 percent reduction in hatchery production across programs.
- **Alternative 4**: No Hatchery Releases Alternative assumes termination of all programs considered in this EA.

2.1. Alternative 1, No Action

The No Action Alternative assumes that NMFS would not make ESA section 4(d) determinations, nor issue and the section 10(a)(1)(A) and 10 (a)(1)(B) permits, but the programs would continue as currently operated. The facilities used, broodstock, and numbers released under this alternative are discussed immediately below.

2.1.1. Current Hatchery Programs

Seven hatchery programs will be evaluated in this EA (Table 2-1). These hatchery programs are currently operating and have for a number of years. Some of the seven hatchery programs have multiple funders and different processes through which the programs are coordinated. The two steelhead hatchery programs (with three release sites) that are being evaluated within this EA have an annual release goal of just over 500,000 smolts[2] that are released in the Methow and Columbia Rivers (Table 2-1). For the summer/fall and fall Chinook salmon programs, the annual release goal is approximately 2 million yearling smolts and just over 6 million subyearlings from various locations within the Upper Columbia River basin (Table 2-1).

[2] The majority of steelhead smolts will be raised as yearlings. However, the Winthrop NFH will be rearing up to 200,000 fish for two years prior to release. The total number of steelhead smolts released per year from Winthrop NFH will depend on the number of natural-origin adults collected for broodstock.

The USFWS operates the Winthrop NFH steelhead program at WNFH, WDFW operates the Eastbank Fish Hatchery, the Dryden and Chelan Falls acclimation facilities, and the Priest Rapids Fish Hatchery, while Douglas PUD operates the Methow and Wells fish hatcheries. . Douglas PUD operates Carlton Acclimation Facility under contract to the facility owner, Grant PUD.

WDFW and the other operators follow the Hatchery and Fishery Reform Policy (C-3619), which was adopted by the Washington Fish and Wildlife Commission in 2009[3] (Washington Fish and Wildlife Commission 2009) and supersedes the 1997 Wild Salmonid Policy (WDFW 1997). Its purpose is to advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. The policy applies to state hatcheries and its intent is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries.

In addition, the hatchery programs being evaluated in this EA are consistent with the Federal recovery plan for the ESA-listed Upper Columbia River spring Chinook salmon and steelhead (UCSRB 2007). The recovery plan includes conservation goals and proposed habitat, hatchery, and harvest actions needed to achieve the conservation goals for each watershed within the geographic boundaries of the listed Evolutionarily Significant Unit (ESU) for spring Chinook salmon and Distinct Population Segment (DPS) for summer steelhead.

[3] Currently, some aspects of the policy are under review.

Table 2-1. Current hatchery production of summer steelhead and summer/fall and fall Chinook salmon that are released within the Upper Columbia region that are evaluated in this environmental assessment.

Hatchery Program	Program Funding Source	Species	Broodstock Collection Site	Rearing Facilities (operator)	Number of Fish Released (program goal)	Release Location
Winthrop National Fish Hatchery Leavenworth Fisheries Complex	Bureau of Reclamation	Summer steelhead	Methow FH, WNFH, and by hook-and-line in the Methow River basin	Winthrop National Fish Hatchery (FH; USFWS)	Up to 200,000 2-year old	Methow Subbasin
Wells Complex Summer Steelhead Program	Douglas PUD	Summer steelhead	Twisp River weir, Methow FH, Winthrop, NFH, Wells FH, Wells Dam, and by hook-and-line in the Methow Basin	Methow FH, Twisp River Acclimation Facility (Twisp Fish only) (), Wells FH, (Douglas PUD)	Up to 48,000 yearlings	Twisp River (RM 6.8)
					Up to 100,000 yearlings	Methow River (RM 7)
					Up to 160,000 yearlings	Columbia River (RM 515)
Methow Component of the Upper Columbia River Summer Chinook Program – Priest Rapids Project Mitigation	Grant PUD	Summer/fall Chinook salmon	Wells Dam (or Methow River)	Eastbank FH (WDFW), Carlton Acclimation Facility (Douglas PUD)	200,000 yearlings	Methow River (RM 37.5)
Wells Hatchery Summer Chinook Program	Douglas PUD	Summer/fall Chinook salmon	Wells Dam and Wells FH	Wells FH (Douglas PUD)	320,000 yearlings and 484,000 subyearlings	Columbia River (RM 515)
Chelan Falls Summer Chinook Program	Chelan PUD	Summer/fall Chinook salmon	Chelan Falls Canal Trap; Wells FH, Entiat	Eastbank FH, Chelan Falls Acclimation Facility (WDFW)	576,000 yearlings	Chelan River (RM 0.25)

Hatchery Program	Program Funding Source	Species	Broodstock Collection Site	Rearing Facilities (operator)	Number of Fish Released (program goal)	Release Location
			Hatchery; Chief Joseph Hatchery			
Wenatchee Summer Chinook Program	Grant PUD	Summer/fall Chinook salmon	Dryden Dam and Tumwater Dam	Eastbank FH, Dryden Acclimation Facility (WDFW)	181,816 yearlings	Wenatchee River (RM 16)
	Chelan PUD			Eastbank FH, Dryden Acclimation Facility (WDFW)	318,815 yearlings	
UCR Fall Chinook Salmon Program – Priest Rapids Project Mitigation, Priest Rapids Hatchery	Grant PUD	Fall Chinook salmon	Priest Rapids Hatchery; Priest Rapids Dam; Hook-and-line angling in Hanford Reach	Priest Rapids FH (WDFW)	5,599,504 subyearlings	Columbia River (RM 413)

In 2014, NMFS completed a Final Environmental Impact Statement (Mitchell Act FEIS) to inform Columbia River Basin hatchery operations and funding of the Mitchell Act hatchery programs (referred to as the Mitchell Act FEIS in this EA) (NMFS 2014). The Mitchell Act (16 U.S.C. §§ 755-757) allows NMFS to distribute appropriated funds to support research, improve fish passage, screen diversions, and build and operate salmon and steelhead hatchery facilities in Oregon, Washington, and Idaho. While the hatchery programs being evaluated in this EA are not funded by the Mitchell Act, 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. These alternatives were related to how hatcheries might be operated to manage effects (negative and positive) on natural salmon and steelhead populations, both ESA-listed and non-listed. The comprehensive Mitchell Act FEIS evaluation of likely effects of hatchery production on broad species and multi-species scales in the Columbia River Basin helps to inform the site-specific analyses within this EA. Releases from programs included in this EA are not identical to those assessed in the Mitchell Act FEIS alternatives; however, release numbers are generally similar to, or fall between, Mitchell Act FEIS alternatives (Table 2-2), so we extrapolate relevant Mitchell Act FEIS analysis in this document based on where the release numbers from these programs fall among the Mitchell Act FEIS alternatives.

The Mitchell Act Mitchell Act FEIS has been incorporated by reference into this EA, and the Mitchell Act FEIS is referenced when information on the appropriate and relevant analyses discussed in the Mitchell Act FEIS is pertinent. Because the Mitchell Act FEIS was published in 2014, NMFS reviewed new studies and information, including additional years of data obtained since the Mitchell Act FEIS was prepared, and determined that there are no significant new circumstances or information relevant to environmental concerns that would change the conclusions of the Mitchell Act FEIS (Jones 2016).

Table 2-2. Summary of which Mitchell Act FEIS alternatives were used for effects analysis for each hatchery program being evaluated in this EA based on the number of fish released for the programs evaluated in this EA and the numbers modeled in the Mitchell Act FEIS under each alternative for each hatchery program.

Program	Species	Release Basin	Proposed Release Numbers	Relation of Release Numbers under the Proposed Action to those under the Six Mitchell Act FEIS Alternatives
Wells Complex Summer Steelhead Program	Steelhead	Columbia	Up to 160,000 yearlings	Alternative 6 (199,653 yearlings)
Winthrop National Fish Hatchery Leavenworth Fisheries Complex	Steelhead	Methow	Up to 200,000 2-year old	Between alternatives 2, 3, 4 (293,724 yearlings), and 5 and 6 (100,201 yearlings)

Program	Species	Release Basin	Proposed Release Numbers	Relation of Release Numbers under the Proposed Action to those under the Six Mitchell Act FEIS Alternatives
Wells Complex Summer Steelhead Program	Steelhead	Methow/ Twisp	Up to 148,000 yearlings	Between alternatives 1, 2, 3, 4 (50,007 yearlings), and 5 and 6 (257,780 yearlings)
Wells Hatchery Summer Chinook Program	Summer/fall Chinook	Columbia	320,000 yearlings and 484,000 subyearlings	Alternatives 1, 2, 3, 4, 5, and 6 (803,024 yearlings)
Chelan Falls Summer Chinook Program	Summer/fall Chinook	Chelan	576,000 yearlings	Alternatives 1, 2, 3, 4, 5, and 6 (600,400 yearlings)
Methow Component of the Upper Columbia River Summer Chinook Program – Priest Rapids Project Mitigation	Summer/fall Chinook	Methow	200,000 yearlings	Alternatives 1, 2, 3, 4, 5, and 6 (399,128 yearlings)
Wenatchee Summer Chinook Program	Summer/fall Chinook	Wenatchee	500,631 yearlings	Alternatives 1, 2, 3, 4, 5, and 6 (863,319 yearlings)
UCR Fall Chinook Salmon Program – Priest Rapids Project Mitigation, Priest Rapids Hatchery	Fall Chinook	Columbia	5,599,504 subyearlings	Alternatives 1, 2, 3, 4, and 5 (6,700,993 subyearlings)

2.2. Alternative 2, Proposed Action NMFS Approves ESA Coverage for the Hatchery Programs

Under the Preferred Alternative, NMFS' would issue one Section 10(a)(1)(A) permit to Douglas PUD and WDFW for the Wells Complex Summer Steelhead Program, make one section 4(d) limit 5 determination for USFWS and USBOR's WNFH Summer Steelhead Program, and issue three section 10(a)(1)(B) permits to Douglas PUD, Chelan PUD, Grant PUD, and WDFW for the five summer/fall and fall Chinook salmon programs being evaluated within this EA. This alternative would operate and release the same number of fish as Alternative 1 (Table 2-1).

2.3. Alternative 3, Reduction of Current Hatchery Releases by 50 Percent

Under Alternative 3, NMFS would issue the same permits and make the same 4(d) determination as under Alternative 2, except the issuances and the determination would reduce the current hatchery program release goals by 50 percent. No changes would be made to where broodstock is collected, adults held and spawned, eggs incubated, juveniles reared, and released. The reduced numbers are shown in Table 2-3. The hatchery programs would be releasing about 260,000 steelhead, approximately 1 million summer/fall Chinook salmon yearlings, and about 3 million summer/fall and fall Chinook salmon subyearlings (Table 2-3). This alternative does not meet NMFS' purpose and need and would not meet the applicants' mitigation needs.

Table 2-3. Reduction of the proposed hatchery release goals being evaluated in this EA by 50 percent.

Hatchery Program	Program Funding Source	Species	Number of Fish Released (program goal)
Winthrop National Fish Hatchery Leavenworth Fisheries Complex	Bureau of Reclamation	Summer steelhead	Up to 100,000 2-year old
Wells Complex Summer Steelhead Program	Douglas PUD	Summer steelhead	Up to 24,000 yearlings
			Up to 50,000 yearlings
			Up to 80,000 yearlings
Methow Component of the Upper Columbia River Summer Chinook Program – Priest Rapids Project Mitigation	Grant PUD	Summer/fall Chinook salmon	100,000 yearlings
Wells Hatchery Summer Chinook Program	Douglas PUD	Summer/fall Chinook salmon	160,000 yearlings and 242,000 subyearlings
Chelan Falls Summer Chinook Program	Chelan PUD	Summer/fall Chinook salmon	288,000 yearlings
Wenatchee Summer Chinook Program	Grant PUD	Summer/fall Chinook salmon	91,000 yearlings
	Chelan PUD		159,500 yearlings
UCR Fall Chinook Salmon Program – Priest Rapids Project Mitigation, Priest Rapids Hatchery	Grant PUD	Fall Chinook salmon	2,799,752 subyearlings

2.4. Alternative 4, Termination of Current Hatchery Releases

The fourth alternative assumes the termination of the hatchery programs that are being considered in this EA. Steelhead hatchery releases in the Methow Basin and mainstem Columbia River upstream of Wells Dam would no longer take place. The summer/fall Chinook salmon released into the Methow, Columbia (at Wells FH) and Chelan Rivers would be reduced to zero, and fall Chinook salmon subyearlings would no longer be released from the Priest Rapids Hatchery for the programs being evaluated in this EA. Many of the facilities used for the proposed programs would continue to operate for other programs, such as the Methow River spring Chinook hatchery programs that release fish from the Winthrop NFH and Methow FH. The Eastbank FH would continue to operate for Wenatchee spring Chinook salmon and other steelhead programs, and the Priest Rapids FH would continue to operate for the USACE's John Day Dam mitigation program for fall Chinook salmon. Facilities that would have operations either considerably reduced or terminated would be the Carlton, Chelan Falls, and Dryden acclimation facilities. Traps at

Dryden and Tumwater dams in the Wenatchee River would continue to be operated because of the Wenatchee River steelhead program, and the Wells Dam fish ladder trap could still be used for broodstock for spring Chinook and coho salmon if needed. This alternative represents one end of the spectrum of potential effects for the purpose of analysis. This alternative does not meet NMFS' purpose and need and would not meet the applicants' mitigation needs.

2.5. Alternatives Considered but Rejected from Further Analysis

The following alternatives were considered but not analyzed, either because the alternatives would not meet the Federal purpose and need, or would not be analytically different from one of the four alternatives described above.

2.5.1. Increase Current Hatchery Production Levels

Under this alternative, NMFS would issue ESA section 10(a)(1)(A) direct take enhancement permit and 10(a)(1)(B) incidental take permits and make a section 4(d) determination that would allow for increased production levels as compared to the levels shown in Table 2-1. This alternative is not analyzed in detail because substantially higher production levels may have a higher level of adverse impacts outside of the hatchery facility (e.g., genetic and ecological impacts to natural populations or other fish species) and no increase in any programs have been proposed at this time. Thus, this alternative may result in adverse impacts and would not meet NMFS' need to conserve the productivity, abundance, diversity, and spatial structure of listed species of salmon and steelhead in the Upper Columbia River. In addition, the PUD's hatchery programs have goals to not affect non-target taxa of concern over a certain containment level, and additional hatchery releases may increase the chance of passing the target containment levels.

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, either would not provide additional insight compared to Alternative 3 and 4, and/or not meet NMFS's need to conserve and protect listed species; therefore, other reduced production alternatives will not be further analyzed in this document.

3. AFFECTED ENVIRONMENT

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

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

Internal scoping identified no other resources that would potentially be impacted by the Proposed Action or alternatives. Current conditions include the operation of hatchery programs nearly identical to those described in the HGMPs because the HGMPs were largely developed through refinement of on-going programs.[4] Production goals and other program details are included in Section 1. Each resource's Analysis Area includes the Project Area as a minimum area, but may include locations beyond the Project Area if discernible effects of the EA's alternatives on that resource would be expected to occur outside the immediate area of the proposed activities (Subsection 1.2, Project Area).

3.1. Water Quantity

Hatchery programs can take water from a well (groundwater) or a neighboring stream (surface water) to use in the hatchery facility. In particular, water withdrawal for adult holding tanks, egg incubation, juvenile fish rearing, and acclimation facilities can affect water quantity. All water use is non-consumptive because, with the exception of small amounts lost through leakage or evaporation, water that is diverted from a stream is discharged back into the stream it was diverted from after it circulates through the hatchery facility. Water removed from groundwater sources is released into the adjacent stream with the surface water. The water may be discharged directly, or through a treatment pond. Therefore, for this

[4] However, the production levels for most of the hatchery programs evaluated in this EA were reduced in the past few years following the processes laid out in the HCPs and SSSA.

resource, the Analysis Area for water quantity will be limited to the areas in close proximity to the hatchery facilities.

When hatchery programs use groundwater, they may reduce the amount of water for other users in the same aquifer. The Winthrop NFH, Methow, Wells, Eastbank, and Priest Rapids FHs use groundwater during various times in the rearing of fish; however, the exact numbers of wells in the Analysis Area is unknown because the aquifer has not been geographically defined. The water use associated with the facilities and programs evaluated in this EA are described in Table 3-1 below.

When hatchery programs use surface water, they may reduce the flow of the river, potentially leading to dewatering of the stream between the water intake and discharge structures in some cases. Dewatering may impact fish and wildlife if migration is impeded or if it leads to increased water temperatures. The potentially impacted segment of the river would be limited to the distance between the water intake and discharge structures. Alternatively, using well water and discharging it into surface waters may actually increase water volumes or alter temperatures (up or down) when mixed with surface waters below the point of discharge.

In general, surface water withdrawal for hatchery programs fluctuates seasonally, with the highest hatchery water withdrawal occurring in the spring months. During these spring months, the seasonal surface flow levels are highest. Prior to release, the hatchery has more fish on hand, and the fish under propagation are at their largest size, and their need for rearing flows for fish health maintenance is highest. Hatchery water withdrawal for fish rearing is lowest in the late summer months (when river flows are usually at their lowest level) because fewer fish are on station after release. In general, the hatchery programs evaluated in this EA primarily rely on groundwater for incubation and early rearing, drawing surface water generally from late fall through early spring for rearing. As such, most of the hatchery facilities do not use their full surface water right throughout the entire year. During the lowest streamflow periods throughout the year, each hatchery facility uses only a small fraction of their full surface water right (Table 3-1).

3.1.1. Methow River Basin Facilities

The Methow FH, WNFH, and the Carlton and Twisp acclimation facilities draw surface water from the Methow River (including withdrawals from Gate Creek, Cold Creek, and Spring Creek) and Twisp River. The Methow Hatchery and the WNFH draw water to the hatcheries using the Foghorn Diversion Canal, which is a diversion from the Methow River. As shown in Table 3-1 the maximum amount of surface water used by the facilities within the Methow River basin during minimal monthly flows are a very low percentage of the total flow.

3.1.2. Wells, Eastbank, and Priest Rapids Fish Hatcheries

The Wells FH is located immediately downstream of Wells Dam (Figure 1-1) and uses surface water from the Columbia River drawn from the forebay of Wells Dam. The 150 cubic-feet-per-second (cfs) of surface water that is used in the hatchery constitutes less than 1 percent of the total flow of the Columbia River during minimum mean monthly flows (Table 3-1). In addition, up to 38 cfs of groundwater is used for various operations.

The Eastbank Hatchery is immediately upstream of Rocky Reach Dam on the Columbia River (Figure 1-1). No surface water is withdrawn for this hatchery; instead 55 cfs of groundwater is used for adult holding, incubation, and early rearing (Table 3-1).

The 98 cfs of surface water for the Priest Rapids FH is obtained from the forebay of Priest Rapids Dam, approximately two miles upstream of the hatchery facility (Table 3-1). The amount of surface water used for the hatchery is less than 1 percent of the total flow of the Columbia River during minimum mean monthly flows (Table 3-1). In addition, 14 cfs of groundwater is available for use for incubation and early rearing.

3.1.3. Chelan Falls and Dryden Acclimation Facilities

The Chelan Acclimation Facility uses 24 cfs of surface water and returns it in the immediate vicinity of the intake (Table 3-1). The amount of water used in the rearing operation at Chelan Falls is nearly 2 percent of the average flow of the Chelan River during mean monthly flows (Table 3-1). The 32 cfs of water for the Dryden Acclimation Facility is withdrawn from the irrigation canal that begins at Dryden Dam on the Wenatchee River, approximately two-thirds of a mile upstream from the facility site. Water is returned immediately below the facility into the Wenatchee River, and this facility is not used during minimal mean monthly flows (Table 3-1).

Table 3-1. Water use associated with the hatchery programs facilities being evaluated in this EA (FH = fish hatchery; AF= acclimation facility).

Hatchery Facility	**Total Facility Water Use (cfs)**	**Maximum Ground-water Use (cfs)**	**Maximum Surface Water Use (cfs)**	**Surface Water Source/Discharge Location**	**Minimum Mean Monthly Surface Water Flows during Facility Operation cfs (month)**	**Surface Water Use (cfs) by Hatchery Facility During Minimum Mean Monthly Surface Flows (previous column)**	**Surface Water use (%) by Hatchery Facility During Minimum Mean Monthly Surface Flows**	**Maximum Length of Stream Affected by Hatchery Water Withdrawal (feet)**
WNFH	66.7	16.7	50	Methow River and Spring Creek/Methow River	195 (Sept)	< 50	< 25.6	12,725[1]
Methow FH	35	10	25	Methow River/Methow River	291 (Jan)	< 25	< 8.5	5,190[2]
Twisp AF	6	0	6	Twisp River	128 (Mar)	0	0	625
Carlton AF	15	0	15	Methow River	316 (Sept)	0	0	200
Wells FH	188	38	150	Columbia River	64,400 (Sept)	< 150	< 0.23	650
Chelan Falls AF	24	0	24	Chelan River	1,440 (Apr)	24	1.7	0
Eastbank FH	55	55	0	Columbia River	66,100 (Sept)	NA	NA	0
Dryden AF	32	0	32	Wenatchee River	1,730 (Feb)	0	0	3,274
Priest Rapids FH	112.4	14	98.4	Columbia River	77,900 (Sept)	98.4	0.13	10,560

Source: For mean monthly minimum flows, USGS web site (https://waterdata.usgs.gov/wa/nwis/rt); gauges 12448998; 12448500; 12450700; 12452500; 12459000; 12472800 for years 1950-2017. For Eastbank Hatchery, see DART River Environment Graphics and Text, http://www.cbr.washington.edu/dart/query/river_graph_text for years 2005-2014 for Columbia River flow at Rocky Reach Dam.

[1] The diversion distance for the WNFH is from the Foghorn Diversion Dam to the WNFH return point to the Methow River because that distance is the reach over which the water is diverted for the purpose of use at the WNFH.

[2] The diversion distance for the Methow Hatchery is from the Foghorn Diversion Dam to the Methow Hatchery return point to the Methow River because that distance is the reach over which the water is diverted for the purpose of use at the Methow Hatchery.

3.2. Water quality

Hatchery operations are required to comply with the Clean Water Act, including obtaining National Pollutant Discharge Elimination System (NPDES) permits for discharge from hatchery facilities. The U.S. Environmental Protection Agency (EPA) retains the authority to issue NPDES permits that allows discharge from Federal facilities. The WNFH obtained its NPDES authorization from the EPA through General Permit Number WAG-130000, administratively extended until March 31, 2021 as well. Beyond 2021, we anticipate that the effluent will continue to discharge in a similar manner, per requirements of the ESA permitting. The Washington Department of Ecology (WDOE), with its authority delegated by the EPA, issued a General Permit that allows the operation of Methow Hatchery and its related facilities (WAG-135000).

Because hatchery production concentrate large numbers of fish within hatcheries, they could produce effluent with elevated levels of ammonia, organic nitrogen, total phosphorus, biochemical oxygen demand (BOD), pH, and solids levels. In addition, the use of water in unshaded ponds and mixing with well water has the potential to change water temperatures. The general effects of these water quality parameters in effluent are discussed further in the Mitchell Act FEIS Subsection 3.6.3.1. The affected environment from the discharge of effluent from the hatchery facilities occurs from the point of discharge downstream until thorough mixing occurs in the adjacent stream or river.

The direct discharge of hatchery facility effluent is regulated by the EPA or WDOE under the Clean Water Act through NPDES permits to minimize effects on water quality. These agencies are responsible for issuing and enforcing NPDES permits that ensure water quality standards for surface waters that remain consistent with public health and enjoyment, and the propagation and protection of fish, shellfish, and wildlife (33 U.S.C. §1251(a)(2)). The Wells, Eastbank, and Priest Rapids hatcheries obtained NPDES authorization from WDOE through General Permit Number WAG-135000 and the Methow FH through WAG-135009. Acclimation facilities do not need NPDES permits because rearing levels in the acclimation facilities are below permit minimums (i.e., produce less than 20,000 pounds of fish per year and use less than 5,000 pounds of feed per month). The WNFH obtained its NPDES authorization from the EPA through General Permit Number WAG-130000, administratively extended until March 31, 2021 as well.

Even though the discharges are within the criteria of the hatchery facilities NPDES permit administered by the WDOE, the effluent may affect water quality, and disease and pathogen load below the hatchery facility. Chemicals discharged from hatcheries do not remain present in the same concentrations for any significant length of time; they are broken down, diluted, and/or carried downstream (EPA 2015). Each of the hatchery facilities (with exception to the acclimation facilities where abatement ponds are not needed) are required by their NPDES permit to circulate the effluent through an abatement pond to settle out uneaten food, fish waste, and any other substances not in solution. After this, the effluent is then discharged into the adjacent stream or river to help reduce the effects on the adjacent stream or river near the hatchery facility. Because the effects of discharge are only discernible before the discharge is diluted by the receiving waters, the Analysis Area for water quality will be limited to the areas surrounding the hatcheries and the acclimation sites.

As part of administering elements of the Clean Water Act, WDOE is required to assess water quality in all rivers, lakes, and marine waters within the state. These assessments are published in what are referred to as the 305(b) report and the 303(d) list (the numbers referring to the relevant sections of the original Clean Water Act text). The 305(b) report reviews the quality of all waters of the state. The 303(d) list identifies specific water bodies considered impaired, based on the number of exceedances of water quality criteria in a water body segment. The Methow, Columbia, and Wenatchee rivers are considered impaired for the temperature parameter. The Methow River is also considered impaired for 2,3,7,8-TCDD (Dioxin), and the parts of the Wenatchee and Columbia rivers are also considered impaired for 4,4’-DDE and Polychlorinated Biphenyls (PCBs). The section of the Columbia River upstream of Rocky Reach Dam, where Eastbank FH operates is also considered impaired for pH, while the Wenatchee River is considered impaired for Endosulfan too. These rivers and specific sections are all on the 303(d) list and the cause of impairments are unknown (Table 3-2).

Table 3-2. Water quality compliance and 303(d) listed water bodies NA = not applicable).

Facility	Compliant with NPDES permit	Discharges Effluent into a 303(d) Listed Water Body	Impaired Parameters	Impairment Cause
WNFH	Yes	Yes, Methow River	Temperature, pH, 2,3,7,8-TCDD (Dioxin)	Unknown
Methow FH	Yes	Yes, Methow River	Temperature, pH, 2,3,7,8-TCDD (Dioxin)	Unknown
Twisp AF	NA	No, Twisp River	NA	NA
Carlton AF	NA	Yes, Methow River	Temperature	Unknown
Wells FH	Yes	Yes, Columbia River	Temperature	Unknown
Chelan Falls AF	NA	No, Chelan River	NA	NA
Eastbank FH	Yes	Yes, Columbia River	Temperature, 4,4'-DDE, Polychlorinated Biphenyls (PCBs), pH	Unknown
Dryden AF	NA	Yes, Wenatchee River	Temperature, 4,4'-DDE, Polychlorinated Biphenyls (PCBs), Endosulfan	Unknown
Priest Rapids FH	Yes	Yes, Columbia River	Temperature	Unknown

Source: WDOE web site: Washington Department of Ecology Water Quality Atlas, https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx (accessed December 15, 2017), and submitted HGMPs.

Regular monitoring of effluent occurs for total suspended solids, settleable solids, chlorine, and temperature level of the effluent. Monitoring of chemical effluent concentrations applied in the hatcheries for fish pathogen control is not required as part of the NPDES discharge permit; chemical concentrations are assumed to be diluted to the levels indicated on the treatment label for the safe treatment of fish before being discharged. All of the hatchery facilities being evaluated in this EA have remained in compliance with the NPDES requirements. All hatchery effluent is passed through pollution abatement ponds (except the acclimation facilities) to settle out uneaten food and fish waste before being discharged into receiving waters.

3.3. Salmon and steelhead

ESA-listed Populations

In the Upper Columbia River, the Spring Chinook Salmon ESU (64 FR 14308, reaffirmed in 2005 (70 FR 37160) and in 2014 (79 FR 20802)) is listed as endangered. The UCR Steelhead DPS was originally listed as endangered (62 FR 43937), but in 2009, was downlisted to threatened (74 FR 42605, and reaffirmed in 2014 (79 FR 20802)). The listings for both species include natural- and hatchery-origin fish. The designated critical habitat for both species includes portions of the Methow Basin, Wenatchee Basin, and the Columbia River (70 FR 52630).

Other populations

The non-ESA-listed salmon and steelhead populations in the Analysis Area are Okanogan, Methow, Entiat, and Wenatchee summer/fall Chinook salmon, Okanogan and Wenatchee sockeye salmon, and coho salmon that are being reintroduced into the Methow and Wenatchee basins through the Mid-Columbia Coho Restoration program (NMFS 2014a).

Critical Habitat and Essential Fish Habitat

Critical habitat has been designated in the Upper Columbia River basin for the Upper Columbia River Spring Chinook Salmon ESU and Upper Columbia River Steelhead DPS. Within designated critical habitat, NMFS identifies physical and biological features, such as freshwater spawning and rearing sites, as well as freshwater estuarine migration corridors. NMFS has determined that the current hatchery programs do not jeopardize listed species, nor result in destruction or adverse modification of their designated critical habitat (NMFS 2013; NMFS 2016; NMFS 2017b; NMFS 2017d). The biological opinions provide greater 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.

The biological opinions also provide an analysis of hatchery program effects on essential fish habitat (EFH), defined under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802). 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 2016). EFH is designated for both Chinook and coho salmon throughout the Analysis Area.

Analysis Area

Fish from the current ongoing hatchery programs are released into the Chelan, Methow, and Wenatchee River subbasins and the mainstem Columbia River from Wells Dam to downstream of Priest Rapids Dam. Adults returning from hatchery releases come back to all of the areas of release, and to the area downstream of Priest Rapids FH, and thus in addition to encompassing the Project Area (Section 1.2), the Analysis Area includes the release and facility sites downstream to the confluence of the Snake River.

Ongoing Effects of Hatchery Programs

Hatchery fish that are released from the seven hatchery programs being evaluated in this EA currently interact with other salmon and steelhead within the Analysis Area once they are released, either as juveniles on their migration to the ocean, or adults as they return to spawn (Table 3-3).[5] 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 seven hatchery programs being evaluated in this EA, as they currently operate.

[5] The hatchery fish from the seven hatchery programs can have an effect on fish in the ocean. However, the effects are not likely to be discernible.

Table 3-3. Effects of hatchery programs on natural-origin salmon and steelhead.

Effect	Description of Effect
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 with natural-origin fish. • Hatchery-origin fish can prey on natural-origin fish.
Prey Enhancement	• Hatchery-origin fish can increase the number of of prey for natural-origin fish.
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: Retain or homogenize within-population genetic diversity of a natural-origin fish population • Productivity: Maintain 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.
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 o Alteration of stream flow 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

3.3.1. Genetics

Hatchery-origin fish affect natural population productivity and diversity when they interbreed with natural-origin fish. There are three major areas of genetic effects of hatchery programs that are ongoing: within-population diversity, outbreeding effects, and hatchery-influenced selection. The following discusses these potential effects that could be occurring with the current hatchery programs.

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 genetic diversity reasonably well, the population size should at least be in the hundreds.

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 1984; Quinn 1993; Quinn 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 "local" adaptation (i.e., outbreeding depression) (Edmands 2007; McClelland and Naish 2007). In general, the greater the geographic separation between the source or origin of hatchery fish and the recipient natural population, the greater the genetic difference between the two populations (ICTRT 2007), and the greater 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. These differences 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). The proportion of hatchery-origin fish on the spawning grounds (pHOS) and the proportion of natural-origin fish used in the broodstock (pNOB) are used to calculate PNI. A PNI exceeding 0.5 indicates that natural selection outweighs hatchery-influenced selection. In other words, the natural environment is influencing the total population (hatchery- and natural-origin fish) genetic diversity more than the hatchery environment.

The recent estimate of the steelhead pHOS in the Methow River basin is near 80 percent (Figure 3-1), suggesting that hatchery steelhead are interbreeding with natural-origin fish. Co-managers have committed to, and are now implementing management actions that will (already are) reduce pHOS in the Methow River basin (Figure 3-1), and the reduction of pHOS should have a positive effect in general on genetic interactions between hatchery- and natural-origin steelhead. In addition, co-managers have transitioned to use of local broodstock that will increase the probability of maintaining the genetic diversity of the population compared to the use of non-local broodstock.

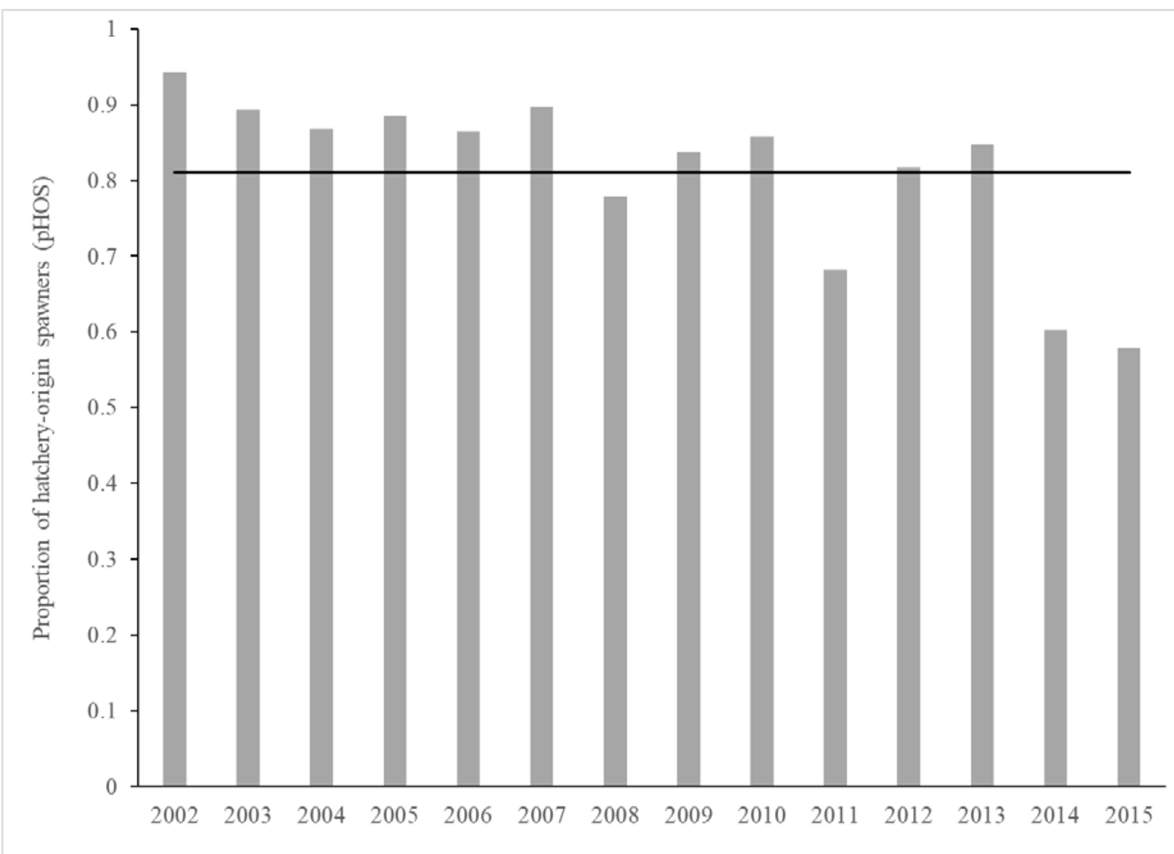

Figure 3-1. The proportion of hatchery-origin steelhead spawning (pHOS) in the Methow River basin from 2002-2015, average is 0.80 (source: Snow et al. (2017)).

Summer/fall and fall Chinook salmon are not likely to interbreed with ESA-listed spring Chinook salmon when they return because they are generally separated by spawning time (Table 3-4) and location (spring Chinook salmon generally spawn in higher order tributaries than summer/fall Chinook salmon). Hatchery summer/fall and fall Chinook salmon are likely to interbreed with naturally produced summer/fall and fall Chinook salmon, however the genetic risk is considered to be low because the demographic risk and pHOS are low for these populations. Salmon and steelhead do not interbreed, so there is no genetic risk between summer/fall and fall Chinook salmon and Upper Columbia River steelhead.

Table 3-4. Adult Chinook salmon and steelhead return and spawning timing for Upper Columbia River fish.

Species	Freshwater Entry	Spawn Timing
Chinook salmon (summer/fall)	June to August	October
Chinook salmon (fall)	August to October	Mid-to-late-October to November
Chinook salmon (spring)	May to June	mid-August to mid-September
Steelhead trout (summer)	July to mid-June	March to mid-July

Source: (WDFW 2002)

3.3.2. 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 and steelhead 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.

Most of the summer/fall and fall Chinook salmon and steelhead that are currently released from the hatcheries that are being evaluated in this EA have been (and continue to be) externally marked to allow for the differentiation of the programs’ fish from natural-origin fish as juveniles, in fisheries, and upon adult return. Mass marking also currently allows for monitoring of hatchery fish stray rates to natural spawning areas, program performance in meeting juvenile to adult fish survival goals, and, where applicable, natural spawning population supplementation objectives. Currently, some of the fall Chinook salmon released from the Priest Rapids FH and steelhead released into the Twisp River are not externally marked prior to release (Hillman et al. 2017; Richards and Pearsons 2015; Snow et al. 2017) since these fish are meant to supplement naturally produced fish on the spawning grounds. However, the proportion of these non-externally marked hatchery fish is low, and some fish that are not externally marked may have internal tags (e.g., CWT) that can be detected by trained technicians and biologist when sampling, thus have had little masking effect when managers estimate natural population abundance and productivity.

3.3.3. Competition and Predation from Hatchery-origin Juveniles

Under current operations, ecological interactions between natural- and hatchery-origin fish may occur during both the adult and juvenile life-history stages. Hatchery fish currently released from the ongoing hatchery programs into habitats where natural-origin salmon and steelhead juveniles rear may compete with or prey on natural-origin fish. Returning adults from the ongoing hatchery programs may also compete with natural-origin salmon and steelhead for spawning and holding sites.

Currently, during the time of hatchery releases for steelhead and yearling summer/fall Chinook salmon (mid-March to mid-May), all species would be present in the Analysis Area and potentially susceptible to competition (Table 3-5). The majority of juvenile hatchery steelhead and yearling summer/fall Chinook salmon released from ongoing hatchery programs migrate out of the tributaries (where natural-origin fish would be rearing) typically within a week of release (HETT 2014; Tatara et al. 2016; USFWS 2012a), which most likely limits the temporal overlap with natural-origin fish in the tributaries. Despite current efforts to release fish that migrate readily out of tributaries, some natural-origin salmon and steelhead juveniles are currently lost to competition and predation from the release of hatchery-origin juveniles, particularly when there is overlap in time and space (Table 3-5). All releases could overlap with natural-origin Chinook, sockeye salmon (in the mainstem Columbia River) and steelhead in the Upper Columbia River Basin.

Table 3-5. Estimated size and freshwater occurrence/release for natural- and hatchery-origin juvenile salmonids.

Species (Origin)	Life Stage	Estimated Size (mm fl)	Occurrence/Release Timing
Chinook salmon (natural)	Fry	< 45	January-April
	Parr	45-110	April-February
	Yearling	87-127	April-June
Chinook salmon (hatchery)	Yearling	120-145	mid April-mid May
	Parr (subyearling)	95-120	early May-end of June
Steelhead (natural)	Fry	< 40	May-October

Species (Origin)	Life Stage	Estimated Size (mm fl)	Occurrence/Release Timing
	Parr	50-150	October-mid May
	Smolt	136-188	February-June
Steelhead (hatchery)	Smolt	100->170	mid April-mid May
Sockeye salmon (natural)	Fry	20-45	January-June
	Yearling	120-270	March-May

Sources: (Chapman et al. 1994a; Chapman et al. 1994b; Murdoch et al. 2012; NMFS 2014; Piper et al. 1986; Richards and Pearsons 2015)

Residualization of hatchery steelhead (i.e., when fish do not migrate to the ocean in the year of their release) is another way in which hatchery-origin steelhead can compete with or prey upon naturally produced rearing fish in the Analysis Area. This potential competition and predation occurs because of overlap in time and space of residualized steelhead and other fish. While naturally produced steelhead also exhibit a residual life history strategy, releasing an excessive number of residual hatchery steelhead may have ecological, demographic, and genetic effects not intended by managers (ISRP and ISAB 2005). Recently, operators at WNFH have modified their steelhead release strategies by allowing fish to voluntarily depart from the rearing ponds and transporting remaining fish to hydrologically-closed lakes. As a result, remaining fish (i.e., residuals) are removed from the river system, and the residual rate of these programs are likely to be less than 10 percent (Larsen et al. 2017; Snow et al. 2013).

In regards to Chinook salmon, there has not been as much research about residualism, although in many current Chinook hatchery programs, a large portion of the males that are released are precocious and do not migrate (Larsen et al. 2004; Larsen et al. 2010). Hatchery-origin summer/fall Chinook that are released as yearlings in ongoing programs can compete with and possibly prey upon other salmonid species based on their size at release in the Methow and Wenatchee rivers (Table 3-5). In the evaluation of these ongoing hatchery programs in NMFS (2017b) and in NMFS (2017d), a model was used to assess the potential effects of competition and predation from the hatchery releases on natural-origin salmonids. The model results suggest that there are currently losses of natural-origin Chinook salmon, steelhead, and sockeye from competition and predation from released hatchery-origin juvenile summer/fall Chinook salmon.

Currently, subyearling Chinook salmon are released as part of the Wells summer/fall Chinook salmon program and the Priest Rapids fall Chinook salmon hatchery programs. The likely timing of the downstream migration of subyearling Chinook salmon currently released from the hatcheries being evaluated in this EA most likely overlaps with listed (Snake River Fall Chinook Salmon) and non-ESA listed subyearling Chinook salmon downstream of the Action Area in the lower Columbia River.

The same situations that currently lead to competition between hatchery-origin and natural-origin juveniles can cause predation risk. Direct predation occurs when hatchery-origin fish eat natural-origin fish; indirect predation occurs when predation from other sources increases as a result of the added abundance of juvenile salmon and steelhead from hatchery releases.

Currently, in direct predation, hatchery smolts prey on natural-origin fry and fingerlings they encounter during downstream migration. Hatchery-origin smolts, sub-adults, and adults may also prey on natural-origin fish of susceptible sizes and life stages (smolt through sub-adult). Because most natural-origin summer/fall and fall Chinook salmon currently migrate to the ocean as subyearlings, they are much smaller than and more vulnerable to predation by all hatchery-origin fish when they mix in the tributaries and mainstem Columbia River (Table 3-5). This ongoing vulnerability to predation by hatchery-origin fish in the mainstem Columbia is lower for the other species (coho salmon, steelhead, and yearling Chinook salmon) because juveniles rear longer in freshwater and pass through the mainstem Columbia River in route to the ocean as older and larger fish (Table 3-5). Natural-origin fish may also benefit from the presence of additional hatchery fish as available prey ("shielding" them from predation).

Currently, hatchery steelhead are relatively large sized when released within the Upper Columbia River region (Table 3-5), and thus have a high potential to prey upon a variety of other fish species. The current degree of predation is related to how much temporal and spatial overlap there is between hatchery steelhead smolts and potential prey, and the size relationship between hatchery steelhead smolts and potential prey. Because naturally produced steelhead usually emerge after the primary smolt migration period in the spring/early summer, it is unlikely that hatchery steelhead smolts currently prey on natural-origin steelhead fry. However, once hatchery-origin steelhead smolts begin their migration through the lower portions of the tributaries where they are released, and in particular, the mainstem Columbia River, there is potential that they currently encounter newly emerged summer/fall and fall Chinook salmon fry, though the likelihood is low because the two species are not likely to overlap within the area of the river (i.e., most of the newly hatched Chinook salmon fry remain close to shore after emergence (in Chapman et al. (1994b)); smolts migrate through areas with a strong current in the river generally towards the middle of the river (Johnsen and Sims 1973). Hatchery-origin steelhead that currently residualize and grow to be above 9.8 inches (250 mm) are more likely to prey upon natural-origin steelhead (Pearsons et al. 1994).

Current releases of large numbers of hatchery-origin fish affect wild juvenile salmonids by attracting other predators, such as birds and non-salmonid fish predators (Steward and Bjornn 1990). On the other hand, ongoing releases of hatchery fish may protect natural-origin fish by providing prey to predators that may have otherwise have eaten natural-origin fish. This potential increase in predation on wild fish is most likely to occur on the mainstem Columbia River, in the tailraces, at the heads of reservoirs, faces of dams, turbine spillways, or bypass discharge areas.

3.3.4. Competition from Hatchery-Origin Adults

Currently, spawning and holding site competition and redd superimposition are possible ecological effects between adult hatchery-origin summer/fall and fall Chinook salmonwith either their natural-origin counterparts or other species. Holding and spawning site competition could occur between hatchery- and natural-origin summer/fall and fall Chinook salmon because hatchery fish spawn at the same time and places that natural-origin fish do (Hillman et al. 2017; Snow et al. 2017). However, because the number of hatchery-origin summer/fall and fall Chinook salmon is comparatively low compared to their natural-origin counterparts, and the demographic risks to the natural spawning aggregations and populations is low, NMFS believes these interactions would have a very low impact.

For returning hatchery-origin summer/fall Chinook salmon from the ongoing hatchery programs that spawn in the major tributaries in the Upper Columbia River, potential effects of spawning site competition and redd superimposition could occur in September when spawning timing of both spring and summer/fall Chinook salmon may overlap. However, neither of these potential interactions is likely because summer/fall Chinook salmon and spring Chinook salmon currently spawn in different areas within the tributaries (Hillman et al. 2017; Snow et al. 2017). Similarly, redd superimposition is not likely currently occurring between hatchery-origin summer/fall Chinook and spring Chinook salmon in the Wenatchee and Methow rivers, based on observations in other basins, such as the Entiat River [6] (USFWS 2017a).

[6] In the Entiat River, the USFWS has recorded redd superimposition of spring Chinook salmon redds by summer/fall Chinook salmon. USFWS. 2017a. Chinook Salmon Spawning Ground Surveys on the Entiat River, 2016. March 2017. USFWS, Leavenworth, Washington. 51p. found that spring Chinook salmon redd superimposition by summer/fall Chinook salmon averaged 17.8%, ranging from 14% to 27% between 2013 and 2016. The spawning habitat in the Entiat River is more limiting for both spring Chinook salmon and summer/fall Chinook salmon compared to the Wenatchee and Methow River basins. We assume that spring and summer/fall Chinook salmon are less likely to overlap in spawning areas in the Wenatchee and Methow Rivers compared to the Entiat River, and it is less likely that superimposition occurs in the Wenatchee and Methow River basins compared to the Entiat River basin.

For hatchery-origin fall Chinook salmon redd superimposition of spring Chinook salmon or other species (e.g., steelhead) is not currently likely because they spawn in different areas of river systems at different times (Hillman et al. 2017; Snow et al. 2017).

Competition for space and redd superimposition between steelhead and other species (spring, or summer/fall Chinook salmon) is not occurring because their spawning times are different than other species of concern (Hillman et al. 2017; Snow et al. 2017). However, the percentage of hatchery-origin steelhead that spawn in the Methow River is currently relatively high (Figure 3-1), while it is approximately about 50% in the Wenatchee River basin (Hillman et al. 2017). Because of the high levels of hatchery spawners in the Methow (and to a lesser degree in the Wenatchee), it is likely that competition for holding and spawning areas between hatchery- and natural-origin steelhead is occurring. However, management of the steelhead programs is designed to reduce hatchery-origin steelhead on the spawning grounds, so the competition for space and redd superimposition on natural-origin steelhead are likely to be reduced in the next several years.

3.3.5. Disease

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 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.

Some major diseases currently identified in salmonids from the Upper Columbia River are Bacterial Kidney Disease (BKD) and Infectious Hematopoietic Necrosis (IHN), which are both caused by pathogens (bacterium *Renibacterium salmoninarum* and IHN virus, respectively). All salmon and steelhead discussed above are susceptible to these pathogens. No detections of exotic pathogens have occurred in recent years at the hatcheries being evaluated in this EA. Diseases that have occurred are caused by endemic pathogens and available treatments have been able to keep these outbreaks in check. Disease outbreaks have not occured often, but in 2014 and 2015, the Winthrop NFH had outbreaks in steelhead of cold water disease (*Flavobacterium psychrophilum*) and Ich (*Ichthyophthirius multifiliis*), respectively. For summer/fall and fall Chinook salmon, the fish released from the Carlton AF have had bacterial gill disease (*Icthyobodo spp)* in 2014, 2015, and 2016, while fish released from other facilities have been shown to get cold water disease and columnaris (*Flavobacterium columnare*) occasionally.

3.3.6. Population Viability

Salmon and steelhead population viability is determined through a combination of four parameters, which include 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 Upper Columbia River Spring Chinook Salmon ESU and the Upper Columbia River Steelhead DPS. Appendix A presents a detailed summary of current population viability trends for the spring Chinook salmon ESU and the steelhead DPS, including estimates of abundance, productivity, spatial structure, and genetic diversity. Because UCR summer/fall and fall Chinook salmon, coho salmon, and sockeye salmon populations are not listed under ESA, NMFS has not developed specific population viability criteria for these populations.

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 37204, 37215, June 28, 2005).

3.3.7. Nutrient Cycling

Salmon are important transporters of marine-derived nutrients into the freshwater and terrestrial systems through the decomposition of carcasses of adults returning from the ocean (Cederholm et al. 2000). Naturally spawning hatchery-origin fish from the ongoing hatchery programs contributes to increased nutrient cycling in the natural environment.

Phosphorous is one example of a marine-derived nutrient that is currently 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 currently benefits salmonids because phosphorus is typically a limiting nutrient for the growth of prey sources (e.g., *Daphnia* spp., a prey item for juvenile salmonids).

Currently, the decreased abundance of natural-origin salmon and steelhead likely translates into a reduction of nutrient availability from the marine environment into freshwater and terrestrial ecosystems. Because natural-origin fish abundance is so low (relative to historical populations in the Upper Columbia

River region), hatchery-origin fish increases nutrient availability in areas where they return and are not removed from the system. Thus, the current summer/fall and fall Chinook salmon hatchery programs can make a contribution of marine-derived nutrients to the freshwater ecosystem where they spawn naturally (and subsequently die and decompose). Unlike Chinook salmon, steelhead are iteroparous and may not die after spawning naturally.

3.3.8. Facility Operations

Because water quantity and water quality are assessed as separate resources in Subsections 3.1 and 3.2, the discussion of the current and ongoing effects of facility operations on salmon and steelhead in this section is restricted to the operation of weirs and traps for juveniles and adults and water intake structures. The facilities that are used in the ongoing hatchery programs that may affect salmon and steelhead species in the Methow River basin are the Twisp weir, volunteer trap at Methow Hatchery, WNFH ladder, the Twisp and Methow screw traps, and the intake structures at rearing and hatching facilities, including the summer Chinook salmon acclimation facility near Carlton. On the mainstem Columbia River, facilities that may affect salmon and steelhead include the Chief Joseph Hatchery trap, Wells Dam ladder trap, Wells Hatchery volunteer trap, Chelan Falls adult trap and intake for the ponds, Priest Rapids Hatchery intake and adult trap, and adult trap at Priest Rapids Dam. In the Wenatchee River basin, the Dryden Dam adult trap and the intake for the Dryden Acclimation facility may affect salmon and steelhead.

The operation of the weirs currently affects salmon and steelhead that pass the weir. Generally, a weir may cause a migratory delay or mortality if the fish is stranded at the weir. However, the effects of migratory delay by weirs are currently minimized by only operating the weir specific times of the day and only periodically throughout the year. In addition, a hatchery staff member is present who can remove non-target fish (i.e., non-summer/fall or fall Chinook salmon and steelhead) from the traps during the target species migration time, and by lowering the weir panels and opening the trap gates when not actively trapping broodstock. The effects of stranding have been currently minimized at all facilities through adaptive management and modifications to structures.

The volunteer traps at the various facilities described above may also currently cause migratory delay for salmon and steelhead. The intent of the volunteer trap and the ladders is to collect broodstock; the trap and the ladders attract fish that are homing. Because the trap and the ladders allow access by any fish, non-target fish species may enter the trap pool. Hatchery staff periodically removes non-target fish from the pools at the various facilities, though handling fish may cause stress or injury to the fish; the trap at Wells Dam allows for non-target fish to continue up the ladder without handling.

Screw traps are currently operated to collect smolts for research, monitoring, and evaluation (RM&E) purposes. Smolt trapping currently typically occurs between late-February and early-December, varying depending on river flow and site logistics. Smolt traps are usually not very efficient in catching a large percentage of the fish that are migrating downstream, but serve as a good index source. Traps are currently checked daily, so non-target (and target) fish can be removed on a daily basis, though handling of fish may cause stress or injury. The fish that are trapped are likely to experience migratory delay (although not believed to be biologically significant), and target species can also experience stress when they are tagged. Traps currently capture natural- and hatchery-origin Chinook salmon, steelhead, coho salmon, and other species.

Each facility from the ongoing hatchery programs with intakes, pumps, or screens has the potential to impact salmon and steelhead species through water intake and withdrawal by drawing in and injuring (or killing) fish. All current intake facilities, with the exception of Priest Rapids FH, were designed to meet the NMFS screening criteria that were current at the time of construction (NMFS 1995). 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 fish. Currently, facilities are routinely observed for any signs that screens are not effectively excluding fish from intakes.

Operators currently monitor the incidence of, and minimize capture, holding, and handling effects on, listed salmon, steelhead, and bull trout. Currently, all incidentally captured listed fish are handled via water-to-water transfer, if possible, and immediately released upstream of the trap. If water temperature at adult traps during trapping or during implementation of live capture methods exceeds 21°C, trap operation and live capture cease pending further consultation with NMFS to determine if continued trap operation and live capture would pose substantial risk to ESA-listed species or until temperatures fell below 21°C.[7]

3.3.9. Research, Monitoring, and Evaluation (RM&E)

The HCP and Settlement Agreement hatchery committees have developed rigorous monitoring and evaluation plans (M&E Plan) that are currently being implemented for the hatchery programs being evaluated in this EA (Hillman et al. 2013; Pearsons et al. 2009; Snow et al. 2014). The M&E programs

[7] One exception is at the Chelan Falls trap, where trapping will not cease when water temperature is greater than 21 °C, but will if any ESA-listed species are encountered. This exception is unlikely to be a great risk to ESA-listed species, as they have not historically been encountered during the trap operation.

currently monitor survival and growth within the hatchery and the effects of hatchery fish on population productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information is collected from (the following is not necessarily all that occurs through the M&E programs):

- Spawning ground surveys to assess distribution and origin (hatchery or natural) of spawners through marking (i.e., coded-wire tags and adipose fin-clips).
- Stock composition sampling to determine population age, sex, and size distribution.
- Juvenile sampling in the hatchery to determine survival between life stages, smoltification status, size distribution, and precocial maturation.
- Smolt trapping using rotary screw traps to determine emigration timing, and size of juveniles.
- PIT tagging to track downstream migration of juveniles, provide information on residualism rates of hatchery fish, population abundance, overwinter survival, and emigration survival of natural-origin fish. Adult steelhead that are PIT tagged (either as juveniles or adults) are also tracked to estimate escapement.

NMFS determined that the effects of ongoing program RM&E on natural-origin salmon (NMFS 2013; NMFS 2017b) and steelhead (NMFS 2017d) populations are minimal and that it is unlikely that these activities 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 resulting from tagging, such as injury to salmon and steelhead, are also considered minimal.

Ongoing collection of adults at traps delays individuals in their upstream migration. 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; NMFS 2008). 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).

Surveying for redds and adults to estimate spawner abundance, distribution, and spawn timing currently occurs in the Twisp, Methow, and Wenatchee river basins for steelhead and in the mainstem Chelan, Methow, and Wenatchee rivers for summer/fall Chinook salmon. Ground and aerial surveys are currently conducted for fall Chinook salmon in the mainstem Columbia River. These ongoing spawning ground surveys are likely to temporarily harass salmon and steelhead in surveyed reaches within the Analysis Area. At times, the research involves observing adult fish, which are more sensitive to disturbance than juveniles. However, these avoidance behaviors are expected to be in the range of normal predator and disturbance behaviors, and ongoing effects from these activities are negligible.

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).

3.4. Other fish species

This section discusses the hatchery program effects that are currently occurring on other fish species (not salmon and steelhead) within the Analysis Area that have a relationship with hatchery fish either as prey, predators, or competitors (Table 3-6). Currently, impacts on other fish species occur (1) through competition for space or food used by hatchery fish, and other fish in the Analysis Area, or (2) if hatchery fish are prey for other fish species or vice-versa. In the Analysis Area, all resident fish species may compete with, be predators of, and/or serve as prey for hatchery fish depending upon the life stage and time of year (Table 3-6).

The largest interaction between the salmon and steelhead released from the on-going hatchery programs being evaluated in this EA is in the mainstem Columbia River on their migration to the ocean. Most of the predators (both native, e.g., Northern Pikeminnow, and non-native, e.g., walleye) listed in Table 3-6 currently consume juvenile salmonids. Other species, like red-sided shiners, compete with salmonids while rearing, but most hatchery juveniles are released when they are believed to be ready to migrate quickly to the ocean and therefore minimize competition with other fish species.

Subyearling Chinook salmon releases from the current Wells and Priest Rapids hatchery programs feed in the natural environment after release and some do not migrate downstream as quickly as yearling Chinook salmon. This impacts other fish species, such as dace, suckers, or red-sided shiners. While the addition of hatchery juveniles may increase prey availability of predator species, non-native predators, like walleye, smallmouth bass, and channel catfish, currently impact salmonids more than rearing hatchery-origin salmonids affecting other species through competition.

The on-going disease and nutrient effects on salmonid species (e.g., bull trout) discussed in this subsection are likely to be similar to the effects discussed in the subsections 3.3.5 and 3.3.7; Disease and Nutrient Cycling, respectively. More details about the disease effects on bull trout is discussed in FERC and USFWS (2012) and in USFWS (2016). Other diseases that are endemic to many fish species (e.g., freshwater "ich," *Ichthyophthirius multifiliis*) are also amplified in a hatchery to affect non-salmonid species.

In the Analysis Area, all of the hatchery facilities currently intercept and/or attract fish species during operation. The inlet (with the exception of Priest Rapids FH) and outlet water discharge for the hatchery facilities are currently screened to prevent fish from entering the facilities. During collection of returning hatchery salmon and steelhead, any other fish species that are incidentally collected are returned immediately back to the river unharmed. For other ongoing broodstock collection and smolt release locations, the standard protocol is to release all other fish unharmed. Rainbow and cutthroat trout, pikeminnow, dace, sculpin, and sucker are the most common fish species captured incidentally to the rotary screw trap operation and released. The hatchery collection facilities are designed specifically to capture and collect adult salmon and steelhead. Most of the non-salmonid species commonly occurring in the Analysis Area are smaller-sized fish and thus freely pass through the facilities unimpeded and back to the stream and are not captured. Non-target species typically have been less than five percent of the total catch (Hillman et al. 2017; Snow et al. 2017).).

Table 3-6. Other fish species that may interact with salmon in Analysis Area.

Species	Range	Federal/State Listing Status	Relationship		
			Prey	**Competitor**	**Predator**
Bull trout	Throughout the Columbia River Basin	Federal threatened species (64 FR 58909, November 1, 1999)	√	√	√

Species	Range	Federal/State Listing Status	Relationship		
			Prey	**Competitor**	**Predator**
Lake chub	Lakes and tributaries of Okanogan County	Washington State species of concern	√	√	√
Common carp	Throughout Washington State	Non-native species		√	√
Tench	Various sections of the mainstem Columbia River	None	√	√	
White sturgeon	Mainstem Columbia River	None			√
Pacific lamprey	All accessible reaches in the Columbia River Basin	Federal species of concern; Oregon State sensitive species; Idaho State endangered species	√	√	√
Sculpin (genus *Cottus* and *Leptocottus spp.*)	All accessible reaches in the Columbia River Basin	None	√	√	√
River lamprey	All accessible reaches in the Columbia River Basin	Federal species of concern; Washington State candidate species	√	√	√
Leopard dace	Columbia River Basin	Washington State candidate species	√		
Umatilla dace	Columbia, Kootenay, Slocan, and Snake Rivers	Washington State candidate species	√	√	
Longnose dace	Throughout Washington State	None	√	√	
Mountain sucker	Middle-Columbia and Upper Columbia River Watersheds	Washington State candidate species	√		
Largescale sucker	Throughout the Columbia River Basin	None		√	√
Bridgelip sucker	Throughout the Columbia River Basin	None		√	

Species	Range	Federal/State Listing Status	Relationship		
			Prey	Competitor	Predator
Redside shiner	Throughout the Columbia River Basin	None		√	
Mountain whitefish	Columbia River Basin	None	√	√	√
Northern pikeminnow	Throughout the Columbia River Basin	None	√	√	√
Rainbow trout	Throughout the Columbia River Basin	None	√	√	√
Westslope cutthroat trout	Upper Columbia River Basin and Snake River	Federal species of concern	√	√	√
Channel catfish	Mainstem Columbia River	Non-native species			√
Centrachids (bluegill, pumpkin seed, etc.)	Mainstem Columbia River	Non-native species			√
Yellow perch	Mainstem Columbia River	Non-native species			√
Walleye	Mainstem Columbia River	Non-native species			√
Largemouth bass	Mainstem Columbia River	Non-native species			√
Smallmouth bass	Some tributaries (e.g., Okanogan River) and mainstem Columbia River	Non-native species			√

Source: (Nelle 2016; Wydoski and Whitney 2003)

3.5. Wildlife

The ongoing and current hatchery facilities and hatchery-origin salmon and steelhead propagated for the hatchery programs included in this EA affect wildlife by acting as either predators or prey, enhancing nutrient availability, transferring pathogens or toxic contaminants outside the hatchery environment, or impeding movement. The Analysis Area for wildlife is the same as the Analysis Area for salmon and steelhead because the interactions with hatchery fish are likely to have a discernible effect on wildlife within the Analysis Area.

Numerous species of birds and mammals 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 3-7). Salmon carcasses and juvenile salmon are an important food source for bald eagles *(Haliaeetus leucocephalus)*. Other avian predators of salmon and steelhead may include osprey (*Pandion haliaetus*) and great blue herons (*Ardea herodias*), which are residents of shorelines and shallow waters, including areas occupied by fish hatcheries.

Mammals that occur in the Analysis Area may consume salmon and steelhead, or may be encountered through the hatchery operations, broodstock collection activities, or juvenile release activities. River otters (*Lontra canadensis*) consume juvenile salmon at hatcheries or after release, spawning salmon, and salmon carcasses (Cederholm et al. 2000). Mink (*Neovison vison*) occur throughout the Analysis Area and may consume salmon and steelhead (Melquist 1997 in (NMFS 2014)).[8]

Currently, the largest ongoing effect of wildlife interaction with hatchery fish is predation on hatchery fish by birds. Various species, such as Caspian terns (*Hydroprogne caspia*) and Double-crested cormorants (*Phalacrocorax auritus*) feed on juvenile salmonids (Table 3-7), but when juvenile salmonids currently pass dams on the mainstem Columbia River, they appear to be more vulnerable to predation than in a natural river setting. In addition, Caspian terns and Double-crested cormorants have increased dramatically in the Columbia River basin in the last 20-30 years (Evans et al. 2012), primarily in the lower river, downstream of Bonneville Dam, but they have also increased in and near the Analysis Area, and have been documented preying on Upper Columbia River fish in the Analysis Area. Total avian predation of UCR steelhead is estimated to be over 15 percent, while predation by birds on juvenile summer/fall Chinook salmon is generally less than five percent (Evans et al. 2018; Zamon et al. 2013).

[8] Canada lynx (*Lynx canadensis*), wolverines (*Gulo gulo luscus*), grey wolf (*Canis lupus*) and grizzly bears (*Ursus arctos horribilis*) maintain large home ranges and are all highly mobile; however, within the Analysis Area, they occur in the upper watersheds above the release sites and therefore unlikely to encounter hatchery-origin fish (WDFW website, accessed June, 2018: Washington State Species of Concern Lists, https://wdfw.wa.gov/conservation/endangered/status/ST/). In addition, Ferruginous hawk (*Buteo regalis*), Marbled murrelet (*Brachyramphus marmoratus*), and Northern spotted owl (*Strix occidentalis caurina*) may also appear technically within the Analysis Area, but are not likely to interact with hatchery fish.

Table 3-7. Primary and listed wildlife species that have the potential to interact with hatchery fish released from the programs being evaluated within this EA within the Analysis Area.

Species	Range	Federal Status	State Status	Potential Effect on Salmonids
Mammals				
River otter (*Lontra canadensis*)	Throughout the Columbia River Basin	None	None	Predator
Mink (*Neovison vison*)	Throughout the Columbia River Basin	None	None	Predator
Birds				
Bald Eagle (*Haliaeetus leucocephalus)*	Throughout the Columbia River Basin	Federally protected under Bald Eagle and Golden Eagle Protection Act (was removed from ESA list)	None	Predator
Osprey (*Pandion haliaetus*)	Throughout the Columbia River Basin	None	None	Predator
Great Blue Heron (*Ardea herodias*)	Throughout the Columbia River Basin	None	None	Predator
American White Pelican (*Pelecanus erythrorhynchos)*	Mainstem Columbia River	None	Threatened	Predator

Sources:
Washington State Species of Concern Lists (https://wdfw.wa.gov/conservation/endangered/status/ST/)
GAP Analysis Predicted Distribution Map for Mink, (http://naturemappingfoundation.org/natmap/maps/wa/mammals/WA_mink.html)
Nature Mapping Program for River Otter (http://naturemappingfoundation.org/natmap/facts/river_otter_712.html)
Nature Mapping Program for Great Blue Heron (http://naturemappingfoundation.org/natmap/maps/wa/birds/WA_great_blue_heron.html)

Currently, the transfer of pathogens to wildlife associated with the hatchery programs is unlikely to contribute to their presence/load in wildlife due to the regulation of hatchery operations through the

NPDES permit and the applicants' fish health policies (NWIFC and WDFW 2006; USFWS 2004). Weirs and traps used for collection of fish may impede wildlife movement and/or benefit wildlife by restricting migration of fish and thereby enhancing predation efficiency. Most of the hatchery programs being evaluated in this EA are currently only using passive methods of predator control (i.e., netting around facilities).

3.6. Socioeconomics

Socioeconomics is defined as the study of the relationship between economics and social interactions with affected regions, communities, and user groups. Current and ongoing hatchery programs affect socioeconomic conditions by providing commercial and recreational opportunities, employment, and economic opportunities through hatchery operations. The funds used in current hatchery operations contribute to jobs at the hatchery and to the community through the purchase of goods and services related to hatchery operations and employment opportunities to provide those goods and services.

Ongoing hatchery programs are operated out of facilities in the Chelan, Methow, Columbia, and Wenatchee river basins. These facilities lie within Okanogan, Douglas, Chelan, and Grant counties. One important current impact that the ongoing hatchery programs can have on social economics is through tribal (addressed in Subsection 3.7, Cultural Resources) and non-tribal commercial or recreational fisheries that target hatchery fish. In the Analysis Area, recreational fisheries for summer/fall and fall Chinook salmon currently occur in upper Columbia, Okanogan, and the Wenatchee Rivers. Steelhead recreational fisheries currently occur in the upper Columbia River mainstem and in the Wenatchee, Methow, and Okanogan rivers when natural-origin fish return in high enough numbers to achieve conservation goals. All recreational fisheries for summer/fall and fall Chinook salmon and steelhead are selective, meaning that only externally marked fish (e.g., adipose fin clipped) can be kept, which reduces harvest impacts on un-clipped (presumably natural-origin) fish.

For this EA, NMFS evaluated the current economic effect of fisheries that occur in what the Mitchell Act FEIS called the Upper Columbia Economic Zone (from the confluence of the Yakima River to Chief Joseph Dam on the mainstem Columbia River, including all tributaries), using the information provided in the Mitchell Act FEIS, and adjusting the salary numbers from the Mitchell Act FEIS from 2009 dollars to 2018 dollars.[9] Fisheries downstream of the Upper Columbia Economic Impact Zone are not considered

[9] Numerous inflation calculators were consulted on the internet. To adjust the "2009" dollar figures to "2018" dollars, the calculators ranged from approximately 14 percent to 16 percent. The average was approximately 15 percent and that was used in the adjustment.

part of the Analysis Area for Socioeconomics because the current number of fish released from programs being evaluated in this EA are only a small proportion of all of the hatchery fish released in the Columbia River Basin, including from hatcheries in the Snake River, Middle and Lower Columbia River regions. Additionally, the hatchery fish contribution from the programs being evaluated in this EA to the fisheries beyond the Upper Columbia Economic Zone is small enough that it would be difficult to separate out or quantify the effects. In addition, the economic impacts of commercial fisheries was not considered in this EA because there are currently no commercial fisheries in the Upper Columbia Economic Zone.

3.6.1. Cost of Current Operation and Maintenance, Research, Monitoring and Evaluation

The current direct economic impacts of operations and monitoring from ongoing hatchery programs are summarized below (Table 3-8). Current annual operations and maintenance (O&M) costs for the ongoing hatchery programs being evaluated in this EA range from $250,000 to $1,096,887 and $51,373 to $392,442 for research, monitoring and evaluation (RM&E) (Table 3-8) (Peven 2018). The current total direct costs for operations and maintenance and research, monitoring, and evaluation for all of the ongoing programs is $550,000 and $1,386,269, respectively (Table 3-8).

Current full-time-equivalent (FTE) staff for the ongoing hatchery programs being evaluated in this EA range from 1.5 to 9.5 for O&M and 0.5 to 4.0 for RM&E (Table 3-8). Total current FTEs for ongoing O&M are 25 and 17 for ongoing RM&E. The economic impact on jobs from the ongoing hatchery programs ranged from 2.5 jobs for the Methow summer/fall Chinook salmon hatchery program to 12.5 jobs for the Priest Rapids Fish Hatchery fall Chinook salmon program (Table 3-8).

Table 3-8. Current annual direct costs for operations and maintenance and research, monitoring and evaluation and the jobs associated with the costs of ongoing hatchery programs in the Upper Columbia River basin that are being evaluated in this EA.

	Direct Costs ($) and Jobs					
Hatchery Program (funding agency)	**Operational and maintenance (O&M) costs[1]**	**Hatchery staffing levels for O&M (Full time equivalent; FTE)[1]**	**Research, monitoring, and evaluation (RM&E) costs[1]**	**Staffing levels for RM&E (Full time equivalent; FTE)[1]**	**Total costs**	**Total FTEs**
Methow Complex steelhead (DPUD)	861,862	3.5	316,826	4.0	1,178,688	7.5

Hatchery Program (funding agency)	Direct Costs ($) and Jobs					
	Operational and maintenance (O&M) costs[1]	Hatchery staffing levels for O&M (Full time equivalent; FTE)[1]	Research, monitoring, and evaluation (RM&E) costs[1]	Staffing levels for RM&E (Full time equivalent; FTE)[1]	Total costs	Total FTEs
WNFH steelhead (USFWS (BOR))	250,000	1.5	300,000	1.5	550,000	3.0
Methow summer/fall Chinook (GPUD)	509,679	2.0	107,051	0.5	616,730	2.5
Wells summer/fall Chinook (DPUD)	603,294	3.5	219,746	2.0	823,040	5.5
Chelan Falls summer/fall Chinook (CPUD)	1,096,887	2.5	51,373	2.0	1,148,260	4.5
Wenatchee summer/fall Chinook (CPUD and GPUD)	993,827	2.5	392,442	3.6	1,386,269	6.1
Priest Rapids fall Chinook (GPUD)	839,902	9.5	356,478	3.0	1,196,380	12.5
Totals	**5,155,451**	**25**	**1,743,916**	**17**	**6,899,367**	**42**

Source: For direct costs and jobs, personal communication with PUDs. Direct and indirect costs and jobs based on Mitchell Act FEIS (NMFS 2014; see below). All dollar values are in 2018 dollars.

[1] The O&M, RM&E, and FTE estimates do not include PUD employee salary or FTEs.

3.6.2. Current Recreational Expenses, Jobs, and Fisheries

To determine the current direct and indirect impacts of the ongoing hatchery programs on recreational fisheries, values calculated in the Mitchell Act FEIS were used. Since the values in the Mitchell Act FEIS were for the total Upper Columbia Economic Impact Zone, the proportion of each species for the programs being evaluated in this EA were calculated based on the proportion of the total current hatchery releases within the Upper Columbia Region. These proportions were then multiplied by the values in the Mitchell Act FEIS (Tables 4-106, 4-109, and 4-100) for the Upper Columbia Economic Impact Zone (Table 3-9). Three economic indicators were evaluated; recreational expenses, which is the amount of money an angler spends for the opportunity to catch fish, and the direct and indirect effects on recreational jobs and personal income.

For steelhead that are currently released into the Columbia River (at Wells Dam), the recreational expenses are estimated at over $356,000 (Table 3-9)[10]. For the same current steelhead releases, the estimated effect on personal income is nearly $260,000, affecting about 9 recreation-based jobs (Table 3-9). For steelhead currently released by the Winthrop NFH into the Methow, the estimated effects on the economic indicators are; from approximately $320,000 to over $445,000 for recreational expenditures, from over $230,000 to approximately $320,000 from personal income, affecting from 6 to 8 jobs (Table 3-9). The estimated effects on the economic indicators for the current Wells FH steelhead releases into the Methow River are; from approximately $236,000 to nearly $330,000 for recreational expenditures, from approximately $171,000 to nearly $240,000 from personal income, affecting from 8 to 12 jobs (Table 3-9). For the current Wells FH summer/fall Chinook salmon hatchery program, recreational expenses were estimated to range from approximately $345,000 to 480,000, personal income from over $250,000 to over $350,000, affecting 8 to 12 jobs. The current Chelan Falls summer/fall Chinook salmon program is estimated to generate approximately $248,000 to $345,000 for recreational expenses, from about $180,000 to $250,000 for personal income and create from 6 to 8 jobs. The current Methow summer/fall Chinook salmon hatchery program is estimated to generate from nearly $86,000 to $120,000 in recreational expenses and about $63,000 to over $87,000 in personal income and 2 to 3 jobs. Current and ongoing recreational expenses are estimated to range from about $215,000 to just over $300,000, approximately $156,000 to $218,000 for personal income and from 5 to 7 jobs for the Wenatchee summer/fall Chinooko salmon hatchery program. For the ongoing Priest Rapids fall Chinook salmon program, the economic indicators are: from approximately 1.2 to over 1.5 million dollars for recreational expenditures, from nearly $888,000 to over 1.2 million dollars from personal income, affecting from 29 to 37 jobs (Table 3-9).

Table 3-9. Estimated direct and indirect effects of the the hatchery programs on recreational expenditures (how much an angler is willing to pay for a fishing opportunity), recreational fisheries, and the number of jobs related to recreation for each hatchery program.

			Economic Indicators[1]		
Program	**Species**	**Release Basin**	**Recreational expenditures[2]**	**Personal income (direct and indirect)[2]**	**Jobs (direct and indirect)[2]**
Wells Complex Summer Steelhead Program	Steelhead	Columbia	356,344	258,689	8.6

[10] For steelhead, recreational fishing is opened on a year-to-year basis dependent on run size. In years when it is not opened, the economic benefits to the area will be less than discussed here.

Program	Species	Release Basin	Economic Indicators[1]		
			Recreational expenditures[2]	Personal income (direct and indirect)[2]	Jobs (direct and indirect)[2]
Winthrop National Fish Hatchery Leavenworth Fisheries Complex	Steelhead	Methow	319,080-445,430	231,636-323,361	8-11
Wells Complex Summer Steelhead Program	Steelhead	Methow/ Twisp	236,119-329,618	171,411-239,287	6-8
Wells Hatchery Summer Chinook Program	Summer/fall Chinook	Columbia	345,505-482,319	250,820-350,141	8-12
Chelan Falls Summer Chinook Program	Summer/fall Chinook	Chelan	247,526-345,542	179,692-250,847	6-8
Methow Component of the Upper Columbia River Summer Chinook Program – Priest Rapids Project Mitigation	Summer/fall Chinook	Methow	85,946-119,980	62,393-87,100	2-3
Wenatchee Summer Chinook Program	Summer/fall Chinook	Wenatchee	215,296-300,550	156,294-218,185	5-7
UCR Fall Chinook Salmon Program – Priest Rapids Project Mitigation, Priest Rapids Hatchery	Fall Chinook	Columbia	1,222,774-1,531,936	887,675-1,112,112	29-37

Source: Mitchell Act EIS, Tables 4-106, 4-109, and 4-110. All values are in 2018 dollars.

[1] Economic indicator values for personal income and jobs includes direct and secondary (indirect) contributions.

[2] The economic values for these programs were derived by multiplying the percentage of each program's proportion of the total Upper Columbia River hatchery releases for a particular species (Mitchell Act FEIS Appendix C and D) by the values obtained from the respective alternatives (Table 2-2) in tables 4-106, 4-109, and 4-110 for the Upper Columbia River economic impact zone in the Mitchell Act FEIS.

3.7. Cultural Resources

Salmon fishing has been a focus for tribal economies, cultures, lifestyles, and identities for several millennia. Beyond generating jobs and income for contemporary commercial tribal fishers, salmon are regularly eaten by tribal individuals and families, and are served at gatherings of elders at traditional dinners and other ceremonies. To Native American tribes, salmon are a core symbol of tribal and individual identity. The survival and well-being of salmon are seen as inextricably linked to the survival and well-being of Indian people and their cultures. Salmon evoke sharing, gifts from nature, responsibility to the resource, and connection to the land and the water. For more details about the importance of salmon to the tribal culture, see the Mitchell Act FEIS Subsection 3.4.4.1.1, Fish Harvests and Tribal Values, and Subsection 3.4.4.1.2, Ceremonial and Subsistence Harvests.

The tribes use salmon in various ways. Tribal members have historically depended on the Columbia River and salmon for their subsistence, and the tribes place greatest cultural importance on harvesting salmon for ceremonial uses. In addition, salmon are considered an important part of tribal members' diets. The ceremonial and subsistence fisheries can occur at any time of the year on the Columbia River (in designated areas), unless closed by tribal regulations to meet management guidelines.

Within the Analysis Area, tribal members from the Colville Confederated Tribes harvest steelhead and summer/fall Chinook salmon upstream of Wells Dam and in the Okanogan River. Members from the Yakama Nation harvest fish in the lower Columbia River, downstream of the Analysis Area, but fish released from the hatchery programs in the Upper Columbia River are caught in those fisheries.

3.8. Environmental Justice

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" (EPA 2016). As such, environmental justice analysis necessitates the analysis of using thresholds to determine whether a disproportionately high and adverse human health or environmental effects of a program exist on minority populations and low-income populations, referred to as the environmental justice communities of concern. Moreover, EPA guidance extends beyond statistical threshold analyses to consider explicit environmental justice effects on Native American tribes (EPA 1998).

Of the environmental justice communities of concern identified in the Mitchell Act FEIS , the Hispanic population in Chelan, Douglas, and Grant counties, and the minority (non-white) and low-income populations in the Okanogan County are relevant to the Proposed Action because of their proximity to the hatchery facilities. These communities of concern might benefit from hatchery fish from the hatchery programs to the extent that these communities benefit from distribution of fish to food banks and other community programs collected for adult management to public entities. Also, the tribes included as environmental justice communities of concern are the same tribes described in Subsection 3.7.

3.9. Human Health and Safety

Section 3.7 in the Mitchell Act FEIS, briefly summarized here, discusses potential risks to human health from hatchery facility operations. Hatchery facilities routinely use chemicals in the management of their facilities. These chemicals include therapeutics (e.g., antibiotics), fungicides, disinfectants, anesthetics, pesticides, and herbicides. These chemicals are not considered hazardous to human health when safety precautions and regulations are followed. However, some chemicals (e.g., antibiotics) do not have established water quality criteria. If discharged to surface waters near hatchery facilities, these chemicals may pose a threat to human health.

A number of parasites, viruses, and bacteria are potentially harmful to human health and may be transmitted from fish species. Many of these are transmitted primarily through seafood consumption. However, exposure to these pathogens may also occur through skin contact with fish or accidental needle-stick injuries during vaccination of fish at the hatchery facilities. 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. In addition, 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, leading to a negligible effect on this resource. However, locally high concentrations could occur depending on the nature of the receiving environment if therapeutics are needed to control or prevent a disease outbreak.

4. ENVIRONMENTAL CONSEQUENCES

This chapter provides an analysis of the direct and indirect effects associated with the alternatives on the nine resource categories evaluated in Section 3. The effects of Alternative 1 are described in terms of how current conditions (Section 1) are likely to appear into the future under continued implementation of the programs. The effects of the other alternatives are described relative to Alternative 1 (No-action). Where applicable, NMFS describes the relative magnitude of impacts 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 substantial.

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 (Subsections 4.2, Water Quantity; 4.3, Water Quality; 4.4 Salmon and Steelhead; 4.5, Other Fish; and 4.6, Wildlife).

4.1. Summary of findings

Most of the consequences of the hatchery programs evaluated in this EA were determined to have a neglible-adverse effect compared to Alternative 1 (Table 4-1). Negible-beneficial and low-beneficial effects compared to Alternative 1 were the next most common designations (Table 4-1). Additional details describing these effects follow in each subsection below.

Table 4-1. Summary of the effects of the hatchery programs on the nine resources evaluated in this EA.

Resource	Effect	Species	Alternative 1 No-action	Effects of Alternative Relative to No-action		
				2	3	4
Water Quantity	NA	NA	Low-adverse	Same as Alt.1	Negligible-beneficial	Negligible-beneficial
Water Quality	NA	NA	Low-adverse	Same as Alt.1	Same as Alt.1	Negligible-beneficial
Salmon and Steelhead	Genetics	Spring Chinook Salmon	Undetectable	Same as Alt.1	Same as Alt.1	Same as Alt.1
		Steelhead	Medium-adverse	Same as Alt.1	Low - beneficial	Medium - beneficial
	Competition and Predation	Spring Chinook salmon	Low-adverse	Same as Alt.1	Negligible-benefit	Low-beneficial
		Steelhead	Medium-adverse	Same as Alt.1	Low-beneficial	Low-beneficial
		Summer/Fall Chinook salmon	Negligible-adverse	Same as Alt.1	Low-beneficial	Low-beneficial
		Sockeye salmon	Negligible-adverse	Same as Alt.1	Same as Alt.1	Same as Alt. 1
		Coho salmon	Negligible-adverse	Same as Alt.1	Same as Alt.1	Low-beneficial
	Diseases	All (see Salmon and Steelhead)	Negligible-adverse	Same as Alt.1	Same as Alt.1	Same as Alt.1
	Population Viability	UCR Spring Chinook Salmon ESU	Negligible-adverse	Same as Alt.1	Same as Alt.1	Low-beneficial
		UCR Steelhead DPS	Low-beneficial	Same as Alt.1	Negligible-adverse	Low-adverse
	Nutrient Cycling	All (see Salmon and Steelhead)	Low-beneficial	Same as Alt.1	Negligible-adverse	Low-adverse

Resource	Effect	Species	Alternative 1 No-action	Effects of Alternative Relative to No-action 2	3	4
	Facility Operations	All (see Salmon and Steelhead)	Negligible-adverse	Same as Alt.1	Same as Alt.1	Negligible-beneficial
	Research, Monitoring, and Evaluation	All (see Salmon and Steelhead)	Negligible-adverse	Same as Alt.1	Same as Alt.1	Same as Alt.1
Other Fish Species	Competition and predation	See Table 13	Negligible-adverse	Same as Alt.1	Negligible-beneficial	Negligible-beneficial
	Prey enhancement	See Table 13	Negligible-beneficial	Same as Alt.1	Negligible-adverse	Negligible-adverse
	Disease	See Table 13	Negligible-adverse	Same as Alt.1	Negligible-beneficial	Negligible-beneficial
	Nutrient cycling	See Table 13	Negligible-beneficial	Same as Alt.1	Negligible-adverse	Negligible-adverse
	Facility operations	See Table 13	Negligible-adverse	Same as Alt.1	Same as Alt.1	Negligible-beneficial
Wildlife	Competition and predation	See Section 3.5	Undetectable	Same as Alt.1	Same as Alt.1	Negligible-adverse
	Prey enhancement	See Section 3.5	Negligible-beneficial	Same as Alt.1	Negligible-adverse	Negligible-adverse
	Disease	See Section 3.5	Negligible-adverse	Same as Alt.1	Undetectable	Negligible-beneficial
	Nutrient cycling	See Section 3.5	Low-beneficial	Same as Alt.1	Negligible-adverse	Negligible-adverse
	Facility operations	See Section 3.5	Negligible-adverse	Same as Alt.1	Negligible-adverse	Negligible-beneficial
Socioeconomics	NA	NA	Medium-beneficial	Same as Alt.1	Negligible-adverse	Negligible-adverse
Cultural Resources	NA	NA	Low-beneficial	Same as Alt.1	Low-adverse	Medium-adverse
Environmental Justice	NA	NA	Medium-beneficial	Same as Alt.1	Negligible-adverse	Low-adverse
Human Health and Safety	NA	NA	Low-adverse	Same as Alt.1	Same as Alt.1	Low-beneficial

4.2. Water Quantity

Under Alternative 1, the hatchery programs would be operated the same as under current conditions. In the Methow River basin, the Methow Hatchery is likely to use groundwater when surface water flow is low, thereby reducing the impact on stream flow, and the WNFH uses surface water from late fall through early spring which also reduces impacts of surface water withdrawal during the low flow periods. For the

Wells and Priest Rapids hatcheries, ground water is also used during certain times of the year, and total surface water used is less than one percent of the total river flow. The Eastbank FH uses only ground water, and all of the acclimation facilities use surface water, primarily at a time that does not negatively affect the total flow from their source streams (Table 3-1).

Because the facilities that rely on groundwater use this water generally during low surface water flow times of the year, the effects on the source streams is minimal. In general, the distances between the water withdrawals and discharge for all facilities are less than 650 feet (Table 3-1), and the amount of time water is withdrawn from the reach between the intake and outfall is minimal since most of the water passing through the hatchery is returned to the stream immediately. The effects on water quantity are likely to be low-adverse (Table 4-1).

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in the water quantity used. Therefore, this alternative would also have the same low-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 3, the release numbers from the hatchery programs would be reduced by 50 percent compared to Alternative 1. For the purpose of this analysis, NMFS assumes that operators would choose to continue to operate the facility, with regard to water use, in similar manner as under Alternative 1, but recognizes that operators may choose to operate differently. However, potential changes at this point in time are too speculative. All of the water needs would essentially remain the same at the hatcheries because other programs are using the same facilities. Water use at the acclimation facilities could be reduced, but the overall effect would be minimal because the use is non-consumptive. In addition, it is unlikely that the smaller number of fish produced would result in much, if any, reduction in water usage because it is likely the same ponds and configurations would be used. Therefore, this alternative would have no more than a negligible-beneficial effect (Table 4-1) compared to Alternative 1.

Under Alternative 4, all hatchery programs evaluated in this EA would be terminated. The facilities used for different programs (e.g., spring Chinook salmon, coho salmon) would continue to operate. The acclimation facilities on the Wenatchee River, Chelan, and Methow rivers would not be used. The hatcheries may reduce their water usage because they no longer would use the facility for summer/fall and fall Chinook salmon and steelhead egg incubation and rearing, though the Methow, Winthrop, and Eastbank hatcheries would maintain early incubation for spring Chinook salmon. Priest Rapids Hatchery would continue to be operated for the U.S. Army Corps of Engineers funded fall Chinook salmon program, which is not part of this EA. Therefore, as water usage would only be somewhat less, this alternative would have a negligible-beneficial effect on water quantity compared to Alternative 1 (Table 4-1).

4.3. Water Quality

Under Alternative 1, the hatchery programs would be operated the same as under current conditions because water quality is regulated by WDOE, and the same standards would continue to apply for effluent discharge for those facilities with NPDES permits; acclimation facilities without NPDES permit requirements would also continue to discharge at a minimal level, as to not need a NPDES permit. Therefore, there would be no expected change in the discharge of ammonia, organic nitrogen, total phosphorus, biochemical oxygen demand (BOD), pH, and solids levels into the Analysis Area annually. Over time, the small amounts of nutrients discharged could accumulate in the environment. The amount of accumulation would depend on the life expectancy of each substance and the uptake of those substances by biological organisms. However, chemicals and nutrients discharged from hatcheries do not remain present in the same concentrations for any significant length of time; they are broken down, diluted, and/or carried downstream and dispersed (EPA 2015), thus their overall impact on the environment is minimal. The potential for additional nutrients in the effluent is also minimized by the continued compliance with the Clean Water Act and fish health policies, so the potential accumulation in the environment results in a low-adverse effect (Table 4-1).

Under Alternative 2, the operation of the hatchery programs would be the same as under Alternative 1, with no change in effluent discharge and water quality. Therefore, this alternative would also have the same, low-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 3, reduction of the current programs by 50 percent, the effects of the hatcheries programs would generally be the same as under Alternative 1. As described above, all of the facilities would still be in use and would continue to operate for these and other programs using the same relevant water quality standards, and it is unlikely that the smaller number of fish produced by reducing the number of fish released from the programs would result in much, if any, change in the quality of effluent discharge. For the purpose of this analysis, NMFS assumes that operators would choose to continue to operate the facility, with regard to effluent discharges, in similar manner as under Alternative 1, but recognizes that operators may choose to operate differently. However, potential changes at this point in time are too speculative. Therefore, this alternative would also have the same, low-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 4, all hatchery programs would be terminated immediately. The hatchery facilities used for different programs would continue to operate (except the acclimation facilities on the Wenatchee River, Chelan, and Methow rivers). The hatcheries may make some changes in water treatment to account for the lack for the steelhead and summer/fall and fall Chinook salmon programs, but these changes would likely be small and have negligible effects because of the other programs that would continue to operate. In addition, all facilities must continue to comply with the NPDES permit and fish health policies for all other programs (e.g., spring Chinook and coho salmon). Therefore, this alternative would have a negligible-beneficial effect on water quality compared to Alternative 1 (Table 4-1).

4.4. Salmon and Steelhead

Fish released from hatchery programs can interact with natural-origin salmon and steelhead and their habitat through a variety of effects (Table 3 3). Not all of these effects may occur through the hatchery programs being analyzed in this EA. In this section, the hatchery program effects under each alternative on natural salmon and steelhead populations in the Analysis Area are discussed and evaluated.

4.4.1. Genetics

As discussed in Subsection 3.3.1, Genetics, the UCR Spring Chinook Salmon ESU and UCR Steelhead DPS could be genetically affected by the Proposed Action. Therefore, the effects on the UCR Spring Chinook Salmon ESU and Steelhead DPS are analyzed in this subsection.

For the hatchery programs being evaluated in this EA, hatchery steelhead released in the Methow River basin have the highest likelihood of interbreeding with natural-origin steelhead. Summer/fall Chinook salmon are not likely to interbreed with spring Chinook salmon (or steelhead) because they are generally separated in space and time of spawning (Table 3-4). While summer/fall and fall Chinook salmon adults returning from the hatchery program have a high likelihood of interbreeding with naturally produced summer/fall and fall Chinook salmon, the genetic risk is considered relatively low because pHOS is low in almost all spawning areas (Hillman et al. 2017; Richards and Pearsons 2015; Snow et al. 2017).

As discussed in Section 3.3.1 pHOS of steelhead spawning naturally in the Methow River basin has averaged near 80 percent (Figure 3-1), and NMFS (2017d) estimated that the average subbasin-wide PNI from 2014 to 2016 was 48 percent, and ranged from 45 percent to 51 percent. A number of changes to the programs that are anticipated to improve the PNI have recently occurred or will be occurring. First, the

Methow safety-net component of the Wells Complex program will only be reared at the Wells hatchery on the mainstem Columbia River, and releases of this program component will be moved downstream to Burma Bridge at RM 7 in the Methow River. This is likely to limit the number of these safety-net fish to areas farther upstream, which is anticipated to decrease their pHOS contribution in those areas.

Second, more effective differential marking of release groups allows certain groups to be targeted more intensely for adult management than others. For example, removal of returning hatchery steelhead through fisheries and other management activities with clipped adipose fin would select for fish from the Wells mainstem and Methow safety-net components of the Wells Complex program, but would protect fish from the Twisp component and the WNFH program. This should result in a decrease in pHOS attributable to safety-net and mainstem components of the Wells Complex program.

Third, release-site-specific marking also allows managers, when necessary, to selectively remove fish at Wells Dam or via a fishery in the mainstem Columbia River if management actions in the Methow River itself are not projected to allow targets to be reached. The use of Wells Dam has been limited in the past due to the possibility of removing fish headed for the Okanogan River. More specific marking should also allow for a higher proportion of conservation program (Twisp component and WNFH) fish to be collected and used for safety-net component broodstock.

Based on the proposed changes to the programs, NMFS (2017d) estimates that the subbasin-wide PNI target of at least 0.67 by 2022 can be achieved. Considering these factors, Alternative 1 would have a medium-adverse effect on the Methow River basin portion of the UCR steelhead DPS (Table 4-1).

While it is not likely that there is much if any interbreeding between summer/fall and spring Chinook salmon based on genetic analyses performed as part of the hatchery RM&E programs (Hillman et al. 2017; Snow et al. 2017), there is some probability that summer/fall and spring Chinook salmon could interbreed. However, it is not likely that fall Chinook salmon would interbreed with spring Chinook salmon because of different spawning areas and times. While it is likely that hatchery- and natural-origin summer/fall and fall Chinook salmon can and do interbreed on the spawning grounds, pHOS is generally low and interbreeding is not considered a big risk (Hillman et al. 2017; Richards and Pearsons 2015; Snow et al. 2017). As such, the hatchery programs would have an undetectable effect on the UCR spring Chinook salmon ESU (Table 4-1).

Under Alternative 2, the operation of the hatchery programs would be the same as under Alternative 1, with no change in effects on natural spring Chinook salmon or steelhead genetics. It is anticipated that improvements to pHOS and adult management for steelhead would continue even without ESA approval. If ESA coverage is provided under Alternative 2, conditions in the permits will ensure that these measures continue during the duration of the permit. Therefore, this alternative would also have the same, moderate-adverse and undetectable effect for the Steelhead DPS and Spring Chinook Salmon ESU, respectively, as Alternative 1 (Table 4-1).

Under Alternative 3, a reduction of 50 percent of the fish released would most likely have a positive effect on the Methow River steelhead population by reducing the number (and percentage) of hatchery-origin steelhead on the spawning grounds. This would reduce, but not eliminate, the potential for negative genetic effects that are associated with hatchery programs (see Section 3.3.1). Therefore, Alternative 3 would have a low-beneficial effect on the UCR steelhead DPS compared to Alternative 1. Reducing the number of summer/fall and fall Chinook salmon would have an undetectable effect on the UCR spring Chinook salmon ESU because summer/fall and fall Chinook salmon do not spawn at the same time or area as spring Chinook salmon, and reducing the number of returning hatchery fish will continue to have an undetectable effect on population genetic diversity (Table 4-1).

Under Alternative 4, all of the hatchery programs would be terminated immediately. The effect of eliminating the steelhead hatchery programs in the Methow River basin could be beneficial to natural-origin steelhead genetics because no hatchery-origin juvenile steelhead would be produced to return as spawners and because this alternative assumes that returning hatchery-origin steelhead would be managed until there are no returning hatchery-origin steelhead. Thus, this alternative would have a medium-beneficial effect on the UCR steelhead DPS compared to Alternative 1. It is unlikely that there would be a detectable effect on the spring Chinook Salmon ESU if the programs were terminated because steelhead do not interbreed with Chinook salmon and summer Chinook salmon do not spawn at the same time and areas as spring Chinook salmon; therefore, the effect is undetectable (Table 4-1).

4.4.2. Masking

For the steelhead hatchery programs being evaluated in this EA, only the portion of fish released into the Twisp River are not externally marked, and could therefore be counted as natural-origin fish upon return. However, the fish from the Twisp River program are 100 percent coded-wire tagged and a portion are PIT tagged, so 100 percent of the fish released are marked. In addition, all technicicans that collect information on abundance are trained to look for internal marks (like CWTs and PIT tags), so the potential for masking is very low.

For summer/fall and fall Chinook salmon, only subyearlings released from the Priest Rapids Hatchery are not externally marked. However, all of the fish receive an otolith mark, so like steelhead, all technicicans that collect information on abundance are trained to look for internal marks; therefore, the potential for masking is very low.

4.4.3. Competition and Predation

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so there would be no expected change in the competition and predation effects from the juveniles released from the programs. The competition and predation effects would be:

- Low-adverse for spring Chinook salmon (Table 4-1). The potential effect of the hatchery releases of steelhead and summer/fall Chinook salmon on juvenile spring Chinook salmon would most likely be greater in the mainstem Columbia River in the Analysis Area than the tributaries because fish spend more time after release in the mainstem Columbia River and migrate out of the tributaries relatively quickly(Tatara and Berejikian 2012). Interaction between hatchery- and natural-origin juveniles in the tributaries is still possible because juvenile spring Chinook salmon could be migrating at the same time in the same areas as hatchery fish after release, meaning possible overlap for interactions through competition or predation. In addition, hatchery steelhead that residualize (less than 10 percent) after release would have a longer period of overlap and could be large enough to prey upon newly emerged Chinook salmon and steelhead. Returning adult steelhead are not likely to have an effect on spring Chinook salmon because of the temporal difference in spawning (Table 3-4). Adult summer/fall Chinook salmon returning from the hatchery programs are not likely to compete for spawning sites, but may potentially superimpose redds; however, the overlap in time and space is not believed to be at a level of concern (see Section 3.4).
- Medium-adverse for steelhead (Table 4-1). Except for the low proportion of released steelhead that residualize, it is not likely that juveniles released from the hatchery programs will compete with naturally rearing steelhead because of how fast they migrate out of the streams where released. However, residualized steelhead may prey upon newly emerged steelhead or spring

Chinook salmon fry. Steelhead adult competition for spawning grounds and redd superimpositions are likely to occur because of the large percentage of hatchery steelhead adults on the spawning grounds in the Methow River basin. Adult hatchery summer/fall Chinook salmon are not thought to negatively interact with steelhead in any discernible way.

- Negligible-adverse for summer/fall Chinook salmon (Table 4-1). Newly emerged summer/fall and fall Chinook salmon fry would be vulnerable as prey to migrating smolts that are released from the hatchery programs. However, in general, during the smolt migration, most of the smolts in the mainstem Columbia River migrate in the bulk of the flow and the water clarity is reduced from snow melt, making predation potentially less likely. Summer/fall and fall Chinook fry have been found to stay close to shoreline habitats until after the spring run-off and would be less likely have spatial overlap with migrating smolts. Returning adult summer/fall and fall Chinook salmon overlap with natural-origin summer/fall and fall Chinook salmon on the spawning grounds and may superimpose redds. Because the populations of summer/fall and fall Chinook salmon in the Upper Columbia River generally have a low demographic risk, the effects of some of the redds being superimposed is considered negligible. As discussed in Subsection 3.3.4, there is not likely to be competition between adult summer/fall and fall Chinook salmon and hatchery-origin steelhead because of differences in spawn timing and habitat, but there may be some competition for holding areas in the late summer. As discussed immediately above, there is most likely some effect from predation of hatchery steelhead on newly emerged summer/fall and fall Chinook salmon.
- Negligible-adverse for sockeye salmon (Table 4-1). Interactions between hatchery juveniles and sockeye smolts would occur in the mainstem Columbia River while emigrating to the ocean because only a small number of natural-origin sockeye salmon are present in the tributaries where the hatchery fish are released (except in the Wenatchee River). Interaction is likely minor, although residualized hatchery steelhead could theoretically prey upon sockeye smolts, most likely in the mainstem Columbia River. In their review of these same hatchery programs, NMFS (2017b) used a model to determine the effects of competition and predation from the hatchery summer/fall and fall Chinook salmon released; the model results suggest that there is limited effect on sockeye salmon within the tributaries (which would only be the Wenatchee River) and the mainstem Columbia River to McNary Dam. Since sockeye stage before spawning in lakes, and spawn at different times than the hatchery-origin returning adults (Table 3-4) in spawning areas upstream of summer/fall Chinook salmon, the interaction between adult sockeye and returning adult fish from the hatchery programs is not likely. Steelhead that could be returning

from the hatchery programs do not overlap on the spawning grounds and usually choose different spawning habitats than sockeye.

- Negligible-adverse for coho salmon (Table 4-1). The smolts from the hatchery programs may have spatial and temporal overlap with naturally rearing coho salmon in the Methow and Wenatchee River basins. While the vast majority of fish released from the hatcheries move quickly out of the streams where they are released, it is likely that some predation and competition occurs between hatchery juveniles and coho juveniles. Adult competition for spawning grounds and redd superimpositions are not likely to occur because of the difference in spawning time, and location for summer/fall Chinook salmon and steelhead.

Under Alternative 2, the operation of both hatchery programs would be the same as under Alternative 1, with no change in release numbers and thus competition and predation effects on other salmon and steelhead species would remain the same. Therefore, this alternative would have the same effects as Alternative 1 (Table 4-1).

Under Alternative 3, the effects of the hatchery programs would be somewhat lower as under Alternative 1, except for the effect on steelhead. The hatchery programs would operate with production reduced 50 percent compared to Alternative 1. The competitive and predatory effects of hatchery smolts would be reduced compared to Alternative 1, and the competitive effects of hatchery-origin adults are likely to be reduced compared to Alternative 1. Relative to Alternative 1, the competition and predation effects would be:

- Neglible-beneficial for spring Chinook salmon (Table 4-1). The potential effect of the hatchery releases on juvenile spring Chinook salmon would be reduced, especially since the interaction mentioned for Alternative 1 already had a low effect. Fewer adult summer/fall Chinook salmon returning from the hatchery programs would be less likely to compete for spawning sites and potentially superimpose redds.
- Low-beneficial for steelhead (Table 4-1). There would be fewer hatchery steelhead that residualize. There would be less adult competition for spawning grounds and redd superimpositions because the percentage of hatchery steelhead adults on the spawning grounds would be reduced.
- Low-beneficial for summer/fall Chinook salmon (Table 4-1). There would be fewer returning adult summer/fall and fall Chinook salmon overlapping with natural-origin summer/fall and fall Chinook salmon on the spawning grounds and less redd superimposition.

- Same as Alternative 1, negligible-adverse, for sockeye salmon (Table 4-1) because the interaction is already most likely minimal, and the effect is even less with fewer hatchery fish released.
- Same as Alternative 1, negligible-adverse, for coho salmon (Table 4-1) because the interaction is already most likely minimal, and the effect is even less with fewer hatchery fish released.

Under Alternative 4, all hatchery programs would be terminated immediately. Because there would be no steelhead or summer/fall and fall Chinook salmon hatchery-origin smolts or adults, the competitive and predatory effects of the hatchery fish would eventually subside, although hatchery fish from other programs would still be interacting with natural-origin fish. Therefore, the effects would be low-beneficial to all species relative to Alternative 1, except for sockeye, where the effect would still be undetectable (Table 4-1).

4.4.4. Disease

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so there would be no expected change in disease effects on other salmon and steelhead species. As discussed in Section 3.3.5, Salmon and Steelhead (Disease), no detections of exotic pathogens have occurred in recent years at the hatcheries being evaluated in this EA. Diseases that have occurred are caused by endemic pathogens, and hatchery operations would continue to use available treatments to keep these outbreaks in check. Therefore, all salmon and steelhead discussed here are negligibly-adversely affected (Table 4-1).

Under Alternative 2, the operation of both 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 on all salmon and steelhead being evaluated in this EA (Table 4-1).

Under Alternative 3, the effects of the hatchery programs would be the same as under Alternative 1. The programs would operate with production reduced 50 percent compared to Alternative 1. However, all hatcheries would continue to operate for other programs that would have similar disease effects on natural salmon and steelhead species. Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1 for all species (Table 4-1).

Under Alternative 4, all hatchery programs would be terminated immediately. However, those facilities that would continue to operate for other programs (e.g., spring Chinook salmon, coho salmon) and could have some disease effects on natural salmon and steelhead species.. Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1 for all species (Table 4-1).

4.4.5. Population Viability

As discussed in Subsection 3.3.6, Population Viability, the discussion here is limited to UCR Spring Chinook Salmon ESU and UCR Summer Steelhead DPS because these are the only species that have established population viability criteria.

Under Alternative 1, the hatchery programs would release the same number of smolts as under current conditions. The population viability would be:

- Negligible-adverse for the UCR Spring Chinook Salmon ESU (Table 4-1). The only potential adverse impact from the hatchery programs on the spring Chinook salmon ESU would be the potential for redd superimposition from hatchery-origin summer/fall Chinook salmon, and some impacts on natural-origin juvenile spring Chinook salmon through competition with hatchery juvenile summer/fall Chinook and steelhead. These interactions have the potential to affect abundance and productivity of natural-origin spring Chinook salmon. However, since the likelihood for redd superimposition and competition is low because of differences in spawning time and location (see Section 3.3.3), the effect of the hatchery programs on the spring Chinook salmon ESU is negligible-adverse.
- Low-beneficial for UCR Steelhead DPS (Table 4-1). Because of the current high levels of pHOS in the Methow River basin and its potential effects on population productivity and because fish that have some hatchery influence may be less fit than natural-origin fish, the current level of pHOS could reduce the productivity of natural-origin fish. Over time, however, other viability factors such as genetic diversity and spatial structure would be anticipated to increase as natural-origin returns increase. In addition, the hatchery programs would increase overall abundance. Therefore, the negative effects of high pHOS are anticipated to decrease over time as abundance increases, thus the effect of the hatchery programs on the UCR Steelhead DPS is low-beneficial.

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, with no change in population viability of UCR Spring Chinook Salmon ESU and UCR Steelhead DPS compared to Alternative 1. Therefore, this alternative would also have the same effect as Alternative 1 (i.e., negligible-adverse effect for UCR Spring Chinook Salmon ESU and low-beneficial effect for UCR Steelhead DPS).

Under Alternative 3, the hatchery programs would release 50 percent of the current production levels. The effect on the UCR Spring Chinook Salmon ESU would be the same as Alternative 1 (negligible-adverse), but the effect on the UCR Steelhead DPS would be neglible-adverse relative to Alternative 1 because while pHOS would go down, the abundance would also be reduced since hatchery-origin fish would no longer supplement the natural-origin fish population. (Table 4-1).

Under Alternative 4, all hatchery programs would be terminated immediately. Relative to Alternative 1, the population viability effects would be:

- Low-beneficial for UCR Spring Chinook Salmon ESU (Table 4-1). Since the current hatchery releases are negligible-adverse on the viability of the UCR Spring Chinook Salmon ESU, the designation for eliminating the programs should improve population viability, although there is some potential that productivity may decrease because of less ocean-derived nutrients being available.
- Low-adverse for UCR Steelhead DPS (Table 4-1). Currently, the hatchery programs are having a low-beneficial effect on natural-origin steelhead population viability (Table 4-1). Eliminating the hatchery releases of steelhead would reduce the number of hatchery-origin spawners, which would be beneficial to population viability because it would reduce the genetic risk and may increase productivity. However, the decrease in the total steelhead abundance on the spawning grounds may increase the demographic risk to the population when spawning escapement is low (e.g., less than 500 fish), leading this alternative to be low-adverse relative to Alternative 1.

4.4.6. Nutrient Cycling

Under Alternative 1, there would be no expected change in the current conditions regarding nutrient cycling effects on other salmon and steelhead. All the salmon and steelhead discussed here currently benefit from additional nutrient provided by the hatchery fish carcasses. Because summer/fall and fall Chinook salmon (and most steelhead) hatchery-origin fish from all programs die after spawning naturally, the programs provide a low-beneficial effect on salmon and steelhead that exist in the spawning streams through nutrient cycling (Table 4-1).

Under Alternative 2, the operation of both hatchery programs would be the same as under Alternative 1, with no change in nutrient cycling effects on other salmon and steelhead. Therefore, this alternative would also have the same low-beneficial effect as Alternative 1 (Table 4-1).

Under Alternative 3, the effects of the hatchery programs would be slightly less as those under Alternative 1 because the hatchery programs would operate with production reduced 50 percent compared to Alternative 1. This would mean that there would be fewer hatchery fish on the spawning grounds, and therefore, this alternative would have a negligible-adverse effect compared to Alternative 1, with change in effects smaller than under Alternative 4 (Table 4-1).

Under Alternative 4, all hatchery programs would be terminated immediately. Because hatchery-origin fish from these programs would no longer be present on the spawning grounds, other salmon and steelhead would no longer benefit from nutrients provided to the environment by the hatchery carcasses. Therefore, termination of the hatchery programs would have low-adverse effects on nutrient cycling for other salmon and steelhead relative to Alternative 1 (Table 4-1).

4.4.7. Facility Operations

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so there would be no expected change in effects on salmon and steelhead.

- The intake facilities are likely to affect all the salmon and steelhead discussed here in the same manner. Facility operations would have negligible-adverse effects for the species that exist in the streams where hatchery fish are released because the program facilities minimize any impediment of fish movement as discussed in Subsection 3.3.8. Facility Operations, and all intake facilities (with the exception of Priest Rapids FH), were designed to meet the NMFS screening criteria that were current at the time of construction (NMFS 1995) (Table 4-1).
- The screw traps are likely to affect all the salmon and steelhead discussed here in the same manner among species that exist in the streams where hatchery fish are released. The traps would have negligible-adverse effects on these salmon and steelhead (Table 4-1) because trapped fish could experience migratory delay, though many fish can avoid the trap. However, the traps are checked daily, so non-target fish can be removed on a daily basis, though handling of fish may cause stress or injury to the fish.

- Weirs, traps, and ladders are likely to affect the salmon and steelhead differently, based on adult run timing (Table 3-4) compared to the timing of broodstock collection. Broodstock collection for summer/fall Chinook salmon occurs during the very later part of the spring Chinook salmon run and during the steelhead run in the Upper Columbia River, so there is overlap in run timing. It is likely that natural-origin steelhead and summer/fall Chinook salmon would be most affected by broodstock collection for summer/fall Chinook salmon and steelhead, with the potential effects ranging from migratory delay to injury and mortality through handling (and transport where applicable); expected handling mortality rate is less than 2 percent for steelhead (NMFS 2016). However, steelhead are likely only negligibly-adversely affected because the best management practices (e.g., visiting the trap multiple times per day and ensuring fast release of non-target fish) that are deployed during broodstock collection, which minimizes the potential negative effects. Sockeye salmon are not likely to be affected by broodstock collection because when encountered during broodstock collection, they are passed upstream without handling.

Under Alternative 2, the operation of the hatchery programs would be the same as under Alternative 1, with no change in effects described above on salmon and steelhead. Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 3, the effects of the hatchery programs would be the same as under Alternative 1. The hatchery programs would operate with production reduced 50 percent compared to Alternative 1. However, the hatchery facilities would continue to operate for other programs. Hatchery facilities exist already, and though hatchery returns may be reduced, run timing would be the same, and therefore adult management using weirs and traps would occur for the same time and duration. Therefore, this alternative would have the same negligible-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately. Facilities would not be used for these programs but would continue to operate for other programs (e.g., spring Chinook and coho salmon). As a result, the frequency with which salmon and steelhead are encountered would be less, and the likelihood of migratory delay or mortality is reduced, resulting in a negligible-beneficial effect on salmon and steelhead compared to Alternative 1 (Table 4-1).

4.4.8. Research, Monitoring, and Evaluation (RM&E)

Under Alternative 1, research and monitoring activities that are part of the hatchery programs would be operated the same as under current conditions. Current RM&E efforts for the hatchery programs collect information on hatchery performance and status and trends of natural-origin populations. These efforts would likely continue at the same locations and possibly the same intensity as currently and there would be no expected change in the effects on salmon and steelhead. Spawning ground surveys would continue to be performed during spawning seasons , the screw traps would continue to be operated the same as under current conditions (Subsection 3.3.8, Facility Operations), and juvenile fish sampling would be performed the same way as under current conditions. The current effects of juvenile fish sampling would continue to be minimized because smolt traps have a negligible effect on migration (Subsection 3.3.8, Facility Operations), and methods of electrofishing would be performed to minimize fish injury (Snow et al. 2014). All salmon and steelhead are likely to be affected in a similar fashion, with the effects ranging from potential migratory delay to stress from handling (Subsection 3.3.9, Research, Monitoring, and Evaluation (RM&E)), leading to a negligible-adverse effect (Table 4-1).

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, and monitoring would continue at the same levels with no change in effects on salmon and steelhead. Therefore, this alternative would have the same negligible-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 3, the RM&E for the hatchery programs would be the same as under Alternative 1, and monitoring would continue at the same levels with no change in effects on salmon and steelhead. Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1 (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately. The spawning ground surveys would continue for other programs (i.e., spring Chinook salmon) but may be reduced in duration and frequency. The screw traps would continue to be operated the same as under current conditions (Subsection 3.3.8, Facility Operations), and juvenile fish sampling would be performed the same way as under current conditions. Thus, the RM&E effects would be the same as Alternative 1, negligible-adverse (Table 4-1).

4.5. Other Fish Species

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so there would be no expected change in effects on other (than salmon and steelhead) fish species. Competition and predation effects would be negligible-adverse for other fish species because other species, like red-sided shiners, compete with salmonids while rearing. However, most hatchery juveniles are released when they are believed to be ready to migrate quickly to the ocean and therefore minimize competition with other fish species that reside in the release areas. Similarly, any fish species that may be a prey to salmon smolts will not overlap with released hatchery fish very long because released smolts migrate quickly to the ocean. Prey enhancement would have a negligible-beneficial effect on other fish species that prey on smolts from the hatchery programs (most predators listed in Table 3-6), though no fish species rely solely on salmonid smolts. Diseases that are endemic to many fish species would have a negligible-adverse effect on these fish species (Table 4-1) because, while the diseases can be transferred from hatchery fish to other fish species, these diseases occur naturally, hatchery fish are not the only sources of these diseases, and the hatchery fish are regularly treated prior to release to reduce any disesase risks. All other fish species in areas where hatchery fish return to are likely to have a negligible-benefit from nutrient cycling of carcasses (Table 4-1). Facility operations would have negligible-adverse effects (Table 4-1) because hatchery programs' facilities impedeme fish movement, but all facilities minimize any impediments and all (with the exception of Priest Rapids FH) intake facilities were designed to meet the NMFS screening criteria that were current at the time of construction (NMFS 1995).

Under Alternative 2, the operation of the hatchery programs would be the same as under Alternative 1, with no change in effects on other fish species.

Under Alternative 3, the programs would operate with production reduced 50 percent compared to Alternative 1. The level of competition and predation would be reduced, leading to a negligible-beneficial effect compared to Alternative 1. There would be fewer smolts available as a prey source under this alternative, though no fish species rely on salmon smolts exclusively as a food source, leading to a negligible-adverse effect compared to Alternative 1. Because the hatchery facilities would continue to be used at a reduced level, the risks of diseases would be slightly lower than under Alternative 1, leading to a negligible-beneficial effect compared to Alternative 1. Hatchery-origin adults would contribute to nutrient cycling in the areas where hatchery adults return to and spawn, leading to a negligible-adverse effect. Hatchery facilities would continue to operate for other programs, as described under Alternative 3, leading to a negligible-adverse effect (the same as Alternative 1) on other fish species (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately. Competition with and predation on other fish species would not occur, leading to a negligible-beneficial effect compared to Alternative 1. The programs would not release smolts, eliminating one source of prey for some fish, leading to a negligible-adverse effect compared to Alternative 1. Hatchery programs would no longer create the risk of disease amplification, leading to a negligible-beneficial effect relative to Alternative 1.

Hatchery-origin adults would no longer contribute to nutrient cycling, leading to a negligible-adverse effect on other fish species compared to Alternative 1. Facilities would terminate for these programs but would continue to operate for other programs, having a negligible-beneficial effect on other fish species compared to Alternative 1 (Table 4-1).

4.6. Wildlife

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so there would be no expected change in the effects on wildlife. Effects on competition and predation are undetectable because hatchery salmon and steelhead are more likely to be prey for most wildlife than for the hatchery fish to compete or prey on wildlife. Prey enhancement would have a negligible-beneficial effect on wildlife because smolts from the programs are believed to be a small percentage of wildlife prey base, and wildlife predators typically do not rely solely on salmon as a prey source. Disease effects are negligible-adverse because many pathogens found in hatcheries are specific for salmon and steelhead, and not likely to affect wildlife. Hatchery fish are likely to have a low-beneficial effect on nutrient cycling for wildlife because of escapement to the spawning grounds is relatively low. Facility operations would have negligible-adverse effects because only passive methods (i.e., netting around the facilities) are used to deter wildlife predators at hatchery facilities (Table 4-1).

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

Under Alternative 3, the hatchery programs would operate with production reduced 50 percent compared to Alternative 1. Effects on competition and predation are the same as Alternative 1 (i.e., undetectable) because hatchery fish are not likely to compete with or prey on wildlife. There would be fewer smolts available as a prey source under this alternative compared to Alternative 1, though no wildlife species rely on salmon smolts exclusively as a food source, leading to a negligible-adverse effect compared to Alternative 1. Disease effects would not be detectably (undetectable effect) different than under Alternative 1 because the hatchery programs already have a low likelihood of transferring pathogens to wildlife, and operating the facilities at a reduced level would not change the likelihood of transferring pathogens to wildlife. Fewer hatchery-origin adults would continue to contribute to nutrient cycling, but there would be less, leading to a negligible-adverse effect. The hatchery facilities would continue to operate for other programs, as described under Alternative 3, leading to a negligible-adverse compared to Alternative 1.

Under Alternative 4, the hatchery programs would be terminated immediately. This alternative may increase competition among wildlife species with shared food preferences (e.g., among piscivorous avian species) and may shift predation pressure to other fish or wildlife species to compensate for the loss in hatchery salmon and steelhead, leading to a negligible-adverse effect relative to Alternative 1. As such, prey enhancement would be negligible-adversly affected, too. Terminating these hatchery programs would eliminate nutrient cycling available from hatchery-origin salmon carcasses (from these hatchery programs) and would lead to a negligible-adverse effect relative to Alternative 1. Disease effects would be negligibly-beneficial because, even though the likelihood of transference to wildlife is low, hatchery fish potentially no longer transfer toxic contaminants and/or pathogens that can be transferred to wildlife species. Operations would terminate for these programs, but the facilities would continue to operate at a reduced level for other programs, therefore having a negligible-beneficial effect relative to Alternative 1 (Table 4-1).

4.7. Socioeconomics

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so employment opportunities and the local procurement of goods and services related to the hatchery operations would remain the same, with the contribution of nearly 7 million dollars and 42 jobs (Table 3-8) to the regional economy.

In addition, recreational expenses related to the hatchery programs range from nearly $86,000 to over $1,500,000, and personal income from recreational fisheries is estimated from over $62,000 to 1.1 million dollars, creating from 2 to 37 jobs, depending on the hatchery program being evaluated (Table 3-9). These economic impacts leads to a medium-beneficial effect of these hatchery programs, as seen under current conditions (Table 4-1).

Under Alternative 2, the operation of both hatchery programs would be the same as under Alternative 1, with no change in employment opportunities or the local procurement of goods and services related to the hatchery operations. Therefore, this alternative would also have a medium-beneficial effect (Table 4-1).

Under Alternative 3, the hatchery programs would operate with production reduced 50 percent compared to Alternative 1. However, the hatchery facilities would continue to operate, and would likely continue to operate at essentially the same levels because of other programs, as described under Alternative 3; it is unlikely that the smaller number of fish produced by these programs would result in much, if any, reduction in staff or materials usage. Therefore, this alternative would have no more than a negligible-adverse effect compared to Alternative 1, with change in effects smaller than under Alternative 4 (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately. Operations of the hatchery programs described in the Proposed Action would no longer contribute jobs or operational expenses to the regional economy, but the facilities would continue to be operated for other programs. The main hatchery facilities also operate other programs (e.g., spring Chinook salmon) that require a year-long juvenile rearing, so the facility operations and the economic impacts of the facility operations are likely to remain at a similar level as Alternative 1. However, the acclimation facilities would not be operated, and other facilities would operate at a reduced level. It is unclear whether staff reduction would occur, though such reduction could occur. Therefore, this alternative would have a negligible-adverse compared to Alternative 1 (Table 4-1).

4.8. Cultural Resources

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, and the survival and well-being of fish propagated under the hatchery programs being evaluated in this EA would be the same relative to current conditions. Because the conservation programs currently in place would be expected to improve the well-being of the species and stocks being released from the programs being evaluated in the EA, and the tribes would continue to receive fish collected for adult management purposes and harvest, the tribes would benefit through the long-term potential for the fish populations to increase in size, resulting in a low-beneficial effect (Table 4-1).

Under Alternative 2, the operation of the hatchery programs would be the same as under Alternative 1, with no change in the survival and well-being of salmon and steelhead. Therefore, this alternative would also have a low-beneficial effect (Table 4-1).

Under Alternative 3, the effects of the hatchery programs would continue to contribute to the tribes receiving surplus fish and to the well-being of the species and stocks being produced through the hatchery programs. The programs would operate with production reduced 50 percent compared to Alternative 1. However, the tribes would likely not receive as many surplus fish from the hatchery programs under this alternative. This alternative would have a low-adverse effect compared to Alternative 1, with smaller effects than under Alternative 4 (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately. Operation of the hatchery programs would no longer contribute to the tribes receiving surplus fish from these hatchery programs, nor to the well-being of the species and stocks being released from these hatchery programs, although the ESUs and DPSs of the species being propagated would continue to exist in the Columbia Basin. Therefore, this alternative would have a medium-adverse effect compared to Alternative 1 (Table 4-1).

4.9. Environmental Justice

Under Alternative 1, the hatchery programs would be operated the same as under current conditions. The hatchery programs would continue to distribute fish collected for adult management to public entities (e.g., local food banks) and the local tribes for ceremonial and subsistence purposes. The environmental justice communities of concern (Subsection 3.8, Environmental Justice) would benefit from the distribution of fish to local food banks to the extent that these communities rely on these food banks. Also, the programs would continue to provide economic opportunities (Subsection 4.7, Socioeconomics) and fish of cultural importance to the tribes (Subsection 4.8, Cultural Resources). Therefore, this alternative would have a medium-beneficial effect (Table 4-1).

Under Alternative 2, the operation of both 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 (Table 4-1).

Under Alternative 3, the hatchery programs would operate with production reduced 50 percent compared to Alternative 1. The reduction in production would not likely affect the distribution of food as described under Alternative 4. Therefore, this alternative would have no more than a negligible-adverse effect compared to Alternative 1, with smaller effects than under Alternative 4 (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately. As previously described, the termination would negligibly affect socioeconomics adversely to some extent (Subsection 4.7, Socioeconomics) and tribal cultural resources medium-adversely (Subsection 4.8, Cultural Resources). If the steelhead hatchery fish programs in the Methow River basin were eliminated, there is a potential that environmental justice communities in Okanogan County may be adversely affected. The termination would not likely affect the distribution of food because of the small number of fish distributed to the food banks,[11] and the food banks are likely to have other food (much being unperishable) to replace the loss of salmon and steelhead as a food source. Therefore, this alternative would have low-adverse effect compared to Alternative 1 (Table 4-1).

4.10. Human Health and Safety

Under Alternative 1, the hatchery programs would be operated the same as under current conditions. As discussed in Section 3.9 (Human Health and Safety), the continued use and discharge of chemicals used in the hatchery programs may lead to increased accumulation of these chemicals in the environment, depending on the environment they are discharged into and the amount of the chemical used. However, this risk is substantially reduced by hatchery personnel following manufactures's recommendations on use and existing permit requirements and best management practices.

While returning hatchery-origin fish may contain chemicals of concern, the risk from consuming contaminants in hatchery-origin fish remains uncertain. The potential for human exposure to contaminants in fish is tied directly to the frequency of consuming fish (EPA 1999). Thus, groups that consume large amounts of fish may have a higher potential for exposure to contaminants. Current information on consumption patterns suggests that some populations may consume greater quantities of fish than the general population (often termed 'subsistence consumers') (EPA 1999). However, information is not available to determine what proportion of the diet of subsistence consumers comes from hatchery-origin fish. In addition, not all the contaminants in hatchery-origin fish are derived from the hatchery facility, and it is unknown whether the contamination levels in hatchery fish pose a risk to human health. Hatchery fish are likely to continue to serve as a source of food for humans. This resource is likely to have a low-adverse effect under this alternative (Table 4-1).

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 also have a low-adverse effect (Table 4-1).

Under Alternative 3, the hatchery programs would operate with production reduced 50 percent compared to Alternative 1. However, it is unlikely that the reduction in production of these programs would result in much, if any, change to human health and safety. In addition, the hatcheries would continue to operate

[11] The number of fish distributed to the food banks varies annually. However, even in a year with a high adult return requiring more adult fish to be removed, only a small number of fish are distributed to the food banks.

for other programs, having the same level of hatchery operation effects on human health. Therefore, this alternative would likely have the same effect as under Alternative 1 (Table 4-1).

Under Alternative 4, the hatchery programs would be terminated immediately, reducing any potentially harmful effects associated with hatchery operations on human health and safety after the last adults return. The number of fish available for consumption would decrease, the effects of hatchery operations (e.g., effects of chemicals in effluent) would also have a reduced level of health risks because only the facilities used for other programs would continue to operate. For reasons given in Subsection 4.9, Environmental Justice, NMFS assumes that other sources of food exist, so the reduction in harmful effects from hatchery practices is likely to outweigh the loss of salmon-based nutrition in the local area. Thus, the effects would be low-beneficial compared to Alternative 1 (Table 4-1).

5. CUMULATIVE EFFECTS

5.1. Introduction

Chapter 3 of this EA describes how past and present conditions have influenced the resources that are evaluated within the Analysis Area. These conditions represent effects from many years of development, as well as habitat restoration, hydropower operations, and existing hatchery production. The expected impacts of the alternatives on all of the resources are described in Chapter 4. However, Chapter 4 does not take into account future foreseeable actions, especially in the context of future climate change. This section considers impacts that may occur as a result of any one of the alternatives being implemented at the same time as other anticipated future actions and presents information in the context of future climate change.

5.2. Past, Present, and Reasonably Foreseeable Actions

The existing environmental conditions, as described in the resource subsections in Chapter 3, include influences from historical and current conditions. Human presence in the Project Area dates back more than 10,000 years when the Columbia River was the dominant contributor of food, water, and transportation for humans. Presently, the primary influencing factor on the Columbia River is the dams that provide electrical power, flood control, and navigational opportunities, as well as supporting agricultural needs. Simultaneously, the dams cause long-term environmental impacts on aquatic life. Associated development and human uses have also impacted the Columbia River ecosystem. These factors include port improvements, dredging, fishing, urban pollution, and land use practices that have degraded tributary habitat, such as channelization. Despite these extensive uses, however, the basin is considered a diverse, highly productive ecosystem that will continue to provide both important biological functions and economic services into the future. Human uses and associated development, as stressors to the existing ecosystem, are expected to continue under future actions as described below.

Reasonably foreseeable future actions and conditions include land use and development, hatchery production, fisheries, habitat restoration activities, and climate change. Many plans, regulations, and laws are in place at the local, state, and federal levels within the Upper Columbia River to continue economic benefits while minimizing and/or reducing environmental degradation (see UCSRB (2007) for description of these plans, regulations, and laws). However, it is unclear if these plans, regulations, and laws will be successful in meeting their environmental goals and objectives. It is not possible to predict the magnitude of effects from future land use and development, and habitat restoration with certainty for several reasons: (1) the activities may not have yet been formally proposed, (2) mitigation measures specific to future actions may not have been identified for many proposed projects, and (3) there is uncertainty whether mitigation measures for these actions will be fully implemented. Therefore, we will not be considering these plans, regulations, and laws in the analysis of cumulative effects.

5.2.1. Geographic and Temporal Scales

The cumulative effects Analysis Area for this EA is the portion of the Columbia River Basin, as defined in Chapter 4 of this EA. The Project Area includes locations immediately adjacent to the hatchery facility, acclimation sites, and weir locations. The scope of the action considered in this EA includes the rearing and release of hatchery steelhead and Chinook salmon in the Methow River Basin, Columbia River mainstem, Chelan River, and Wenatchee River. Adult collection, rearing, and release activities would occur in localized areas only; the associated direct and indirect effects of these activities would occur to varying degrees in the Project Area and larger Analysis Areas, depending upon the affected resource, as analyzed in Chapter 4.

NMFS considered whether the mainstem Columbia River downstream from the Analysis Area, the estuary, and the ocean should be included in the broad Analysis Area in this EA; however, as with the direct and indirect effects, for the purpose of analyzing the cumulative effects, NMFS was unable to detect or measure effects of the Proposed Action beyond the Analysis Area, as summarized below.

Available knowledge and research abilities are insufficient to discern the role and contribution of the Proposed Action to density dependent interactions affecting salmon and steelhead growth and survival in the mainstem Columbia River downstream from the Analysis Area, the Columbia River estuary, and in the Pacific Ocean. NMFS's general conclusion is that the influence of density-dependent interactions on growth and survival is likely small enough, compared with the effects of large scale and regional environmental conditions, that effects of the Proposed Action in the Analysis Area may contribute to effects outside the Analysis Area, but this contribution would not be meaningful or discernible outside the Analysis Area. While there is evidence that hatchery production, on a scale many times larger than the Proposed Action, can impact salmon survival at sea, the degree of impact or level of influence is not yet understood or predictable, nor is there any evidence that hatchery programs of the size of the programs being evaluated in this EA, have effects in the ocean. Thus, neither direct nor indirect impacts of the programs on the human environment outside the Analysis Area are expected.

It is also important to consider how effects of certain activities, such as other hatcheries, located outside the Analysis Area may or may not interact with the Proposed Action in such a way that impacts on resources are exacerbated. Thus, how cumulative impacts within the Analysis Area might interact with the cumulative impacts of hatchery programs in the Columbia River Basin was evaluated in the Mitchell Act FEIS, not this EA. The analysis of cumulative effects within the Analysis Area presented in this EA represents a more local, specific evaluation of effects than is provided in the larger scale of the Mitchell Act FEIS, with the goal of determining if the cumulative effects within the Analysis Area are substantially different from or reveal effects not considered in the Mitchell Act FEIS.

The ESA sections 10(a)(1)(A) and 10(a)(1)(B) permits would be issued for 10 years from the date of issuance, until the applicants replace them, or until NMFS determines that the plans are no longer effective in protecting and achieving a level of salmonid productivity commensurate with conservation of the listed salmonids. The 4(d) limit 5 permit would be issued for an unlimited amount of time. NMFS would review the annual reports provided by the applicants, and the permits would be modified when warranted by NMFS as specified in the permits.

5.2.2. Climate Change

The changing climate is becoming recognized as a long-term trend that is occurring throughout the world. While the Mitchell Act FEIS does address climate change, this section updates the effects described in the Mitchell Act FEIS. Changes to biological organisms and their habitats are likely to include shifts in timing of life history events, changes in growth and development rates, changes in habitat and ecosystem structure, and rise in sea level and increased flooding (Johannessen and Macdonald 2009; Littell et al. 2009). The most heavily affected ecosystems and human activities along the Pacific coast are likely to be near areas having high human population densities, and on the continental shelves off Oregon and Washington (Halpern et al. 2009). For the Pacific Northwest, Ford (2011) summarized expected climate changes in the coming years as leading to the following physical and chemical changes (the characterized certainty of occurring is in parentheses):

- Increased air temperature (high certainty)
- Increased winter precipitation (low certainty)
- Decreased summer precipitation (low certainty)
- Decreased winter and spring snowpack (high certainty)
- Decreased summer stream flow (high certainty)

- Earlier spring peak flow (high certainty)
- Increased flood frequency and intensity (moderate certainty)
- Increased summer stream temperatures (moderate certainty)
- Increased sea level (high certainty)
- Increased ocean temperatures (high certainty)
- Intensified upwelling (moderate certainty)
- Delayed spring transition (moderate certainty)
- Increased ocean acidity (high certainty)

Hamlet (2011) notes that climate changes will have multiple effects in the Pacific Northwest, including (only those changes that are related to hatchery programs are listed):

- Increases in sediment inputs into water bodies from roads
- Increases in landslides
- Increases in debris flows and related scouring that damages human infrastructure
- Increases in fires and related loss of life and property
- Reductions in the quantity of water available to meet multiple needs at certain times of year (e.g., for irrigated agriculture, human consumption, and habitat for fish)
- Shifts in irrigation and growing seasons
- Changes in plant, fish, and wildlife species' distributions and increased potential for invasive species
- Changes in heating and energy demand

The cumulative effects of climate change will be separately discussed for each resource (water quality and quantity, salmon and steelhead, other fish species, wildlife, socioeconomics, environmental justice, cultural resources, and human health and safety) in the following sections: 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.6, 5.3.7, 5.3.8, and 5.3.9.

5.3. Effects Analysis

This section presents information regarding cumulative effects on the nine resources evaluated in Chapter 4. Each subsection includes effects of past and present conditions, actions that are reasonably certain to occur in the future, and the expected direct and indirect effects of the alternatives. The Mitchell Act FEIS is also incorporated by reference here because it not only evaluates Mitchell Act-funded hatchery programs, but all the hatchery programs within the Columbia River Basin, including the programs evaluated in this EA.

5.3.1. Water Quantity

Successful operation of hatcheries depends on a constant supply of surface, spring, or groundwater that, after use in hatchery facilities, is discharged to adjacent receiving environments. Section 3.1, Water Quantity, describes the current conditions of water quantity, and Section 4.2, Water Quantity, evaluates the direct and indirect effects of the four alternatives being evaluated in this EA. The amount of water available in the stream or river at the hatchery and local groundwater sources is the result of many years of land use and development. Reasonably foreseeable actions that may occur in the future in regards to water quantity include the effects of climate change, continued irrigation demands, restoration of habitat, and preservation of headwaters in the U.S. Forest Service lands that encompass headwater areas of the tributaries.

5.3.1.1. Alternative 1

Under Alternative 1, the hatchery programs would be operated the same as under current conditions. Climate change is expected to affect water quantity by increasing water temperatures and changing seasonal river flows. As a result, cumulative effects may lead to less water quantity, which may be exacerbated by climate change. Two factors that may mitigate the effects of climate change are habitat restoration and protection of headwater areas. Some actions (e.g., restoring floodplain connection) could lead to increased inter-gravel flow and recharge of ground water, which could increase flow and cool temperatures downstream, but the effects of these actions are difficult to quantify. Another action that has been occurring with more frequency in the Upper Columbia region is the changes in the amount of water diverted from streams for irrigation. By increasing the efficiency of the pumps and delivery systems, large water savings have been seen in recent years in the Wenatchee and Methow River basins.

In the Mitchell Act FEIS, the current condition for water quantity is, “compliance with NPDES permits and changes in water quality”. The anticipated effects of the all hatchery program being evaluated in this EA is, “continued compliance with NPDES permits and changes in water quality” (alternatives 1, 2, 4, 5, and 6 in the Mitchell Act FEIS). Except for Winthrop steelhead, all other hatchery programs being evaluated in this EA could also have the same effect as Alternative 3 in the Mitchell Act FEIS, where the expected impact is “continued compliance, potential improvements in water quality, and reduction in water use.”

In sum, the effects of Alternative 1 plus the effects of all reasonably forseeable future actions will probably have a low-negative impact, as it is unlikely that measureable water quantity benefits would be realized in the analysis area in the future, although minor improvements could occur over time from protection of headwater areas and local habitat restoration efforts.

5.3.1.2. Alternative 2

Under Alternative 2, the cumulative effects would be the same as under Alternative 1.

5.3.1.3. Alternative 3

Under Alternative 3, the release numbers of fish would be reduced by 50 percent, but it is unlikely that this would have any detectable effect on water quantity because other hatchery programs are using (and are anticipated to use in the future) the same facilities for other species. Acclimation facilities on the Chelan, Methow, and Wenatchee rivers would still be used, but it is not anticipated that much water quantity savings would be accomplished through this alternative (Subsection 4.2). This alternative is not expected to mitigate the effects of reasonably foreseeable actions (e.g., climate change) that may occur in the future in regards to water quantity. In sum, it is anticipated that the effects of this alternative on water quantity would be the same as Alternatives 1.

5.3.1.4. Alternative 4

Under Alternative 4, all hatchery programs evaluated in this EA would be terminated. The facilities used for different programs (e.g., spring Chinook salmon, steelhead, coho salmon) would continue to operate. Acclimation facilities in the Wenatchee, Chelan, and Methow rivers would not be used, and would reduce water use, but the fraction of water used by the acclimation facilities is so low, it is not anticipated any difference would be detectable. This alternative is not expected to mitigate the effects of reasonably foreseeable actions (e.g., climate change) that may occur in the future in regards to water quantity. It is anticipated that overall water quantity would not be substantially affected by this alternative, and therefore the effects would be similar to Alternative 1.

5.3.2. Water Quality

Subsection 3.2, Water Quality, describes the baseline conditions of water quality, and Subsection 4.3, Effects on Water Quality, evaluates the direct and indirect effects of the five alternatives of the hatchery programs within the Analysis Area. Successful operation of hatcheries depends on a constant supply of high quality surface, spring, or groundwater that, after use in hatchery facilities, is discharged to adjacent receiving environments. The hatchery fish and operations add substances and diseases to the water within the specified limits of the NPDES permit for each hatchery, where applicable. However, as evaluated in Subsection 4.3, Effects on Water Quality, the effects are minimal and short-lived because the effluent is diluted as it travels downstream and generally becomes undetectable within a quarter of a mile or less downstream.

As discussed in Section 3.2, sections of the Methow, Wenatchee, and Columbia rivers all have various water quality parameters that the WDOE have listed on the 303(d) list (Table 3-2). Future land management, land development, and climate change can be expected to further impair water quality on existing 303(d) stream reaches due to increases in water temperature and continued agricultural practices. It is assumed that at the very least, hatchery production in the Analysis Area will continue into the future, though production levels may vary.

5.3.2.1. Alternative 1

Under Alternative 1, the hatchery programs would be operated the same as under current conditions, so there would be no expected change in the discharge of ammonia, organic nitrogen, total phosphorus, and the resulting biochemical oxygen demand (BOD), pH, and solids levels into the analysis area annually.

It is anticipated that water temperatures will rise through climate change. To some degree, habitat restoration may be able to mitigate some of the rise in temperatures in specific areas by increasing inter-gravel flow and ground water flows through such actions as increasing access to floodplains of streams that have been cut off. However, the continued hatchery operations will not likely contribute to temperature increases.

In addition, land management and development activities are expected to impact water quality into the future. These activities may influence water temperature, as well as have other impacts to water quality, such as pesticides being released into the water, or run-off from storm water, which can effect other parameters, like turbidity. It is not anticipated that the Proposed Action will mitigate these potential future effects.

In the Mitchell Act FEIS, the current condition for water quality is, "compliance with NPDES permits and changes in water quality". The anticipated effects of the all hatchery program being evaluated in this EA is, "continued compliance with NPDES permits and changes in water quality" (alternatives 1, 2, 4, 5, and 6 in the Mitchell Act FEIS). Except for the Winthrop steelhead, all other hatchery programs being evaluated in this EA could also have the same effect as Alternative 3 in the Mitchell Act FEIS, where the expected impact is "continued compliance, potential improvements in water quality, and reduction in water use." In sum, the effects of Alternative 1 plus the effects of ongoing and reasonably forseeable future actions discussed above will likely have a negligible-negative impact, as it is unlikely that measureable water quality benefits would be realized in the analysis area in the future, although minor improvements could occur over time from local habitat restoration efforts.

5.3.2.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.2.3. Alternative 3

Under Alternative 3, the release numbers of fish would be reduced by 50 percent, but it is unlikely that this would have any substantial effect on water quality because other hatchery programs are using the same facilities for other species. Acclimation facilities on the Chelan, Methow, and Weantchee rivers would still be used, but it is not anticipated that water quality parameters would deteriorate more through this alternative (Section 4.3). In sum, considering the effects of this Alternative in concert with reasonably likely to occur future actions associated with land use management and development, continued hatchery productions, and climate change, it is anticipated that the effects of this alternative on water quality would be the same as Alternative 1.

5.3.2.4. Alternative 4

Under Alternative 4, all hatchery programs evaluated in this EA would be terminated immediately. The hatchery and acclimation facilities used for different programs would continue to operate (except the acclimation facilities on the Wenatchee River, Chelan, and Methow rivers). The hatcheries may make some changes in water treatment to account for the lack for the steelhead and summer/fall and fall Chinook salmon programs, but these changes would likely be small and have negligible effects because of the other hatchery programs that would continue to operate. In addition, all facilities must continue to comply with the NPDES permit and fish health policies for all other programs (e.g., spring Chinook and coho salmon). In sum, the effects of Alternative 4 plus the effects of all reasonably forseeable future actions (land use and development, other hatchery productions, climate change) would be similar to Alternative 1, as it is unlikely that measureable water quality benefits would be realized in the analysis area in the future, although minor improvements could occur over time from local habitat restoration efforts.

5.3.3. Salmon and Steelhead

Subsection 3.3, Salmon and Steelhead, describes baseline conditions for salmon and steelhead. These conditions are the result of many years of dam construction and operation, land use and development, habitat restoration, hatchery production, and fisheries (Lackey et al. 2006). The expected direct and indirect effects of the alternatives on salmon and steelhead are described in Chapter 4, Salmon and Steelhead.

Past Actions

In the past, land use practices within the Upper Columbia River have detrimentally affected salmon and steelhead in various ways. The consequences of these past practices continue to threaten salmon and steelhead; for example, past land use are still substantial factors that continue to limit viability of salmon and steelhead (sometimes called “legacy” effects).

These past land use practices include:

- Agricultural development, especially along lowland valley bottoms in main tributary reaches, and lower reaches of principal subbasins has directly negatively impacted riparian areas and floodplains. Historical floodplain habitats were also lost through the filling of wetlands and levee construction. Runoff from agricultural lands where pesticides, herbicides, and fertilizers are applied may have affected water quality
- Livestock grazing directly impacted soil stability (trampling) and streamside vegetation (foraging), and delivered potentially harmful bacteria and nutrients (animal wastes) to streams

- Urban and rural-residential development led to the degradation of riparian and floodplain conditions, as well as an alteration of the natural drainage network due to roads, ditches and impervious surfaces.

Together these past activities continue to inhibit the amount and quality of spawning and rearing habitats available to UCR salmon and steelhead populations, principally by reducing or eliminating access to historically productive habitats, and/or by weakening the important watershed processes and functions that once created and maintained healthy freshwater ecosystems for UCR salmon and steelhead production.

Current and Future Actions

Current actions that continue to affect natural-origin salmon and steelhead in the Analysis Area include operation of the hydropower system, habitat degradation and land use activities within the tributaries, fisheries, and hatchery productions. 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 2014). In addition, climate change effects are anticipated to affect salmon and steelhead in the Analysis Area, as discussed below.

One of the current threats to UCR spring Chinook salmon and summer steelhead is from the construction and continued operation of the dams that were built for power production on the mainstem Columbia River. Specific factors that continue to limit viability of UCR salmonids from dams include passage of juveniles and adults going to and from the ocean, changes in the timing of the hydrograph, changes to sediment load (which could affect predation among other issues), increases in total dissolved gas, which may affect both juveniles and adults, and other issues associated with habitat function. Within the Upper Columbia River, juvenile and adult salmonids have to pass up to nine hydroprojects to migrate to and from the ocean. The PUDs are currently meeting survival standards that are set through the HCPs (Section 1.3.3) for juvenile and adult salmonids passing their projects, so this threat has been reduced from all of the work that has occurred at their respective dams over the last 30 years.

The potential for landowner and developer noncompliance with regulations continue to affect aquatic habitat used by salmon and steelhead. Although regulatory changes have increased environmental protection (such as local critical areas ordinances), and monitoring and enforcement have helped reduce impacts of development on salmon and steelhead in freshwaters, development and noncompliance may continue to reduce salmon and steelhead habitat, decrease water quality, and contribute to salmon and steelhead productivity loss.

Today, many land use practices are better than they were in the past and, as a result, many stream reaches once degraded by past practices are recovering. Many landowners now understand the advantages of good conservation practices and are changing their approaches to contribute to restoration of healthy watershed processes and functions. A suite of regulatory programs have also been implemented to protect and restore salmon and steelhead physical habitat and water quality. Together, these changes are improving the physical quality of salmon and steelhead habitats and providing more suitable environments for spawning and rearing.

Restoration of habitat in the Analysis Area will improve salmon and steelhead habitat in general under all alternatives, with particular benefits to environments considered to be important for the rearing and reproduction of fish. In the Upper Columbia River, there are many habitat restoration actions that are occurring with Federal, state, and PUD funds that are restoring access and function of habitat for salmon and steelhead. However, habitat restoration alone will not substantially increase survival and abundance of salmon and steelhead; other threats need to be addressed, too. In addition, while the money available from the PUDs will continue for the term of the HCPs, some of the habitat restoration is dependent on continued state or Federal funding, which is difficult to predict.

The effects of climate change on salmon and steelhead are described in general in ISAB (2007), and would vary among species and among species' life history stages. Effects of climate change may affect the life history of UCR Chinook salmon and steelhead in the cumulative effects Analysis Area (Glick et al. 2007; Mantua et al. 2009). Cumulative effects from climate change, particularly changes in streamflow and water temperatures, would likely impact hatchery-origin and natural-origin salmon and steelhead life stages in various ways as shown in Table 5-1. Under all alternatives, impacts to salmon and steelhead from climate change are expected to be similar because climate change would impact fish habitat under each alternative in the same manner.

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 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 lead to more frequent disease outbreaks.

Sources: ISAB (2007), Glick et al. (2007), Beamish et al. (2009), and Beechie et al. (2013).

Impacts from recreational and tribal fisheries in freshwater that catch hatchery fish produced from Upper Columbia River hatcheries will continue to affect natural-origin salmon and steelhead abundance and will likely remain similar to current levels into the future. The fisheries management structure is based upon the status of natural-origin salmon and steelhead, and not on the abundance of hatchery fish. Therefore, fisheries will continue to be restricted if natural-origin fish abundance decreases, and liberalized in years when abundance increases. The harvest of available hatchery fish will be within the limits established for natural-origin salmon and steelhead, and thus not likely change substantially in the future.

In summary, future effects from hydropower, continued land use, climate change, hatcheries, and fisheries will affect the viability of natural-origin fish and their habitats in the Analysis Area. Habitat restoration and protection will offset some of these effects, but these actions are not anticipated to fully compensate for these continual anthropogenic impacts. To the extent aquatic habitat will continue to degrade over time under all alternatives, the abundance and productivity of natural-origin salmon and steelhead populations may continue to be reduced in the future. Hatchery-origin salmon and steelhead may be similarly affected, but likely to lesser extent.

5.3.3.1. Alternative 1

Under Alternative 1, the current levels of hatchery fish released remains the same. The effects of these releases on salmon and steelhead have been discussed in Chapters 3 and 4. In the past few years, releases of steelhead in the Methow River have been modified to reduce the abundance and proportion of hatchery fish on the spawning grounds, which should have a positive effect on productivity of the natural steelhead population. Considering the cumulative effects of past actions, such as land use practices from agriculture, livestock, and land development that reduced floodplain connectivity and riparian function and cover, and likely foreseeable threats, such as climate change, that is anticipated to increase water temperature and reduce flow in summer, and limiting factors, the release of hatchery fish from the programs evaluated in this EA are not a major limiting factor negatively affecting natural populations of salmon and steelhead in the Upper Columbia River.

Within in the Mitchell Act FEIS, the baseline condition for abundance is approximately 341,000 fish, and the abundance of natural-origin fish would increase between 7 and 15 percent, depending on the Mitchell Act FEIS alternative and which hatchery program from this EA is considered, compared to the baseline condition (Table 5-2). For productivity, the baseline condition in the Mitchell Act FEIS is the estimated productivity of 17 existing ESUs/DPSs. Implementing the Mitchell Act FEIS alternatives is estimated to increase productivity in 11 of 17 to 15 of 17 ESUs/DPSs depending on which hatchery program is considered (Table 5-2).

For the VSP indicator for genetic diversity, the Mitchell Act FEIS used a baseline using the estimated number of populations meeting stronger performance criteria.[12] Implementing the alternatives in the Mitchell Act FEIS would increase the number of populations meeting stronger performance goals from 13 to 48 percent, depending on which hatchery program from this EA is considered (Table 5-2).

[12] Hatcheries operated using *stronger performance* goals would maintain or promote beneficial effects (benefits) and minimize adverse effects (risks) of hatchery programs on salmon and steelhead populations when compared to baseline conditions.

Table 5-2. Summary of the cumulative effects on salmon and steelhead population viability for the hatchery programs being evaluated in this EA, based on the analyses in the Mitchell Act FEIS.

Program	Species	Release Basin	Cumulative Effect Based on Mitchell Act FEIS Results		
			Natural-origin Abundance	ESU/DPS Mean Adjusted Productivity[1]	Populations Meeting Stronger Performance[2]
Wells Complex Summer Steelhead Program	Steelhead	Columbia	Increase of 7 percent	11 of 17 ESUs/DPSs with increased productivity	Increase of 13 percent
Winthrop National Fish Hatchery Leavenworth Fisheries Complex	Steelhead	Methow	Increase from 7 to 15 percent	From 11 of 17 to 15 of 17 ESUs/DPSs with increased productivity	Increase from 13 to 48 percent
Wells Complex Summer Steelhead Program	Steelhead	Methow/ Twisp	Increase from 7 to 15 percent	From 11 of 17 to 15 of 17 ESUs/DPSs with increased productivity	Increase from 13 to 48 percent
Wells Hatchery Summer Chinook Program	Summer/ fall Chinook	Columbia	Increase from 7 to 15 percent	From 11 of 17 to 15 of 17 ESUs/DPSs with increased productivity	Increase from 13 to 48 percent
Chelan Falls Summer Chinook Program	Summer/ fall Chinook	Chelan	Increase from 7 to 15 percent	From 11 of 17 to 15 of 17 ESUs/DPSs with increased productivity	Increase from 13 to 48 percent
Methow Component of the Upper Columbia River Summer Chinook Program – Priest Rapids Project Mitigation	Summer/ fall Chinook	Methow	Increase from 7 to 15 percent	From 11 of 17 to 15 of 17 ESUs/DPSs with increased productivity	Increase from 13 to 48 percent
Wenatchee Summer Chinook Program	Summer/ fall Chinook	Wenatchee	Increase from 7 to 15 percent	From 11 of 17 to 15 of 17 ESUs/DPSs with increased productivity	Increase from 13 to 48 percent
UCR Fall Chinook Salmon Program – Priest Rapids Project Mitigation, Priest Rapids Hatchery	Fall Chinook	Columbia	Increase from 10 to 15 percent	15 of 17 ESUs/DPSs with increased productivity	Increase from 26 to 48 percent

[1] The baseline for productivity for the Mitchell Act FEIS was the estimated productivity for 17 existing ESUs/DPSs.

[2] Hatcheries that are operating using *stronger performance* goals maintain or promote beneficial effects (benefits) and minimize adverse effects (risks) of hatchery programs on salmon and steelhead populations when compared to baseline conditions in the Mitchell Act FEIS.

While the Michell Act FEIS showed that future hatchery production would increase the number of salmon and steelhead populations meeting stronger performance goals, continued effects from hydropower, fisheries, and legacy and anticipated future effects from land use, development, and climate change may negatively affect salmon population viability. In summary, based on the analyses in the Mitchell Act FEIS, natural population abundance and productivity may increase in the future with operation of hatchery programs and/or potential future habitat restoration projects, but future effects of hydropower operation, fisheries, climate change, and land use and development actions could reduce this potential.

5.3.3.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.3.3. Alternative 3

Under Alternative 3, the release numbers of fish would be reduced by 50 percent. While all populations of salmon and steelhead in the UCR have been affected to some degree by legacy effects (fisheries, dams, agriculture, and land use development) and will be affected in the future from these continued effects and the effects of climate change, the cumulative impact of this alternative depends on the specific population of natural fish in the subbasin or area where hatchery fish are released. For example, for Methow steelhead, there may be a slight negative effect on population demographics (by reducing the abundance of spawners), but a potential positive effect on population genetics (by reducing pHOS), while for summer/fall Chinook salmon, there would likely be no measureable effect because they are at less of a demographic risk compared to Methow steelhead. Therefore, in summary, the overall effect of this alternative would be negligible, with potentially some positive effect on Methow steelhead.

5.3.3.4. Alternative 4

Under Alternative 4, the hatchery programs evaluated in this EA would be terminated. As stated above, all populations of salmon and steelhead in the UCR have been effected to some degree by legacy effects (fisheries, dams, agriculture, and land use development) and will continue to be affected in the future from these effects, as well as those from other hatchery productions and climate change. Therefore, in summary, this alternative would probably increase the demographic risk for Methow steelhead by decreasing the total number of spawning fish, and have a minor demographic risk to summer/fall and fall Chinook salmon because most of the natural populations are already meeting likely viability criteria. Impacts to other populations of salmon and steelhead in the Upper Columbia River would most likely be minimal.

5.3.4. Other fish species

Subsection 3.4, Other Fish Species, describes the baseline conditions of fish species other than salmon and steelhead. These conditions are the result of many years of land use and development, habitat restoration, hatchery production, and resident fish fisheries. The direct and indirect effects of the alternatives on other fish species are described in Subsection 4.5, Other Fish Species.

Other fish species that have a relationship to salmon and steelhead in the Upper Columbia River include bull trout, rainbow trout, cutthroat trout, sturgeon, lamprey, forage fish, and other resident freshwater fish, both native and non-native to the Upper Columbia River (Subsection 3.4, Other Fish Species). Similar to salmon and steelhead species, these fish species require and use a diversity of habitats. However, similar to effects described above for salmon and steelhead, other fish species, including bull trout, will continue to be affected from the legacy effects of dams, land use and development, and also be affected by continued hatchery productions and climate change because of the overall potential for loss or degradation of aquatic habitat or the inability to adapt to warmer water temperatures. In addition, climate change and land use and development may attract non-native aquatic plants that may, over time, out-compete native aquatic plants that provide important habitat to native fish. Non-native fish, such as bass and walleye may actually thrive and increase in abundance and productivity as the climate (and water temperatures) warms.

5.3.4.1. Alternative 1

Under Alternative 1, the current levels of hatchery fish released remains the same. The current effects of these releases on other fish species that have a relationship with salmon and steelhead have been discussed in Subsections 3.3 and 4.5. While past land use development, construction and operation of dams has reduced or degraded aquatic habitat, future land use and development, in addition to climate change may attract or increase the range of non-native species that may, over time, out-compete native species. Non-native fish, such as bass and walleye, may actually thrive and increase in abundance and productivity as the climate (and water temperatures) warms, though resident fish fisheries targeting those species may temper such increase in abundance.

In the Mitchell Act FEIS**,** other fish species that have a relationship with salmon and steelhead that can be prey for salmon and steelhead (e.g., dace, chub), would likely benefit if hatchery production was reduced (alternatives 2 through 5 in the Mitchell Act FEIS) by reducing predation with fewer adults returning, or if water quality was improved. However, it is not likely that juvenile salmon and steelhead released from the hatchery programs being evaluated in this EA are substantial predators of fish like chub, dace, etc. because while they are migrating to the ocean, there is likely not much overlap in time and space, reducing the potential for predation. For Alternative 6 in the Mitchell Act FEIS, hatchery production would increase and therefore most likely lead to increased predation on prey and potentially additional competition between species.

For bull trout, the primary effects from operation of the hatchery programs would be the amount of a potential food source from released fish, and the potential to delay of migration from broodstock trapping, habitat alteration and fragmentation, and fish handling. In addition, bull trout require cooler water temperatures than other salmonids, and increases in water temperature from climate change, and potentially from land use and development, will likely have a negative effect on bull trout productivity in the future. Dams will continue to affect those bull trout that use the Columbia River mainstem. In Mitchell Act FEIS alternatives 2 through 5, there was a negative affect on bull trout by reducing the amount of hatchery fish released (reduced food source), but there was a positive affect on bull trout by decreasing potential competition for food and habitat resources. Best management practices, as discussed in Subsection 3.3.8, Facility Operations, would mitigate any potential negative effects on bull trout migration. Mitchell Act FEIS Alternative 6 would increase the production of hatchery fish and there would be a positive effect by increasing a food source, but potential negative effect through competition.

River and Pacific lamprey are predators of salmon and steelhead (Table 3-6) in their adult stages, and provide prey to salmonids as juveniles. It is likely that in the future, increases in water temperatures from climate change and continued land use development would have negative impacts on lamprey. In the Mitchell Act FEIS, the primary effect on lamprey from the operation of the hatchery programs is disruption of migration from weirs and sampling traps. The effects could be to isolate certain populations (if they cannot negotiate the weir or trap), and potentially increasing predation on lamprey by increasing the spatial and temporal overlap with predators. In addition, for the alternatives that reduced hatchery production in the Mitchell Act FEIS (alternatives 2 through 5), fewer salmon and steelhead would be available for prey for lamprey, but this may be mitigated by the availability of other prey sources. Conversely, Althernative 6 in the Mitchell Act FEIS increased releases of hatchery fish that may be beneficial to lamprey. In addition, salmon and steelhead hatchery improvement BMPs may benefit lamprey through the development of fish entrainment structures that do not prevent the movement of lamprey into streams.

In summary, continued hatchery productions could have a negative effect on other fish species (through competition), but increase food sources for bull trout and lamprey. It is unlikely that reasonable foreseeable actions will change the effects of hatchery releases on other fish species, but could negatively impact overall production for some species and increase productivity for others.

5.3.4.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.4.3. Alternative 3

Under Alternative 3, the release numbers of fish would be reduced by 50 percent. The cumulative impact of this alternative on other fish species would most likely be no different than Alternative 1 because such change in release numbers is not anticipated to change the degree of the competition and predator/prey interactions between hatchery-origin fish and other fish species. Considering the conintued effects from historic land use and development, dam operations, and the anticipated effects of reasonably certain to occur future actions (climate change, land use and development, and other hatchery operations), the overall impact of this alternative would be similar to Alternative 1.By implementing Alternative 3, the 50 percent reduction would likely reduce predation on other fish species, and competition and predation by other spceies would be reduced.

5.3.4.4. Alternative 4

Under Alternative 4, the hatchery programs analyzed in this EA would be terminated immediately. In terms of the cumulative impact, termination of hatchery programs may decrease the prey base available for other fish species (like cutthroat and bull trout) that use salmon and steelhead as a food source, although it is not believed that this would limit production for these species since they prey on other food sources. Competition and predation by other species would be reduced; however, effects from climate change and other future land use practices may negatively effect other fish species.

Considering the conintued effects from historic land use and development, dam operations, and the anticipated effects of reasonably certain to occur future actions (climate change, land use and development, and other hatchery productions), the overall impact of this alternative would likely be positive for some species (competitors) and negative for others (predators).

5.3.5. Wildlife

Subsection 3.5, Wildlife, describes the baseline conditions for wildlife, and Section 4.6 discusses the effects of the hatchery program alternatives on wildlife. These conditions represent the legacy effects of many years of land use and development, habitat restoration, and hatchery production.

Various wildlife species have a relationship with salmon and steelhead, as discussed in Section 3.5 (Table 3-7), so any change to salmon and steelhead productivity is also likely to impact wildlife species. As discussed in Section 5.3.3, Salmon and Steelhead, climate change, future land use and development may reduce the abundance and productivity of natural-origin salmon and steelhead populations. Hatchery-origin salmon and steelhead would be similarly affected after being released, but to a lesser degree since they would have more favorable conditions in their early life stages (while in the hatchery facility) as water temperature and food availability would potentially be controlled. Overall, the total number of salmon and steelhead available as prey to wildlife (Table 3-7), may be lower for all alternatives. Reduced abundance of salmon and steelhead would also decrease the number of salmon and steelhead carcasses available to wildlife for scavenging and for nutrient contribution to the freshwater system.

The potential benefits of restoration actions within the Analysis Area are difficult to quantify. It is unknown whether these actions would fully, or even partially, mitigate for the impacts of climate change and development on salmon and steelhead abundance. Therefore, it is difficult to estimate future trends in available prey bases for wildlife and available nutrient contributions to the freshwater system. Again, however, localized microclimate fish habitat improvements may be realized from these restoration actions. This potential benefit, if improvements occur, would be experienced in the future by wildlife that reside in the same localized ecosystems.

5.3.5.1. Alternative 1

While populations of salmon and steelhead will continue to be affected by historic land use and development, operations of dams, and hatchery practices, Alternative 1 is expected to provide benefits to nearly all wildlife species because hatchery fish can be an important prey item for some wildlife species. These benefits may help offset some of the impacts expected in the future due to land use and development, climate change, and the potential resultant loss in natural production of salmonids. As stated above, hatchery fish productivity (number of returning adults) may be reduced by future reasonably certain to occur actions, but the impacts are expected to be less than those expected for natural-origin fish because of their life history differences which bypass the usual juvenile mortality. In addition, returning hatchery fish that spawn in the wild would help mitigate the amount of marine-derived nutrients that are available if natural-origin fish productivity is reduced by future actions/threats.

Within the Mitchell Act FEIS, in terms of the wildlife resources evaluated, Caspian terns and other bird species were evaluated as well as Southern Resident killer whales, California sea lions, and Steller sea lions. Because the Analysis Area for this EA does not extend downstream of the confluence with the Snake River or into the ocean, only the effects of the hatchery programs were considered for Caspian terns, since this species occurs within the Analysis Area.

The baseline condition in the Mitchell Act FEIS for Caspian terns was that, "populations were likely to increase". For steelhead released into the Columbia River mainstem (Wells FH), Mitchell Act FEIS Alternative 6 is estimated to be the same as the baseline. For steelhead released into the Methow River basin (Winthrop NFH and Wells FH), depending on the alternative, would either be the same as the baseline condition or there could be a potential reduction in abundance, distribution, and fitness (compared to the baseline), and the effects would be the same (as steelhead released into the Methow basin) for summer/fall and fall Chinook salmon.

5.3.5.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.5.3. Alternative 3

Under Alternative 3, 50 percent of the current number of hatchery fish would not be released. This would likely negatively affect wildlife that prey upon salmonids, and not offset likely losses of natural production from future threats as discussed previously. As discussed above for Alternative 1, reducing hatchery releases likely would have a negative effect upon wildlife that prey on salmon and steelhead, such as Caspian terns. The potential future effects from climate change and anticipated land use and development may exacerbate these effects if it reduces the productivity of natural-origin fish, providing less prey overall to those predators.

5.3.5.4. Alternative 4

Under Alternative 4, all of the current numbers of hatchery fish being evaluated in this EA would stop being released. This would negatively affect wildlife that prey upon salmonids to a greater extent than Alternative 3, and not offset likely losses of natural production from future threats as discussed previously. In addition to the negative effects of climate change, and anticipated land use and development reducing the productivity of natural-origin fish, the effects of elimination of the hatchery program will be negative to salmon and steelhead predators, like Caspian terns. In addition, the increase of marine-derived ntrients from naturally spawning hatchery fish would reduce nutrient input.

In summary, reducing hatchery releases may have a negative effect on salmon and steelhead predators. It is unlikely that reasonable foreseeable actions will change the effects of hatchery releases on wildlife species. However, if future actions/threats reduce natural-origin fish productivity, hatchery releases may offset the impacts on wildlife.

5.3.6. Socioeconomics

Subsection 3.6, Socioeconomics, describes the baseline conditions for socioeconomics within the Analysis Area. These conditions represent the effects of many years of dams, land use and development, habitat restoration, and hatchery production. The expected direct and indirect effects of the alternatives on socioeconomics are described in Subsection 4.7, Socioeconomics.

It is likely that cumulative effects from dams, climate change, land use and development, and hatchery production would decrease the number of fish available for sport fisheries and reduce angler expenditure and economic revenue relative to conditions considered in Subsection 4.7, Socioeconomics.

This subsection discusses the incremental impacts of the alternatives in addition to past, present, and reasonably foreseeable future actions (i.e., cumulative effects) on socioeconomic resources. Although unquantifiable, climate change and land use and development actions, and changes in hatchery production and fisheries may reduce the number of salmon and steelhead available for sport fisheries over time as described in Subsection 5.3.3, Salmon and Steelhead. This, in turn, may reduce angler expenditure and economic revenue relative to conditions considered in Subsection 4.7, Socioeconomics. Likewise, it may reduce the number of salmon and steelhead available as a food source and may increase reliance on other consumer goods or increase travel costs to participate in other fisheries.

5.3.6.1. Alternative 1

Under Alternative 1, the current numbers of hatchery fish released would remain the same. The cumulative socioeconomic effects of Alternative 1 in concert with the likely future positive effects from habitat restoration and hatchery productions would help mitigate natural production reduction and likely maintain fisheries (and the associated economic benefits) that currently exist that are based on the returning hatchery-origin fish from the hatchery programs being evaluated in this EA. However, future negative effects from land use and development, climate change, and dam operations may reduce the number of salmon and steelhead available for sport fisheries and food.

Within the Mitchell Act FEIS, four indicators were evaluated for socioeconomic impacts; commercial gross ex-vessel value, total (direct and indirect (called *secondary* in the Mitchell Act FEIS)) economic benefit to income, total economic impacts on jobs, and recreational expenditures. Because there are no commercial fisheries within the Analysis Area, the indicator commercial gross ex-vessel value, was not evaluated in this EA.

For total economic benefit to income, the baseline condition in the Mitchell Act FEIS is for over 173 million dollars in total personal income. For steelhead released into the Columbia River mainstem (Wells FH), using the Mitchell Act FEIS results for Alternative 6, total income would increase by 8 percent compared to the baseline. For steelhead released into the Methow River basin (Winthrop NFH and Wells FH), the effect would be the same as the baseline condition, an increase by 8 percent (Alternative 6), or there could be a reduction from 4 to 33 percent (alternatives 2, 3, and 4). For the summer/fall Chinook salmon hatchery programs, the potential effects would be the same as for steelhead released into the Methow River basin. For the fall Chinook salmon program from Priest Rapids FH, the effects would be the same as those for steelhead released into the Mewthow River basin except there would be no increase in total income (Alternative 6).

For total economic impacts on jobs, the Mitchell Act FEIS estimated the baseline condition as just over 4,500 jobs. For steelhead released into the Columbia River mainstem (Wells FH), using the result of the Mitchell Act FEIS for Alternative 6, there would be a 7 percent increase from the baseline condition. For steelhead released into the Methow River basin (Winthrop NFH and Wells FH), there would be a 1 to 32 percent reduction in jobs (alternatives 2, 3, 4, and 5), or an increase of 7 percent (Alternative 6). For the summer/fall Chinook salmon hatchery programs, the potential effects would be the same as for steelhead released into the Methow River basin. For the Priest Rapids fall Chinook salmon hatchery program, there would be be a 1 to 32 percent reduction in jobs (alternatives 2, 3, 4, and 5).

For recreational expenditures, the Mitchell Act FEIS estimated the baseline condition at over 125 million dollars. For steelhead released into the Columbia River mainstem (Wells FH), Mitchell Act FEIS Alternative 6, there would be a 3 percent increase from the baseline condition. For steelhead released into the Methow River basin (Winthrop NFH and Wells FH), there would be a 1 to 32 percent reduction in jobs. For the summer/fall and fall Chinook salmon hatchery programs, the potential effects would be the same as for steelhead released into the Methow River basin. For steelhead, the impact of Alternative 6 was estimated to be a 3 percent increase compared to the baseline condition. For summer/fall and fall Chinook salmon, the Mitchell Act FEIS estimated that there would be reduction in recreational expenditures compared to baseline, ranging from 3 percent (Alternative 5) to 31 percent (Alternative 2).

Although unquantifiable, climate change, land use and development actions, and changes in fisheries may reduce the number of salmon and steelhead available for sport fisheries over time as described in Subsection 5.3.3, Salmon and Steelhead, though such reduction may be mitigated slightly by hatchery productions. This, in turn, may reduce angler expenditure and economic revenue relative to conditions considered in Subsection 4.7, Socioeconomics. Likewise, it may reduce the number of salmon and steelhead available as a food source and may increase reliance on other consumer goods or increase travel costs to participate in other fisheries. In summary, future reasonably certain actions (e.g., climate change) may affect fishermen's ability to fish (e.g., water too low or hot and managers do not open fisheries), which may reduce angler expenditure and economic revenue. Likewise, it may reduce the number of salmon and steelhead available as a food source and may increase reliance on other consumer goods or increase travel costs to participate in other fisheries.

5.3.6.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.6.3. Alternative 3

Under Alternative 3, there would be a 50 percent reduction in the number of hatchery fish currently being released. The reduction in returning adults would likely reduce the socioeconomic effects, but most likely not to a substantial degree because of other hatchery programs that would continue to operate that affect fisheries and other socioeconomic factors. As suggested above, climate change, land use and development actions, and changes in fisheries may also reduce the number of salmon and steelhead available for sport fisheries over time as described in Subsection 5.3.3, Salmon and Steelhead, though such reduction may be mitigated slightly by hatchery productions. This, in turn, may reduce angler expenditure and economic revenue relative to conditions considered in Subsection 4.7, Socioeconomics. Reducing the hatchery production by 50 percent would most likely exacerbate these effects on the number of salmon and steelhead returning in the future.

5.3.6.4. Alternative 4

The potential negative effects discussed above for Alternative 3 would likely increase to some degree by the termination of the hatchery programs being evaluated in this EA, with the largest potential negative effect being the likely cessation of the steelhead fishery upstream of Wells Dam.[13] Reasonably certain to occur future actions may affect fishermen's ability to fish (e.g., water too low or hot and managers do not open fisheries), which may reduce angler expenditure and economic revenue. Likewise, legacy and future actions may reduce the number of salmon and steelhead available as a food source and may increase reliance on other consumer goods or increase travel costs to participate in other fisheries. However, as mentioned above, there are other hatchery programs that would continue to slightly mitigate for the reduction in the number of salmon and steelhead available for sport fisheries.

5.3.7. Cultural Resources

The hatchery programs being evaluated in this EA have a direct and positive impact the tribal identity of various tribes within the Columbia River Basin. This is because fish released from these hatchery programs directly contribute to tribal fisheries. These fisheries provide salmon and steelhead to tribal members for food and for ceremonial purposes.

Legacy and continued effects and future effects from land use and development and climate change may reduce the number of naturally produced salmon and steelhead available for tribal harvest over time. This may reduce the number of salmon and steelhead available to tribal members for food, ceremonial purposes, and as a part of their tribal identity. This reduction in salmon and steelhead may also increase tribal reliance on other consumer goods. Although habitat restoration is likely to improve habitat for salmon and steelhead and may help mitigate the some of the effects of climate change and development, the potential benefits of habitat restoration actions within the cumulative effects Analysis Area are difficult to quantify. The adverse effects of climate change would also be mitigated by hatcheries, which will likely ensure that some salmon and steelhead remain in the tribes' Usual and Accustomed Fishing Areas.

[13] Eliminating the summer/fall Chinook salmon hatchery programs may affect fisheries also, but the natural population may still be able to sustain fisheries in some areas (e.g., Wenatchee River) in the future.

5.3.7.1. Alternative 1

As discussed in Section 3.7, Cultural Resources, fish released from the hatchery programs being evaluated in this EA provide tribal fisheries primarily in the lower Columbia River (outside the Analysis Area). The actions under Alternative 1 positively affect cultural resources available to the tribes that participate in the fisheries.

"Cultural resources" was not a resource that was evaluated in the Mitchell Act FEIS, however, two indicators, under the resource "Environmental Justice" apply to the evaluation of this EA's resource, Cultural Resources; total tribal fish harvest, and tribal fishing revenue. It is important to understand that most of the impacts to these two indicators in the Mitchell Act FEIS apply to the tribal fisheries downstream of the Analysis Area.

The baseline condition for total tribal fish harvest is estimated in the Mitchell Act FEIS to be nearly 217,000 fish. For steelhead released into the Columbia River mainstem (Wells FH), Mitchell Act FEIS Alternative 6, there would be a 3 percent increase from the baseline condition. For steelhead released into the Methow River basin (Winthrop NFH and Wells FH), there would be a 5 to 42 percent reduction in harvest compared to the baseline (alternatives 2, 3, 4, and 5), or a 3 percent increase in harvest (Alternative 6). For the summer/fall and fall Chinook salmon hatchery programs, the potential effects would be the same as for steelhead released into the Methow River basin, except the fall Chinook program would not see the 3 percent increase estimated for Alternative 6 from the Mitchell Act FEIS.

For tribal fishing revenue, the baseline condition in the Mitchell Act FEIS was estimated at nearly three million dollars. For steelhead released into the Columbia River mainstem (Wells FH), Mitchell Act FEIS Alternative 6, there would be an 18 percent increase from the baseline condition. For steelhead released into the Methow River basin (Winthrop NFH and Wells FH), there would be either a 6 to 18 percent increase in revenue (alternatives 5 and 6), or a 9 to 44 percent decrease in revenue (alternatives 2, 3, and 4). For the summer/fall Chinook salmon hatchery programs, the potential effects would be the same as for steelhead released into the Methow River basin. For the Priest Rapids fall Chinook salmon program, the effects would be the same as the steelhead released into the Methow River basin, but the increase in revenue would be only 6 percent (Alterntaive 5).

Under Alternative 1, there will likely not be much change or effect to Cultural Resources when considering the potential effects of climate change, land use and development, habitat restoration, and fisheries activities. As discussed in Section 5.3.6, future conditions are expected to increase water temperature and potentially reduce flow. These conditions could effect fishing seasons and total openings, which would have a negative impact on Cultural Resources. However, the extent of the impact is difficult to quantify at this time.

5.3.7.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.7.3. Alternative 3

Under Alternative 3, 50 percent of the current production from the hatchery programs being evaluated in this EA would be released. This would likely reduce the number of hatchery fish returning and have some negative effect on tribal fisheries. However, the fisheries would continue because of other hatchery programs that produce fish that are caught in the tribal fisheries. It is not anticipated that reducing the hatchery programs by 50 percent will mitigate for the likely effects of future actions associated with land use and development, climate change, habitat restoration, and fisheries.

5.3.7.4. Alternative 4

Under Alternative 4, all of the current production from the hatchery programs being evaluated in this EA would be eliminated. This would reduce the number of hatchery fish returning and have a negative effect on tribal fisheries. While fisheries would continue because of other hatchery programs that produce fish that are caught in the fisheries, it is likely that, in concert with anticipated effects from climate change, land use and development the continued effects from dams, fisheries and hatchery programs, the number of summer/fall and fall Chinook salmon available for harvest by tribal fishermen would be reduced.

5.3.8. Environmental Justice

Subsection 3.8, Environmental Justice, describes environmental justice communities and counties of concern in the analysis area. Environmental justice user groups and communities of concern within the cumulative effects analysis area include people that fish for salmon and steelhead and low income or minority communities. The expected direct and indirect effects of the alternatives on environmental justice are described in Subsection 4.9, Environmental Justice.

This subsection considers potential effects that may occur as a result of implementing any one of the alternatives at the same time as other anticipated actions. This subsection discusses the incremental impacts of the alternatives in addition to past, present, and reasonably foreseeable future actions (i.e., cumulative effects) on environmental justice user groups and communities of concern.

Dams, land use and development actions, and changes in hatchery production and fisheries may reduce the number of salmon and steelhead available for sport fisheries over time as described in Subsection 3.3, Salmon and Steelhead. This, in turn, may reduce fishing opportunity in the analysis area relative to conditions considered in Subsection 4.8, Environmental Justice.

The potential benefits of habitat restoration actions within the cumulative effects analysis area are difficult to quantify. These actions may not fully mitigate for the impacts of climate change and land use and development on the abundance of fish that would be available for commercial or recreational harvest.

5.3.8.1. Alternative 1

Under Alternative 1, the number of hatchery fish being released would remain the same as the current condition. However, it is likely that cumulative effects from climate change, development, and hatchery production would decrease the number of fish available for harvest relative to conditions considered in Subsection 4.8, Environmental Justice. It is not likely that Alternative 1 would affect the overall trend in cumulative effects on environmental justice because the production level would remain the same as the current condition.

5.3.8.2. Alternative 2

Under Alternative 2, the effects would be the same as under Alternative 1.

5.3.8.3. Alternative 3

Under Alternative 3, the current hatchery production would be reduced by 50 percent. This would likely have a negligible effect on the Environmental Justice communities because there are other hatchery programs that provide angling opportunities.

5.3.8.4. Alternative 4

Alternative 4 would eliminate the hatchery production from the programs being reviewed within this EA. While this would reduce the number of salmon and steelhead available for harvest, it is not believed that there would be a large effect because the number of fish released under current programs are a small fraction of the total harvestable salmon and steelhead in the analysis area available to environmental justice communities, except if the steelhead hatchery fish programs in the Methow River basin were eliminated, environmental justice communities in Okanogan County may be adversely affected.

5.3.9. Human Health and Safety

Hatchery operations employed by programs evaluated in this EA pose some potential low-adverse effects on human health and safety through the release of chemicals and therapeutics through the hatchery effluent (Subsection 3.9, Human Health and Safety). Future climate change, development, and habitat restoration actions in the basin are not expected to affect the use, handling, or safety of chemicals used in hatchery facilities because all chemicals would continue to be used according to their labels. As a result, no cumulative effects would be expected beyond those already discussed in Section 4.10, Human Health and Safety.

6. PERSONS AND AGENCIES CONSULTED

Michael Humling, Fish Biologist, U.S. Fish & Wildlife Service
Alene Underwood, Fish and Wildlife Manager, Chelan County PUD
Catherine Willard, Senior Fisheries Biolgoist, Chelan County PUD
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Deanne Pavlik-Kunkel, Fisheries Program Supervisor, Grant County PUD
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7. Finding of No Significant Impacts

7.1. Background

Proposed Action:

NMFS' issuance of one ESA Section 10(a)(1)(A) permit to Douglas PUD and WDFW for the Wells Complex Summer Steelhead Program; make one ESA section 4(d) limit 5 determination for USFWS and USBOR's WNFH Summer Steelhead Program; and issue three ESA Section 10(a)(1)(B) permits to WDFW, Douglas PUD, Chelan PUD, and Grant PUD for the five summer/fall and fall Chinook salmon programs. See the Environmental Assessment for more details.

Alternatives Evaluated in the Environmental Assessment:

- Alternative 1: No Action Alternative assumes that NMFS would not make ESA section (4d) determinations, nor issue the ESA section 10(a)(1)(A) and 10(a)(1)(B) permits, but the programs would continue as currently operated.
- Alternative 2: Proposed Action Alternative (Preferred Alternative) would mean NMFS made the ESA section 4(d) determination, as well as issued the ESA section10(a)(1)(A) and 10(a)(1)(B) permits, allowing for continued operation of the current programs with ESA coverage.
- Alternative 3: Reduced production Alternative assumes NMFS made the ESA section 4(d) determination, as well as issued the ESA section 10(a)(1)(A) and 10(a)(1)(B) permits, but an ESA coverage for 50% reduction in hatchery production across programs.
- Alternative 4: No Hatchery Releases Alternative assumes termination of all programs considered in this EA.

Selected Alternative:

Alternative 2: Proposed Action Alternative (preferred Alternative) would mean NMFS issued the ESA section 10(a)(1)(A) and 10(a)(1)(B) permits, as well as made the ESA section 4(d) determination, allowing for the continued operation of the current programs with ESA coverage.

Related Consultations:

ESA and Magnuson-Stevens Act Essential Fish Habitat (EFH) consultations related to salmon and steelhead are described in the EA.

The consultations with USFWS for bull trout are:

- Winthrop National Fish Hatchery steelhead program (USFWS 2016)
- Wells Complex summer steelhead hatchery program (USFWS 2017b; USFWS 2017d)

- Wenatchee summer/fall Chinook salmon program (USFWS 2017b)
- Chelan Falls, Methow, and Wells summer/fall Chinook salmon programs and Priest Rapids fall Chinook salmon program (USFWS 2017c)

7.2. Significance Review

The Council on Environmental Quality (CEQ) Regulations state that the determination of significance using an analysis of effects requires examination of both context and intensity, and lists ten criteria for intensity (40 C.F.R. § 1508.27). In addition, the Companion Manual for National Oceanic and Atmospheric Administration Administrative Order 216-6A provides sixteen criteria, the same ten as the CEQ Regulations and six additional, for determining whether the impacts of a proposed action are significant. Each criterion is discussed below with respect to the proposed action and considered individually as well as in combination with the others.

1. Can the proposed action reasonably be expected to cause both beneficial and adverse impacts that overall may result in a significant effect, even if the effect will be beneficial?

Response: The NMFS' determination for ESA coverage for the continuation of the seven hatchery programs analyzed in the attached EA is not reasonably expected to cause neither beneficial nor adverse impacts that overall may result in a significant effect, nor result in significant negative impacts even if the overall effect will be beneficial. This conclusion pertains to both the overall impacts of the action as well as to the specific impacts to various resources considered. The EA identified nine resources that the proposed action may impact and categorized the magnitude of the potential impact from undetectable to medium. Two impacts were determined to be no more than medium-adverse: the impact from hatchery-origin spawners on natural steelhead population diversity, and predation and competition through the interaction of hatchery-origin and natural-origin juveniles throughout the analysis area. The other identified resource impacts fall to the lower end of the relative magnitude spectrum, within the low to undetectable ranges.

The proposed action is expected to benefit the conservation efforts for the UCR Steelhead DPS by way of the intergraded recovery program, and provide a cultural and local economic benefit to fisheries in the Upper Columbia River Basin by augmenting available catchable fish for recreational and tribal fisheries. In addition, these activities are monitored and controlled by regulations that minimize negative impacts on the biological and physical components of the environment while promoting benefits to the human component. See Section 4 of the EA, for more detailed information of the potential impacts.

2. Can the proposed action reasonably be expected to significantly affect public health or safety?

Response: The proposed action is expected to have a low-adverse impact on public health or safety, directly or indirectly. Hatchery facility operations associated with the proposed action are implemented in compliance with state and Federal safety regulations and environmental laws, thus reducing potential risks to public health. The public will have limited exposure to hatchery facility operations, and any known potential impacts to public health as a result of the proposed action is limited to the willful consumption of hatchery-origin fish, which is directly associated with the frequency of consuming fish, regardless of whether fish are of hatchery or natural-origin.

3. Can the proposed action reasonably be expected to result in significant impacts to unique characteristics of the geographic area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?

Response: The proposed action is not expected to induce more than medium-adverse impacts on unique geographic areas, such as proximity to historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas because no new infrastructure is proposed through the action.

NMFS and USFWS found that the proposed action is not likely to destroy or adversely modify any ESA-designated critical habitats for ESA-listed UCR spring Chinook salmon , UCR steelhead, and bull trout within the analysis area (NMFS 2017b; NMFS 2017d; USFWS 2016; USFWS 2017b; USFWS 2017c; USFWS 2017d). The habitat impacts analyzed in the EA are determined to be no more than medium-adverse under the proposed action. For more information, see the EA, Subsection 4.4, Salmon and Steelhead.

4. Are the proposed action's effects on the quality of the human environment likely to be highly controversial?

Response: The proposed action's effects on the quality of the human environment are not likely to be highly controversial because the impacts of these hatchery programs, as identified, are consistent with or an improvement from implementation of the hatchery programs over prior years, of which, the same conclusion from previous analyses in FEIS (NMFS 2014; NMFS 2017a) occurred. Moreover, NMFS has provided an opportunity for public comment in developing the proposed action and in analyzing the likely impacts of the proposed action (Section 1.4), and the public input, limited to two comments raising general concerns about threats to the Columbia River ecosystem, did not identify any aspects of the proposed action as highly controversial. Therefore, these impacts are well-studied and well-understood by the public, and no significant opposition has been raised.

5. Are the proposed action's effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: The proposed action's effects on the human environment are not likely to be highly uncertain or involve unique or unknown risks. No unique or unknown risks have been identified, and numerous scientific studies on hatchery risks have identified what NMFS believes is an accurate list of potential concerns. However, as with most hatchery programs there is some degree of uncertainty as to how well the hatchery programs would be able to achieve goals stated in the HGMPs, particularly the genetic impacts of hatchery-influenced selection on natural-origin fish. This uncertainty regarding potential genetic effects from the hatchery-origin steelhead under the proposed action is minimized through actions which would help natural selection prevail over hatchery selection: the use of endemic and/or localized broodstock and other management steps emphasizing natural selection (i.e., making management decision to ensure to the number of hatchery-origin spawners on natural-origin spawning grounds are minimized to the maximum extent possible). In addition, the proposed action includes explicit steps to monitor and evaluate these uncertainties in a manner that allows timely adjustment to risks that might arise. NMFS retains the ability, through its regulations, to require changes if the program is determined to be ineffective, particularly with respect to the control of genetic effects on salmon and steelhead. Finally, numerous actions described in these hatchery programs are already in place and have demonstrated their effectiveness, at least initially, reducing the level of uncertainty.

6. Can the proposed action reasonably be expected to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

Response: The proposed action is not likely to establish a precedent for future actions with significant effects or to represent a decision in principle about a future consideration. Other hatchery operations in the Upper Columbia River Basin have been analyzed through similar ESA analyses and NEPA reviews, so this action and the analysis thereof is not unique. Moreover, future applications for ESA 4(d) determination and section 10(a)(1)(A) and section 10(a)(1)(B) direct and incidental take permits in the action area would be analyzed on their own merits and impacts. Each such activity presents unique actions and effects, limiting the extent to which prior analyses can act as any sort of precedent.

7. Is the proposed action related to other actions that when considered together will have individually insignificant but cumulatively significant impacts?

Response: NMFS is well aware of the possibility that hatchery practices in one basin may not be likely to raise significant impacts on their own, but that the totality of hatchery operations in the Upper Columbia River Basin could give rise to cumulatively significant impacts. Therefore, NMFS has completed FEISs on hatchery operations across the Basin (NMFS 2014, as incorporated by NMFS (2017c)), which can be relied upon to consider whether the proposed action could give rise to cumulatively significant impacts. Here, NMFS (2014) has been incorporated into the analysis, and cumulative impacts of the proposed action have been considered in the EA and in the associated Section 7 consultation biological opinions (NMFS 2017b; NMFS 2017d). The take of ESA-listed species is small enough to result in a no-jeopardy ESA determination when considering all existing conditions, all other permits, and other actions in the area affecting these conditions and permits. These hatchery programs are coordinated with monitoring so that hatchery managers can respond to changes in the status of affected listed species. If the cumulative impacts of salmon management efforts fail to provide for recovery of listed species, adjustments to the hatchery production levels would likely be proposed through consultations between the relevant applicants and NMFS.

The proposed action is related to other hatchery production programs in that many are guided by the same legal agreements, mitigation responsibilities, and managed by the same agencies. While direct and indirect impacts of the proposed action are not expected to be measurable outside the project area, it is also important to consider how impacts of certain activities outside the project area may or may not interact with the proposed action in such a way that impacts on resources are exacerbated.

The EA relied on the cumulative impacts considerations in the FEIS for overall guidance, and then compared the potential cumulative effects of the proposed action (section 5) added to the cumulative effects of the operation of all the hatchery programs in the Columbia River Basin as evaluated in the FEIS (NMFS 2014; NMFS 2017c).

8. Can the proposed action reasonably be expected to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?

Response: The proposed action does not include any new construction and is, therefore, unlikely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places. Accordingly, it is equally unlikely that the proposed action may cause loss or destruction of significant scientific, cultural, or historic resources because of the limited geographic scope of the project area, which includes none of the aforementioned structures or resources. In addition, the proposed action would produce salmon and steelhead, which are culturally important to the tribes.

9. Can the proposed action reasonably be expected to have a significant impact on endangered or threatened species, or their critical habitat as defined under the Endangered Species Act of 1973?

Response: The degree to which the proposed action adversely impacts endangered or threatened species, or their critical habitat, as described in the EA, will be no more than medium-adverse. In the EA, NMFS took into account the analysis performed in two ESA biological opinions completed on the proposed hatchery programs that determined that the programs will not reduce appreciably the likelihood of survival and recovery of the to two ESA-listed species within the action area, and therefore concluded the UCR Spring Chinook Salmon ESU and the UCR Steelhead DPS will not be jeopardized (NMFS 2017b; NMFS 2017d).

The EA also summarizes the impacts of the proposed action on ESA-designated critical habitat, which was analyzed in detail in NMFS (2017b) and in NMFS (2017d). The aforementioned biological opinions concluded that the expected impacts on critical habitat for endangered or threatened species from the activities associated with the hatchery programs (such as maintenance of facilities and instream structures) are unlikely to adversely modify or destroy critical habitat elements.

The EA also analyzed impacts on bull trout. ESA section 7 consultations were completed by USFWS on incidental impacts of the proposed hatchery programs on ESA-listed bull trout. USFWS concluded that the effects of the proposed hatchery programs would adversely affect bull trout abundance and productivity; but on such a marginal scale, the programs would not substantially affect the conservation efforts of the bull trout Mid-Columbia Management Unit and would not jeopardize the continued existence of bull trout nor destroy or adversely modify their critical habitat (USFWS 2016; USFWS 2017b; USFWS 2017c; USFWS 2017d).

10. Can the proposed action reasonably be expected to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection?

Response: The proposed action is not expected to threaten any violations of Federal, state, or local laws or requirements imposed for environmental protection. The contexts of the determined effects of the proposed action was developed in the broader context of consultations involving Federal and state agencies charged with recovery planning and implementation of the ESA. No regulatory violations or other significant environmental impacts are expected to result from the proposed action. The proposed action is also specifically designed to comply with the ESA, and is part of the purpose of the action.

Hatchery operations are required to comply with the Clean Water Act, including obtaining and operating within the limit of National Pollutant Discharge Elimination System (NPDES) permits for discharge from hatchery facilities. Acclimation facilities without NPDES permit requirements discharge at a minimal level, as to not need a NPDES permit.

11. Can the proposed action reasonably be expected to significantly adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act?

Response: The proposed action is not expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act. Impacts on marine mammals are not likely because marine mammals are not present in the Upper Columbia Basin. While not a main food source, the hatchery-origin salmon from the Upper Columbia River Basin released into the Columbia River provide a potential food source benefits for the marine mammals inhabiting the pelagic zones off the coast of Washington and Oregon along with pinniped populations located in the lower portions of the Lower Columbia River Basin and Columbia River Estuary.

12. Can the proposed action reasonably be expected to significantly adversely affect managed fish species?

Response: The proposed action is not expected to affect managed fish species beyond what NMFS identifies as medium-adverse. The impacts of the proposed action on managed fish species, specifically salmon, steelhead, and bull trout, within the Upper Columbia River Basin are limited to the ecological impacts of intra and inter-species competition and predation related to the release of juveniles; genetic diversity from hatchery-origin spawners, and the direct effects on target and non-target species due to broodstock collection activities. Any and all effects to managed fish within the project area related to the proposed action have been analyzed in the biological opinions (NMFS 2017b; NMFS 2017d; USFWS 2017b). See the opinions for further details on the impacts of the proposed action to managed species.

13. Can the proposed action reasonably be expected to significantly adversely affect essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act?

Response: The proposed action is not reasonably expected to adversely affect essential fish habitat (EFH), as defined under the Magnuson-Stevens Act, to a degree beyond low-adverse. Specifically, Pacific salmon EFH is affected by the proposed action through ecological interactions between hatchery and natural-origin progeny as a result of the proposed action. The activities described in the HGMPs, such as maintenance of intake structures, are unlikely to remove or destroy habitat elements, and these activities do not include any construction or habitat modification and therefore do not affect EFH necessary for these species to carry out spawning, breeding, feeding, or growth to maturity.

The return of hatchery-origin UCR summer steelhead, summer/fall and fall Chinook salmon produced by these hatchery programs is likely to have a positive effect on water quality related to marine-derived nutrients because the additional returns from hatchery production will result in a net increase of marine-derived nutrients in the project area.

14. Can the proposed action reasonably be expected to significantly adversely affect vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystems?

Response: The proposed action is not expected to have an adverse effect on vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystem because any meaningful or discernible effects would be limited to the affected environment (i.e., the Upper Columbia River Basin) which does not extend to the marine environment. The proposed action is expected to have a low-adverse impact to Pacific salmon EFH, but the associated impacts due to the proposed action are anticipated to only take place within the Columbia River Basin, and therefore will not affect vulnerable marine or coastal ecosystems.

15. Can the proposed action reasonably be expected to significantly adversely affect biodiversity or ecosystem functioning (e.g., benthic productivity, predator-prey relationships, etc.)?

Response: The proposed action is expected to have no more than a medium-adverse effect on biodiversity or ecosystem functions within the affected environment. The hatchery programs minimize the effects to the action area ecosystems through the use of endemic broodstock native to the Upper Columbia River Basin and improved hatchery management protocols that limit the effects of hatchery-origin spawners. The hatchery programs may result in small improvements to benthic productivity through increased deposits of marine-derived nutrients resulting from returning hatchery-origin adult carcasses to the watersheds post-spawning. Although summer steelhead and summer/fall and fall Chinook salmon produced in these hatchery programs are expected to prey on other fish species in the project area, predation is not expected in large quantities since juvenile hatchery-origin salmon and steelhead generally migrate through the action area quickly after being released (see subsection 4.4.3, Competition and Predation). Hatchery-origin summer steelhead and summer/fall and fall Chinook salmon produced in these hatchery programs may also provide a prey base for other predatory species (see Subsection 4.4.3, Competition and Predation), but these programs represent only a small portion of the total amount of food available to predator species, so the proposed action is not expected to have significant impacts on biodiversity and ecosystem function.

16. Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

Response: The proposed action is not reasonably expected to result in the introduction or spread of nonindigenous species because the proposed action has no potential to cause the transport, release, propagation or spread of non-indigenous species. The proposed action involves the operation of hatchery facilities for the purpose of artificial propagation of salmonids in the Upper Columbia River Basin for an integrated conservation program, and sports and tribal fisheries. These artificial propagation programs use local endemic summer steelhead and UCR summer/fall and fall Chinook salmon adults as broodstock and therefore will not introduce nonindigenous species to the project area. Fishing activities associated with the proposed action are not likely to introduce or spread non-indigenous species any more than other ongoing activities such as hiking, camping, tourist activities, fishing for non-listed species, and forestry practices. The gear used in these fisheries (tackle and boats, etc.) are not expected to be brought in from outside the basin in any great number, and the states have in place check stations and other mechanisms, independent of the proposed activities, that would reduce transfer from out-of-basin locations of any non-indigenous species to levels no different from other activities not part of the proposed action.

7.3. Determination

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for NMFS' determination under ESA Section 4(d) and the issuance of ESA section 10(a)(1)(A) and 10(a)(a)(B) permits for the continuation of the seven proposed programs (Douglas PUD and WDFW for the Wells Complex Summer Steelhead Program; USFWS and USBOR's WNFH Summer Steelhead Program; and WDFW, Douglas PUD, Chelan PUD, and Grant PUD for the five summer/fall and fall Chinook salmon programs) will not significantly impact affect the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an environmental impact statement for this action is not necessary.

____________________________________ August 30, 2019

Barry A. Thom — Date

Regional Administrator
West Coast Region
National Marine Fisheries Service

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9. APPENDIX A

Population Viability of the Upper Columbia River Spring Chinook Salmon ESU and the Upper Columbia River Steelhead DPS

Upper Columbia River Spring Chinook Salmon ESU

The UCR Spring Chinook Salmon ESU consists of one major population group composed of three existing and one extirpated population—the Wenatchee, Entiat, Methow, and the extirpated Okanogan[14] populations. These fish spawn and rear in the Columbia River tributaries between Rock Island and Chief Joseph Dams. Spring Chinook were already at very low numbers when their upriver migration was blocked into the upper Columbia River basin by Grand Coulee Dam in 1939 (Fish and Hanavan 1948).

Upper Columbia River spring Chinook salmon were listed as endangered under the ESA in 1999, and reaffirmed in 2005 (70 FR 37160) and 2014 (79 FR 20802). Hatchery programs associated with this ESU include the Chiwawa River and Nason Creek in the Wenatchee River basin, and the WNFH and Methow Hatchery programs in the Methow River basin.

Annual spawning escapements for all three of the extant Upper Columbia spring Chinook salmon populations showed steep declines beginning in the late 1980s, leading to extremely low abundance levels in the mid-1990s (Table 8-1Figure 8-1). The steep downward trend reflects the extremely low return rates for natural production from the 1990-94 brood years (NWFSC 2015). Brood year replacement rates (a measure of productivity) were consistently below 1.0 even at low parent spawner levels throughout the 1990s. Updating the data series to include 2009-2014, the short-term (e.g., 15 year) trend in wild spawners has been neutral for the Wenatchee River population and positive for the Entiat and Methow populations (Table 8-1). In general, both total and natural-origin escapements for all three populations increased sharply from 1999 through 2002 and have shown substantial year to year variations in the years following, with peaks around 2001 and 2010. Average natural-origin returns of UCR spring Chinook salmon remain well below ICTRT minimum threshold levels (Table 8-2).

[14] Though this population is currently considered extirpated, the Okanogan spring Chinook Hatchery program has been reintroducing spring Chinook salmon since 2014 in the Okanogan Subbasin as an experimental population under ESA section 10(j) (79 FR 40004).

Table 8-1. Five-year geometric mean of *natural-origin* spring Chinook salmon spawner counts. Five-year geometric mean of *total* (hatchery- and natural-origin) spring Chinook salmon spawner counts is shown in parenthesis. Percent change between the most recent two five-year periods is shown on the far right.

Population	Five-year geometric mean (spawner count times fraction of natural-origin fish)[1]					
	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	Percent change
Methow	722 (867)	44 (75)	292 (2,171)	379 (1,470)	425 (1,828)	12
Entiat	153 (179)	37 (56)	148 (280)	129 (278)	265 (360)	105
Wenatchee	621 (735)	120 (192)	860 (1,652)	385 (1,671)	785 (2,254)	104

Source: Table 5 of NWFSC (2015).

[1] Please see NWFSC (2015) for more information on how means were derived.

For spatial structure and diversity, there has been a decline in the proportion of natural-origin fish on the spawning grounds for all three populations (Figure 8-1). The decline in the fraction of natural-origin spring Chinook salmon in the Upper Columbia River tributaries corresponds with spring Chinook salmon hatchery programs that began in the late 1980s to early 1990s in the Weantchee and Methow River basins, and the subsequent returns of those fish. Spring Chinook salmon were historically released into the Entiat River from Entiat NFH, but those releases ceased after 2007, and the proportion of natural-origin fish has increased since that time (Figure 8-1). Current hatchery-origin spring Chinook salmon spawners in the Enitat River are primarily strays from the Chiwawa River spring Chinook salmon hatchery program (Wenatchee River basin), where prior to a reduction in the number of fish released from the program in 2012, strays from the program made up between 72 to 81 percent of the hatchery spring Chinoook salmon recovered (USFWS 2017a). The number of strays has dramatically been reduced in recent years and pHOS in general has decreased substantially (Figure 8-1).

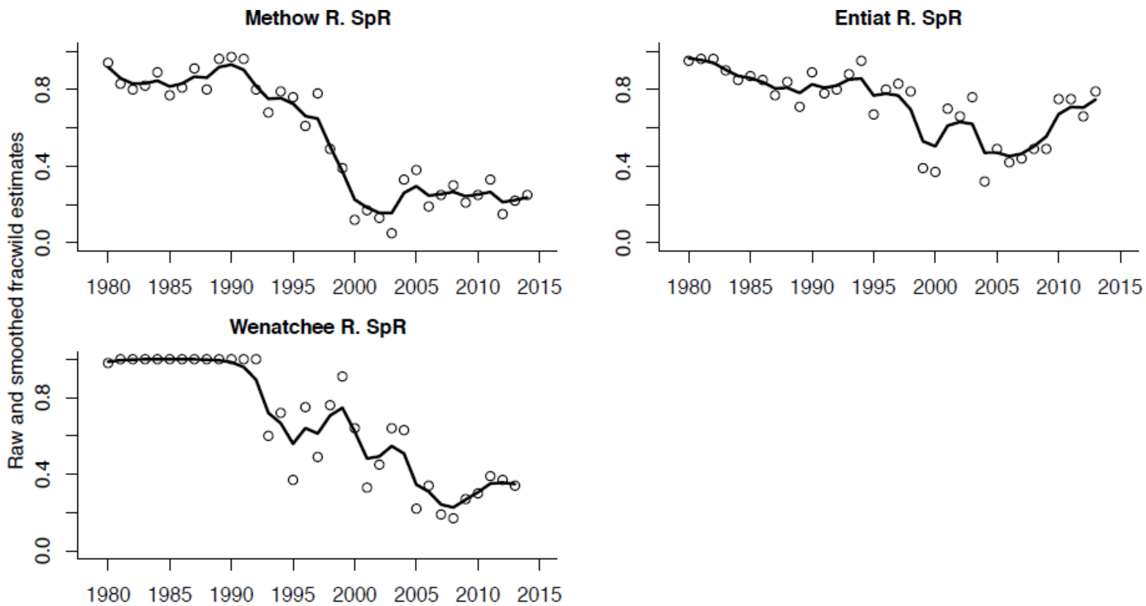

Figure 8-1. Smoothed trend in the estimated fraction of the spring Chinook salmon natural spawning population consisting of fish of natural-origin in the Wenatchee, Entiat, and Methow River basins. Points show the annual raw estimates. Figure 12 of NWFSC (2015).

The current average estimates of pHOS for spring Chinook salmon are over 60 percent for the Wenatchee River basin (Hillman et al. 2017; NWFSC 2015), about 25 percent in the Entiat,[15] and just over 75 percent for the Methow River basin (Snow et al. 2017) The predominance of hatchery fish on the spawning grounds is a risk, and populations that rely solely on hatchery spawners are not considered viable, because the viability criteria apply only to natural-origin fish (McElhany et al. 2000), which is why the spatial structure and diversity metrics are still ranked at a high risk of extinction (Table 8-2).

For spring Chinook salmon, the Recovery Plan recommends the minimum number of naturally produced spawners (expressed as a 12-year geometric mean) should exceed 2,000 each for the Wenatchee and Methow River populations and 500 within the Entiat River. Minimum productivity thresholds were also established in the Recovery Plan. The 12-year geometric mean productivity should exceed 1.2 spawners per parent spawner for the Wenatchee and Methow River populations, and 1.4 for the Entiat River population. The current abundance and productivity estimates remain well below these recommendations (Table 8-2).

[15] The average pHOS from 2004-2016 for the Entiat is 39 percent, but has dropped to less than 20 percent since the Entiat NFH stopped releasing spring Chinook salmon and the Chiwawa River program reduced the number of spring Chinook salmon releases.

Table 8-2. Risk levels and viability ratings for natural-origin UCR spring Chinook salmon populations from 2005-2014.

Population	Abundance and Productivity (A/P)				Spatial Structure and Diversity (SS/D)			Overall Risk
	Minimum Abundance Threshold	Natural Spawning Abundance [1]	Productivity	A/P Risk	Natural Processes Risk	Diversity Risk	SS/D Risk	
Wenatchee River	2000	545 (311-1030)	0.60	High	Low	High	High	High
Entiat River	500	166 (78-354)	0.94	High	Moderate	High	High	High
Methow River	2000	379 (189-929)	0.46	High	Low	High	High	High

Source: (NWFSC 2015)

[1] The numbers in this column are geometric mean with the range in parentheses.

Upper Columbia River Steelhead DPS

The Upper Columbia River Steelhead DPS includes all anadromous populations that spawn and rear in the middle reaches of the rivers and tributaries upstream of the Yakima River to the U.S. Canadian border. There are four populations in a single major population group that spawn in the Wenatchee, Entiat, Methow, and Okanongan River basins.[16] The Upper Columbia River Steelhead DPS, that includes hatchery fish from the Wenatchee, Wells (Methow and Okanogan river basins), Winthrop, Omak, and Ringold programs, were initially listed under the ESA as endangered on August 18, 1997 (62 FR 43937) and later as threatened on January 5, 2006 (71 FR 834), and reaffirmed on April 14, 2014 (79 FR 20802).

The total abundance of steelhead (hatchery and naturally produced) has been heavily influenced by hatchery fish returns since at least the 1980s. Abundance of natural-origin steelhead for all four of the major populations declined to low levels in the mid-1990s, and began to increase in the early 2000s. The most recent status review (NWFSC 2015) shows that for the four major populations, abundance has increased substantially since the previous review (Table 8-3). The percent increase from the period 2005-2009 and 2010-2014 ranged from 67 to 128 percent (Table 8-3).

[16] Small numbers of steelhead are believed to spawn in the small tributaries that drain into the Columbia River from the west between the Wenatchee and Yakima rivers. Crab Creek (drains from the east and enters the Columbia River downstream of Vantage, WA) is also part of the DPS, but population estimates are not available.

Table 8-3. Five-year geometric mean of *natural-origin* steelhead spawner counts. Five-year geometric mean of *total* (hatchery- and natural-origin) steelhead spawner counts is shown in parenthesis. Percent change between the most recent two five-year periods is shown on the far right.

Population	Five-year geometric mean (spawner count times fraction of natural-origin fish)[1]					
	1990-1994	**1995-1999**	**2000-2004**	**2005-2009**	**2010-2014**	**Percent change**
Okanogan	65 (678)	23 (522)	123 (2,163)	144 (1,735)	248 (2,123)	72
Methow	274 (1,206)	100 (927)	434 (4,228)	504 (3,463)	842 (3,839)	67
Entiat	68 (134)	38 (200)	107 (491)	102 (462)	209 (696)	105
Wenatchee	525 (1,847)	265 (742)	772 (2,318)	678 (1,857)	1,548 (2,767)	128

Source: Table 9 of NWFSC (2015).

[1] Please see NWFSC (2015) for more information on how means were derived.

For spatial structure and diversity, there has been an increase in the proportion of natural-origin fish on the spawning grounds for all four populations for the time period ending in 2015 (Table 8-3; Figure 8-2). The increase in the fraction of natural-origin steelhead in the Upper Columbia River tributaries corresponds with a change in management of steelhead stocks since the listing in 1997. The fraction of natural-origin steelhead is the highest in the Wenatchee River, followed by the Entiat, Methow and finally Okanogan rivers (Table 8-3; Figure 8-2). Hatchery steelhead have not been released into the Entiat River since the late 1990s, and, based on PIT tag recaptures, most hatchery-origin fish appear to be from the Wenatchee River steelhead program (Hillman et al. 2017). Since the 2011 brood year, over-winter rearing of hatchery steelhead has occurred at the Chiwawa River acclimation site, and Hillman et al. (2017) has shown a decline in the number of strays from the Wenatchee River steelhead program.

The current average estimates of pHOS is approximately 50 percent in the Wenatchee River basin (Hillman et al. 2017), ranging from 10 to 30 percent in the Entiat River basin (Murdoch 2018), 80 percent for the Methow River basin, and 89 percent for the Okanogan River basin (Snow et al. 2017). The predominance of hatchery fish on the spawning grounds is a risk, and populations that rely solely on hatchery spawners are not considered viable, because the viability criteria apply only to natural-origin fish (McElhany et al. 2000), which is why the spatial structure and diversity metrics are still ranked at a high risk of extinction (Table 8-4).

For steelhead, the Recovery Plan (UCSRB 2007) recommends the minimum number of naturally produced spawners (expressed as 12-year geometric means) should exceed 1,000 each for the Wenatchee and Methow River populations and 500 within the Entiat and Okanogan River populations. Minimum productivity thresholds were also established in the Recovery Plan. The 12-year geometric mean productivity should exceed 1.1 spawners per parent spawner for the Wenatchee and Methow River populations, and 1.2 for the Entiat and Okanogan River populations. The current abundance and productivity estimates remain well below these recommendations, except for the Wenatchee River population that was considered a high risk in the previous status review (Ford et al. 2011), and was upgraded to “maintained” in the most recent status review (NWFSC 2015) (Table 8-4).

Table 8-4. Risk levels and viability ratings for natural-origin UCR steelhead populations from 2005-2014.

Population	Abundance and Productivity (A/P)				Spatial Structure and Diversity (SS/D)			Overall Risk
	Minimum Abundance Threshold	Natural Spawning Abundance[1]	Productivity	A/P Risk	Natural Processes Risk	Diversity Risk	SS/D Risk	
Wenatchee River	1000	1025 (386-2235)	1.207	Low	Low	High	High	Maintained
Entiat River	500	146 (59-310)	0.434	High	Moderate	High	High	High
Methow River	1000	651 (365-1105)	0.371	High	Low	High	High	High
Okanogan River	750	189 (107-310)	0.154	High	High	High	High	High

Source: NWFSC (2015)

[1] The numbers in this column are geometric mean with the range in parentheses.

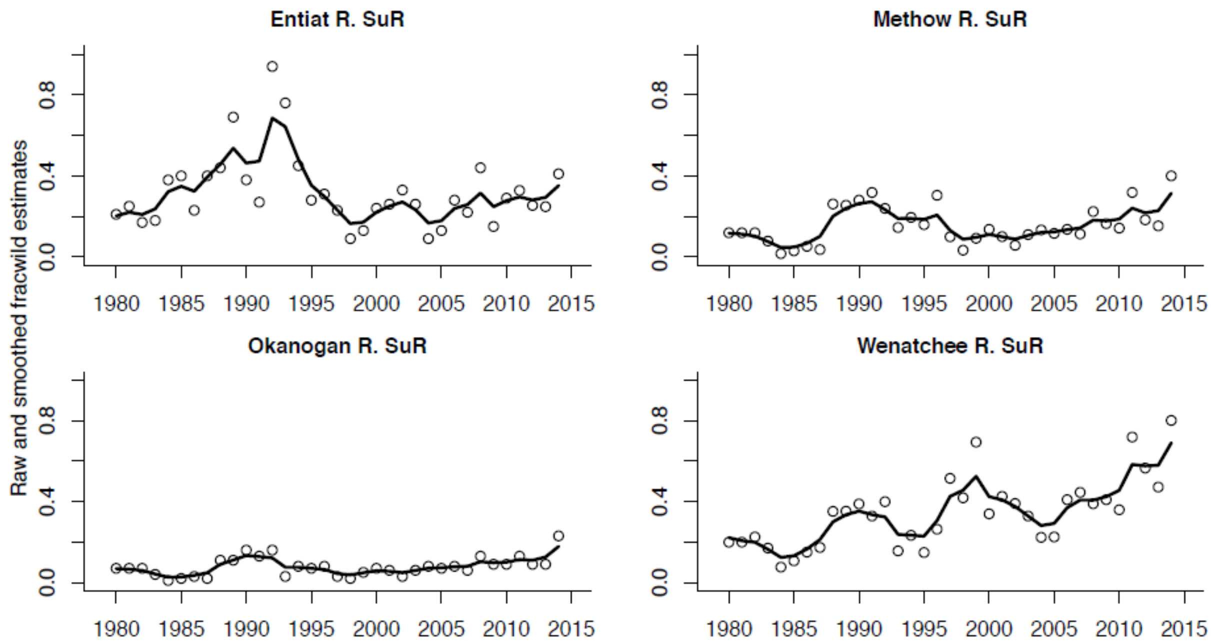

Figure 8-2. Smoothed trend in the estimated fraction of the steelhead natural spawning population consisting of fish of natural-origin in the Wenatchee, Entiat, Methow, and Okanogan River basins. Points show the annual raw estimates. Figure 19 of NWFSC (2015).

10. APPENDIX B: PUBLIC COMMENTS RECEIVED, AND NMFS RESPONSES TO COMMENTS

From: **Jean Public** <jeanpublic1@yahoo.com>
Date: Tue, Apr 2, 2019 at 11:55 AM
Subject: Fw: public comment on federal register malicious vicious agency killing herons, seals everything on columbia river for fish when its commercial fishemen taking all the fish - not the animals, vicious action going on here
To: Hatcheries.Public.Comment@noaa.gov <Hatcheries.Public.Comment@noaa.gov>, emi.kondo@noaa.gov <emi.kondo@noaa.gov>, info@sharkonline.org <info@sharkonline.org>, Pew Trusts <info@pewtrusts.org>, information@sierraclub.org <information@sierraclub.org>, info@peeer.org <info@peeer.org>, foe@foe.org <foe@foe.org>, humanelines@hsus.org <humanelines@hsus.org>, info@peta.org <info@peta.org>, info@idausa.org <info@idausa.org>, info@cok.net <info@cok.net>

the vicious, malicious killing of herons, seals, dolphins etc in the columbia river and blaming no fish on the animals makes no sense at all. the fact of the matter is the salmon commercialfishemen took all the fish for their own profiteering.and that is the reason they are all gone. such commercial fishermen can quickoy wipe out species and the takings from this river have beenenormous andmade many fortunes in the commercial fishermen families. then they have propandists tha blame it all on animals, which is a lie and fakery to the people of this country. this is national river and we need to protect and preserve all animal species that need to get food and water from this river. they deserve it as much as people. they do not deserveto be plotted against by this vicious, destructive aency that needs to have its funds cut. this plan is all wrong. hatciers btw produce unhealthy dirty fish and it doent work to produce fish from hatcheries. if we have such plundering commerical fisherment, maybe we have to give up eating fish. bu you donm kill a single animal and blame them. they only take enough to eat, the commercialfishemen take it and waste all species of fish.this comment is for the public record. the commercial fishmen take the fish for wealth. there is a difference for most people. this commetn is for th epublic record. please receipt.jeanpubliee jean public1@yahoo.com

[Federal Register Volume 84, Number 63 (Tuesday, April 2, 2019)] [Notices] [Page 12594-12595]
From the Federal Register Online via the Government Printing Office [www.gpo.gov]
[FR Doc No: 2019-06316]
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(Text of the subject Federal Register Notice was included with the comment, but the full text of the notice is omitted here for brevity)

NMFS Responses to Comment Received Via Email From "jean public" jeanpublic1@gmail.com - Date: April 2, 2019

1. Comment noted.

From: **Susan Crampton** <scrampton@methownet.com>
Date: Fri, Apr 19, 2019 at 5:39 PM
Subject: Comments on Upper Columbia Hatchery programs approvals
To: <Hatcheries.Public.Comment@noaa.gov>

To NOAA/
This public comment is submitted against support of current and proposed hatchery programs. Even quick scan of paperwork proposals shows ongoing off-target resource planning. Thousands of pages of paperwork do not change the detrimental effects of hatchery programs to functional river and fish ecosystems.

Please look to more worthwhile change. Thank you.

Susan Crampton
Twisp, WA

NMFS Responses to Comment Received Via Email From Susan Crampton
scrampton@methownet.com **- Date: April 19, 2019**

1. The commenter suggests that the Proposed Action is an example of "ongoing off-target resource planning." While the meaning of the statement may not be exactly clear, NMFS suggests that the process of approving hatchery programs is carefully planned, and through the NEPA process, the potential effects of the hatchery programs on natural and human habitat within the analysis area is evaluated and issues associated with the Proposed Action are mitigated.
2. The commenter suggests that hatcheries are detrimental to "functional river and fish ecosystems," without providing specific information or supporting documentation. Potential negative effects of hatchery programs are discussed in Section 3 of the draft EA, and issues specific with the Proposed Action are highlighted and discussed within Chapters 4 and 5.