United States Department of the Interior

U.S. Fish and Wildlife Service

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Allyson Purcell, Acting Chief
National Marine Fisheries Service
Northwest Region
Salmon Management Division
1201 NE Lloyd Boulevard, Suite 1100
Portland, Oregon 97232

Subject: National Marine Fisheries Service Issuance of two Section 10(a)(1)(A) Permits for the Continued Operation of the Snake River Sockeye Salmon Hatchery Program—Idaho (Ada, Custer, and Bingham Counties),Washington (Kitsap and Garfield Counties), and Oregon (Hood River County)—Biological Opinion
In Reply Refer to: 01EIFW00-2017-F-0819

Dear Ms. Purcell:

Enclosed is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) on the National Marine Fisheries Service's (NMFS') and Bonneville Power Administration's (BPA's) actions and determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, including: (1) NMFS' issuance of two section 10(a)(1)(A) permits for continued operation and maintenance (O&M) and research, monitoring, and evaluation (RM&E) of the Snake River Sockeye Salmon Hatchery Program (Program), and (2) BPA's continued funding of O&M and RM&E of the Program, including funding of O&M at various facilities in Idaho, Oregon, and Washington. This consultation addresses all aspects of the Program as described in the 2017 Biological Assessment (Assessment), the 2017 Addendum to the Assessment, and related Hatchery and Genetic Management Plans, and is intended to document compliance with the Act for the Federal action agencies who authorize, fund, or carry out various components of the program, and for associated partners/operators, including the Idaho Department of Fish and Game (IDFG), the Oregon Department of Fish and Wildlife (ODFW), and the Shoshone-Bannock Tribes (SBT).

In a letter dated March 31, 2017 and received by the Service on April 3, 2017, NMFS and BPA requested formal consultation on the determination under section 7 of the Act that NMFS' issuance of the permits, and BPA's continued funding of the Program O&M and RM&E (and facility O&M), may affect, and is likely to adversely affect, bull trout (*Salvelinus confluentus*) and bull trout critical habitat. NMFS and BPA also determined that the proposed action will have no effect on the following listed species: Canada lynx (*Lynx canadensis*), marbled murrelet (*Brachyramphus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), Banbury Springs limpet (*Lanx* sp.), Bliss Rapids snail (*Taylorconcha serpenticola*), Snake River Physa snail (*Physa natricina*), yellow-billed cuckoo (*Coccyzus americanus*), and Ute ladies'-tresses

(*Spiranthes diluvialis*), slickspot peppergrass (*Lepidium papilliferum*), fisher (*Martes pennanti*), and designated critical habitat for lynx, murrelet, and spotted owl. The Service acknowledges these no effect determinations.

The enclosed Opinion is based primarily on our review of the proposed action, as described in your 2017 Assessment[1], and the anticipated effects of the action on listed species and critical habitat, and was prepared in accordance with Section 7 of the Act. Our Opinion concludes that the proposed issuance of the permits and continued funding of the Program O&M and RM&E (and facility O&M), are not likely to jeopardize the continued existence of bull trout or result in the destruction or adverse modification of bull trout critical habitat. A complete record of this consultation is on file at this office.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Clay Fletcher at 971-701-1497 or Russ Holder at 208-378-5384 if you have questions concerning this Opinion.

Sincerely,

RUSSELL HOLDER Digitally signed by RUSSELL HOLDER Date: 2017.12.18 16:14:03 -07'00'

For Gregory M. Hughes
State Supervisor

Enclosure

cc: NMFS, Portland (Meyers-Cherry)
BPA, Portland (Shull, Lord, Grange)
IDFG, Eagle (Kozfkay)
SBT, Fort Hall (Tardy)

[1] The 2017 Assessment was prepared by BPA and submitted to the Service by the NMFS in 2013 and again in 2017 after revision.

BIOLOGICAL OPINION
FOR THE
ISSUANCE OF TWO SECTION 10(a)(1)(A) PERMITS, AND CONTINUED FUNDING, OPERATION, MAINTENANCE, MONITORING, AND EVALUATION OF THE SNAKE RIVER SOCKEYE SALMON HATCHERY PROGRAM AND OPERATION AND MAINTENANCE OF ITS ASSOCIATED FACILITIES

01EIFW00-2017-F-0819

U.S. FISH AND WILDLIFE SERVICE
IDAHO FISH AND WILDLIFE OFFICE
BOISE, IDAHO

Supervisor _____

Date _____ RUSSELL HOLDER Digitally signed by RUSSELL HOLDER Date: 2017.12.18 16:14:42 -07'00'

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1. BACKGROUND

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) on the effects of the issuance of two section 10(a)(1)(A) permits, and continued funding of operation and maintenance (O&M) and research, monitoring, and evaluation (RM&E) of the Snake River Sockeye Salmon Hatchery Program (Program), including O&M of its associated facilities, on bull trout (*Salvelinus confluentus*) and bull trout critical habitat. In a letter dated March 31, 2017and received by email on April 3, 2017, the National Marine Fisheries Service (NMFS) and Bonneville Power Administration (BPA)[1] specifically requested formal consultation[2] with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for their proposal to:

- Issue two Section 10(a)(1)(A) permits to NMFS and Idaho Fish and Game (IDFG) for O&M and RM&E of the Program, respectively;
- Fund O&M of the Program, including broodstock collection, adult spawning, juvenile rearing and release, and adult outplanting;
- Fund RM&E of the Program for both in-hatchery and off-station activities, including sampling and tagging; weir monitoring on the Salmon River (Sawtooth Hatchery) and Redfish Lake Creek; juvenile outmigration monitoring on Redfish Lake Creek, Alturas Lake Creek, and Pettit Lake Creek; population abundance monitoring on Redfish Lake, Pettit Lake, and Alturas Lake; experimental rearing and acclimation at Sawtooth and Oxbow fish hatcheries; and experimental adult out-plantings to Alturas Lake; and,
- Fund O&M of four hatchery facilities (NMFS' Manchester Research Station and Burley Creek Fish Hatchery in Washington, and IDFG's Springfield Hatchery, and Eagle Fish Hatchery in Idaho) and associated collection facilities (IDFG's Sawtooth Fish Hatchery Weir and Redfish Lake Creek Weir in Idaho, and Lower Granite Dam Trap in Washington, and Oxbow Fish Hatchery in Oregon), which includes water withdrawal, hatchery effluent, fish disease management, and facility maintenance.

NMFS and BPA determined that the proposed action may affect, and is likely to adversely affect, bull trout and bull trout critical habitat. As described in this Opinion, and based on the Biological Assessment (BPA and NMFS 2017, entire), the Addendum to the Assessment (BPA 2017, entire) and other information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of bull trout or result in the destruction or adverse modification of critical habitat.

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[1] NMFS is the federal permitting agency and lead agency for section 7 consultation. BPA is the federal funding agency.

[2] The letter from NMFS referenced the 2013 request for formal consultation and revisions to the Assessment in February 2014, July 2015, November 2015, March 2016, November 2016, and February 2017.

NMFS and BPA determined that the proposed action will have no effect on the following listed species: Canada lynx (Lynx canadensis), marbled murrelet (*Brachyramphus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), Banbury Springs limpet (*Lanx* sp.), Bliss Rapids snail (*Taylorconcha serpenticola*), Snake River Physa snail (*Physa natricina*), yellow-billed cuckoo (*Coccyzus americanus*), and Ute ladies'-tresses (*Spiranthes diluvialis*). NMFS and BPA also determined no effect for the slickspot peppergrass (*Lepidium papilliferum*)[3], fisher (*Martes pennanti*)[4], and for designated critical habitat for lynx, murrelet, and spotted owl. The Service acknowledges these no effect determinations.

This consultation addresses all aspects of the Program as outlined in the Assessment, the Addendum to the Assessment, and related Hatchery and Genetic Management Plan[5] (HGMP) (IDFG 2012, entire), and is intended to document Act compliance for the Federal action agencies who authorize, fund, or carry out various components of the Program, and for associated partners/operators, including NMFS, IDFG, the Oregon Department of Fish and Wildlife (ODFW), and the Shoshone-Bannock Tribes (SBT).

1.2 Consultation History

The Service and action agencies have had the following correspondence and coordination on the continued operation of the Snake River Sockeye Salmon Hatchery Program since August 9, 2013

August 9, 2013:	The Service received a draft Assessment from BPA by email.
September 6, 2013:	The Service received an email from NMFS (the lead agency for consultation) with a letter requesting formal consultation and the Assessment attached. The Service received hard-copies of these documents (dated September 4, 2013) on September 9, 2013.
September 13, 2013	The Service sent a letter to NMFS conditionally accepting the draft Assessment as sufficient to initiate consultation. In the letter, the Service explained that the need for supplemental information was anticipated and coordination with Service field offices would be needed.
January 17, 2014:	The Service sent comments on the draft Assessment to BPA by email.

[3] Slickspot peppergrass was reinstated as a threatened species under the Act in September 2016; however, the NMFS and BPA determination of no effect for this species would remain applicable.

[4] On October 5, 2017, the Service published in the Federal Register our determination that listing of the fisher as a threatened or endangered species under the Act is not warranted at this time.

[5] Construction and operation of the Springfield Hatchery was addressed in a separate consultation with the Service; therefore, construction of this hatchery will not be discussed in this Opinion. The Service issued a concurrence letter for the "not likely to adversely affect" determination for bull trout and its critical habitat for the hatchery's construction and operation on April 3, 2012 (file 01EIFW00-2012-I-0059). The concurrence letter addressed operation of the Springfield Hatchery, but not the larger Snake River sockeye captive broodstock program. The operation of the Springfield Hatchery is therefore included in this Opinion in its context as a component of the larger captive broodstock program.

April 8, 2015	The Service received a revised draft Assessment from BPA by email. This revision incorporated comments from the Service and IDFG.
July 2, 2015:	The Service sent comments on the draft Assessment to BPA by email.
August 13, 2015:	The Service participated in a conference call to discuss the draft Assessment with BPA.
October 6, 2015:	The Service received an updated Assessment from BPA by email.
October 16, 2015:	The Service received the draft Assessment with updated Appendix B from BPA by email.
November 4, 2015:	The Service sent comments on the updated Assessment to BPA by email.
January 15, 2016:	The Service received a revised Assessment addressing Service comments by email.
March 30, 2016:	The Service sent comments on the draft Assessment to BPA by email.
October 21, 2016	The Service received a revised Assessment incorporating edits from the Service, an updated program description from IDFG, and relevant edits to the effects analysis.
November 2, 2016:	The Service sent additional comments on the draft Assessment to BPA by email.
January 20, 2017:	The Service received a revised Assessment from BPA by email.
February 21, 2017:	The Service sent a few additional comments on the draft Assessment by email and stated that once BPA had addressed the comments they could send the final Assessment and letter requesting formal consultation.
April 3, 2017:	The Service received from NMFS the final Assessment and letter requesting the Service's determination on whether the Assessment was sufficient to proceed with formal consultation.
April 27, 2017:	The Service sent an email to NMFS and BPA stating the Assessment was sufficient (i.e., no additional information was needed) to initiate formal consultation However, the Service noted that during the drafting of the Opinion additional clarifications on some aspects of the Program as described in the Assessment may be needed.
June 13, 2017:	The Service sent an early draft of the Opinion to BPA for review by email. The Service also requested additional information needed to complete the Opinion.
July 11, 2017:	The Service received comments on the draft Opinion from BPA by email.
September 13, 2017:	The Service sent the final draft Opinion to BPA by email for distribution to Program cooperators for their review.
September 29, 2017:	The Service received comments on the draft Opinion from NMFS by email.

October 17, 2017: The Service received comments on the draft Opinion from IDFG, forwarded by email from BPA.

October 19, 2017: The Service received comments on the draft Opinion from BPA by email.

December 7, 2017: The Service received the final Addendum to the Assessment from BPA and NMFS by email. The Addendum addresses IDFG updates to Program.

2. BIOLOGICAL OPINION

2.1 Description of the Ongoing[6] Action

This section describes the ongoing Federal action, including any measures that may avoid, minimize, or mitigate adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action (i.e., the action area). The term "action" is defined in the implementing regulations for section 7 as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The term "action area" is defined in the regulations as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

On September 27, 2013, the NMFS issued two Section 10(a)(1)(A) research/enhancement permits pursuant to the Endangered Species Act of 1973 (Act), as amended. These permits, one to the IDFG, and one to NMFS, authorized the continued operation, monitoring, and evaluation of the Snake River Sockeye Captive Broodstock Program (Snake River Sockeye Program), releasing listed Snake River sockeye salmon through 2023.

IDFG has determined that smolts released to the upper Salmon River and Redfish Lake Creek directly from rearing at the Springfield Fish Hatchery suffer a very high percentage of mortality. This mortality is believed to result from water chemistry differences (primarily pH) between the rearing waters at the Springfield Hatchery and the release waters at Little Redfish Lake Creek, but that has yet to be verified. Accordingly, the solution to the problem has also yet to be determined, and a broader availability of hatchery facilities and their uses is proposed to provide opportunity to effectively test and ultimately implement effective solutions.

The following sections are adapted from the description of the ongoing action contained in the Assessment (BPA and NMFS 2017, entire) and the Addendum to the Assessment (BPA 2017).

This Opinion is intended to remain valid until NMFS's section 10(a)(1)(A) permits expire in 2023.

2.1.1 Background

Precipitous declines of Snake River sockeye salmon led to their Federal listing as endangered in 1991 (56 FR 58619). In that same year, the Idaho Department of Fish and Game (IDFG) initiated a captive broodstock program to maintain Snake River sockeye salmon and prevent

[6] Because the action under analysis in this Opinion (the issuance of the Section 10(a)(1)(A) permits for operating, maintaining, monitoring, and evaluating the Snake River Sockeye Salmon Hatchery Program and the funding of operation, maintenance, monitoring, and evaluation of the Program, including operation and maintenance of associated facilities) was completed (and is ongoing, with respect to the operation of the program), in this Opinion, the action is referred to as the "ongoing action" rather than the "proposed action."

species extinction. The long-term program goal is to reestablish sockeye salmon runs to Upper Salmon River Basin waters and to provide sport and treaty harvest opportunities. The near-term program goal is to prevent species extinction, slow the loss of critical population genetic diversity and heterozygosity, and to begin increasing the number of individuals in the population.

These goals are part of the proposed recovery strategy, which consists of three phases. Phase I in recovery—the captive broodstock program—has helped maintain the population and prevent species extinction. The program is transitioning into Phase II—recolonization—with the goal of incorporating more natural-origin sockeye returns in the hatchery-spawning program to maintain the genetic fitness of the natural population and to provide anadromous adults to recolonize available habitat in Redfish, Pettit, and Alturas lakes. This phase will ultimately focus exclusively on smolt and adult releases to Basin lakes (primarily Redfish and Pettit in the next decade or so). However, egg and pre-smolt release strategies with Redfish Lake stock (in Redfish, Alturas, and Pettit lakes) will continue as practices are evaluated to improve survival of released juveniles.

Program adjustments will be evaluated to resolve the issue of poor survival of sockeye smolts released following production and rearing actions at the Springfield Fish Hatchery. Specific actions to be taken are as yet uncertain, and the Salmon Basin Technical Oversight Committee (SBTOC) will be engaged to advise and ultimately approve selection of those to be implemented. Such actions to be evaluated will likely include:

- rearing at locations other than Springfield hatchery (such as Oxbow or Sawtooth hatchery)
- pre-release acclimation at rearing hatcheries, or Sawtooth hatchery (near release site)
- water treatments at rearing hatcheries or during transport
- modifying timing and location of release
- releasing different age classes of juvenile fish

Ultimately, the program will move to Phase III, which will emphasize natural adaptation and viability. In this phase, broodstock collections would transition to primarily naturally-produced fish rather than hatchery produced fish to manage the proportion of natural influence (PNI) and the percentage of hatchery origin fish on spawning grounds (pHOS) as adult return numbers increase. The use of captive broodstock will ultimately be phased out in annual spawning events.

At the same time, recovery efforts will address habitat, fisheries, and hydro-related issues affecting Snake River sockeye salmon. Together, these efforts aim to provide sufficient fish to restore self-sustaining populations adapted to the specific conditions of lakes in the Upper Salmon River Basin, while also protecting and improving habitat conditions and addressing passage, competition, and predation concerns (NMFS 2015, entire).

The Snake River Sockeye Captive Broodstock Program was founded in 1991. Between 1991 and 1998, 16 returning anadromous adult sockeye salmon, several hundred Redfish Lake wild outmigrating smolts, and several residual sockeye salmon adults were captured and used to develop what has become the captive broodstocks at the IDFG Eagle Fish Hatchery and at NMFS facilities in Washington State. On the basis of critically low population numbers,

aggressive gene rescue actions were initiated to stem extinction risks for Snake River sockeye salmon. These measures included taking a majority of the remaining population into captivity and initiating actions in the freshwater rearing habitat to promote survival of reintroduced fish (Flagg et al. 1995, p. 81; 2004, p. 387).

The captive broodstock phase has achieved sufficient success to initiate the next phase, population recolonization. The increased production capacity required to accomplish recolonization of Upper Salmon River Basin lakes is being achieved at the Springfield Hatchery complex in Bingham County, Idaho[7]. Production at Springfield Hatchery commenced in December 2013. Addition of production at the Springfield Fish Hatchery will help meet the goal of rearing up to one million Snake River sockeye salmon to the full-term smolt stage of development for release in the Upper Salmon River Basin. However, other juvenile release strategies may be employed while protocols and rearing and release strategies are being optimized at Springfield Hatchery.

The Snake River Sockeye Salmon Captive Broodstock Program was initiated to conserve and rebuild the Redfish Lake sockeye salmon stock in the Upper Salmon River Basin of central Idaho. Historically, five Upper Salmon River Basin lakes – Alturas, Pettit, Redfish, Stanley, and Yellowbelly – supported sockeye salmon. Restoration efforts are focused on Alturas, Pettit, and Redfish lakes; activities in Stanley and Yellowbelly Lakes are not considered part of this action and therefore these lakes will not be discussed further in this document.

Annually, the Program produces eggs and fish for reintroduction into natal waters (currently Redfish and Pettit lakes). In Phase I, eyed eggs were planted in egg boxes in lakes in the fall, and pre-smolts were released directly to the lakes in the fall. In Phase II, smolts are primarily released to Redfish Lake Creek below the trap site in the spring, and pre-spawn adults are released to Redfish and Pettit lakes in the fall. The eggs, smolts, and adults are monitored to document the success of each strategy.

The Program conducts ongoing research to determine the most successful release options. The research component of the program is responsible for post-release monitoring of eggs, juveniles, and adults, as well as population monitoring and predator investigations. Additionally, personnel from the IDFG Eagle Fish Genetics Laboratory assist with genetic evaluations for program-specific research.

Through 2017, the IDFG and NMFS hatchery programs have produced in excess of 1,603,000 pre-smolts; 3,648,000 smolts; 14,340 adults; and 1,108,000 eyed-eggs for reintroduction to Upper Salmon River Basin lakes and tributary streams. Between 1995 and 2014, approximately 406,000 naturally-produced and 2,271,000 hatchery-produced sockeye salmon smolts (estimated) emigrated from the Upper Salmon River Basin. Production goals currently focus on smolt and adult releases, and vary by year and return numbers. Adult releases will depend on anadromous return numbers and captive adults available for release.

[7] As previously noted, construction and operation of the Springfield Hatchery was addressed in a separate consultation with the Service; therefore, construction of this hatchery will not be discussed in this Opinion. The operation of the Springfield Hatchery is included in this Opinion in its context as a component of the larger captive broodstock program.

Ultimately, the program will move to Phase III, which will emphasize natural adaptation and viability. In this phase, broodstock collections would transition to primarily naturally-produced fish rather than hatchery-produced fish to manage PNI and the pHOS as adult return numbers increase. The use of captive broodstock will ultimately be phased out in annual spawning events, though a small captive broodstock would be retained to serve as a safety net, with the fish released if not needed for brood.

Key performance standards for the program will continue to be tracked in a targeted monitoring and evaluation program. These standards include (1) abundance and composition of natural spawners and hatchery broodstock; (2) number of juveniles released; (3) in-hatchery and post-release survival rates; (4) total adult recruitment, harvest, and escapement of the natural and hatchery components; and (5) abundance, productivity, diversity, and spatial structure of the naturally spawning sockeye population.

2.1.2 Action Area

The Snake River Sockeye Program encompasses captive broodstock production at five hatcheries and related facilities (e.g., weirs and traps) in three states: the Springfield, Eagle, and Sawtooth (proposed) fish hatcheries in Idaho, the Manchester Research Station and Burley Creek Fish Hatchery in Washington, and the Oxbow Fish Hatchery at Cascade Locks in Oregon. Smolt releases occur in Redfish Lake Creek and in the Salmon River just above the Sawtooth Fish Hatchery. The Redfish Lake Creek weir and trap and the Sawtooth Fish Hatchery weir, where broodstock collection and smolt release occurs, are included here as program facilities because of the potential impacts of their operation to bull trout. The Lower Granite Dam trap is included as a program facility because on rare occasion, Snake River sockeye are intentionally collected from this facility, and bull trout may be incidentally captured in the trap.

The action area for analysis of effects will focus primarily on the Stanley Basin area of the upper Salmon River Basin, which is where the hatchery program collects and releases sockeye salmon (Figures 1 and 2). The action area for the analysis of the effects of the program activities includes the following:

- Redfish Lake, Pettit Lake, Alturas Lake, and their tributaries.
- The migration corridor between the lakes and the mainstem Salmon River (i.e., Redfish Lake Creek, Alturas Lake Creek, and the outlet of Pettit Lake to Alturas Lake Creek).
- The mainstem Salmon River from the confluence with Alturas Lake Creek (approximately 10 miles upstream of the Sawtooth Fish Hatchery) downstream to the confluence with the Valley Creek near the town of Stanley, Idaho. This is consistent with the boundary of the Snake River sockeye Evolutionarily Significant Unit (ESU) and reflects the upstream extent of the species' range.
- The receiving water bodies up to 50 yards downstream of each facility where effluent or sediment plumes may extend.

The action area also includes Puget Sound nearshore habitat near the Manchester Research Station and the Oxbow Fish Hatchery on the Lower Columbia River (Figure 3).

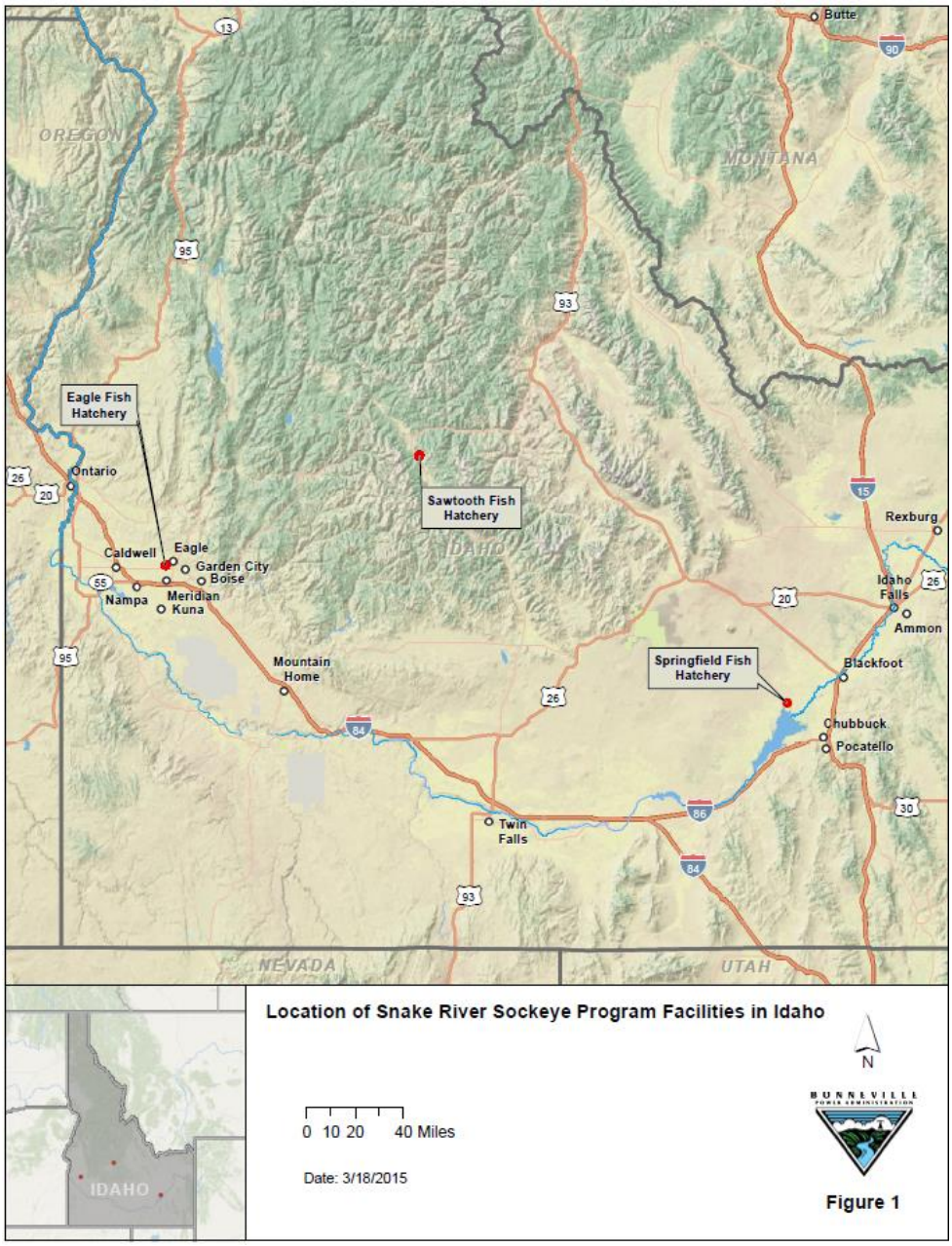

Figure 1. Snake River Sockeye hatchery program facilities in Idaho (Figure 1 in the draft Assessment [BPA and NMFS 2016])

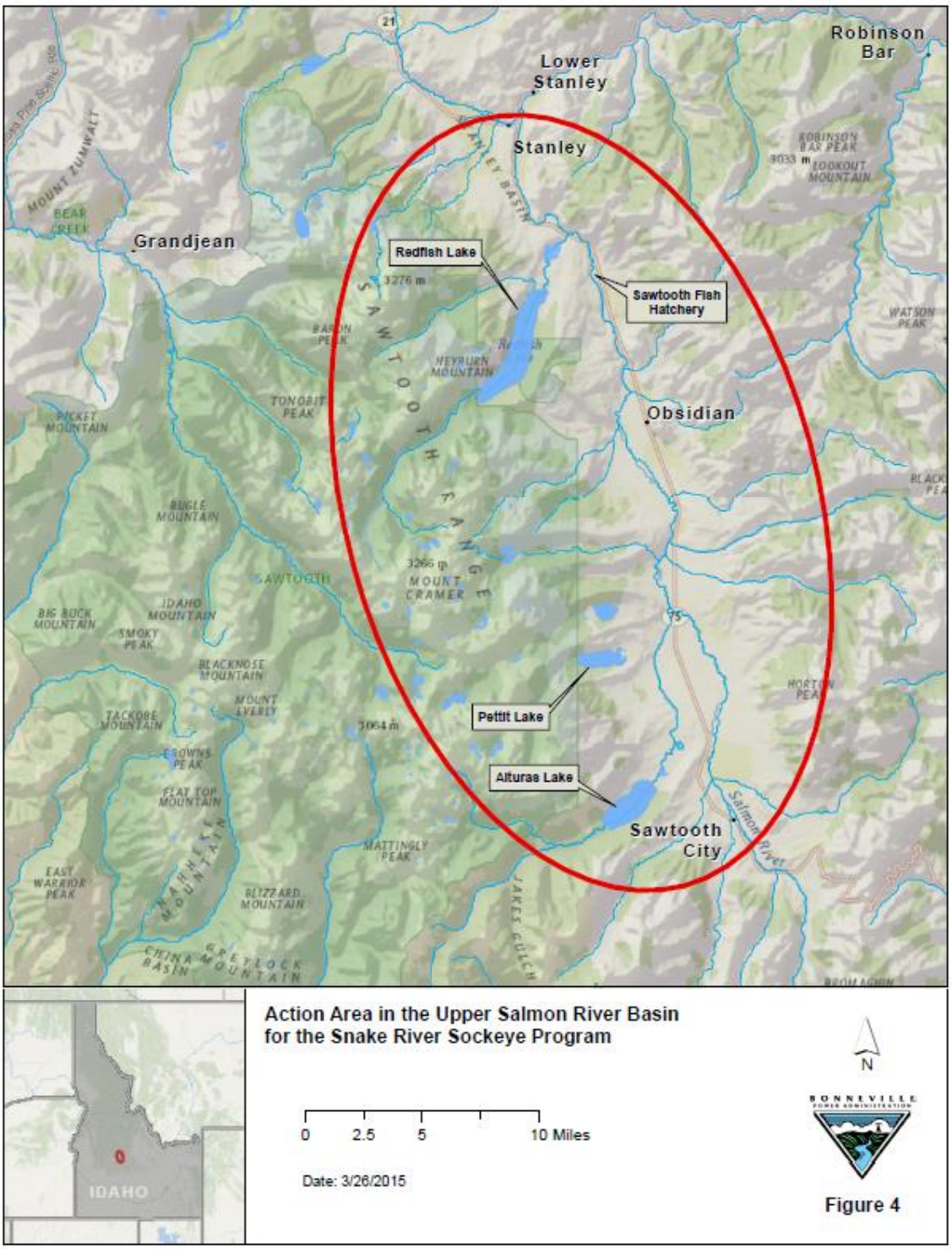

Figure 2. Action area in the Stanley Basin, Idaho (Figure 3 in the draft Assessment [BPA and NMFS 2016]).

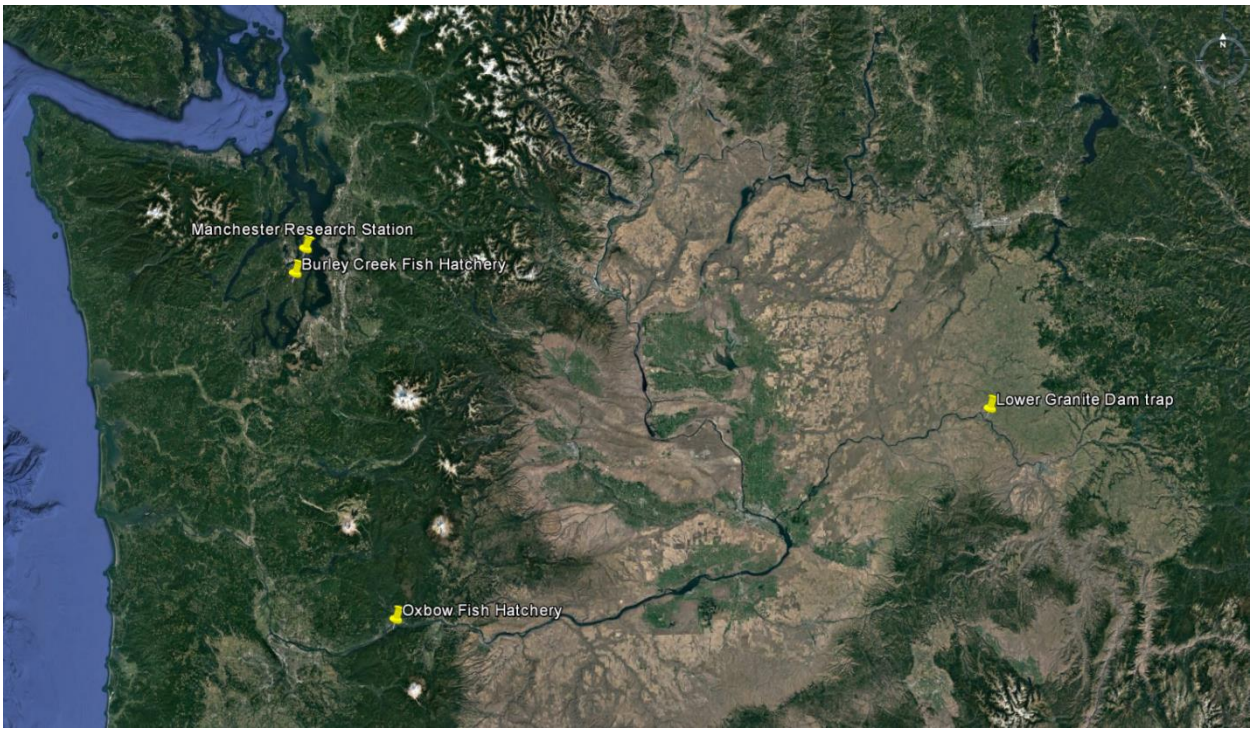

Figure 3. Snake River sockeye program facilities in Washington and Oregon (from Addendum, BPA 2017).

The operation of hatchery facilities also has the potential to affect bull trout in streams or water bodies adjacent to hatchery facilities (e.g., nearshore marine habitat in the Puget Sound) through the diversion of surface water or minor maintenance of in-stream structures (e.g., cleaning water intake and discharge structures). The following facilities are thus included in the action area (Idaho facilities are shown in Figures 1 and 2, and Washington and Oregon facilities in Figure 3):

- Sawtooth Fish Hatchery and weir, on the Salmon River near Stanley, Idaho
- The Redfish Lake Creek Hatchery and weir, approximately 0.9 mile downstream of the outlet of Redfish Lake
- The adult fish trap below Lower Granite Dam where adult Snake River sockeye may be trapped for transport in low flow years
- Burley Creek Hatchery, in Kitsap County near Port Orchard, Washington
- Manchester Research Station, on the Puget Sound near Port Orchard, Washington
- Eagle Hatchery, in Ada County near the town of Eagle, Idaho
- Springfield Hatchery, in Bingham County near the town of Springfield, Idaho
- Oxbow Hatchery in Hood River County near Cascades Locks, Oregon

Sockeye salmon released from the program inhabit the Columbia River, some of its tributaries, and the Pacific Ocean. Other areas outside the Salmon River Basin where juvenile sockeye generated from other hatchery programs may co-occur with listed salmon and steelhead will not be included in the action area. Considering the small proportion of fish from the program in the total numbers of fish in the mainstem Columbia River, the estuary, and ocean, it is not possible to meaningfully measure, detect, or evaluate the effects of those juvenile interactions in the mainstem Columbia River, estuary, and near ocean due to the low likelihood or magnitude of such interactions in locations outside the action area and their associated effects (NMFS 2012, p. 24).

2.1.3 Ongoing Action[8]

On September 27, 2013, NMFS issued two Section 10(a)(1)(A) research/enhancement permits pursuant to the Act. These permits, one to the IDFG and one to NMFS, authorize the continued operation, monitoring, and evaluation of the Snake River Sockeye Salmon Hatchery Program through 2023. Project activities also include the trial and assessment of various culture, transport, acclimation, and release practices to identify effective measures to increase survival of juvenile sockeye salmon released into the Upper Salmon Basin.

These permits are:

Permit Number 1454: Scientific Research/Enhancement Permit for the IDFG to Operate, Monitor, and Evaluate the Snake River Sockeye Salmon Hatchery Program; expires September 27, 2023 (NMFS 2013a, entire).

Permit Number 1455: Scientific Research/Enhancement Permit for NMFS to Operate, Monitor, and Evaluate the Snake River Sockeye Salmon Hatchery Program; expires September 27, 2023 (NMFS 2013b, entire).

The Program Cooperators and Program Facilities are:

- IDFG – Manages and operates the Eagle, Springfield, and Sawtooth fish hatcheries, and the Redfish Lake Creek traps, and conducts population monitoring.
- BPA – Funding agency for project sponsors and facilitator of Stanley Basin Sockeye Technical Oversight Committee (SBTOC).
- NMFS – Co-culture of Snake River sockeye salmon at NMFS's Manchester Research Station and Burley Creek Fish Hatchery. NMFS also operates the adult trap at Lower Granite Dam.
- SBT – The SBT conduct lake-habitat investigations and sockeye-specific monitoring and evaluation in Redfish, Alturas, and Pettit lakes.
- ODFW – manages and operates Oxbow fish hatchery for egg incubation and rearing of Snake River sockeye salmon.[9]

[8] This description of the ongoing action is excerpted (with minor modifications) from the Assessment (BPA and NMFS 2017, pp. 15-55), and from the Addendum (BPA 2017)

Activities necessary for this hatchery program include elements that are separated into two categories. One category is related to the Operation of the Program, which includes broodstock collection (and adult spawning); rearing and release of hatchery juveniles; out-planting of adults; and research, monitoring, and evaluation (RM&E). RM&E includes in-hatchery and off-station activities: sampling and tagging; weir monitoring on the Salmon River (Sawtooth Hatchery) and Redfish Lake Creek; juvenile outmigration monitoring on Redfish Lake Creek, Alturas Lake Creek, and Pettit Lake Creek; and population abundance monitoring on Redfish Lake and Pettit Lake.

The other category is related to the Operation and Maintenance of Program Facilities (i.e., NMFS' Manchester Research Station and Burley Creek Fish Hatchery in Washington; ODFW's Oxbow Fish Hatchery in Oregon; and IDFG's Springfield Hatchery, Eagle Fish Hatchery, Sawtooth Fish Hatchery and weir, and Redfish Lake Creek weir in Idaho, and Lower Granite Dam trap in Washington) which includes water withdrawal, hatchery effluent, fish disease management, and facility maintenance. These elements represent activities that are common to various facilities and locations contained in this action. While not all of these elements occur at all of the locations (e.g., see Table 1), the likely effect of these elements, where they do occur and where listed species and/or their critical habitat occur, will be similar and vary only in magnitude, based on the particular location.

Table 1. List of facilities and corresponding production phase included in the ongoing action.

Facility/Operator	County, State	Water body	Broodstock Collection	Spawning*	Incubation**	Rearing***	Release
Eagle Fish Hatchery/IDFG	Ada, ID	Boise River		X	X	X	X[1]
Sawtooth Fish Hatchery and weir/IDFG	Custer, ID	Upper Salmon River	X		X	X	X
Redfish Lake Creek Weir/IDFG	Custer, ID	Redfish Lake Creek	X				X
Springfield Fish Hatchery/IDFG	Bingham, ID	Crystal Springs Pond			X	X	
Manchester Research Station/NOAA	Kitsap, WA	Puget Sound			X	X	

[9] The use of Oxbow as a program facility was discontinued in 2016. However, this hatchery had been used in the earliest phases of the program and records show that smolts raised there had the highest rate of released smolt survival of all facilities. The use of facility is now proposed as a possible solution to the smolt release-survival issue.

Facility/Operator	County, State	Water body	Broodstock Collection	Spawning*	Incubation**	Rearing***	Release
Burley Creek Fish Hatchery/NMFS	Kitsap, WA	Puget Sound		X	X	X	
Lower Granite Dam trap/NMFS	Garfield, WA	Snake River	X				
Oxbow Fish Hatchery/ODFW	Hood River, OR	Herman Creek			X	X	

*Spawning refers to artificial fertilization of sockeye eggs in the hatchery.
**Incubation refers to in-hatchery rearing of sockeye eggs from fertilization until hatching.
***Rearing refers to in-hatchery care of juvenile sockeye salmon from hatching until release.
[1]The mark in this box does not indicate that salmon are released at Eagle Hatchery. Rather, it indicates that prespawn anadromous adults captured at Sawtooth Fish Hatchery weir are transferred to Eagle Fish Hatchery for brood, or released to Redfish Lake or Redfish Lake Creek above the weir to spawn naturally.

A description follows for each of these elements. Additionally, conservation measures that are broadly applied to minimize effects of the program elements to bull trout and bull trout critical habitat are described in section 2.1.3.3.

2.1.3.1 Operation of the Program

2.1.3.1.1 Broodstock Collection

Broodstock collection (the collection of returning adult salmon for spawning in the hatcheries) can be accomplished in several ways, but in most hatchery operations it occurs by trapping. There are two main categories of traps: run-at-large with a weir or dam and associated trap that blocks the entire stream, either on a temporary or permanent basis; and volunteer traps associated with facilities.

In run-at-large trapping, non-target fish may be trapped inadvertently and held for some time before being returned to the stream, causing migration delay and possibly injury. Even if the fish are not trapped, presence of the structure may slow migration.

Non-target fish are much less likely to be affected by volunteer traps, where the target fish are enticed by attraction water and directed by homing instinct, although this depends on trap size relative to the stream.

Broodstock is collected to supply the Snake River Sockeye Captive Broodstock Program at Redfish Lake Creek and in the Salmon River at the Sawtooth Fish Hatchery. A target number of 1,150 fish are collected, and generally, all sockeye salmon that return to the Redfish Lake Creek and Sawtooth Hatchery traps would be collected. Sockeye salmon that are not incorporated into the broodstock would be held for up to 6 weeks before being released to spawn naturally. The broodstock would be a minimum of 10 percent natural-origin adults in Phase II (population re-colonization phase). As the hatchery program transitions into Phase III (local adaptation phase),

an increasing number of natural-origin adults would be incorporated into the broodstock.

Genetic samples may be taken from all fish and based on the results, a spawning design would be developed that maximizes the genetic diversity of the population, and that equalizes sex ratios and family contribution. IDFG would engage the SBTOC concerning review and approval of the spawning design annually, and determine when random broodstock selection and random mating would be implemented.

Weirs are typically operated between mid-July and mid-October, though it may start as early as June 10. Both weirs are intended for the run-at-large. The weir support structures are permanent and remain in place year-round. Preparing the weirs for operation consists of fitting picket panels into the support structures without any in-stream use of heavy equipment. Walkways are used at the Redfish Lake Creek trap and the weir trolley is used at the Sawtooth Fish Hatchery weir to avoid unnecessary in-water activity during panel placement and removal. Installation and removal requires up to four people walking within the stream. No other disturbance of bed or banks is required. The weir traps are checked two-three times per day—the first check is usually between 7:00 a.m.-10:00 a.m., but the traps may be emptied more often if necessary. Traps are checked multiple times per day/night during peak returns. During trap checks, the weirs are cleaned by hand as necessary to remove debris from the weir pickets. Redfish Lake Creek is a stable stream with flows being stabilized by Redfish Lake upstream; therefore, only a small quantity of debris collects on the weir.

Spring Chinook salmon intercepted at either facility would be incorporated into the Chinook broodstock at Sawtooth or passed upstream to spawn naturally. If they are not natural origin and not needed upstream or in the hatchery, they may be culled, given to the Tribe, or given to a food bank.

On an annual basis, a small number of anadromous adult sockeye return to the Sawtooth weir and fail to enter the adult trapping facility; these fish routinely “stage” in a deep pool immediately downstream below the weir structure and are unavailable for broodstock needs. Reasons for stopping below the weir are unknown, but program biologists suspect that the weir structure and/or operation may present unknown challenges/obstacles to a portion of the returning fish. To address the need for broodstock collection, IDFG may conduct annual adult collection efforts below the weir using hand-held seines and dipnets to live-capture adult sockeye salmon that fail to ascend the weir structure. Collection efforts are generally conducted in September and usually involve events on 2 separate days spaced approximately 2 weeks apart. The seining operation generally lasts approximately 1 to 2 hours and involves two to three passes of the seine in same location. Previously, netted sockeye have been worked up and released into Redfish Lake for volitional spawning. Sockeye collected by seining may also be transferred to Eagle Fish Hatchery for incorporation into the captive broodstock or worked up and released to Redfish Lake.

NMFS may also trap sockeye at Lower Granite Dam during years when passage conditions are sub-optimal (e.g., low flow, elevated temperature). Sockeye trapped at this site are transported as broodstock to Eagle Fish Hatchery. Sockeye pass Lower Granite Dam between mid-June and mid-August, with peak passage the first and second weeks of July.

Program operators do not expect the trapping at Lower Granite Dam to be an annual event. The need to trap Snake River sockeye at this facility could roughly be anticipated to occur once every 3 years.

2.1.3.1.2 Release of Snake River Sockeye

In the current phase of the program, smolts are intended to be the only juvenile life history-type released in the program, and they would be released to the Redfish drainage only. As discussed below, monitoring has revealed a need to experiment with the release of all age classes of juveniles (including pre-smolts and eggs), and to test other release locations while determining a solution to the smolt survival problem. So these actions are included as part of the proposed action here.

Pre-spawn captive adults may be released to either Redfish Lake or Pettit Lake for natural spawning (following SBTOC discussions); surplus anadromous adults not required for broodstock may be released into Redfish Lake to spawn naturally.

While transitioning into Phase II, program monitoring identified poor smolt survival as a significant issue and the need exists to continue experimental release of all age classes of juveniles to improve survival of captive bred sockeye. Only juveniles will be released to Redfish Lake Creek. Pre-spawn adults (anadromous or surplus broodstock) will be released into Redfish Lake to spawn naturally; small numbers (<400) of surplus captive-origin pre-spawn adults may be released to Pettit Lake, depending on surplus adults for Redfish Lake needs. Adult sockeye that are collected at the Sawtooth Fish Hatchery weir and identified as Alturas-origin adults (based on early return timing and coloration) are released into Alturas Lake.

Smolts

Smolts are released to Redfish Lake Creek in April and May. Release dates are based on historical out-migration timing and peak flow rates. In the spring of each year (April-May), smolts are released below the Redfish Lake Creek smolt trap and at a release site on Redfish Lake Creek approximately 0.75 mile downstream of the lake's outlet. All sockeye smolt releases are forced releases from large tanker trucks. Up to three trucks per day release a total of no more than 4,000 gallons per day into Redfish Lake Creek. Approximately 20-25 trucks release smolts over approximately a 7-day period. Transport tanks are tempered to receiving water temperatures prior to the release of fish. Trucks do not leave the roadbed to release smolts at the release sites. Where necessary, a pipe is used to deliver the fish from the tanks to the river or creek.

Fish are transported in pathogen-free well water and have been off feed for several days prior to hauling. Fish health parameters are sampled and fish have been screened for disease and treated for parasites prior to transport and release.

Adults

In past years, prespawn adult sockeye salmon have been distributed to Redfish Lake, Alturas Lake, and Pettit Lake. Going forward, adult fish from the sockeye captive broodstock program will be released only in Redfish and Pettit lakes. No adults will be released to Alturas Lake unless they are identified as wild Alturas-origin fish. As in the past, these releases will be from

truck-mounted transportation tanks; to reduce stress, they will be released at dusk at public access points with transport-tank water temperatures tempered to those of the receiving waters.

Adults are released to Redfish Lake from September into October. Time of release occurs 2 weeks prior to the observed spawn timing of anadromous sockeye. Adult releases of surplus captive adults to Pettit Lake, when conducted, also occur in September. Adults are typically released by hand-netting individual fish from truck-mounted holding tanks to the lake. Fish health parameters are sampled and fish have been screened for disease and treated for parasites prior to transport and release.

Current IDFG recovery efforts have focused on Redfish and Pettit lakes; the Alturas Lake population of sockeye exhibits distinct life history traits from Redfish Lake sockeye stock (e.g., earlier run timing) and is now considered a separate population. Although sockeye from the Redfish Lake stock have been out-planted in Alturas Lake in the past, these releases did not result in large returns of anadromous adults. Currently the only adults released in Alturas Lake are natural-origin adults that are collected at the Sawtooth Fish Hatchery weir and are identified as Alturas-origin adults, based on early return timing and advanced (spawning) coloration or through genetic analysis.

However, the Sockeye Salmon Recovery Plan acknowledges the need to restore returns to Alturas Lake and includes, under "Phase I Monitoring, Objective 6" under 'key information needs' (NMFS 2015, pp. 340-341) the following questions:

- Is the current Redfish Lake Sockeye Salmon captive broodstock genetic structure appropriate for use in rebuilding efforts in other Sawtooth Valley lakes (especially Alturas)?
- How can remnant anadromous Sockeye Salmon gene resources in other Sawtooth Valley lakes be used for recovery efforts on a lake-specific basis?
- What stock or stocks should be used for reintroduction into Alturas Lake?

In an attempt to answer these questions, this action includes a proposal for the experimental release of pre-spawn Redfish-captured sockeye adults into Alturas Lake to determine their suitability for restoring runs to this lake that might coexist with existing sockeye there.

Prior to release, all juvenile and adult sockeye released from the sockeye captive broodstock program would have clipped adipose fins to identify hatchery-reared fish. A health certification would be conducted (major bacterial, viral, and parasitic pathogens); and IDFG and NMFS fish health professionals would sample and certify the health of all release and/or transfer groups.

The estimated number of juvenile and adult sockeye released to the Upper Salmon River Basin in Phase I and Phase II of the recovery strategy (see section 2.1.1) can be found in Table 2 and Table 3, respectively.

Table 2. Annual releases of Snake River sockeye in Phase I

Life Stage	Release Location	Phase I Annual Release Levels
Eyed Eggs	Upper Salmon River Basin Lakes	Up to 50,000
Unfed Fry	Upper Salmon River Basin Lakes	0
Fry	Upper Salmon River Basin Lakes	0
Pre-smolt	Upper Salmon River Basin Lakes	Up to 150,000
Smolt	Upper Salmon River Basin Lakes	Up to 1 million
Adults	Upper Salmon River Basin Lakes	Up to 1,500

Table 3. Annual releases of Snake River sockeye in Phase II

Age Class	Source	Maximum Number	Size (fpp)[1]	Release Date	Location
Redfish Lake					
Smolts	Springfield	1,000,000	10 – 20	April	Redfish Lake Subbasin
Smolts	Springfield	1,000,000	10 – 20	April - May	Salmon River
Pre-smolts	Springfield/ Sawtooth Hatchery	300,000		October	Redfish Lake
Redfish Lake Captive and Anadromous Adults	Eagle, NMFS Facilities	250 (minimum)	0.25	September/ October	Redfish Lake
Pettit Lake					
Redfish Lake Captive Adults	Eagle, NMFS Facilities	50-100 (subject to change)	0.25	September	Pettit Lake
Alturas Lake					

Age Class	Source	Maximum Number	Size (fpp)[1]	Release Date	Location
Anadromous or Captive Adults (to be determined by SBTOC, recovery plan)	Eagle, NMFS Facilities	50-100 (subject to change)	0.25	September/ October	Alturas Lake
[1]The acronym "fpp" refers to "fish per pound" and is a measure of fish size used in hatchery operations.					

Transfer of Snake River Sockeye

Containers used to transport fish vary by task, and include 5-gallon plastic buckets and coolers for short-term holding and inventory, barge-mounted holding tanks for mid-lake (pelagic) fish releases, and commercial air service for egg shipments. Truck-mounted tanks, used for long distance transfers, include those with 946-liter (L) (250-gallon), 3,785-L (1,000-gallon), 9,463-L (2,500-gallon), and 18,926-L (5,000-gallon) capacities. Transport density guidelines are in place not to exceed 89 grams/L (0.75 pound/gallon).

Juveniles transported to the Upper Salmon River Basin for release are withheld feed for 2-3 days prior to transport to minimize fish waste products in the tank environment (mainly fecal-casts and dissolved ammonia). Gut contents (and resulting regulated waste products) are largely absent to maintain the highest water quality for transported fish. Federal water quality standards (e.g., National Pollution Discharge Elimination System [NPDES]/Environmental Protection Agency [EPA] standards) for aquaculture operations limit the production of suspended solids as well as dissolved ammonia, dissolved nitrogen, and dissolved phosphorus (all of which are associated with the feeding of aquatic organisms; these products are not present in non-fed fish).

Where necessary, a pipe is used to deliver juvenile fish from the tanks to the river or creek during releases. Water temperature of the tank environment is often regulated to match the release environment and minimize stress to transported fish; therefore, there are no thermal discharge issues. Water chemistry parameters may be modified during transport as a means of acclimating fish for the transition from Springfield Hatchery waters to those at the release site.

All full-term smolts reared at Springfield Fish Hatchery (IDFG) are loaded on transport trucks filled with specific pathogen-free well or spring water. Aquatic nuisance species are therefore not present. Chemicals are not used in transport. Additionally, smolts are sampled for major fish health pathogens (e.g., viral, bacterial, parasitic) prior to transport; fish health pathogens transferred with fish (if any) are generally ubiquitous in wild populations of salmonids (i.e., fish with "novel" pathogens would not be released to natural environment).

As options are evaluated to resolve the smolt survival issue, additional transport actions (unspecified at this time) may be needed to relocate sockeye of various age classes between hatcheries. Additional details on transfer methods are available in the HGMP (IDFG 2012, pp. 46, 57, 58).

Prior to release, all juvenile and adult sockeye released from the sockeye captive broodstock program would have clipped adipose fins to identify hatchery-reared fish. A health certification would be conducted (major bacterial, viral, and parasitic pathogens), and IDFG and NMFS fish health professionals would sample and certify the health of all release and/or transfer groups.

2.1.3.1.3 Research, Monitoring, and Evaluation

Section 7 of the Act identifies agency responsibilities to further the purposes of the Act, and ensures that otherwise lawful activities do not limit the recovery/survival of listed species; RM&E can fulfill both of these requirements.

RM&E programs for hatchery production are not only necessary for adaptive management purposes but are required to ensure that hatchery programs do not limit the recovery of listed populations. Though necessary to monitor and evaluate impacts on the target listed species from hatchery programs, RM&E programs are designed in coordination with other plans to maximize the data collection while minimizing take of listed species, particularly non-target listed fish.

RM&E for the Snake River sockeye program is separated into two main areas of focus: in-hatchery RM&E and off-station RM&E of the program fish and the Snake River sockeye population in general. The in-hatchery RM&E is primarily focused on the performance of sockeye in the hatchery facilities, from growth-rate and mortality rates at the various life stages, to marking and tagging rates and retention estimates. While all of the aspects of in-hatchery RM&E are vital to the continued operation and success of the program, none of these in-hatchery activities have an effect to any species other than the captive species being cultured, so the effects of these activities on other listed species will not be analyzed in this Opinion.

Off-station RM&E actions that are part of the Snake River sockeye program could affect bull trout (as described in section 2.5.1.1.3). The off-station RM&E activities associated with this program take place at select locations (described below) in the Upper Salmon River Basin. These activities are focused in two major areas of concern—adult spawner and juvenile production estimates for sockeye salmon.

In general, RM&E may include the use of traps, weirs, nets, and hook-and-line sampling. Other sampling involves trapping, netting, and handling fish to gather biological information including biological sampling of adult sockeye salmon at Lower Granite Dam.

RM&E actions are conducted through collaboration among IDFG, NMFS, and the SBT. IDFG will engage the SBTOC in their proposal to release adult Redfish Lake Creek Sockeye into Alturas Lake in an effort to answer the questions discussed in Section 2.1.3.1.2, above, concerning the identification of stocks suitable for reintroduction/restoration of anadromous sockeye at Alturas Lake and other upper Salmon River Basin lakes.

All projects described below are funded by BPA under Project No. 2007-402-00 or 1991-073-00 (Salmon River screw trap).

Genetic Sampling

Juvenile and adult sockeye salmon are routinely sampled (non-lethally; fin clips removed/analyzed) at weirs to provide genetic information for the population. The program uses genetic analyses to construct in-breeding avoidance matrices in the hatchery, determine founder contribution among the captive and anadromous adults, determine release strategies of out-

migrants and anadromous adults, determine the proportion of kokanee and sockeye salmon in the trawl estimates to help refine population abundances and composition within the lakes, and to determine the proportion of sockeye salmon in the creel to determine "take" for permitting.

Annual genetic monitoring of captive and anadromous broodstock is conducted at the Eagle Fish Genetics Laboratory. Genetic sampling of juvenile sockeye salmon is also conducted for juvenile sockeye encountered in program traps in the Upper Salmon River Basin.

Juvenile Outmigration Monitoring

Smolt trapping enables program operators to estimate natural smolt production from the Basin, and to evaluate performance of hatchery releases. The IDFG installs and operates the juvenile outmigrant trap on Redfish Lake Creek annually between April and June. All sockeye salmon smolts captured at the Redfish Lake Creek trap are measured for fork length, weight, and scanned for PIT tags. The smolt trap uses the same permanent supports as the broodstock trap (described in section 2.1.3.1.1), but the trap operates differently.

The SBT are responsible for juvenile outmigrant monitoring on outlets from Pettit and Alturas lakes (complete weir and screw trap, respectively). Standard Quality Assurance/Quality Control (QA/QC) procedures are followed for all data generated. All sockeye salmon smolts captured at the Alturas Lake Creek trap are measured for fork length, weight, and scanned for PIT tags. All sockeye salmon smolts captured at the Pettit Lake Creek weir are scanned for PIT tags, enumerated by wild and hatchery origin, and then a sub-sample are treated the same as the other traps. Scales are removed from a sub-sample of natural origin and adipose fin-clipped hatchery reared sockeye (five fish from each 5-mm length group) and returned to the laboratory for aging. The Pettit Lake Creek trap design allows for all outmigrants to be collected, so up to 50 sockeye smolts per day (natural and hatchery origin) are PIT-tagged and released downstream at sunset. The Pettit Lake Creek trap is typically installed annually in mid-April and removed in mid-June. It is not usually in operation during adult migration. Survival to—and arrival timing at—Lower Granite Dam is modeled using PIT tag data. All captured non-target species are counted and released immediately.

To estimate trapping efficiency, up to 50 natural origin sockeye salmon smolts (determined by presence of an adipose fin) and 30 hatchery origin sockeye salmon smolts are PIT tagged daily and released approximately 250 m upstream of the weir one-half hour after sunset. Tag files are uploaded to the PTAGIS database (www.ptagis.org). All remaining fish are identified (natural origin and hatchery origin), scanned for PIT tags, counted, and released 15 m below the weir one-half hour after sunset. Flow-through live boxes with locking lids are used to hold fish until the evening release. Trapping efficiencies are calculated for natural origin smolts and hatchery fall direct-released smolts. Intervals are selected based on stream discharge similarities and the number of PIT-tagged smolts released upstream of the weir that are available for recapture (trap efficiencies). Stream velocity is measured below the trap weekly. Smolt outmigration estimates are calculated separately for natural origin and fall direct-released hatchery origin sockeye salmon smolts.

A screw trap (operated and reported under IDFG Section 6 permit with the USFWS) (BPA project 1991-073-00) is set on the Salmon River approximately 300 meters upstream of the Sawtooth Hatchery weir. Its primary purpose is to monitor out-migrations of juvenile Chinook and steelhead under IDFG's Idaho Natural Production Monitoring and Evaluation Project

(INPMEP, 1991-073-00) but it is also used to monitor juvenile sockeye out-migrations. The trap operates on an annual basis from March to November, 24 hours a day, and is checked daily, 7 days a week. The trap is removed from the river between December and February. When bull trout are encountered, lengths and weights are taken and they are released below the trap. Bull trout from this trap are not PIT tagged, though genetic samples are sometimes taken. Approximately 50 bull trout are trapped and handled each year (minimum of 11 and maximum of 76) over the last ten years; and no mortality of bull trout has been observed. The operation of the screw trap is included in the NMFS Section 10 permit (#1454) for the Snake River sockeye program, and RM&E operations that might impact bull trout are included in the Section 6 agreement with the Service.

Adult Weir Monitoring

Two adult traps are used to capture returning anadromous sockeye salmon in the Sawtooth Valley (see Broodstock Collection, section 2.1.3.1). The first trap is located on Redfish Lake Creek approximately 1.4 km downstream from the lake outlet. The second trap is located on the upper Salmon River at the Sawtooth Fish Hatchery weir. Traps are checked two-three times per day by IDFG staff. Trapped adults are either transferred to the Eagle Fish Hatchery where they are held for subsequent release to lakes for natural spawning, retained and incorporated in the captive broodstock program, or returned directly to Redfish Lake Creek after data collection. Some adults may also be released above Sawtooth weir for volitional migration to their upstream, natal lakes.

Spawning Surveys

Pedestrian Surveys

Ground-based (by foot) redd surveys are conducted for both sockeye and bull trout from approximately mid-October through early November. Surveys are conducted in Fishhook Creek, Redfish Lake Creek, the Salmon River between Sawtooth Fish Hatchery and the mouth of Redfish Lake Creek, Valley Creek, and Little Redfish Lake. The survey area is segmented into reaches and the various reaches are surveyed, one time, minimally. River reaches are accessed through common road and stream access points. Reaches are walked (waded) and examined for new salmon redd deposition on each temporal survey. Redd counts are typically conducted by one person per stream or specifically defined transect in a stream. The surveyor counts redds and fish while walking on the stream bank or in the stream. Investigators are instructed to avoid live fish and to avoid walking in the streams as much as possible. Presence of actively spawning, courting, or guarding behavior is also observed. Redd counts in traditional trend areas are typically done only once per year in the fall, shortly after spawning is completed. Minimal disturbances to live fish and fish habitat are expected.

Telemetry Surveys

IDFG conducts redd surveys in Redfish Lake by boat. Adult sockeye released into Redfish Lake are observed for indications of natural spawning behavior. Up to five male and five female (captive and anadromous, each) sockeye salmon have traditionally been fitted with gastric implant radio transmitters prior to release. Telemetry investigations of adult locations begin immediately after release and continue weekly until spawning activity has ended (typically the second week of November). Fish locations are recorded weekly by tracking movements via

powerboat. Redd counts are conducted once a week (coinciding with radio telemetry events) beginning in mid-October and continuing until mid-November. The entire shoreline within Redfish Lake is sampled using a powerboat for each survey. During redd surveys, any observed carcasses that can be retrieved are recovered to collect biological information (e.g., fish sex and spawning status). Redd counts are also performed at Little Redfish Lake and in Pettit Lake. As the program continues to expand, redd surveys will likely become routine in Alturas Lake.

Snorkel Surveys

To snorkel and observe fish, an investigator typically wears a wet suit, mask, and snorkel tube while crawling or swimming in an upstream direction identifying, counting, and estimating the size of fish observed within a measured reach. Sockeye Beach, located near the Redfish Lake boat ramp, and a small section of the southeast corner of Redfish Lake are spawning grounds for residual and adult sockeye salmon. Night snorkel surveys are conducted at both locations to estimate numbers of spawning residual sockeye salmon, anadromous sockeye salmon, and hatchery sockeye salmon. Snorkel surveys in Redfish Lake are conducted weekly from the first week of October through the first week of November. At least three observers, equipped with waterproof flashlights, snorkel parallel to shore, 10 meters (m) apart, at depths ranging from 0.5 to 5 m. Spawning ground surveys in the south end of the lake are conducted in the 200-m shoal area near the two small southeast inlet streams. Residual sockeye salmon spawning ground snorkel surveys are also conducted in Pettit Lake during the same period of time. As the program continues to expand, snorkel surveys may be conducted in Alturas Lake.

Population Abundance Monitoring

IDFG uses mid-water trawl-based techniques to develop annual estimates of sockeye population abundance, density, and biomass for Sawtooth Basin sockeye salmon nursery lakes (Redfish, Pettit and Alturas lakes). Population data, along with limnology data generated by the SBT, are used to develop annual estimates of lake carrying capacity. Trawl-based surveys are conducted at night during the dark (new) phase of the moon. Trawling is performed in a stepped-oblique fashion as described by Kline (1994, p. 8). Sockeye population size and densities are estimated by individual age class. Sockeye tissue samples are collected and preserved for genetic analysis.

Abundance monitoring is also conducted using hydroacoustic methods. Echo sounding data are collected with a Hydroacoustic Technology, Inc. Model 240 split-beam system. Fifteen, six, and eight transects are sampled at Redfish, Pettit, and Alturas lakes, respectively. Surveys are conducted on one moonless night in September/October. SBT begins the transects approximately 1½ hours after sunset and maintains a boat speed of approximately 1.5 m/s during data collection. The data collected are used to estimate sockeye length (age class), density, and population abundance. Gill-netting may also be used to sample residual sockeye in Pettit Lake and has been used to sample sockeye in Redfish Lake. Gill-netting is conducted annually.

2.1.3.2 Operation and Maintenance of Program Facilities

2.1.3.2.1 Water Withdrawal

Water supply is the most important aspect of fish hatchery operations. Water supplies for most hatchery facilities come from either surface water diversions, groundwater sources (wells and springs), or a combination of both. Surface water intakes, which draw from stream and river

sources, typically have diversion structures associated with them to efficiently withdraw the required water volume to operate the hatchery facility. Water intakes are screened to reduce impingement and entrainment.

Table 4. Water source and use by hatchery facility for Snake River sockeye salmon program (from Assessment Table 10, as modified in the Addendum).

Hatchery Facility	Surface Water Use (cfs)	Ground-water Use	Surface Water Source	Minimum Surface Water Flows (cfs)	Maximum Percentage of Surface Water Diverted (%)	Discharge Location	Max effluent release** (cfs)	Facility Effluent as % of Stream flow at discharge
Springfield Hatchery	0	<50 cfs	N/A	N/A	N/A	Boom Cr., American Falls Reservoir	54-56	89-93
Eagle Fish Hatchery	0	6.9 cfs	N/A	N/A	N/A	Boise River	Up to 6.9	0.7-3.5
Burley Creek Fish Hatchery	0	500 gpm	N/A	N/A	N/A	Burley Cr.	1.1	3.3
Manchester Research Station	5.6 (2,500 gpm)	0.07 cfs	Puget Sound	N/A	N/A	Clam Bay, Puget Sound	5.6	N/A
Sawtooth Fish Hatchery*	55	7.8 cfs	Salmon River	Approx. 300 cfs**	Approx. 18**	Salmon River	55 cfs	Approx. 18%**
Oxbow Fish Hatchery	9.5	40 cfs	Upper and Lower Herman Creek; Oxbow springs	10	95	Little Herman Creek	9.5	95

*water use amounts are for current levels of other (non-sockeye) salmonid production activities

** Flow estimations from near Stanley Idaho, five miles downstream of Sawtooth Hatchery

Groundwater is utilized as the primary or supplemental source of water for many hatchery facilities. Groundwater typically has the added benefit of more stable temperature throughout the year than surface water diversions. Groundwater withdrawal can have effects on the total

supply of groundwater available if overdrawn, but can also have effects on the thermal condition of surface water to which it may be connected via subsurface flow. Many species utilize these interconnected (upwelling) areas as thermal refugia to counteract elevated surface water conditions. For example, in the Swan River, Montana, abundance of bull trout redds (spawning areas) was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al. 1999, p. 854).

Of the facilities in Table 4, the only facilities where bull trout may occur are Manchester Research Station and the Sawtooth Fish Hatchery (see Section 2.4.1.1 for a discussion of bull trout distribution). Therefore, these are the only hatcheries discussed below.

Manchester Research Station

The water intake at Manchester Research Station is screened in compliance with NMFS screen criteria to protect juvenile fish. Water withdrawal volumes at Manchester Research Station for surface water and groundwater are very small compared to the water sources (5.6 cfs of surface water from Puget Sound; 0.07 cfs from groundwater).

Sawtooth Fish Hatchery

Sawtooth Fish Hatchery facilities have been utilized continuously since 1991 for various aspects of the sockeye captive broodstock program. As of June 2015, use of the hatchery for juvenile rearing was discontinued and production was transferred to Springfield Fish Hatchery. The role of the Sawtooth Fish Hatchery in the Snake River sockeye captive broodstock program is intended for broodstock collection only. However, use of this hatchery is again being proposed for possible sockeye production and rearing, or smolt acclimation, as it relates to the search for a solution to the smolt survival issue. The goal remains to accommodate all production and rearing at the Springfield Hatchery, but use of the Sawtooth hatchery facility is proposed as a temporary measure as needed to resolve the survival issue.

The Service recently addressed water withdrawal at the Sawtooth Hatchery in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017). If the facility is used for the sockeye Program, there is no proposal to increase water withdrawals or increase the amount of effluent discharged over what is currently occurring at the hatchery.

2.1.3.2.2 Hatchery Effluent

Hatchery operations discharge waste water from normal operations. This water is typically discharged (returned) to the stream it was first withdrawn from and is returned downstream of the facility and withdrawal diversion point. The water is used throughout the facility for all aspects of hatchery operations, including adult broodstock trapping and holding, egg incubation, juvenile rearing, fish health treatments, and pond cleaning. Many of these operations will introduce substances/compounds into the water that can then be carried in the effluent back into the stream. In addition to the substances and compounds that can be added to the hatchery effluent, the open pond structures and high biomass densities can raise temperatures, reduce dissolved-oxygen levels, and can affect pH. These additions and changes to the water can have effects on aquatic species living in the streams adjacent to and downstream of the facilities.

Hatchery facility waste products include uneaten food, fecal matter, soluble metabolites (e.g., ammonia), algae, parasitic microorganisms, drugs, and other chemicals. Fish hatchery facility wastewater commonly includes suspended solids and settleable solids (those that settle out of suspension), as well as nutrients, such as various forms of nitrogen (e.g., ammonia) and phosphorus (Michael 2003, p. 214).

The Federal Clean Water Act (CWA) regulates discharges of dredged or fill material into waters of the United States. The purpose of the CWA is to restore the physical, biological, and chemical integrity of the waters of the United States using two basic mechanisms: (1) direct regulation of discharges pursuant to permits issued under the National Pollution Discharge Elimination System (NPDES) and Section 404 (discharge of dredge or fill materials); and (2) the Title III water quality program. Washington State is responsible for issuing and reporting on NPDES permits. The EPA issues and monitors the NPDES standards for the state of Idaho; permitted aquaculture facilities are covered under general blanket aquaculture Permits IDG-130000 and IDG-131000. The threshold applied for fish hatchery operations under the CWA is that any facility that rears 20,000 lbs. of fish or more and discharges effluent into navigable waters must obtain a permit. Springfield Fish Hatchery (Permit IDG-130038) is the only facility in the Snake River sockeye program in Idaho that meets this threshold (annual production at Eagle Fish Hatchery is below this threshold). It is noted that the intent of the CWA is to reduce the pollution in navigable waters of the US, so standards were not set specifically to avoid effects to listed salmonids. Therefore, compliance with NPDES permit criteria does not solely ensure that impacts to listed salmonids will be minimized or avoided.

2.1.3.2.3 Fish Disease Management

Effluent also poses disease risk. Because of the structure of hatchery facilities and the typically high biomass densities in artificial fish culture, fish diseases that occur in the natural environment can be amplified in the hatchery. Pathogens of concern (parasitic, bacterial, viral) already exist in native fish populations (both salmonids and non-salmonid). All juvenile fish released from captive (hatchery) Snake River sockeye programs undergo American Fisheries Society (AFS)-approved fish health sampling/testing (to meet or exceed AFS Blue Book[10] sampling criteria) prior to release. Fish are sampled at statistically-rigorous rates and in numbers to assure detection of major bacterial and viral pathogens if/when present in the Snake River sockeye program. Most common pathogens are ubiquitous in both wild and cultured (hatchery) populations of salmonids. Anadromous fish—both hatchery and wild—share the same migration corridor and ocean environments, and Columbia Basin anadromous adult fish will generally be exposed to, or carry, similar pathogens and are capable of introducing/perpetuating these organisms in freshwater environments when they return to spawn. In addition to major bacterial and parasitic pathogens, major viral pathogens of concern are also monitored in the Snake River sockeye program (and anadromous ocean-returning adults) and detection of a "novel" viral pathogen may prevent the release of infected groups.

Snake River sockeye program managers follow a standard protocol. Within the hatchery system, broodstock (parent fish) are sampled at spawning to detect major pathogens that may/may not be

[10] Available at: http://www.afs-fhs.org/bluebook/bluebook-index.php (last accessed May 5, 2017).

capable of transmission to offspring, and eggs may/may not be culled to minimize/prevent the spread of these pathogens to juvenile fish. Throughout the period of rearing in the hatchery environment, juveniles are sampled multiple times during culture (and prior to release as smolts) using industry-standard fish health protocols and techniques. Detection of major pathogens (parasitic, bacterial, viral) will dictate ultimate fate of smolt release groups (cull or release).

The Snake River sockeye program operates under coordinated fish health policies by all parties to the action. The primary objective of the fish health management of any production program is to produce healthy juveniles that contribute to the program goals of the particular stock. Another equally important objective is to prevent the introduction, amplification, or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally producing stocks. A Fish Health Specialist visits approximately once per month to examine juvenile fish at program facilities. Juvenile fish are sampled to ascertain general health on each stock and brood year. Based on pathological signs, age of fish, and concerns of fish hatchery personnel, the examining Fish Health Specialist determines the appropriate tests.

Periodically, the rearing fish are treated for a variety of fish diseases, both internal and external. For external treatment, the fish are provided a mild concentration of formalin or hydrogen peroxide for 15 to 60 minutes, depending on the situation. For internal treatment, the fish are fed feed prepared with fish approved antibiotics for 3 to 10 days. Specific fish health monitoring measures are described below (adapted from IDFG 2012, pp. 71-72).

Eagle Fish Hatchery

Fish health is monitored daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, or unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist.

Presence of moribund fish is immediately reported to the fish pathologist for blood and parasite sampling; the fish pathologist routinely monitors captive broodstock mortalities to try to determine cause of death. AFS Bluebook procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology. Moribund fish are routinely analyzed for common bacterial and viral pathogens (e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc.). When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate therapeutic drugs to control the problem. Select carcasses are appropriately preserved for pathology, genetic tests, and other analyses. After necropsy, carcasses that are not vital to further analysis are disposed of as per language contained in the Section 10 permit for the program.

Manchester Research Station and Burley Creek Fish Hatchery

Biosecurity practices are in place to prevent the spread of diseases from one stock to another within the program. Housing fish within a fully enclosed building and rearing them on treated water is essential to ensure that pathogens from wild fish do not reach the listed captive broodstocks. For the seawater system, an insight that was developed over the course of operations was to ensure a direct linkage (both on or both off) between the pumps and the ultraviolet (UV) treatment to ensure untreated water was not pumped into tanks. In recent years,

the holding of salmonids has been prohibited in facility net pens located near the intake pumps to reduce potential salmonid pathogens from entering the water supply.

Biosecure culture practices form the basic approach to prevent pathogens from being spread from one cultured stock to another. Separate brushes and nets are provided for each pool; staff use a new pair of disposable gloves per pool when brushing pools or removing mortalities. All equipment is disinfected in 100 ppm iodophore for a minimum of 30 minutes before being moved to a new pool. Disinfection includes crowder screens, nets, transfer tubes, anesthetic tank, tables, weighing pan, scale, PIT tag reader equipment, waders, and raingear. Personnel are expected to change raingear as they move between pools to provide proper disinfection time. Shower curtains are placed around anesthetic tanks during fish sampling and transfer to prevent splashed water from reaching adjacent pools. Adjacent pools may be temporarily covered with disinfected plastic when there is a risk of cross-contamination. After fish handling, the floor is sprayed with an iodophore disinfectant.

Fish health is monitored in several ways. Fish are observed daily for feeding response, external condition, and behavior as initial indicators of developing problems. Indicators include signs of lethargy, erratic swimming, side swimming, flashing, unusual respiratory activity, body surface abnormalities and unusual coloration. Dead or morbid fish are removed immediately, bagged, PIT tags read, and submitted for pathology screening. A fish pathologist performs necropsies to determine cause of death. Infectious disease screening includes collection of kidney tissue, which is subjected to enzyme-linked immunosorbent assay (ELISA) to determine *Renibacterium salmoninarum* infection (bacterial kidney disease or BKD). Virology screening is performed on the kidney samples using a Chinook salmon epithelial cell (CHSE) tissue culture-based assay in order to detect infectious hematopoietic virus (IHNV) and viral hemorrhagic septicemia virus (VHSV). Any tissue culture monolayer showing signs of cytopathic effects are then subjected to polymerase chain reaction (PCR)-based identification of the virus species. Samples from other overt lesions are also cultured on a variety of laboratory medium and subjected to microbial analysis. Other common bacterial pathogens that may be encountered include *Aeromonas salmonicida*, *Vibrio anguillarum*, and members of the *Flavobacterium* genus. Typically, when a treatable pathogen is either detected or suspected, the NMFS fish pathologist prescribes appropriate prophylactic and therapeutic drugs, e.g., oxytetracycline or erythromycin. Azithromycin (an erythromycin derivative) is also used to treat BKD in *R. salmoninarum*-infected populations. Medication is either mixed with feed or injected, with dosages based on fish weight. Prior to transfer to seawater, fish in the adult release group receive an injection of the *Vibrio anguillarum* bacterin vaccine. In addition, maturing fish are injected with erythromycin as a prophylactic approximately 1 month prior to spawning. The injection is administered at the base of the ventral fins at a dose of 20 or 30 mg/kg of fish wet weight. Ovarian fluid and milt from spawning adults are also screened with the BKD-ELISA and for IHNV and VHSV.

Springfield Fish Hatchery

Fish are observed daily for feeding response, external condition, behavior, and initial indicators of developing problems. In particular, fish culturists will look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface

abnormalities, or unusual coloration. Presence of any of these behaviors or conditions will be immediately reported to the program fish pathologist.

Sawtooth Fish Hatchery

See discussion in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017).

Oxbow Fish Hatchery

ODFW has adopted a Fish Health Management Policy that describes measures that minimize the impact of fish diseases on the state's fish resources. The primary objective of fish health management programs at ODFW hatcheries is to produce healthy smolts that will contribute to the fishery and to return sufficient numbers of adults to continue propagation of the stocks and provide supplementation if desired. Equally important is to prevent the introduction, amplification, or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks.

ODFW has implemented both disease control and disease prevention programs at all of its facilities to achieve these objectives. These programs include the following standard elements (ODFW 2017):

<u>Disease Control</u> (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease. This includes recommending modifications in fish culture practices, when appropriate, to alleviate disease-contributing factors.
- Apply a disease control policy as stated in the Oregon Administrative Rules, which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

<u>Disease Prevention</u> (Proactive)

- Routinely remove dead fish from each rearing container and notify ODFW Fish Pathology if losses are increasing. Monthly mortality records are submitted to Fish Pathology from each hatchery.
- Routinely perform examinations of live fish to assess health status and detect problems before possible disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the use of vaccines or antibiotics in order to avoid a disease problem.
- Use a disease prevention policy that restricts the introduction of stocks into a facility. This will help avoid new disease problems and fish pathogens not previously found at the site.

- Use sanitation procedures that prevent introduction of pathogens into and/or within a facility.
- Conduct applied research on new and existing disease prevention techniques.
- Utilize pond management strategies (e.g., Density Index and Flow Index guidelines) to help optimize the quality of the aquatic environment and minimize fish stress that can be conducive to infectious and noninfectious diseases. For example, a Density Index is used to estimate the maximum number of fish that can occupy a rearing unit based on the rearing unit's size. A Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Health Monitoring

- Monthly health monitoring examinations of healthy and clinically diseased fish are conducted on each fish lot at the hatchery. The sample includes a minimum of 10 moribund/dead fish (if available) and 4-6 live fish per lot.
- All fish are given a health inspection no longer than 6 weeks before fish are released or transferred. This exam may be in conjunction with the routine monthly visit.
- Examinations for *Myxobolus cerebralis*, the agent of whirling disease, are conducted annually on 60 fish held for a minimum of 180 days at the facility.
- Whenever abnormal behavior is reported or observed, or mortality exceeds 0.1 percent per day over 5 consecutive days in any rearing container, the fish pathologist will examine the affected fish, make a diagnosis, and recommend the appropriate remedial or preventative measures.

Reporting and control of specific fish pathogens are conducted in accordance with ODFW's Fish Health Management Policy. Results from each examination mentioned above are reported on the ODFW Fish Health or Virus Examination forms.

2.1.3.2.4 Hatchery Maintenance

Routine maintenance of the Sawtooth Hatchery and weir, Redfish Lake Creek weir, Lower Granite Dam trap, Manchester Research Station, Burley Creek Fish Hatchery, Eagle Fish Hatchery, and Springfield Fish Hatchery is conducted as needed to support the hatchery program. Normal and preventative maintenance of hatchery facility structures and equipment is necessary for proper functionality and to prevent financially and environmentally costly failures. Routine maintenance activities include pond cleaning, pump maintenance, debris removal from intake and outfall structures, building maintenance, and grounds maintenance.

Routine maintenance activities that do not include working in facility water structures, i.e., grounds maintenance, building maintenance, and non-pump mechanical maintenance, will have no effect on bull trout or their critical habitat and will not be analyzed in this Opinion.

Hatchery maintenance that occurs directly in watered structures, such as pond maintenance, pump maintenance, and removal of minor amounts of debris from intake or outfall structures may cause short-term reductions in water quality (e.g., suspended sediment) in the areas directly adjacent to and downstream of the activity.

Hatchery pond maintenance is a more regular occurrence at some of the program facilities. This involves vacuuming and removing accumulated sediment on the bottoms of hatchery ponds. Precautions are taken with pond level at the time of cleaning to reduce the chance of elevating the sediment level in the normal hatchery effluent. Solids are removed from the abatement structures and typically disposed of elsewhere on the hatchery grounds or through commercial means.

There are also semi-routine maintenance tasks at hatcheries that are not yearly occurrences, but can occur with frequency over a period of 5 to 10 years. Such examples would be: in-stream (below the Ordinary High Water Mark (OHWM)) work like clearing gravel and/or major debris blockages from water intakes and outfalls after larger flood events; minor bridge repair (if present); equipment failure such as intake pumps and screening structures (screen media); or weir, ladder, and trap maintenance. All facilities are expected to have some element of semi-routine maintenance necessary on an infrequent basis.

Non-routine maintenance or facility component replacements that include significant in-stream work that could result in additional effects to listed species and/or their critical habitat, including major repair, removal, replacement, construction, or reconstruction of in-river hatchery structures such as surface water diversion and hatchery outfall structures, are not considered in this Opinion under the hatchery maintenance element. These activities may require a separate consultation with the Service.

Bull trout occur at the Sawtooth Fish Hatchery weir and the Redfish Lake Creek weir in the Upper Salmon River Basin, at the Lower Granite Dam trap, and potentially at Manchester Research Station on Puget Sound (refer to Section 2.4.1 for a discussion of occurrence in the action area). Bull trout are not present at the Eagle Fish Hatchery, Springfield Fish Hatchery, Burley Creek Fish Hatchery, and Oxbow Fish Hatchery. Maintenance actions at these facilities will have no effect on bull trout and are not addressed further in this section of the Opinion.

Sawtooth Fish Hatchery and Weir

At the Sawtooth Hatchery, the water intake and discharge structures are the only in-stream structures not associated with the weir (discussed below). Past maintenance activities have included the installation of pilings and boulders at the intake site to protect the structure during high flows. Maintenance of these for continued effectiveness can be expected. Gravel is periodically excavated from the water diversion point and can also be expected to occur periodically in the future.

Habitat improvements in the form of tree and willow planting along the Salmon River at the hatchery site were implemented in 2006. Habitat maintenance or improvements along the river here are presumed likely to continue periodically in the future.

Aside from damages or loss of functionality related to high water events, the integrity of the adult weir may be compromised simply by age and exposure to changing weather conditions. Hatchery personnel must periodically complete a visual inspection of the structures by entering the river channel with hip boots or waders. Minor repairs may be completed in place by workers using hand tools, while more extensive repairs may require individual weir panels to be temporarily removed for repair or replacement. Should removal of these structures exceed the

lifting capability of hatchery personnel, a crane or similar device operated from the stream bank would be employed. Heavy equipment will not enter the stream channel.

Refer to the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs for details on maintenance for the Sawtooth Fish Hatchery and weir (USFWS 2017).

Redfish Lake Creek Weir

Aside from damages or loss of functionality related to high water events, the integrity of the adult weir may be compromised simply by age and exposure to changing weather conditions. Hatchery personnel must periodically complete a visual inspection of the structures by entering the river channel with hip boots or waders. Minor repairs may be completed in place by workers using hand tools, while more extensive repairs may require a crane or similar device operated from the stream bank. Heavy equipment will not enter the stream channel.

Lower Granite Dam Trap

Maintenance at the Lower Granite Dam trap is similar to that described above for the weirs. The trap is closed for winter from the end of November through early March. Most maintenance is done in February, but it can be done in December and January. Routine preventive maintenance is done on the turn pool gate, trap gates, and the fish screen to the collection area. The trap requires cleaning by hand to remove debris, visual inspections, and simple repairs.

Manchester Research Station

At Manchester Research Station, the pump station and pipeline are the only in-water components requiring routine maintenance. This consists of brushing screens as needed and switching lines approximately every 3 weeks to prevent the settlement of mussels, barnacles, and similar organisms inside the pipelines (also known as “biofouling”). Switching lines minimizes the growth of these organisms within the pipe and prevents pipeline clogging. Semi-routine in-water maintenance consists of the occasional replacement of floatation, anchor lines, pipe fasteners, and intake snorkels when they fail. Semi-routine maintenance occurs approximately every 5 years. The pump station floats more than 20 feet off the bottom; therefore, these activities do not produce any suspended sediment or turbidity.

2.1.3.3 Conservation Measures

Conservation measures are actions to benefit or promote the recovery of listed species that are included by the federal agency as an integral part of the Snake River sockeye program. These actions will be taken by the program operators and serve to minimize or compensate for project effects on the species under review.

General hatchery operation avoidance and minimization measures for limiting effects to bull trout include the following (from Snake River Sockeye HGMP [IDFG 2012, pp. 101-102]):

1. Continuing to reduce effects of releasing large numbers of juvenile sockeye at a single site by spreading the release over a number of days.
2. Continuing research to improve post-release survival of sockeye to potentially reduce numbers released to meet management objectives.

3. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC[11] guidelines.
4. Monitoring hatchery effluent to ensure compliance with the National Pollutant Discharge Elimination System permit.
5. Continuing Hatchery Evaluation Studies that comprehensively monitor and evaluate sockeye, also providing valuable incidental bull trout data.
6. Conducting adult trapping activities to minimize impacts to bull trout and other non-target species. Trapping provides valuable incidental bull trout data.
7. Continuing to modify broodstock collection traps to minimize bull trout mortality as necessary.

2.1.3.3.1 Broodstock Collection

Measures applied to minimize potential effects during broodstock collection activities include:

1. All program adult collection activities are directed and coordinated through a series of annual planning meetings between cooperating agencies and the Stanley Basin Sockeye Technical Oversight Committee.
2. Traps are operated under strict standards to minimize risk to all fish in general and non-target species in particular. Fish are quickly removed from the trap and all non-target fish are returned to the stream immediately with minimal handling. Traps are to be checked every 24 hours, unless an agreement with the Services has been obtained.
3. During broodstock collection at the Sawtooth Hatchery weir, IDFG observes the weir and its vicinity for sockeye. If bull trout are observed staging upstream of the weir, the weir panel will temporarily be opened to allow them to pass in order to minimize downstream migrational delays.
4. Adult collection traps are operated only when temperatures are less than 68°F (19°C), though special handling conditions may be developed and agreed to by operators and by NMFS and the Service when temperatures exceed 68°F (19°C).
5. Ensure that the fish traps receive sufficient flow in all seasons to attract and effectively pass fish of all life stages. Catalog and prioritize those traps that do not meet Anadromous Salmonid Passage Facility Design (NMFS 2011, entire) for upgrades as funding becomes available.

[11] The Integrated Hatchery Operations Team (IHOT) is a multi-agency group established by the Northwest Power Planning Council to direct the development of basin-wide standards for managing and operating fish hatcheries. AFS is the American Fisheries Society. The Pacific Northwest Fish Health Protection Committee (PNFHPC) is an organization of technical and policy representatives from conservation agencies, tribes, and commercial fish producers from the Pacific Northwest. These guidelines are specifically not included as a static reference in the literature cited section since they may be updated and the most current documents are to be followed.

6. The program is operated in accordance with the policies and procedures developed by the Integrated Hatchery Operations Team (IHOT 1995, entire) for Columbia Basin anadromous salmonid hatcheries.

2.1.3.3.2 Release of Snake River Sockeye

The following measures are recommended to minimize potential resource competition and predation effects during juvenile release activities while acknowledging potential benefits to bull trout from these releases:

1. Releasing all hatchery fish as actively migrating smolts through volitional release practices so that the fish migrate quickly seaward, limiting the duration of interaction with any co-occurring natural-origin fish downstream of the release site.
2. Operating hatcheries such that hatchery fish are reared to sufficient size that smoltification occurs in nearly the entire population.
3. Where appropriate and consistent with the final bull trout recovery plan and SBTOC decisions for juvenile releases, evaluate potential benefits to bull trout from intentional early life stage releases and other releases of surplus hatchery parr and presmolts.

2.1.3.3.3 Research, Monitoring, and Evaluation

For Federally-funded entities whose actions cannot be appropriately covered under the IDFG's section 6 Cooperative Agreement as an Agent of the State, the following measures are to be applied to minimize potential effects of RM&E on bull trout.

1. RM&E activities shall be conducted in accordance with approved study plans.
2. Fish trapping, trap maintenance, fish handling, fish anesthesia, and fish PIT-tagging protocols shall be followed explicitly and all staff shall be trained in their use and application before working under field conditions.
3. All appropriate actions to minimize potential impacts to bull trout such as non-lethal, small-scale sampling prior to large-scale sampling shall be conducted.
4. Surveys shall be conducted to minimize disturbance of live fish spawning activities and non-target species behavior. Fish shall be kept in water as much as possible during the sampling and handling.
5. Investigators may observe fish using snorkeling methods but shall avoid causing individuals to be displaced from the original encounter site during observation.
6. All survey, capture, retention, handling, and observation methods shall be implemented at times that would avoid temperature stress to fish being sampled. At locations that have potential to contain bull trout, sampling shall not be done if water temperature exceeds 18 degrees Celsius (64 degrees Fahrenheit). Sampling shall be conducted at water temperatures less than 15 degrees Celsius (59 degrees Fahrenheit) where possible.
7. Disturbance of, or impacts to, bull trout habitat shall be minimized during project activities. Surveyors shall take precautions to avoid stepping in areas that may be potential redd locations for resident or fluvial bull trout (e.g., small gravel deposits behind boulders; under overhanging vegetation; near wood debris or logs; or areas of

hydraulic influence such as confluences of tributaries, springs, seeps, pool tail crests, or edges of pools), since redds of resident and small fluvial bull trout may be difficult to see due to their small size.

8. Boots and sampling equipment intended for use in the water shall be disinfected and air-dried prior to use in each location when sampling in multiple subbasins.
9. Water containing chemicals used in handling fish and used for disinfecting equipment shall not be allowed to enter the water body being sampled.
10. Equipment shall be sanitized before and after use to prevent the spread of invasive species.
11. Bull trout shall not be used for smolt trap efficiency tests.
12. Active weirs and traps shall be monitored at least once daily. Traps shall be checked more frequently when crowding (produced by an increasing catch rate or high debris loading) results in a higher probability of injury or mortality to bull trout being held in a weir or trap.
    a. Conduct regular checks of the traps and live boxes to ensure that traps are maintained and that no mortalities occur. Trap check intervals are determined by the stream conditions and numbers of fish being trapped.
    b. Smolt trap cones and debris drums shall also be regularly checked to ensure that traps are not causing fish impingement or descaling and that fine debris is removed from the traps.
    c. Water temperatures and stream discharge are regularly monitored to ensure safe capture and handling of all fish.
13. PIT-tagging of bull trout shall not be conducted when water temperatures are in excess of 18°C (64°F).
14. The following practices and equipment modifications are in place to minimize stress and mortality associated with smolt studies:
    a. Oversized live-boxes are fitted to the smolt traps. These live-boxes are roughly twice as large as the standard live-box fitted to a rotary screw trap. The increased volume in the live-box allows for a lower trapped-fish density, better ability for juveniles to avoid predators, and will help to keep debris from crushing fish.
    b. On the adult traps, a baffle is fitted to the live box to dissipate water velocity. This will reduce potential fish injury/impingement during high runoff conditions.
    c. Traps and live boxes are checked regularly throughout the day and night to ensure that traps are maintained and that no mortalities occur. Smolt trap cones and debris drums are also regularly checked to ensure that traps are not causing fish impingement or descaling and that fine debris is removed from the traps. Water temperatures and stream discharge are regularly monitored to ensure safe capture and handling of all fish.

15. If bull trout are captured or handled, the following measures will be applied:

    a. Authorized personnel shall ensure that their hands are free of sunscreen, lotion, or insect repellent prior to conducting activities that may involve handling bull trout.

    b. Any captured bull trout that appears healthy and able to maintain itself shall be released as soon as possible, and as close as possible to the point of capture.

    c. Any captured bull trout that shows signs of stress or injury shall only be released when it is able to maintain itself. It may be necessary to nurture the fish in a holding tank until it has recovered. The holding tank water shall be conducive to bull trout health (i.e., clean, cool water with ample dissolved oxygen).

    d. Because bull trout are aggressive predators and are known to be cannibalistic, investigators shall attempt to partition captured fish individually or by size class and should avoid holding numerous bull trout in the same live-well.

    e. A healthy environment must be provided for bull trout held in a holding tank, and the holding time must be minimized. Water-to-water transfers, the use of shaded or dark containers, and supplemental oxygen shall all be considered in designing fish handling operations. Bull trout may be held for up to 1 hour during electrofishing operations.

    f. Bull trout shall be closely monitored in holding tanks if the ambient water temperature in these tanks is greater than 15 degrees Celsius. All operations shall cease if fish show signs of stress.

    g. Holding tanks shall be non-toxic plastic, aluminum, or stainless steel containers. Do not use metal containers that have lead or zinc coatings.

    h. Fish statistics (e.g., length, weight, sex, ripeness, scale sample, mark, condition/health, angling injury) may be collected from captured bull trout.

    i. Handling and measurement of captured fish shall follow commonly accepted techniques for salmonid field sampling.

    j. If stream temperatures are greater than 15 degrees Celsius, the collection of fish statistics shall be limited to fish length to avoid over-stressing captured fish.

    k. If a non-lethal bio-sample (i.e., fin clip or punch) is taken, it shall not exceed 0.75 square centimeters in size. Bio-samples shall be used for genetic analyses.

    l. Bull trout may be marked via a non-lethal fin clip during mark-recapture population surveys. This fin clip may be used as a bio-sample as indicated above.

    m. To reduce stress on captured bull trout, handling of the same individual multiple times during permitted activities shall be avoided, to the extent possible.

    n. A colored fish key with all char, trout, and salmon species that are known to, or may possibly be in the system, shall be on hand when identifying fish. Captured bull trout and unidentified fish that may be bull trout shall be photographed for

verification in areas where bull trout occur infrequently or if identification of the fish is difficult.

16. For electrofishing activities:

    a. Electrofishing shall be conducted using the methods outlined in the NMFS's electrofishing guidelines (available at http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf). Electrofishing equipment shall be operated at the lowest possible effective equipment settings to minimize injury or death to bull trout.

    b. Electrofishing shall be avoided in areas such as the mouths of rivers when adult bull trout may be staging as part of their spawning migration.

    c. Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor. This condition may be experienced when the sampler cannot see the stream bottom in 1 foot of water.

    d. During the bull trout spawning season (typically late August to November), a cursory observation of the survey reach shall be completed prior to electrofishing, and electrofishing shall only be performed in areas where adult bull trout or their redds are not observed. If an adult bull trout is subsequently shocked, electrofishing at that site shall be suspended. Electrofishing may continue after emergence of fry occurs the following year.

    e. Outside the bull trout spawning season, visual or snorkel surveys for bull trout shall be conducted prior to electrofishing, where conditions allow. If bull trout are documented in visual surveys, moving to a new sample location should be considered if possible. However, electrofishing may occur in areas where bull trout are present if there is no alternative that is consistent with the study plan.

    f. Because electrofishing during the spring in bull trout habitat runs the risk of injuring or killing alevins or fry that remain in or near the gravels, if salmonid alevins or fry are seen during spring electrofishing, the electrofishing activity shall immediately cease until the alevins or fry can be identified. If they are determined to be bull trout, electrofishing shall be terminated at the site until after fry have fully emerged.

17. For gillnetting activities:

    a. Where bull trout may be encountered when employing gill nets, bull trout will be the first species to be removed from the nets to maximize survival of individuals.

    b. Gillnet sampling shall be implemented using standard, non-lethal methods that avoid mortality to salmonids, including the use of appropriate mesh size for target species, and net set duration of no longer than the minimum required to gather necessary data.

    c. If gillnetting is to occur in lake settings when water temperatures may be elevated above 18 degrees Celsius in the sampling location, and adult bull trout

are suspected to be in the area, gillnetting shall be suspended or moved to an alternate location to avoid harming or killing bull trout.

2.1.3.3.4 Water Withdrawals

Measures applied to minimize potential effects of water withdrawals include the following:

1. Facilities operate within their water right with respect to maximum withdrawal from surface and or groundwater sources, while complying with any minimum in-stream flow requirements.
2. Site, design, operate, and maintain withdrawal structures to prevent barriers to fish passage.
3. All surface water intakes are designed to meet NMFS fish screening criteria to reduce and/or eliminate the risk of fish impingement or entrainment across the range of expected flow conditions.
4. Catalog and prioritize any intakes and traps that do not meet Anadromous Salmonid Passage Facility Design (NMFS 2011, entire) for upgrades as funding becomes available.

2.1.3.3.5 Hatchery Effluent

General measures applied to minimize potential effects of hatchery effluent include the following:

1. Facilities in this program that meet NPDES standards (fish hatchery operations that rear 20,000 lbs. of fish or more and discharge effluent into navigable waters) operate under an applicable EPA NPDES permit, which includes periodic water quality sampling for compliance[12].
2. Proper feeding volume and application is performed to reduce non-utilized feed.
3. All pond cleaning activities use pollution abatement structures to reduce the suspended sediment from these activities.
4. All hatchery maintenance performed on watered or in-water facilities will be performed to minimize potential effects to hatchery effluent, i.e., sediment disturbance, water temperature, and chemical composition.

12 Under the NPDES program, EPA sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply these limits. EPA has delegated responsibility for the NPDES permitting program to most States. Under the water quality standards program, EPA has issued water quality criteria to establish limits on the ambient concentration of pollutants in surface waters that will still protect the health of the water body. States issue water quality standards that reflect the Federal water quality criteria and submit the standards to EPA for review. State water quality standards are subject to review every 3 years (triennial review). States apply the water quality standards to NPDES discharge permits to ensure that discharges do not violate the water quality standards. Compliance with the CWA through the NPDES program does not imply compliance with the Endangered Species Act for any actions or programs described in the NPDES permit.

2.1.3.3.6 Fish Disease Management

Specific measures applied to minimize disease risk from effluent include the following:

1. Operate programs in accordance with the policies and procedures developed by the IHOT for Columbia Basin anadromous salmonid hatcheries.
2. Follow the measures outlined in the PNFHPC Model Comprehensive Fish Health Protection Program[13].
3. Administration of therapeutic drugs and chemicals to fish and eggs reared at program facilities is performed only when necessary to effectively prevent, control, or treat disease conditions.
4. All treatments are administered according to label directions in compliance with the Food and Drug Administration (FDA) and the EPA regulations for the use of aquatic animal drugs and chemicals. EPA and FDA consider the environmental effects acceptable when the therapeutic compounds are used according to the label; however, compliance with the FDA and EPA regulations does not imply Act compliance for use of these drugs and chemicals.
5. Notify program fish health staff at least 6 weeks prior to a release or transfer of fish from the hatchery. Tissue samples are collected on any stock being transferred or released. Testing is conducted in accordance with protocols in the AFS Fish Health Section Blue Book. Pathogens screened for include infectious hematopoietic necrosis virus (IHNV); infectious pancreatic necrosis virus (IPNV); viral hemorrhagic septicemia virus (VHSV) (viral replicating agents); *Renibacterium salmoninarum; Aeromonas salmonicida; Yersinia ruckeri* (bacterial replicating agents); and under certain circumstances, other parasitic pathogens such as *Myxobolus cerebralis* and *Ceratomyxa shasta*. If detected, actions associated with the presence of major bacterial or viral pathogens would be addressed in consultation with fisheries managers in the Basin. Options to address the presence of major bacterial or viral pathogens in Snake River sockeye juveniles or adults could include culling (destroying) fish to prevent the amplification of these pathogens in future generations; as a species, sockeye are generally regarded as most susceptible to these pathogens and management strategies involving positive (infected) fish are typically more risk-averse.
6. Snake River sockeye program managers follow a standard protocol to sample sockeye at various life stages to test for major pathogens. Detection of major pathogens (bacterial/viral) will dictate the ultimate fate of smolt release groups (cull or release).

2.1.3.3.7 Facility Maintenance

Measures applied to minimize potential effects of hatchery facility maintenance include the following:

[13] Available at: https://drive.google.com/file/d/0Bz5kwZ2PeZQrcjdhWUxLTC1RMFU/view.

1. All normal hatchery maintenance performed on watered or in-water facilities will be performed at times and with methods to minimize potential effects to hatchery effluent, i.e., sediment disturbance, water temperature, and chemical composition.
2. All non-routine maintenance with potential effects to listed species or their critical habitat will require a separate, individual section 7 consultation with the Service.
3. Prepare and implement a pollution and erosion control plan to prevent pollution related to Operation & Maintenance activities. The plan will be made available for inspection on request by BPA, NMFS, and the Service. Pollution and erosion control plan will address equipment and materials storage sites, fueling operations, staging areas, cement mortars and bonding agents, hazardous materials, spill containment and notification, and debris management.
4. Complete any in-water work during the allowable freshwater work times established for each location, unless otherwise approved in writing by IDFG, NMFS, and the Service.
5. Cease operations if, at any time, fish are observed in distress as a result of the action activities.
6. Select equipment that will have the least adverse effects on the environment (e.g., minimally-sized rubber tires, etc.) when heavy equipment must be used on the bank.
7. Operate all equipment above the OHWM or in the dry whenever possible to reduce impacts.
8. Make absorbent material available on site to collect any lubricants in case of a pressurized line failure. Dispose of all used materials in the proper manner.
9. Stage and fuel all equipment in appropriate areas above the OHWM.
10. Clean all materials used prior to placement below the OHWM.
11. Have the proper approved oils/lubricants when working below the OHWM.
12. Clean all equipment to ensure that it is free of vegetation, external oil, grease, dirt, and mud before equipment is brought to the site and prior to removal from the project area.
13. Involve local habitat entities with the maintenance actions and notify local habitat entities prior to, and following, the activity's completion.
14. Ensure that all work meets State and Federal fish passage requirements.
15. Minimize impacts to riparian vegetation at the work sites and upon completion of the work. Grade and replant disturbed areas to match the landscape and existing vegetation at the site.
16. Install silt barriers at the site during work to prevent/reduce sediment from entering the river.
17. Dispose of all discharge water created by maintenance tasks (e.g. debris removal operations, vehicle wash water) at an adjacent upland location. No discharge water will be allowed to return to the adjacent water bodies unless specifically approved by NMFS and the Service.

18. Obtain all appropriate State and Federal permits before work is initiated.
19. Catalog and prioritize those structures that do not meet Anadromous Salmonid Passage Facility Design criteria (NMFS 2011, entire) for upgrades as funding becomes available.

2.2 Analytical Framework for the Jeopardy and Adverse Modification Determinations

2.2.1 Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components:

1. The *Status of the Species*, which evaluates the bull trout's rangewide condition, the factors responsible for that condition, and its survival and recovery needs.
2. The *Environmental Baseline*, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the bull trout.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities reasonably certain to occur in the action area on the bull trout.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the bull trout's current status, taken together with cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

Recovery Units (RUs) for the bull trout were defined in the final *Recovery Plan for the Coterminous United States Population of [the] Bull Trout* (USFWS 2015a, entire). Pursuant to Service policy, when a proposed Federal action impairs or precludes the capacity of a RU from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the biological opinion describes how the proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this biological opinion considers the relationship of the action area and affected core areas (discussed below under the *Status of the Species* section) to the RU and the relationship of the RU to both the survival and recovery of the bull trout as a whole as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Within the above context, the Service also considers how the effects of the proposed Federal action and any cumulative effects impact bull trout local and core area populations in determining the aggregate effect to the RU(s). Generally, if the effects of a proposed Federal action, taken together with cumulative effects, are likely to impair the viability of a core area population(s), such an effect is likely to impair the survival and recovery function assigned to a RU(s) and may represent jeopardy to the species (USFWS 2005a, 70 FR 56258).

2.2.2 Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" was published on February 11, 2016 (USFWS and NMFS 2016, 81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The destruction or adverse modification analysis in this biological opinion relies on four components:

1. The *Status of Critical Habitat*, which describes the rangewide condition of designated critical habitat for the bull trout in terms of the key components of the critical habitat that provide for the conservation of the bull trout, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the bull trout.
2. The *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.
4. The *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

For purposes of making the destruction or adverse modification determination, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the value of the critical habitat rangewide for the conservation/recovery of the listed species would remain functional or would retain the current ability for the key components of the critical

habitat that provide for the conservation of the listed species to be functionally re-established in areas of currently unsuitable but capable habitat.

Note: Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), “physical or biological features” (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (USFWS and NMFS 2016, 81 FR 7214) discontinue use of the terms “PCEs” or “essential features” and rely exclusively on use of the term PBFs for that purpose because that term is contained in the statute. To be consistent with that shift in terminology and in recognition that the terms PBFs, PCEs, and essential habit features are synonymous in meaning, we are only referring to PBFs herein. Therefore, if a past critical habitat designation defined essential habitat features or PCEs, they will be referred to as PBFs in this document. This does not change the approach outlined above for conducting the ‘‘destruction or adverse modification’’ analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features.

2.3 Status of the Species and Critical Habitat

This section presents information about the regulatory, biological and ecological status of the bull trout and its critical habitat that provides context for evaluating the significance of probable effects caused by the proposed action.

2.3.1 Bull Trout

2.3.1.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (USFWS 1999, 64 FR 58910-58933). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 2; Brewin and Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Howell and Buchanan 1992, entire; Leary and Allendorf 1997, pp. 716-719; USFWS 1999, 64 FR 58910).

The final listing rule for the United States coterminous population of the bull trout discusses the consolidation of five Distinct Population Segments (DPSs) into one listed taxon and the application of the jeopardy standard under section 7 of the Endangered Species Act (Act) relative to this species, and established five interim recovery units for each of these DPSs for the purposes of Consultation and Recovery (USFWS 1999, 64 FR 58930).

The 2010 final bull trout critical habitat rule (USFWS 2010a, 75 FR 63898-64070) identified six draft recovery units based on new information that confirmed they were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity. The final bull trout recovery plan (RP) (USFWS 2015a, pp. 36-43) formalized these six recovery units: Coastal, Klamath, Mid-Columbia, Columbia Headwaters,

Saint Mary, and Upper Snake. The final recovery units replace the previous five interim recovery units and will be used in the application of the jeopardy standard for Section 7 consultation procedures.

2.3.1.2 Reasons for Listing and Emerging Threats

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (USFWS 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Since the time of coterminous listing the species (64 FR 58910) and designation of its critical habitat (USFWS 2004a, 69 FR 59996; USFWS 2005a, 70 FR 56212; USFWS 2010a, 75 FR 63898) a great deal of new information has been collected on the status of bull trout. The Service's Science Team Report (Whitesel et al. 2004, entire), the bull trout core areas templates (USFWS 2005a, entire; 2009, entire), Conservation Status Assessment (USFWS 2005b, entire), and 5-year Reviews (USFWS 2008, entire; 2015h, entire) have provided additional information about threats and status. The final RP lists many other documents and meetings that compiled information about the status of bull trout (USFWS 2015a, p. 3). As did the prior 5-year review (2008), the 2015 5-year status review maintains the listing status as threatened based on the information compiled in the final bull trout RP (USFWS 2015a, entire) and the Recovery Unit Implementation Plans (RUIPs) (USFWS 2015b-g, entire).

When first listed, the status of bull trout and its threats were reported by the Service at subpopulation scales. In 2002 and 2004, the draft recovery plans (USFWS 2002a, entire; 2004a, entire; 2004b, entire) included detailed information on threats at the recovery unit scale (i.e. similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 5-year Reviews, the Service established threats categories (i.e. dams, forest management, grazing, agricultural practices, transportation networks, mining, development and urbanization, fisheries management, small populations, limited habitat, and wild fire) (USFWS 2008, pp. 39-42; USFWS 2015h, p. 3). In the final RP, threats and recovery actions are described for 109 core areas, forage/migration and overwintering areas, historical core areas, and research needs areas in each of the six recovery units (USFWS 2015a, p 10). Primary threats are described in three broad categories: Habitat, Demographic, and Nonnative Fish for all recovery areas within the coterminously listed range of the species.

The 2015 5-year status review references the final RP and the RUIPs and incorporates by reference the threats described therein (USFWS 2015h, pp. 2-3). Although significant recovery actions have been implemented since the time of listing, the 5-year review concluded that the listing status should remain as "threatened" (USFWS 2015h, p. 3).

New or Emerging Threats

The 2015 RP (USFWS 2015a, entire) describes new or emerging threats such as climate change and other threats. Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout RP and RUIPs summarize the threat of climate change and

acknowledge that some bull trout local populations and core areas may not persist into the future due to anthropogenic effects such as climate change. The RP further states that use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015a, pp. vii, 17-20).

Mote et al. (2014, pp. 487-513) summarized climate change effects in the Pacific Northwest to include rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff et al. 2002, p. 34; Koopman et al. 2009, entire; PRBO Conservation Science 2011, p. 13). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling et al. 2006, p. 940) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout (USFWS 2015c, p. B-10).

Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Rieman et al. 2007, p. 1552). Climate change is expected to reduce the extent of cold water habitat (Isaak et al. 2015, p. 2549, Figure 7), and increase competition with other fish species (lake trout, brown trout, brook trout, and northern pike) for resources in remaining suitable habitat. Several authors project that brook trout, a fish species that competes for resources with and predates on the bull trout, will continue increasing their range in several areas (an upward shift in elevation) due to the effects from climate change (e.g., warmer water temperatures) (Wenger et al. 2011, p. 998, Figure 2a, Isaak et al. 2014, p. 114).

2.3.1.3 Species Description

Bull trout, member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden (*Salvelinus malma*) were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19). Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated (Rode 1990, p. 1)), Klamath River Basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-169; Bond 1992, pp. 2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are wide spread throughout the Columbia River Basin, including its headwaters in Montana and Canada.

2.3.1.4 Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993, p. 4). Watson and Hillman (1997, p. 248) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear. It was also concluded that these characteristics are not necessarily ubiquitous throughout these watersheds, thus resulting in patchy distributions even in pristine habitats.

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz 1989, pp. 22-25; Pratt 1992, p. 6; Thomas 1992, pp. 4-5; Rich 1996, pp. 35-38; Sexauer and James 1997, pp. 367-369; Watson and Hillman 1997, pp. 247-249). Jakober (1995, p. 42) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993, p. 6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 368-369).

The size and age of bull trout at maturity depend upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Goetz 1989, p. 15). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, p. 95; Fraley and Shepard 1989, p. 135; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and

have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p.1) and, after hatching, fry remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning, but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro zooplankton and small fish (Boag 1987, p. 58; Goetz 1989, pp. 33-34; Donald and Alger 1993, pp. 239-243). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989, p. 135; Donald and Alger 1993, p. 242).

2.3.1.5 Population Dynamics

Population Structure

As indicated above, bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al. 2004, p. 105; Starcevich et al. 2012, p. 10; Barrows et al. 2016, p. 98). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106) and Wenatchee River (Ringel et al. 2014, pp. 61-64). Parts of these river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem rivers. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes.

Benefits of connected habitat to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

Whitesel et al. (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003, entire) best summarized genetic information on bull trout population structure. Spruell et al. (2003, entire) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell et al. 2003, p. 17). They were characterized as:

i. "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

ii. "Snake River", which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

iii. "Upper Columbia River" which includes the entire Basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003, p. 17) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999, entire) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003, p. 328) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell et al. (2003, p. 26) and the biogeographic analysis of Haas and McPhail (2001, entire). Both Taylor et al. (1999, p. 1166) and Spruell et al. (2003, p. 21) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, pp. 519-523). Based on a recommendation in the USFWS's 5-year review of the species' status (USFWS 2008, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part,

information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS and NMFS 1996, 61 FR 4722-4725) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010a, 75 FR 63898). These six recovery units, which were identified in the final bull trout recovery plan (USFWS 2015a) and described further in the RUIPs (USFWS 2015b-g) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake.

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, p. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, entire). Burkey (1989, entire) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, entire).

A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000, entire). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999, entire). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999, entire) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000, pp. 56-57). Research does, however, provide

genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho (Whiteley et al. 2003, entire). Whitesel et al. (2004 pp. 14-23) summarizes metapopulation models and their applicability to bull trout).

2.3.1.6 Status and Distribution

The following is a summary of the description and current status of the bull trout within the six recovery units (RUs) (shown in Figure 4, below). A comprehensive discussion is found in the Service's 2015 RP for the bull trout (USFWS 2015a, entire) and the 2015 RUIPs (USFWS 2015b-g, entire). Each of these RUs is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

Coastal Recovery Unit

The Coastal RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015b, entire). The Coastal RU is located within western Oregon and Washington. The RU is divided into three regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River Regions. This RU contains 20 core areas comprising 84 local populations and a single potential local population in the historic Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011, and identified four historically occupied core areas that could be re-established (USFWS 2015a, p. 47; USFWS 2015b, p. A-2). Core areas within Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This RU also contains ten shared foraging, migration, and overwintering (FMO) habitats which are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015b, p. A-5).

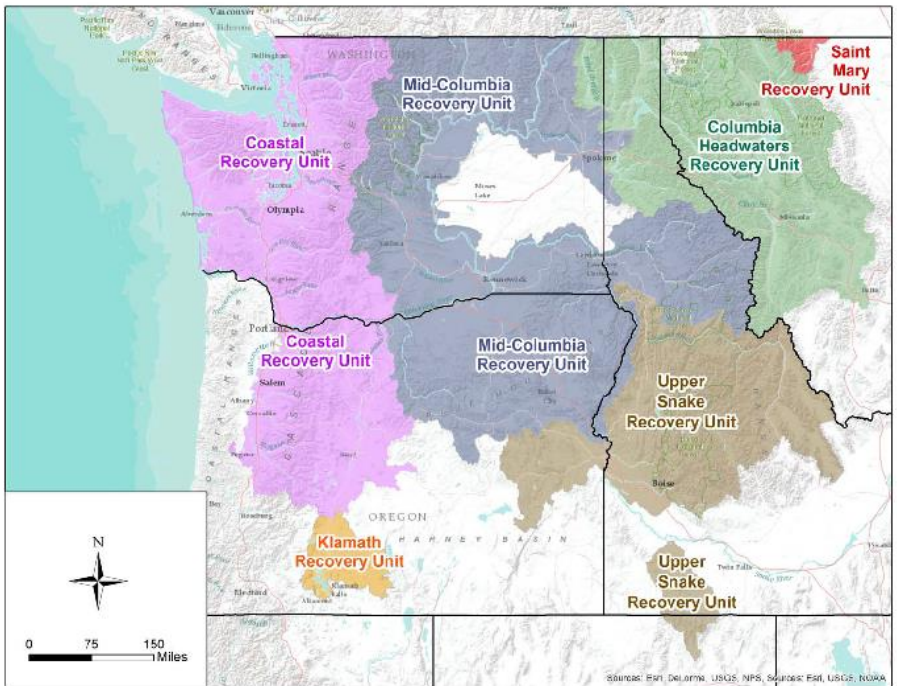

Figure 4. Map showing the location of the six bull trout Recovery Units.

There are four core areas within the Coastal RU that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015a, p.79). These are the most stable and abundant bull trout populations in the RU.

Most core areas in the Puget Sound region support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area [Chilliwack Lake] and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within the Puget Sound region are likely stable overall, although some at depressed abundances. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (e.g., North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas).

Within the Olympic Peninsula region, demographic status of core areas is poorest in Hood Canal and Strait of Juan de Fuca, while core areas along the Pacific Coast of Washington likely have the best demographic status in this region. The connectivity between core areas in these disjunct regions is believed to be naturally low due to the geographic distance between them. Internal connectivity is currently poor within the Skokomish River core area (Hood Canal) and is being restored in the Elwha River core area (Strait of Juan de Fuca). Most core areas in this region still have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas).

Across the Lower Columbia River region, status is highly variable, with one relative stronghold (Lower Deschutes core area) existing on the Oregon side of the Columbia River. The Lower Columbia River region also contains three watersheds (North Santiam River, Upper Deschutes River, and White Salmon River) that could potentially become re-established core areas within the Coastal Recovery Unit. Adult abundances within the majority of core areas in this region are relatively low, generally 300 or fewer individuals.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (e.g., flood control, floodplain disconnection, bank armoring, channel straightening, loss of in-stream habitat complexity), agriculture (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (e.g., dams, culverts, in-stream flows) residential development, urbanization, forest management practices (e.g., timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of non-native species.

The RP identifies three categories of primary threats[14]: Habitat (upland/riparian land management, in-stream impacts, water quality), demographic (connectivity impairment, fisheries

[14] Primary Threats are factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (4 to 10 bull trout generations, approximately 50 years).

management, small population size), and nonnatives (nonnative fishes). Of the 20 core areas in the Coastal RU, only one (5 percent), the Lower Deschutes River, has no primary threats identified (USFWS 2015b, Table A-1).

Conservation measures or recovery actions implemented in this RU include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats. For more information on conservation actions see section 2.3.1.7 below.

Klamath Recovery Unit

The Klamath RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c, entire). This RU is located in southern Oregon and northwestern California. The Klamath RU is the most significantly imperiled RU, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural recolonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015a, p. 39). This RU currently contains three core areas and eight local populations (USFWS 2015a, p. 47; USFWS 2015c, p. B-1). Nine historic local populations of bull trout have become extirpated (USFWS 2015c, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015c, p. B-3).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices. Identified primary threats for all three core areas include upland/ riparian land management, connectivity impairment, small population size, and nonnative fishes (USFWS 2015c, Table B-1).

Conservation measures or recovery actions implemented include removal of nonnative fish (e.g., brook trout, brown trout, and hybrids), acquiring water rights for in-stream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culvert replacement, and habitat restoration. For more information on conservation actions see section 2.3.1.7 below.

Mid-Columbia Recovery Unit

The Mid-Columbia RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d, entire). The Mid-Columbia RU is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia RU is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic Regions. This RU contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015a, p. 47; USFWS 2015d, p. C-1 – C4).

The current demographic status of bull trout in the Mid-Columbia Recovery Unit is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the

deleterious effects of small population size. Conversely, strongholds do exist within the RU, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the recovery unit. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin. More detailed description of bull trout distribution, trends, and survey data within individual core areas is provided in Appendix II of the RUIP (USFWS 2015d).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, agricultural practices (e.g., irrigation, water withdrawals, livestock grazing), fish passage (e.g. dams, culverts), nonnative species, forest management practices, and mining. Of the 24 occupied core areas, six (25 percent) have no identified primary threats (USFWS 2015d, Table C-2).

Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and in-stream flow requirements. For more information on conservation actions see section 2.3.1.7 below.

Columbia Headwaters Recovery Unit

The Columbia Headwaters RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e, entire). The Columbia Headwaters RU is located in western Montana, northern Idaho, and the northeastern corner of Washington. The RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene Geographic Regions (USFWS 2015e, pp. D-2 – D-4). This RU contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015e, p. D-1). Fish passage improvements within the RU have reconnected some previously fragmented habitats (USFWS 2015e, p. D-1), while others remain fragmented. Unlike the other RUs in Washington, Idaho and Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015e, p. D-41).

Conclusions from the 2008 5-year review (USFWS 2008, Table 1) were that 13 of the Columbia Headwaters RU core areas were at High Risk (37.1 percent), 12 were considered At Risk (34.3 percent), 9 were considered at Potential Risk (25.7 percent), and only 1 core area (Lake Koocanusa; 2.9 percent) was considered at Low Risk. Simple core areas, due to limited demographic capacity and single local populations were generally more inherently at risk than complex core areas under the model. While this assessment was conducted nearly a decade ago, little has changed in regard to individual core area status in the interim (USFWS 2015e, p. D-7).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, mostly historical mining and contamination by heavy metals, expanding populations of

nonnative fish predators and competitors, modified in-stream flows, migratory barriers (e.g., dams), habitat fragmentation, forest practices (e.g., logging, roads), agriculture practices (e.g. irrigation, livestock grazing), and residential development. Of the 34 occupied core areas, nine (26 percent) have no identified primary threats (USFWS 2015e, Table D-2).

Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species. For more information on conservation actions see section 2.3.1.7 below.

Upper Snake Recovery Unit

The Upper Snake RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f, entire). The Upper Snake RU is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 207 local populations (USFWS 2015a, p. 47), with almost 60 percent being present in the Salmon River Region.

The population trends for the 22 core areas in the Upper Snake RU are summarized in Table E-2 of the Upper Snake RUIP (USFWS 2015f, pp. E-5 – E-7): six are classified as increasing, two are stable; two are likely stable; three are unknown, but likely stable; two are unknown, but likely decreasing; and, seven are unknown.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing). Of the 22 occupied core areas, 13 (59 percent) have no identified primary threats (USFWS 2015f, Table E-3).

Conservation measures or recovery actions implemented include in-stream habitat restoration, in-stream flow requirements, screening of irrigation diversions, and riparian restoration. For more details on conservation actions in this unit see section 2.3.1.7 below.

St. Mary Recovery Unit

The St. Mary RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015g). The Saint Mary RU is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed which the St. Mary flows into is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This RU contains four core areas (St. Mary River, Slide Lake, Cracker Lake, and Red Eagle Lake), and seven local populations (USFWS 2015g, p. F-1) in the U.S. headwaters.

Current status of bull trout in the Saint Mary River complex core area (U.S.) is considered strong. The three simple core areas (Slide Lake, Cracker Lake, and Red Eagle Lake) appear to be self-sustaining and fluctuating within known historical population demographic bounds. Note: the NatureServe status assessment tool ranks this RU as imperiled (Figure 5).

The current condition of the bull trout in this RU is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (e.g.,

entrainment, fish passage, in-stream flows), and, to a lesser extent habitat impacts from development and nonnative species. Of the four core areas, the three simple core areas (all lakes) have no identified primary threats (USFWS 2015g, Table F-1).

For more information on conservation actions see section 2.3.1.7 below.

Status Summary

The Service applied the NatureServe status assessment tool[15] to evaluate the tentative status of the six RUs. The tool rated the Klamath RU as the least robust, most vulnerable RU and the Upper Snake RU the most robust and least vulnerable recovery unit, with others at intermediate values (Figure 5).

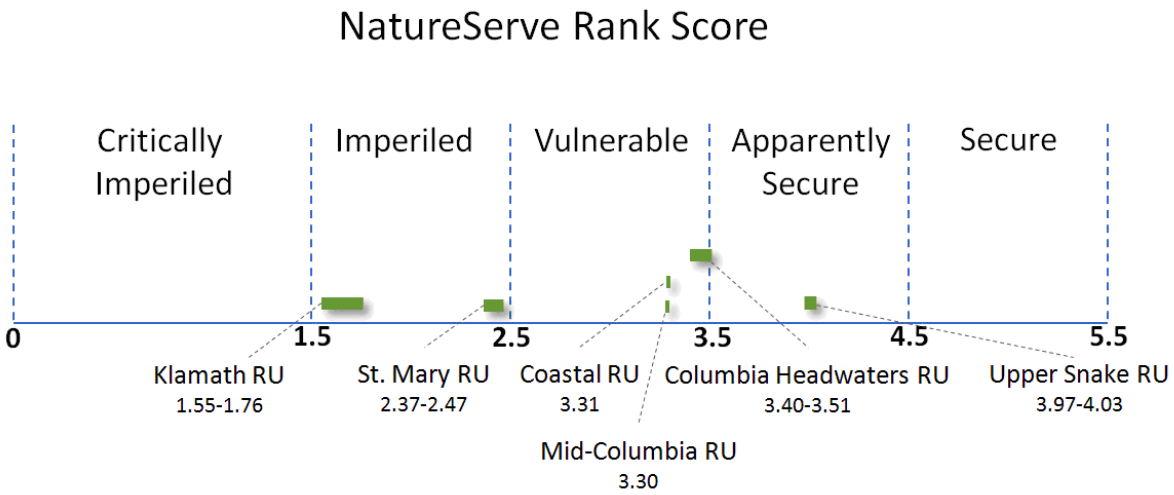

Figure 5. NatureServe status assessment tool scores for each of the six bull trout recovery units. The Klamath RU is considered the least robust and most vulnerable, and the Upper Snake RU the most robust and least vulnerable (from USFWS 2015a, Figure 2).

2.3.1.7 Conservation Needs

The 2015 RP for bull trout established the primary strategy for recovery of bull trout in the coterminous United States: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable in six RUs; (2) effectively manage and ameliorate the primary threats in each of six RUs at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management

[15] This tool consists of a spreadsheet that generates conservation status rank scores for species or other biodiversity elements (e.g. bull trout Recovery Units) based on various user inputs of status and threats (see USFWS 2015a, p. 8 and Faber-Langendoen et al. 2012, entire, for more details on this status assessment tool).

principles to implementing the bull trout recovery program to account for new information (USFWS 2015a, p. 24.).

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002a, entire; 2004b, entire; 2004c, entire) provided information that identified recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation. Many recovery actions were completed prior to finalizing the RP in 2015.

The 2015 RP (USFWS 2015a, entire) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the coterminous range of the bull trout.

The Service has developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the Act are no longer necessary (USFWS 2015a, p. 45-46).

To implement the recovery strategy, the 2015 RP establishes three categories of recovery actions for each of the six RUs (USFWS 2015a, pp. 50-51):

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.
3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
4. Work with partners to conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change.

Bull trout recovery is based on a geographical hierarchical approach. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. The single DPS is subdivided into six biological-based recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Columbia Headwaters Recovery Unit (5) Upper Snake Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015a, p. 23). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met: representation (conserving the genetic makeup of the species); resiliency (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to withstand catastrophic events) (USFWS 2015a, p. 33).

Each of the six recovery units contain multiple bull trout core areas, 109 total, which are non-overlapping watershed-based polygons, and each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015a, pp. 3, 47, Appendix F). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015a, p. 3). Core areas can be further described as complex or simple (USFWS 2015a, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and FMO. Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A core area is a combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) and constitutes the basic unit on which to gauge recovery within a recovery unit. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. A core area represents the closest approximation of a biologically functioning unit for bull trout. Core areas are presumed to reflect the metapopulation structure of bull trout.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015a, p. 73). A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (e.g., those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

2.3.1.8 Federal, State, and Tribal Conservation Actions Since Listing

Since our listing of bull trout in 1999, numerous conservation measures that contribute to the conservation and recovery of bull trout have been and continue to be implemented across its range in the coterminous United States. These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners.

In many cases, these bull trout conservation measures incorporate or are closely interrelated with work being done for recovery of salmon and steelhead, which are limited by many of the same threats. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature;

in-stream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures.

At sites that are vulnerable to development, protection of land through fee title acquisition or conservation easements is important to prevent adverse impacts or allow conservation actions to be implemented. In several bull trout core areas, fisheries management to manage or suppress non-native species (particularly brown trout, brook trout, lake trout, and northern pike) is ongoing and has been identified as important in addressing effects of non-native fish competition, predation, or hybridization.

A more comprehensive overview of conservation successes since 1999, described for each recovery unit, is found in the Summary of Bull Trout Conservation Successes and Actions since 1999 (Available at: (http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/USFWS_2013_summary_of_conservation_successes.pdf).

2.3.1.9 Consulted on Effects

Consulted-on effects are those effects that have been analyzed through Section 7 consultation as reported in a biological opinion. These effects are an important component of objectively characterizing the current condition status of the species.

Projects subject to section 7 consultation under the Act have occurred throughout the range of bull trout. Singly or in aggregate, these projects could affect the species' status. The Service reviewed 137 opinions produced by the Service from the time of listing in June 1998 until August 2003 (Nuss 2003, entire). The Service analyzed 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc.). Twenty opinions involved multiple projects, including restorative actions for bull trout.

The geographic scale of projects analyzed in these opinions varied from individual actions (e.g., construction of a bridge or pipeline) within one basin, to multiple-project actions, occurring across several basins. Some large-scale projects affected more than one recovery unit.

The Service's assessment of opinions from the time of listing until August 2003 (137 opinions), confirmed that no actions that had undergone Section 7 consultation during this period, considered either singly or cumulatively, would appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any (sub) populations (USFWS 2006, pp. B-36 – B-37).

Between August 2003 and July 2006, the Service issued 198 additional opinions that included analyses of effects on bull trout (USFWS 2006). These opinions also reached "no-jeopardy" determinations, and the Service concluded that the continued long-term survival and existence of the species had not been appreciably reduced range-wide due to these actions (USFWS 2006).

Since July 2006, a review of the data in our national Tracking and Integrated Logging System (TAILS) reveal this trend has changed. One biological opinion, the Idaho Water Quality Standards for Numeric Water Quality Criteria for Toxic Pollutants completed in 2015 (USFWS 2015i) resulted in a "Jeopardy" determination and issued Reasonable and Prudent Alternatives.

2.3.2 Bull Trout Critical Habitat

2.3.2.1 Legal Status

Ongoing litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (USFWS 2010b, 75 FR 2260) and a final rule on October 18, 2010 (USFWS 2010a, 75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range within the Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Upper Snake, and St. Mary recovery units[16].

Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles in 32 critical habitat units (CHU) as bull trout critical habitat (see Table 5). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) FMO

Table 5. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

State	Stream/Shoreline Miles	Stream/Shoreline Kilometers	Reservoir/ Lake Acres	Reservoir/ Lake Hectares
Idaho	8,771.6	14,116.5	170,217.5	68,884.9
Montana	3,056.5	4,918.9	221,470.7	89,626.4
Nevada	71.8	115.6	-	-
Oregon	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho	107.7	173.3	-	-
Washington	3,793.3	6,104.8	66,308.1	26,834.0
Washington (marine)	753.8	1,213.2	-	-
Washington/Idaho	37.2	59.9	-	-
Washington/Oregon	301.3	484.8	-	-
Total	**19,729.0**	**31,750.8**	**488,251.7**	**197,589.2**

[16] Note: the adverse modification analysis does not rely on recovery units.

Compared to the 2005 designation, the final rule increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs.

This rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (USFWS 2010a, 75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of water bodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

2.3.2.2 Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (USFWS 2010a, 75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

As previously noted, 32 CHUs within the geographical area occupied by the species at the time of listing are designated under the final rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical and biological features associated with Physical and Biological Features (PBFs) 5 and 6, which relate to breeding habitat (see list below).

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of anadromous bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PBFs that are critical to adult and subadult foraging, migrating, and overwintering.

In determining which areas to propose as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PBFs laid out in the appropriate quantity and spatial arrangement for conservation of the species. The PBFs of designated critical habitat are:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

2.3.2.3 Current Rangewide Condition of Bull Trout Critical Habitat

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (USFWS 2002b, 67 FR 71240). This condition reflects the condition of bull trout habitat.

The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and nonnative species presence or introduction (USFWS 2010b, 75 FR 2282).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PBFs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows:

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).
2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).
3. The introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).
4. In the Coastal-Puget Sound region where anadromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development.
5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

The bull trout critical habitat final rule also aimed to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PBFs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with nonnative fishes).

2.4 Environmental Baseline of the Action Area

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of State and private actions which are contemporaneous with this consultation.

2.4.1 Bull Trout

2.4.1.1 Status of the Bull Trout in the Action Area

Program facilities and operations are located in three bull trout RUs: the Upper Snake (Eagle Fish Hatchery, Sawtooth Fish Hatchery weir, Redfish Lake Creek weir, and Springfield Fish Hatchery), the Mid-Columbia (Lower Granite Dam trap on the lower mainstem Snake River), and the Coastal (Manchester Research Station and Burley Creek Fish Hatchery). Each of these RUs is discussed below.

Upper Snake RU

Within the Upper Snake RU, the following subbasins contain Snake River sockeye program facilities: the Upper Salmon River subbasin (which is the Upper Salmon River core area), the Upper Mainstem Snake River subbasin (not a core area), and the Lower Boise River subbasin (not a core area).

Upper Salmon Core Area

<u>Geographic Description</u>

This core area is located in Custer County and extends from the mouth of the Pahsimeroi River to the headwaters in the Sawtooth Mountains, including the mainstem Salmon River and tributaries. The area covers 6,242 square kilometers (2,410 square miles) and contains 5,230 kilometers (3,251 miles) of streams. Eighty-nine percent of this core area is in public ownership, and most of this public land is managed by the Federal government. The U.S. Forest Service manages 99 percent of the land in this core area (USFWS 2015f, p. E-95).

Bull Trout Distribution and Abundance

Bull trout are currently known to use spawning and rearing habitat in at least 18 streams or stream complexes (i.e., local populations). These local populations include Valley Creek; Basin Creek; Yankee Fork Creek; Thompson Creek; Squaw Creek; Challis Creek; Garden Creek, Morgan Creek; East Fork Salmon River; Slate Creek; Warms Springs Creek; Fourth of July Creek; Germania Creek; Upper Salmon River; Yellowbelly Creek; and, within the action area, Alturas Lake Creek, Pettit Lake, and Redfish Lake Creek (USFWS 2015f, p. E-95).

Both resident and migratory (fluvial and adfluvial) bull trout are present in the Sawtooth Valley. The inlet of Alturas Lake has adfluvial bull trout and is one of the largest local populations in the Sawtooth Valley. Adfluvial bull trout are present in Redfish Lake (USFWS 2002c, p. 24). Bull trout are present in the mainstem Salmon River at the Sawtooth Fish Hatchery weir as migrating and overwintering adults, in Redfish Lake as year-round residents (migrating and overwintering adults; rearing juveniles), at the Redfish Lake Creek weir as migrating adults, and in Pettit and Alturas lakes as year-round residents (adults and rearing juveniles).

Bull trout in the Upper Salmon River may spawn and overwinter in different tributary systems. Schoby and Curet (2007, pp. 22-23), for example, found that bull trout spawn in the Yankee Fork subbasin and overwinter in Redfish Lake, or spawn in the East Fork Salmon River subbasin and overwinter in middle reaches of the mainstem Salmon River (e.g., near Challis, Idaho). The same study found that the average distance between spawning and wintering locations of bull trout in the Upper Salmon River Basin varied by tributary use. Generally, bull trout spawning in the upper reaches of the Basin (e.g., Yankee Fork), migrated into the Redfish Lake system to overwinter. Migration distances between spawning and overwintering areas averaged 66.1 km.

Redfish Lake provides key overwintering habitat not only for fluvial bull trout from throughout the Basin, but also for adfluvial bull trout that spawn and rear in Fishhook Creek (a tributary to Redfish Lake). Since 1998, bull trout spawning in Fishhook Creek has been stable at 11 to 33 redds (ICF International 2012, p. 26).

The mainstem Salmon River in the vicinity of the Sawtooth Fish Hatchery weir serves as FMO habitat for adult bull trout. Overwintering habitat may be suboptimal in the upper reaches of the Salmon River (particularly above the mouth of the East Fork Salmon River) for large migratory bull trout. These reaches are dominated by relatively shallow, turbulent water that is susceptible to ice accumulations that may limit the amount of suitable habitat available to bull trout during winter (Schoby 2006, pp. 25-26).

Timing

Fluvial bull trout in the mainstem Salmon River migrate upstream toward spawning and overwintering habitat from mid-summer to fall (early July to late October). Movement into spawning tributaries generally begins in August and spawning occurs in mid- to late-September and October (USFWS 2002c, p. 25). Bull trout may remain in tributaries for 2-3 months prior to spawning (Schoby 2006, p. 24). In Fishhook Creek (a tributary to Redfish Lake), bull trout spawn in early fall and return to Redfish Lake to overwinter. In other tributaries, bull trout spawn, make rapid migrations downstream to the Salmon River, and move to wintering locations between September and November. In the spring, movement of adult bull trout from overwintering habitat occurs between April and June.

Upper Mainstem Snake River (Not a Core Area)

The Springfield Fish Hatchery is located in the American Falls subbasin of the Snake River system. Bull trout are not present in this subbasin.

Lower Boise River (Not a Core Area)

Eagle Fish Hatchery is located in the Lower Boise River subbasin. Bull trout are not present in this subbasin.

Mid-Columbia RU – Lower Snake River Mainstem

The Mid-Columbia RU contains 24 designated bull trout core areas. The only portion of the action area that occurs in this RU is the Lower Granite Dam trap, which is located on the mainstem Snake River. It is not within a core area (USFWS 2015a, pp. C-1, C-2), but is FMO habitat.

Lower Granite Dam is part of the Federal Columbia River Power System (FCRPS) in the lower Snake River. The reservoir impounded by Lower Granite Dam is known as Lower Granite Lake and extends upstream approximately 51 rkm to the town of Lewiston, Idaho. Lower Granite Dam is fitted with a single fish ladder on the south shore of the dam for upstream passage with south and north shore entrances, a powerhouse collection system, and a transportation channel under the spillway. For downstream fish passage, Lower Granite Dam has a juvenile bypass system and a removable spillway weir (RSW) (Barrows et al., 2016, pp. 160-161).

The Tucannon River core area is the core area nearest to Lower Granite Dam. Lower Granite Dam fish passage is required for bull trout from the Tucannon River subbasin to interact with bull trout from upstream subbasins (e.g., Clearwater, Asotin, Imnaha). Both adult and subadult bull trout use the Snake River in areas near Lower Granite Dam. Bull trout that enter the mainstem Snake River typically do so during the fall and winter (e.g., October – February) and return to tributary subbasins in spring and early summer (e.g., March – July). This timing indicates bull trout are likely present somewhere in the mainstem Snake River near Lower Granite Dam in all but the warmest summer months (August – September) (Barrows 2016, p. 161).

Coastal RU

The Coastal RU contains 21 designated bull trout core areas. Snake River sockeye program facilities are located in Puget Sound (Manchester Research Station and Burley Creek Fish Hatchery). Neither of these facilities is located within a core area.

The Puget Sound is one of only two regions currently supporting anadromous populations of bull trout (the other region being the Olympic Peninsula). Although bull trout in the Lower Columbia River region share a genetic past with the Puget Sound and Olympic Peninsula regions, it is unclear whether Lower Columbia River core areas supported the anadromous life history to any significant degree in the past, or could in the future. Historically, the Lower Columbia River region is believed to have largely supported the fluvial life history form; however, hydroelectric facilities built within a number of the core areas have isolated or fragmented watersheds and largely replaced the fluvial life history with the adfluvial form (USFWS 2015b, p. A-7).

Puget Sound

In the Puget Sound region, bull trout populations are concentrated along the eastern side of Puget Sound with most core areas concentrated in central and northern Puget Sound. Although the Chilliwack River core area is considered part of this region, it is technically connected to the Fraser River system and is transboundary with British Columbia, making its distribution unique within the region. Most core areas support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area [Chilliwack Lake] and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within this region are likely stable overall, although some at depressed abundances. Two core areas (Puyallup River and Stillaguamish River) contain local populations at either very low abundances (Upper Puyallup and Mowich Rivers) or that have likely become locally extirpated (Upper Deer Creek, South Fork Canyon Creek, and Greenwater River). Connectivity among and within core areas of this region is generally intact. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (e.g., North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas) (USFWS 2015b, p. A-4).

Unique to the Puget Sound (and Olympic Peninsula) region of this RU is the use of nearshore marine and estuarine habitats, and the frequent use of a number of independent (i.e., separated by marine waters not directly connected to a core area), non-natal river or creek basins for foraging and overwintering by anadromous bull trout (USFWS 2015b, p. A-4).

Bull trout in this population use Puget Sound marine waters for foraging and migration. Habitat use is primarily nearshore areas, with few long distance trips across open water (Goetz et al. 2004). Data from various studies suggest a general pattern that larger bull trout are found at greater depths and further offshore (Goetz et al. 2004, p. 74), and that the greatest density of bull trout is found at depths greater than 2.5 m (Beamer and Henderson 2004, p. 14).

No historic or current data are available to describe the presence, timing, or distribution of bull trout on the west side of Puget Sound, the main Puget Sound Basin, or Kitsap Peninsula (i.e., in the vicinity of the Burley Creek Fish Hatchery or the Manchester Research Station) (Goetz et al. 2004, p. 25). However, based on known habitat use and timing of bull trout in other portions of Puget Sound (Goetz et al. 2004, entire), it is reasonable to assume that bull trout from the Puget Sound population may utilize nearshore habitat in the vicinity of the Burley Creek Fish Hatchery and the Manchester Research Station. If present, they would be expected to occur in the vicinity of these facilities as juveniles from March to June and as adults from July to October. Data are not currently available to determine the tributary from which any bull trout in this portion of Puget Sound may originate.

Bull trout are not present in Burley Creek, a tributary to Puget Sound.

Lower Columbia River

Oxbow Fish Hatchery is located on the Lower Columbia River and lies within the Coastal Recovery Unit. It is not within a core area.

The Oxbow Fish Hatchery is located on Herman Creek, a small tributary to the Columbia River. Bull trout use the Columbia River and are potentially able to enter and use the mouth of Herman Creek, but there is no use upstream because of an impassable waterfall on Little Herman Creek between Oxbow Fish Hatchery and the point where Little Herman Creek flows into Herman Creek. Therefore, any bull trout present in the mainstem Columbia River would not be able to access any waterways in the vicinity of the hatchery.

Although bull trout in the Lower Columbia River region share a genetic past with the Puget Sound and Olympic Peninsula regions, it is unclear whether Lower Columbia River core areas supported the anadromous life history to any significant degree in the past, or could in the future. Historically, the Lower Columbia River region is believed to have largely supported the fluvial life history form; however, hydroelectric facilities built within a number of the core areas have isolated or fragmented watersheds and largely replaced the fluvial life history with the adfluvial form (USFWS 2015a).

Bull trout in the lower Columbia River primarily inhabit tributary systems, including the Lewis, Klickitat, and Hood Rivers. Bull trout in these tributaries may use the main tributary for migration to and from the mainstem Columbia River (USFWS 2002). No populations are currently known to occur in the White Salmon, Cowlitz, or Kalama Rivers, although bull trout may have historically occupied these rivers and suitable habitat may be present.

Current bull trout abundance, spatial distribution, and temporal use of the mainstem Columbia River have not been thoroughly documented. Bull trout exhibit both anadromous and resident (or fluvial) life histories; bull trout in the lower Columbia River basin are thought to be of the resident life history form, remaining in creeks and tributaries throughout their life cycle. Current knowledge does not support anadromous populations occurring in the mainstem Columbia River; however, the Lower Columbia Recovery Team considers the mainstem Columbia River to contain core habitat for foraging, migrating, and overwintering, which may be important for full species recovery to occur (USFWS 2002a).

Bull trout populations in tributaries were historically linked by the Columbia River, and in higher reaches of the Columbia River watershed (e.g., Wenatchee and Walla Walla rivers) bull trout are known to migrate seasonally to some extent from tributaries downstream into the Columbia River to overwinter and feed (USFWS 2002a). The extent to which this occurs in the lower Columbia River (below Bonneville Dam) is not well documented, although populations in some tributaries (bull trout from Hood River, in particular) are known to migrate to the mainstem Columbia River as part of their normal life history strategy.

The Oxbow Fish Hatchery is not located within a bull trout core area and neither bull trout or bull trout critical habitat are present in Herman Creek, which serves as the hatchery water source and effluent discharge location. The only Program activities that would occur at the hatchery are incubation and rearing and associated water withdrawal, effluent discharge, disease management, and maintenance.

2.4.1.2 Factors Affecting the Bull Trout in the Action Area

Upper Snake RU - Upper Salmon River Core Area

Baseline conditions for the upper Salmon River watershed are summarized in Table 6 (Assessment, Table 11), and discussed in following sections. Alturas Lake Creek and Pettit Lake Creek are included here for general information because sockeye smolts could be released at these locations. However, smolts raised at the Springfield Hatchery can be released at Redfish Lake Creek or the main Salmon River. All broodstock collection would continue to take place at the Redfish Lake Creek trap and at the Sawtooth Fish Hatchery trap on the upper Salmon River. Therefore, this baseline conditions description is focused on the conditions in Redfish Lake Creek and the Upper Salmon River in the vicinity of the adult traps and smolt release sites.

Table 6. Summary of Bull Trout Habitat Baseline Conditions in the Upper Salmon River Basin (from Assessment Table 11).

Watershed Condition/Indicator [a]	Alturas Lake and Creek [b]	Pettit Lake and Creek [b]	Redfish Lake and Creek [b]
Subpopulation Character			
Subpopulation Size	FR	FUR	FA
Growth and Survival	FR	FUR	FR
Life History Diversity and Isolation	FUR	FUR	FUR
Persistence and Genetic Integrity	FUR	FUR	FR
Water Quality			
Temperature	FA	FA	FA
Sediment/Turbidity	FUR	FR	FR
Chemical Contaminants/Nutrients	FA	FA	FR
Habitat Access			
Physical Barriers	FA	FA	FA
Habitat Elements			
Substrate Embeddedness	FUR	FR	FA
Large Wood	FA	FA	FA
Pool Frequency and Quality	FA	FR	FA
Large Pools/Pool Quality	FR	FR	FA
Off-Channel Habitat	FA	FA	FA
Refugia	FR	FR	FR
Channel Condition and Dynamics			
Wetted Width/Maximum Depth Ratio	FA	FA	FA
Streambank Condition	FR	FA	FA
Floodplain Connectivity	FA	FA	FA

Watershed Condition/Indicator [a]	Alturas Lake and Creek [b]	Pettit Lake and Creek [b]	Redfish Lake and Creek [b]
Flow/Hydrology			
Change in Peak/Base Flows	FA	FR	FA
Change in Drainage Network	FA	FA	FA
Watershed Conditions			
Road Density and Location	FR	FR	FA
Disturbance History	FR	FA	FR
Riparian Conservation Areas	FR	FA	FA
Disturbance Regime	FA	FA	FA
Integration of Species and Habitat Conditions	FR	FR	FR

[a] Watershed condition indicators as described in USFWS 1998, entire.

[b] FA=Functioning Appropriately, FR=Functioning at Risk, FUR=Functioning at Unacceptable Risk

Subpopulation Characteristics

The Redfish Lake local population of bull trout is considered a strong population. Redfish Lake provides key overwintering habitat for fluvial bull trout from throughout the Upper Salmon core area and adfluvial bull trout that spawn and rear in Fishhook Creek. Sockeye salmon broodstock collection at the Redfish Lake occurs at the time that fluvial bull trout migrate upstream to spawn and overwinter at Redfish Lake. Since 1998, bull trout spawning in Fishhook Creek (a tributary to Redfish Lake) has been stable at 11 to 33 redds. There are no physical barriers to isolate Redfish Lake subpopulations, although natural solar heating in Redfish Lake may present a thermal barrier at times. Bull trout persist in Fishhook Creek and are bolstered by a strong fluvial run from the upper Salmon River. However, brook trout are also present, and bull trout-brook trout hybrids have been observed.

Water Quality

In the Upper Salmon River Basin in general, higher elevation streams are not water-quality limited and all beneficial uses are fully supported (IDEQ 2003, p. 62). Lower-elevation streams of the Basin typically have lower water clarity, more fine-grained sediments, lower stream gradients, and generally denser macrophyte growth. These streams frequently are subjected to channelization, loss of riparian habitat by cattle grazing, and diversions for irrigation (Maret et al. 2006, p. 5).

Mining runoff from roads, dumps, processing facilities, and ponds is a problem in several of the watersheds in the Upper Salmon River Basin. Mining operations can contribute contaminants and sediment to streams and have sub-lethal and lethal toxicity effects on all life stages of bull trout (USFWS 2002c, p. 44).

Redfish Lake detains sediment and regulates fluctuations in flow so that sediment is relatively stable in Redfish Lake Creek. Nutrient levels are quite low. Recreational and residential development associated with Redfish Lake has released chemical and nutrient pollutants and has degraded bull trout habitat in the lake (USFWS 2002c, p 48). Historically, sockeye salmon runs most likely contributed to a more productive trophic condition in Redfish Lake. Solar heating causes naturally high water temperatures in lake surface waters and in the upstream portion of Redfish Lake Creek during summer months (ICF International 2012, p. 26).

Habitat Access

Migration is unimpeded by physical, biological, or water quality barriers for the majority of the Upper Salmon River Basin. However, migration could be temporarily delayed in some portions of the action area. In some portions of the Upper Salmon River Basin, fish passage is directly or indirectly inhibited between the mainstem river and tributary streams by land use that degrades hydrologic function and flow (e.g., irrigation diversions, culverts, road placement in the river channel, mining alterations of stream channels). Consequent isolation of bull trout populations in portions of the Basin has occurred, and is a significant threat to the species in the Basin (USFWS 2002c, p. v).

Weirs are used in two locations to collect Snake River sockeye broodstock: a permanent weir at the Sawtooth Fish Hatchery, and temporary weirs on Redfish Lake Creek and at the outlet of Pettit Lake. These adult fish weirs trap migrating bull trout and adult sockeye salmon from July 10 to October 20. However, all bull trout that are detained are released upstream of the weir so that the weir does not present a substantive obstacle to passage. During the time that the weir is operating, the movement of bull trout is upstream during summer prior to spawning, which takes place primarily in Fishhook Creek, and during fall as bull trout move to Redfish Lake to overwinter. From July to October, there is no directed migration downstream at the weir location within Redfish Creek (ICF International 2012, p. 26).

As mentioned previously, during the spring of most years (April through June), IDFG also operates the Redfish Lake weir as a smolt trap, with five to nine panel bays capable of collecting smolts. In this configuration, the weir is not a barrier to adult bull trout (ICF International 2012, p. 27). During this period, some bull trout may be moving downstream from overwintering habitat along with outmigrating salmonids.

Habitat Elements

Because of the presence of Redfish Lake upstream and limited gradient and sediment sources along Redfish Lake Creek, substrate quality is expected to be excellent, with little embeddedness. Large woody debris (LWD) may increase in Redfish Lake Creek because of a recent infestation of mountain pine beetle, which is affecting a large number of lodgepole pines in the vicinity. Over the long term, roads and developments along the lake and stream shorelines may have reduced large wood recruitment. Pool frequency was found to have been functioning appropriately in Redfish Lake Creek in 1991, which is not expected to have changed since that time because of the stability of this stream. Pool quality is also thought to be functioning appropriately, although it could be affected by naturally occurring sediment in Fishhook Creek. Redfish Lake provides key overwintering refuge habitat, although brook trout are present and most likely interbreed and compete with bull trout in this system.

Channel Condition and Dynamics

Some lakeshores have been modified, but stream banks are stable and mostly in a natural condition.

Flow/Hydrology

Much of the streamflow in the Upper Salmon River Basin comes from snowmelt; however, groundwater levels in the upper Basin are high and are important contributors to streamflow (USFWS 2002c, pp. 7). Streamflow between precipitation and snowmelt periods generally is sustained by discharge from the local groundwater system. The Basin typically receives little precipitation during late summer and early fall, resulting in base flows reliant on local groundwater conditions. Discharge of relatively cold groundwater into streams during base flow conditions can have a significant effect on the overall water temperature of the stream (Maret et al. 2006, p. 5).

There are no dams or other man-made flow controls to alter channel dynamics upstream of the broodstock collection and smolt release sites, and little or no functional increase in drainage networks.

Watershed Conditions

Road density is low, although there are a few locations where roads are in proximity to the Upper Salmon River upstream of the Sawtooth Fish Hatchery: Road density is 0.2 mile per square mile in the Redfish Lake Creek watershed, with roads occurring along 3 percent of the stream network. Disturbance in the watershed includes lakeshore development at the north end of Redfish Lake and the loss of a large number of lodgepole pines from an infestation of mountain pine beetles.

Mid-Columbia RU – Lower Snake River Mainstem

Migration Delays

Bull trout attempting to migrate upstream in the Snake River over Lower Granite Dam must do so through the single, south shore fish ladder via entrances on both the north and south shores, or through the powerhouse collection system (Barrows et al. 2016, pp. 161-162). Upstream passage through the fish ladder is not possible for most of January and February when bull trout are

present and potentially migrating in the lower Snake River. Any bull trout intending to migrate upstream of Lower Granite Dam during this time period will be delayed (Barrows et al. 2016, p. 164).

Bull trout attempting to migrate downstream in the Snake River over Lower Granite Dam can do so via the juvenile fish bypass system, the turbines, removable spillway weir (RSW), or spillway depending on the time of year. The juvenile fish bypass is operational from March 25 through December 15. Downstream passage through the turbines can occur at any time throughout the year, and downstream passage via the spillway or RSW could occur from about April 3 through August 31. During the winter time period from December 16 through March 24 with no juvenile bypass or spill operations, downstream passage is only possible through the turbines (Barrows et al. 2016, pp. 163-164).

The Juvenile Fish Transportation Program is typically implemented from April through October at Lower Granite Dam. All juvenile fish are transported with the exception of those marked for in-river studies. Any bull trout that are entrained into the bypass system and not removed on the separator would likely be transported along with the anadromous fish to a release site below Bonneville Dam. The disposition of any bull trout captured, transported, and released below Bonneville Dam is unknown, but they may be lost to the population of origin (Barrows et al. 2016, p. 164).

Low water velocities and seasonally warm water temperatures in Lower Granite Lake has the potential to affect bull trout migration, but no studies have been conducted to evaluate this (Barrows et al. 2016, p. 164).

Survival

Lower Granite Dam has the potential to affect bull trout survival during upstream and downstream passage, but this has not been specifically investigated. Similarly, the effect of mainstem habitat conditions on bull trout survival has not been assessed, but reservoir temperatures during the summer months may be high enough to influence bull trout survival. Reservoir conditions have also created suitable habitat for both native (e.g., pikeminnow) and non-native (e.g., smallmouth bass) predator species (Barrows et al. 2016, p. 165).

Coastal RU

Puget Sound

All core areas containing the anadromous bull trout life history form are reliant on access to marine and estuarine FMO habitats (Goetz et al. 2004; Hayes et al. 2011, entire), so restoration of impaired and protection of functioning estuarine and nearshore marine habitats is considered a critical component of bull trout recovery in this region. Although specific studies examining the impacts of shoreline development to bull trout are lacking, nearshore ecosystem impacts, impacts to salmonids in general, and impacts to bull trout prey species are clear. This degradation significantly impacts habitats not only required by anadromous bull trout, but also their key prey species (e.g., juvenile salmon, surf smelt, sandlance, herring) (Shipman et al. 2010, entire; Fresh et al. 2011, pp. 14-15). In 2000, it was estimated that one third of Puget Sound's shoreline had been modified, with over half of the main Basin of Puget Sound having been altered (PSWQAT 2000, pp. 22-23). Although efforts to remove armoring have since been implemented, overall shoreline armoring continues to increase in Puget Sound (PSP 2013, pp. 64, 94-95). Nearly 100 percent of the

Duwamish estuary and Elliott Bay shoreline has been modified by some type of armoring (BMSL et al. 2001). Over 98 percent of the historic intertidal and subtidal habitat in Commencement Bay is reported to have been lost (WSCC 1999, p. 3). In areas where nearshore habitats currently remain intact or only partially modified, development continues to threaten these habitats (PSP 2013). Specific recovery actions in the Puget Sound region may include removing or modifying artificial structures such as bulkheads, riprap, dikes, and tide gates; restoring tidal flow to coastal wetlands; contaminant remediation; or restoring eelgrass beds, kelp beds, and other nearshore habitats or processes.

Throughout Puget Sound, development and related impacts (e.g., flood control, flood plain disconnection, bank armoring, channel straightening, loss of in-stream habitat complexity) along mainstem river corridors are common. Some of the most complex and costly restoration actions will be required to restore more natural features and functions to these areas. Although the impacts of agriculture, residential development, and urbanization are not currently believed to pose a primary threat to migratory bull trout using the lower Chilliwack River and lower Fraser River, conservation actions that address these activities should continue to be implemented in these areas as these river reaches are key migration corridors for the continued expression of the anadromous life history form (USFWS 2015b, pp. A9 – A10).

Manchester Research Station

Manchester Research Station focuses on captive broodstock technology for depressed and endangered fish populations, and the culture, genetics, marking, and tagging technology of salmon and marine fish species. Unique features of the Manchester facility include a large floating marine net-pen complex for understanding the environmental impacts of commercial rearing activities; unique semi-natural and other specialized rearing systems for salmon and marine fish studies; a State-approved salmon quarantine facility; and systems for research and testing of passive integrated transponder tagging technology.

Manchester Research Station is located in a forested setting on the east side of the peninsula separating the Port Orchard and Rich Passages in Puget Sound. It sits amid an agricultural/rural residential area of Kitsap County, Washington north of the town of Manchester and immediately north of Middle Point. The Manchester Research Station stands on property that historically supported a fortification for protection of the Puget Sound Naval Shipyard and then a Navy fuel depot.

The research station site is characterized by north-northeast trending ridges up to approximately 60 feet above sea level. It is drained by many small creeks and streams that predominantly flow northward and discharge into Clam Bay on Rich Passage in Puget Sound. Beaver Creek (immediately south of the facility) is the largest and flows into the bay adjacent to the facility forming the Beaver Creek estuary. Sediments from Beaver Creek are deposited to the south end of the bay largely during spring flooding. Clam Bay has a shallow gradient (less than 5 percent) extending from the shoreline out approximately 1500 feet. Aquatic vegetation in Clam Bay consists of macro-algae (*Ulva lactuca*) and eelgrass (*Zostera capensis)* which exist in patches at a maximum depth of 8 feet (Karnezis and Mayer 2003, p. 13). This vegetation provides fish forage habitat. There is a commercial net pen facility located approximately 200 yards offshore that raises Atlantic salmon for eventual harvest and market.

Clam Bay has a history of human disturbance. The shoreline and intertidal zone north of Manchester Research Station were part of an EPA Superfund site clean-up project that removed hydrocarbon-contaminated sediments and put in clean fill in the late 1990s. Monitoring continues; however, groundwater in that area is still not a source of potable water or other uses. In spite of this history, Clam Bay provides seawater of excellent quality to the research facility.

The research facility's contribution to existing ecological issues in Puget Sound is low. Its primary effect would be through its effluent, but that is treated with ozone at approximately 1 part per million in a formula–based system and other processes that destroy pathogens and remove any iodine that had been used to clean the fish tanks. At current levels of operation, the facility is not required by the EPA to operate under a NPDES permit for discharge.

Burley Creek Fish Hatchery

The Burley Creek Fish Hatchery is located in a rural residential area of Kitsap County, Washington west of highway 16, approximately 6.5 miles south of Port Orchard. The facility is on a 5-acre, largely undeveloped agricultural and woodland parcel near Burley Creek. It is about 4.5 miles west of Puget Sound and 4.25 miles north of Carr Inlet/Henderson Bay.

The hatchery is in a mixed agricultural, pastoral, and forest setting. It is located near, but not immediately along, Burley Creek. Its water source comes from wells, not the creek. Treated effluent from the hatchery discharges into a constructed, artificial wetland channel which then drains into Burley Creek. Burley Creek is a meandering, low-flow stream with abundant riparian vegetation, but fairly homogenous substrate (sand and fines, rounded gravel, cobbles) with no visible pool/riffle complexes.

Water quality in Burley Creek has been compromised by residential and agricultural uses above and below the hatchery, but water quality is generally high near the hatchery. The creek flows through a mature and fully functional riparian plant approximately 125 to 150 feet wide.

The hatchery's contribution to existing ecological issues in Puget Sound appears to be low. It does not withdraw water from Burley Creek, which would affect its flows; and effluent is pre-treated through an artificial wetland prior to flowing into Burley Creek, ultimately enhancing its flow. Bull trout do not occur in Burley Creek.

Lower Columbia

Lands along the Lower Columbia River from the mouth of the Columbia River to the John Day Dam are under a mix of private, State, and Federal ownership. National wildlife refuges are present at several locations along the river. The Columbia River Gorge National Scenic Area is 133.5 km (83.0 mi) in length and extends from the mouth of the Sandy River to the confluence of the Deschutes River. Management of this area is under jurisdiction of the U.S. Forest Service The Lower Columbia River includes two Federal dams, Bonneville and the Dalles, between the mouth of the Columbia and John Day Dam. They are operated by the Army Corps of Engineers and form reservoirs in the Columbia River. River flows in the Columbia River upstream and downstream from the dams is affected by operations for hydropower, navigation, flood control, and anadromous fish migration. The Columbia River is free flowing downstream from Bonneville Dam and is tidally influenced.

The connectivity from the Pacific Ocean to John Day Dam allows for anadromous and fluvial life history expressions and the genetic exchange and diversity that are essential to the Coastal RU, which includes the Coastal Puget Sound (Washington) and lower Columbia River bull trout populations below the John Day Dam.

Habitat in the Lower Columbia River is presently considered to be suitable for foraging, overwintering, and migration. At present, bull trout populations in the lower Columbia River are somewhat disconnected from each other and are at low levels. However, with improved population status and increased connectivity, this river section will provide important FMO habitat much like it currently serves in areas upriver. It will also be essential for maintaining habitat connectivity and for providing for the expression of historic migratory life history forms in the lower Columbia region of the Coastal Recovery Unit. While summer temperatures may preclude bull trout use, suitable temperatures and availability of forage do exist in fall, winter, and spring months. Bull trout are known to migrate large distances for foraging opportunities even for short periods of time.

Downstream passage for juvenile anadromous fish is provided by fish passage facilities, by spilling water over dam spillways, or traveling through the powerhouse. Bonneville and John Day dams have fish screen and bypass facilities for juvenile anadromous salmonids. During the summer, fish that are collected at juvenile fish facilities at McNary Dam are transported by barge or truck and released at a site downstream from Bonneville Dam. It is uncertain if the juvenile fish facilities are effectively passing bull trout because these structures were designed for juvenile anadromous salmon and steelhead. Bull trout have been observed in the fish ladders at Bonneville and The Dalles dams.

Climate Change

Changes in hydrology and temperature caused by changing climate have the potential to negatively impact aquatic ecosystems in the action area, with salmonid fishes being especially sensitive. Average annual temperature increases due to increased carbon dioxide are affecting snowpack, peak runoff, and base flows of streams and rivers (Mote et al. 2003, p. 45). Increases in water temperature may cause a shift in the thermal suitability of aquatic habitats (Poff et al. 2002, p. iii). For species that require colder water temperatures to survive and reproduce, warmer temperatures could lead to significant decreases in available suitable habitat. Increased frequency and severity of flood flows during winter can affect incubating eggs and alevins in the streambed and over-wintering juvenile fish. Eggs of fall spawning fish, such as bull trout, may suffer high levels of mortality when exposed to increased flood flows (ISAB 2007, p. iv).

Isaak et al’s 2010 (p. 1350) study of changing stream temperatures over a 13-year period in the Boise River Basin estimated an 11 to 20 percent loss of suitable cold water bull trout spawning and early juvenile rearing habitats. These results suggest that a warming climate is already affecting suitable bull trout in-stream habitats. This is consistent with Rieman et al. (2007, p. 1552) and Wenger et al. (2011, p. 988) conclusions that bull trout distribution is strongly influenced by climate, and predicted warming effects could result in substantial loss of suitable bull trout habitats over the next several decades. Bull trout already seem to inhabit the coldest available streams in study areas (Wenger et al. 2011, p. 1002), and in several watersheds bull trout do not have the potential to shift upstream with warming stream temperatures at lower elevations.

2.4.2 Bull Trout Critical Habitat

2.4.2.1 Status of Bull Trout Critical Habitat in the Action Area

The action area is encompassed by critical habitat units (CHUs) in the Upper Snake, Coastal, and Mid-Columbia RUs (USFWS 2010c, pp. 4-7). The CHUs are the Salmon River Basin, Puget Sound, and Mainstem Snake River. These CHUs and applicable critical habitat subunits (CHSUs) are described in the following sections.

Salmon River Basin CHU (Upper Snake River RU)

The Salmon River Basin CHU is essential for maintaining bull trout distribution within this unique geographic region of the Upper Snake RU. This CHU extends from the Idaho–Montana border to the Oregon–Idaho border before entering the Snake River, and represents the most northern and eastern extents of the Upper Snake RU. This CHU is the largest CHU of the Upper Snake RU and contains the largest populations of bull trout in this RU. It supports bull trout populations that express adfluvial, fluvial, and resident life history expression. Migratory life history expression is needed for the long-term conservation of the species, and some resident populations may also contain unique genes that promote persistence from specific threats. Large portions of this CHU occur within the Frank Church—River of No Return Wilderness, which implies that many CHSUs in the Salmon River Basin have few threats compared to other areas in the Upper Snake RU (USFWS 2010c, p. 673).

Upper Salmon River CHSU

This CHSU is essential to bull trout conservation because it provides a rare adfluvial life history expression in the Upper Snake RU. It contains many individuals, a large amount of habitat, and few threats. This CHSU contains populations that contain fluvial life history expressions that are important in the long-term recovery of the species (USFWS 2010c, p. 779).

Under the 2010 critical habitat designation, the Salmon River from approximately its confluence with the Pahsimeroi River upstream to Alturas Lake Creek is classified as FMO habitat, and from Alturas Lake Creek upstream to its headwaters is classified as spawning and rearing habitat (USFWS 2010c, p. 779).

Redfish Lake Creek contains FMO habitat from its confluence with the Salmon River upstream 1.0 km (0.6 mi) to the outlet of Little Redfish Lake; Little Redfish Lake (25.8 ha (63.7 ac)); Redfish Lake Creek from the inlet of Little Redfish Lake to the outlet of Redfish Lake 2.6 km (1.6 mi); Redfish Lake (608.4 ha (1,503.4 ac)); and Redfish Lake Creek from the inlet of Redfish Lake upstream 0.1 km (0.1 mi) to a barrier and Fishhook Creek provides spawning and rearing habitat from its confluence with Redfish Lake upstream 6.6 km (4.1 mi) to an unnamed tributary entering from the west (USFWS 2010c, pp. 781-782).

Alturas Lake Creek, from its confluence with the Salmon River upstream to Alturas Lake, and Alturas Lake itself are classified as FMO habitat. Alturas Lake Creek upstream of Alturas Lake is classified as spawning and rearing habitat (USFWS 2010c, p. 782).

Pettit Lake Creek from its confluence with Alturas Lake Creek upstream to and including Pettit Lake are classified as FMO habitat (USFWS 2010c, p. 782).

The Sawtooth Hatchery weir and Redfish Lake Creek weir are located in this CHSU.

Upper Mainstem Snake River (Not a Core Area)

The Springfield Fish Hatchery is located in the American Falls subbasin of the Snake River system. Bull trout and bull trout critical habitat are not present in this subbasin.

Lower Boise River (Not a Core Area)

Eagle Fish Hatchery is located in the Lower Boise River subbasin. Bull trout and bull trout critical habitat are not present in this subbasin.

Mainstem Snake River CHU (Mid-Columbia RU)

The Snake River Mainstem CHU is located from the confluence of the Snake River with the Columbia River upstream to Brownlee Reservoir. The Snake River is within Franklin, Walla Walla, Columbia, Whitman, Garfield, and Asotin Counties in Washington; Wallowa, Whitman, Baker, and Malheur Counties in Oregon; and Nez Perce, Idaho, Adams, and Washington Counties in Idaho.

The mainstem Snake River plays an important role in the recovery of bull trout populations by providing essential FMO habitat necessary for populations found in the Tucannon River, Asotin Creek, Grande Ronde River, Imnaha River, Clearwater River, Salmon River, Sheep Creek, Granite Creek, Powder River, Pine Creek, Indian Creek, and Wildhorse Creek. Brownlee Reservoir contains potential FMO habitat for fluvial bull trout in the Powder River and Eagle Creek.

In the lower section of the Snake River are a series of dams and locks built by the U.S. Army Corps of Engineers. The Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dams serve as hydroelectric power sources and provide a navigable route for barge traffic to Lewiston, Idaho. The major features in the Hells Canyon Hydroelectric Complex reach of the Snake River are Hells Canyon, Oxbow, and Brownlee Dams and their reservoirs.

Downstream from Hells Canyon Dam to the Oregon–Washington border, the Snake River is designated a Wild and Scenic River. It also lies within the Hells Canyon National Recreation Area and the Hells Canyon Wilderness, which are administered by the U.S. Forest Service. The Snake River, from its mouth to Brownlee Dam, is occupied by bull trout in most of its reaches and is essential to the long-term conservation of the species by conserving the opportunity for expressing life history, facilitating genetic exchange, and ensuring connectivity among populations and core areas.

The Snake River and its reservoirs provide an abundant food source for migratory bull trout during the fall, winter, and spring. Forage fish such as juvenile salmon and steelhead, whitefish, sculpins (family Cottidae), suckers (family Catostomidae), and minnows (family Cyprinidae) are present throughout the Lower Snake River (USFWS 2010c, pp. 583-584).

The Lower Granite Dam adult trap is the only Snake River sockeye salmon hatchery program facility located on the mainstem Snake River.

Puget Sound CHU (Coastal RU)

The Puget Sound CHU is essential for maintaining bull trout distribution within this unique geographic region of the RU. Puget Sound is a fjord-like estuary that covers an area of approximately 2,330 square kilometers (km^2) (900 square miles (mi^2)), including 3,700 kilometers (km) (2,300 miles(mi)) of nearshore marine coastline. It was designated as an "Estuary of National Significance" by the EPA in 1988. This CHU is essential for maintaining distribution of the anadromous life history form within the Coastal RU, which is rare across this species' geographic range. It is not only essential for maintaining this life history form within this RU but within its coterminous range. It is one of only two CHUs that contain the anadromous life history form (USFWS 2010c, p. 85).

Puget Sound Marine CHSU

The Puget Sound Marine CHSU is essential to bull trout conservation and for supporting the expression of the anadromous life history form in the Puget Sound region. It contains essential FMO habitat required for the expression of the anadromous life history form within the Puget Sound CHU. The estuarine and marine waters of Puget Sound provide foraging and migration habitat for anadromous bull trout outside of freshwater core areas. Anadromous bull trout use nearshore habitat along the eastern shore of Puget Sound from the U.S.–Canada border south to the Nisqually River delta. Bull trout have also been documented using the nearshore habitat of islands along this eastern shore, especially in the northern part of the sound. The extent of bull trout use along the western Puget Sound shoreline is not well known, but available information suggests it is used to a much lesser degree than the eastern shore. The current distribution data for bull trout most likely underrepresent the amount of occupied marine nearshore habitat due to the depressed status of some anadromous bull trout populations; the seasonal and temporal variability in their migratory behavior; and perhaps most importantly, the difficulty of sampling for subadult and adult life stages in large estuarine and marine environments. The Puget Sound Marine CHSU includes the estuarine and nearshore areas along the eastern Puget Sound shorelines. A total of approximately 911 km (566 mi) of marine and estuarine shoreline is designated as critical habitat (USFWS 2010c, p. 191).

Critical habitat is not designated in the vicinity of Manchester Research Station or Burley Creek Fish Hatchery.

Mainstem Lower Columbia River CHU

The Columbia River, from the Pacific Ocean upstream to John Day Dam, is essential for maintaining bull trout distribution and provides essential FMO habitat for extant tributary populations of bull trout in the Lewis, Hood, Klickitat, and Deschutes rivers and connectivity between these core areas, as well as facilitating the potential reestablishment of a population within the White Salmon River. Connectivity from the Pacific Ocean and upriver allows for the opportunity for anadromous and fluvial life history expressions and genetic exchange and diversity, which are essential to the recovery unit.

The mainstem Lower Columbia River CHU is located in the states of Oregon and Washington. It includes Clatsop, Columbia, Multnomah, Hood River, Wasco, and Sherman counties in Oregon and Pacific, Wahkiakum, Cowlitz, Clark, Skamania, and Klickitat counties in Washington.

The Oxbow Fish Hatchery is located on Herman Creek, a tributary to the Lower Columbia River. Herman Creek is not designated as critical habitat and is not included in this CHU or any CHSU.

2.4.2.2 Factors Affecting Bull Trout Critical Habitat in the Action Area

The same threats described above for bull trout in section 2.4.1 also apply to bull trout critical habitat, including climate change.

With a warming climate, thermally suitable bull trout spawning and rearing areas are predicted to shrink during warm seasons, in some cases very dramatically, becoming even more isolated from one another under moderate climate change scenarios (Rieman et al. 2007, pp. 1558–1562; Porter and Nelitz 2009, pp. 5–7). Climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in section 2.3.2.2 (PBFs 1, 2, 3, 5, 7, 8 and 9).

2.5 Effects of the Proposed Action

Effects of the action considers the direct and indirect effects of an action on the listed species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

2.5.1 Bull Trout

2.5.1.1 Direct and Indirect Effects of the Proposed Action

Adverse effects to bull trout are limited to the Upper Salmon River Basin and occur as a result of incidental capture and handling and potential migrational delays. The potential for bull trout to be adversely affected outside this Basin (with the exception of Lower Granite Dam) as a result of program activities is insignificant or discountable. For Lower Granite Dam, the Service concludes that sockeye broodstock collection at the dam is not likely to adversely affect bull trout (see discussion below).

The proposed inclusion of Sawtooth and Oxbow hatcheries does not incur new actions in bull trout habitat above what is already occurring (see Addendum [BPA 2017b]).

The use of the Sawtooth Fish Hatchery would create effects only through the withdrawal and discharge of water, which is already occurring as part of the ongoing spring Chinook production there (see USFWS 2017). No changes to water withdrawal or effluent discharge are proposed.

Oxbow Fish Hatchery is located on Herman Creek. Bull trout do not occur in Herman Creek and Herman Creek is not designated as critical habitat; therefore all effects to bull trout and bull trout critical habitat from Program activities will be insignificant or discountable.

All other activities included in the proposed action are envisioned to occur within hatcheries or on transport trucks where there would be no disturbance of bull trout or their habitat. No changes in collection practices are proposed that would create additional impacts to bull trout.

Effects to bull trout (and their critical habitat, section 2.5.2) will be analyzed relative to the operational elements of the proposed action previously discussed in section 2.1.3.

See the Assessment, Appendix B for a summary of bull trout take associated with past program activities.

2.5.1.1.1 Broodstock Collection

The timing of program broodstock collection overlaps with many bull trout life history stages, as shown in Table 7. The potential for direct effects of the Program to bull trout primarily arise from broodstock collection at the Redfish Lake Creek weir and the Sawtooth Fish Hatchery trap (including seining the river below the trap). Incidental capture, disturbance (i.e., stress), and mortality of bull trout can occur during broodstock collection. A small percentage of bull trout sampled in a fish trap may be injured or killed, as evidenced by the low level of mortality reported by IDFG (see Assessment, Appendix B). This trapping activity has occurred for many years in the Salmon River Basin, apparently without hindering positive population growth rates of bull trout since 1994 (High et al. 2008, p. 1687), and is not expected to limit bull trout population growth rates in the future. However, all trapping involves risk. Installation and operation of adult traps may capture, delay, or otherwise disrupt the movements and distribution of fish in the stream. Traps can also stress, injure, or kill fish if improperly designed or operated. For these reasons, broodstock collection at both the Redfish Lake Creek weir and the Sawtooth Fish Hatchery trap are likely to adversely affect bull trout, as described below. Sockeye broodstock collection at the Lower Granite Dam adult trap is not likely to adversely affect bull trout, as discussed below.

Table 7. Bull Trout Life Stages and Broodstock Collection Activities in the Upper Salmon River Basin (from Assessment Table 14).

Bull Trout Life Stage/Activity	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Adult Fluvial Migration							■	■	■	■		
Adult Spawning									■	■		
Downstream Adult Migration from Overwintering				■	■	■						
Adult/Subadult Rearing	■	■	■	■	■	■	■	■	■	■	■	■
Egg Incubation thru Fry Emergence	■	■	■	■	■				■	■	■	■
Juvenile Rearing	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile/Subadult Migration	■	■	■	■					■	■	■	■
Broodstock Collection Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sawtooth Fish Hatchery							■	■	■	■		
Redfish Lake Creek							■	■	■	■		
Lower Granite Dam							■	■				

Sawtooth Fish Hatchery Trap

Migratory bull trout are captured in the Sawtooth Fish Hatchery trap. From 2005 through 2014, 78 bull trout were captured and released upstream, with one mortality (see Appendix B of the

Assessment). Handling and releasing bull trout may result in injury or mortality, and is likely to adversely affect individual fish.

Adult traps are typically operated between mid-July (July 10) and mid-October, though operations may start as early as mid-June (Table 7). During this time, fluvial bull trout in the mainstem Salmon River are moving upstream toward spawning (in tributaries) and overwintering (in lakes and mainstem) habitat, or rearing in the vicinity of the trap (Table 7). Bull trout that are moving upstream are captured in the traps, along with adult sockeye, and moved upstream by IDFG personnel who check the traps daily.

During the last few years, up to 10 bull trout have been observed above the weir during the last 5 days that the weir panels have been in place. These adult bull trout are delayed from moving downstream until either IDFG staff open a panel temporarily to let them pass, or until the weir panels are removed. It may be that these fish have spawned somewhere upstream of the Sawtooth Fish Hatchery weir and are moving downstream to overwintering habitat in Redfish Lake, although there are no data to verify if that is the case. The delay in downstream passage would be for a limited duration; however, a migrational delay would present an adverse effect to bull trout. For example, environmental factors (e.g., elevated water temperatures) may be present that would stress or disturb bull trout that are temporarily prevented from passing through this portion of the river. This temporary delay would not be expected to prevent the ability of these fish to reach overwintering habitat; nonetheless, it may result in a short-term adverse effect to bull trout.

Bull trout that are captured in the adult traps at the weir are anesthetized, measured, and in some cases tagged or sampled for genetic analysis by IDFG before being released a safe distance upstream of the weirs. Bull trout present during this timeframe are adults migrating upstream. Trapping, handling, and tagging of bull trout could result in injury, mortality, and/or disturbance any of which is considered an adverse effect.

Bull trout may also be incidentally collected when IDFG uses hand-held seines to capture sockeye that have not entered the hatchery trap. This activity occurs on 2 days, 2 weeks apart in September. Seining may adversely affect bull trout through incidental capture and handling.

Redfish Lake Creek Weir

Adult traps are in operation from June 10 through October 20 of each year at Redfish Lake Creek, and fluvial bull trout are moving upstream during this time (Table 7). IDFG anticipates handling and releasing fewer than 200 bull trout per year at the Redfish Lake Creek weir (Assessment, Appendix B). Captured bull trout are moved upstream by IDFG personnel on a daily basis. Passage delays for bull trout are of short duration and do not affect the ability of bull trout to reach overwintering habitat. Handling of bull trout to remove them from the trap could result in injury, mortality, and/or harassment, any of which is considered an adverse effect.

During operation of the adult traps, downstream passage is blocked to adult fish. However, bull trout have not been observed swimming in the vicinity of the upstream side of the Redfish Lake weir, and bull trout are not expected to be migrating downstream at this location at this time of year. Bull trout are present in the system and have volitional movement, so their presence at the upstream side of the Redfish Lake weir cannot be entirely discounted. However, the likelihood

of downstream migrating adults being present upstream of the trap at this time, and experiencing migration delays, is discountable.

Lower Granite Dam

The trap operated at Lower Granite Dam (in part to capture Snake River sockeye in low-flow years) can incidentally capture bull trout. This occurs on an infrequent basis when Sockeye pass Lower Granite Dam between mid-June and mid-August (with peak passage the first and second weeks of July). Between 2009 and 2015, a total of eight bull trout have been captured: four bull trout in 2013, two bull trout in 2012, and one bull trout each year in 2009 and 2010; no bull trout were captured in 2011, 2014, or 2015). These fish were captured between May 28 and June 4 (Ogden 2015, *in litt*.). Based on the recorded size (fork length) of these bull trout, they have all been adult fish. Prior to 2016, bull trout captured at the Lower Granite Dam trap were measured and then released immediately back into the fish ladder. Beginning in 2016, bull trout are PIT-tagged and fin-clipped prior to release to conduct research on origins and movements, per the study plan covered by Service recovery permit TE-82106B-O, issued to NMFS. In 2016, nine bull trout were captured and eight were PIT-tagged and fin-clipped (one was a recapture). The captures occurred between April 20 and June 17 with five captures occurring between June 1 and June 9. Given that sockeye broodstock collection only occurs on an infrequent basis and that the operational period for capturing sockeye is mid-June to mid-August with peak passage the first two weeks in July, it is unlikely that bull trout will be captured during sockeye broodstock collection. Trapping adult sockeye at Lower Granite Dam is therefore not likely to adversely affect bull trout.

2.5.1.1.2 Release of Snake River Sockeye

Releases of Snake River sockeye and corresponding life stages of bull trout are summarized in Table 8. As shown in Table 8, the timing of juvenile and adult releases overlaps with many bull trout life stages in the action area.

Table 8. Bull Trout Life Stages and Sockeye Releases in the Upper Salmon River Basin (from Assessment Table 15).

Bull Trout Life Stage/Activity	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Fluvial Migration													■	■	■	■	■	■	■	■				
Adult Spawning																		■	■	■				
Downstream Adult Migration from Overwintering							■	■	■	■	■	■												
Adult/Subadult Rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Bull Trout Life Stage/Activity	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Egg Incubation (fall) thru Fry Emergence (spring)												
Juvenile Rearing												
Juvenile/Subadult Migration												
Sockeye Life Stage												
Juvenile Release												
Adult Release												

The release of sockeye smolts in the spring of each year has the potential to affect bull trout through the following mechanisms:

- *Interspecific interactions.* Competition is possible between juvenile bull trout and juvenile sockeye. However, rapid transit downstream of juvenile sockeye, differences in habitat use, and differences in diurnal behavior patterns reduce any significant competition between juvenile sockeye and bull trout. For example, adult sockeye and bull trout utilize different spawning habitat (lake shore vs. tributary, respectively), thereby avoiding competition for spawning habitat. Because these species evolved sympatrically in the Upper Salmon River Basin, some form of resource partitioning would be expected. Therefore, potential competition is not expected to be a significant limiting factor for bull trout.
- *Water quality and disease control*. Hatchery Best Management Practices (BMPs) currently used at the existing sockeye hatcheries will be continued to minimize potential effects associated with water quality and disease.
- *Forage benefits for bull trout*. Releasing juvenile sockeye likely increases the forage base for migratory adult and subadult bull trout (a beneficial effect), which are highly piscivorous.

Interspecies Interactions

Ecological effects that pose risks to natural salmonids occur when the presence of hatchery fish detrimentally affects how wild fish interact with others of their own species, with their environment, or with other species. However, not all ecological interactions generated by artificially produced salmonids are negative for natural populations. The negative ecological effects of hatchery programs are most severe when wild and hatchery fish share a limited environment for a substantial period of time (Kostow 2009, p. 17). A brief review of the life

history traits of listed salmonids in the Upper Salmon River Basin (Chinook salmon, steelhead, bull trout) suggests that ecological interactions between Snake River sockeye salmon and co-occurring listed salmonids are of relatively minor concern. Snake River sockeye salmon typically spend 1 to 2 years in a nursery lake prior to emigrating from Upper Salmon River Basin lakes as smolts in spring. This extended period of juvenile lake residence contrasts with the typical life history phases of bull trout—fluvial populations of bull trout generally adopt a stream- or riverine-type rearing environment. Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Release of hatchery sockeye smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate out of the spawning and rearing areas. It is estimated that less than 1 percent of released sockeye smolts remain at the release sites (BPA and NMFS 2017, p. 83). PIT-tagged sockeye smolts have been tracked from their release site to the Lower Granite Dam in 9-12 days. This rapid rate of movement through the system reduces the opportunity for interspecies competition (Johnson et al. 2016, p. 28). Competition likely occurs at some unknown (but probably lower) level as smolts move downstream through the migration corridor (NMFS et al. 1998, p. 33). The result is very little spatial overlap between juvenile sockeye and juvenile bull trout. With the exception of occasional terrestrial insects in a lake environment, sockeye are exclusively planktivorous, while bull trout are piscivorous. This partitioning of food resources and rearing habitat between the species is expected to further limit effects to bull trout from either competition for habitat or food resources.

Adult sockeye are released in September into Redfish Lake and occasionally into Pettit Lake to spawn naturally; releases into Alturas Lake are also proposed. Snake River sockeye utilize lake shore habitat for spawning, and anadromous Snake River sockeye spawn almost exclusively in Redfish and Pettit lakes. Bull trout spawn high in tributary streams in September and October. Some spawning by anadromous sockeye has been documented in the lower reaches of Fishhook Creek (a tributary to Redfish Lake), but these sockeye do not overlap with bull trout since the latter species spawns much higher in the tributary. Although spawning timing is similar for both species, spatial separation and use of different spawning habitat types avoids interspecific competition for spawning habitat. Competition between sockeye and bull trout is expected to have an insignificant effect to bull trout.

Large concentrations of migrating hatchery fish may attract predators (birds, fish) and consequently contribute indirectly to predation of emigrating naturally produced fish (Steward and Bjornn 1990, p. 57). Studies indicate that increases in the number of predators in response to juvenile releases results in higher predation of wild fish (Steward and Bjornn 1990, p. 57; Collis et al. 1995, p. 353; Nickelson 2003, p. 1054). However, as previously noted, there is unlikely to be significant spatial or temporal overlap between juvenile bull trout and sockeye salmon smolts, and we assume that predators targeting salmon smolts are unlikely to target larger adult or subadult bull trout. Additionally, a mass of hatchery fish migrating through an area may overwhelm established predator populations, providing a beneficial, protective effect to co-occurring listed naturally produced fish (NMFS et al 1998, p. 34).

In conclusion, the release of hatchery smolts from the Snake River sockeye salmon hatchery program is not likely to adversely affect bull trout by increasing bull trout vulnerability and susceptibility to predation. The release of uniformly and actively smolting yearlings that will

emigrate away from the general release area in a matter of hours to days will significantly minimize the spatial and temporal overlap of sockeye smolts with juvenile bull trout (NMFS 2015, p. 60).

Water Quality and Disease Control

Releasing juvenile and adult sockeye carries a risk of facilitating the release of pathogens that may be present in either the fish or the transport water. Transmission of disease from hatchery sockeye to naturally produced fish, including bull trout, could adversely affect natural populations by increasing the risk of illness and mortality, and by reducing overall fitness. However, the risk of transporting pathogens or water of compromised quality during the process of releasing sockeye is minimized through the following measures: (1) the Snake River sockeye program adheres to strict fish health protocols and procedures during the production stages, (2) well water is used to fill transport trucks and contains no pathogens, (3) and transported fish are not fed en route and thus produce minimal amounts of waste. The strict adherence to conservation measures minimizes the risk of pollutants being released with fish to an insignificant level.

Forage Benefits

Beneficial effects of the Snake River sockeye program on bull trout include an increase in the potential prey base downstream of the smolt release locations. Adult bull trout are highly piscivorous. A study of predation in Redfish and Alturas lakes conducted in 1993 indicated that the stomach contents of bull trout from these lakes contained 89 percent sockeye or kokanee (*O. nerka*) (BPA 1995, p. 26). Releases of sockeye juveniles is expected to provide a benefit to adult and subadult bull trout by increasing forage prey base in FMO habitat.

2.5.1.1.3 Research, Monitoring, and Evaluation

Program RM&E includes activities associated with monitoring the success of the hatchery program in the restoration of the natural Snake River sockeye salmon population and the production of adults for harvest. In general, RM&E may include the use of traps, weirs, nets, and hook and line sampling. Other sampling involves trapping, netting, and handling fish to gather biological information. Bull trout may be incidentally captured resulting in disturbance, injury, and/or mortality during some of these activities, any of which is considered an adverse effect. These adverse effects (and any incidental take) resulting from RM&E conducted by IDFG are covered by IDFG's section 6 agreement with the Service. However, unless specifically designated as agents of the state, IDFG's section 6 coverage does not extend to NMFS or BPA, the Federal action agencies that authorize and fund IDFG's RM&E. Therefore, all adverse effects to bull trout resulting from the RM&E described below are addressed in this Opinion and covered in the Incidental Take Statement (Section 2.8).

RM&E actions are conducted through collaboration among IDFG, NMFS, ODFW, and the SBT. IDFG will engage the SBTOC in their proposal to release adult Redfish Lake Creek Sockeye into Alturas Lake in an effort to answer the questions discussed in Section 2.1.3.1.2, concerning the identification of stocks suitable for reintroduction/restoration of anadromous sockeye at Alturas Lake and other upper Salmon River Basin lakes. All projects described below are funded by BPA under Project No. 2007-402-00 or 1991-073-00 (Salmon River screw trap).

Genetic Sampling

Annual genetic monitoring of captive and anadromous broodstock occurs in hatchery settings and will have no effect on bull trout.

Juvenile Outmigration Monitoring

IDFG operates the Redfish Lake weir as a smolt trap from April through June during most years. Juvenile (rearing) and adult (migrating) bull trout may be present during these timeframes. Although the weir is set up as a smolt trap, it is not a barrier to either upstream- or downstream-migrating adult bull trout. Smolt traps are generally not installed in all weir sections; therefore, upstream-migrating fish have the ability to migrate above the trap without the need for handling or capture. If migrating through a section of the weir with a smolt trap, downstream-migrating adults would not be captured because of trap bar-spacing that only captures juveniles. Bull trout have not been observed spawning in the vicinity of the weir. Through 2014, there is no record of any juvenile bull trout ever being captured in the sockeye smolt trap at the Redfish Lake Creek weir; if captured, any juvenile bull trout would be enumerated and released downstream. However, if captured, bull trout would be adversely affected through incidental capture and handling.

The presence of adult bull trout in the vicinity of the smolt trap affects the estimates of trap efficiency and of sockeye outmigrants. IDFG therefore employs hook and line angling to capture adult bull trout that frequent the smolt trap area (upstream and downstream) during the outmigration season. Captured bull trout are PIT-tagged and relocated away from the weir, which allows the program to develop accurate outmigration estimates and reliable trap efficiency rates for sockeye (Peterson et al. 2012, pp. 45, 47). The use of hook and line angling to capture bull trout during outmigration monitoring may injure or kill adult bull trout.

The SBT are responsible for juvenile outmigrant monitoring on outlets from Pettit and Alturas Lakes (complete weir and screw trap, respectively). Standard Quality Assurance/Quality Control (QA/QC) procedures are followed for all data generated. All sockeye salmon smolts captured at the Alturas Lake Creek trap are measured for fork length, weight, and scanned for PIT tags. All sockeye salmon smolts captured at the Pettit Lake Creek weir are scanned for PIT tags, enumerated by wild and hatchery origin, and then a sub-sample are treated the same as the other traps. The Pettit Lake Creek and Alturas Lake Creek traps are installed annually in mid-April and removed in mid-June. All captured non-target species are counted and released immediately, but would be adversely affected through capture and handling.

IDFG will also operate a screw trap on the Salmon River (BPA Project No. 1991-073-00). The effects to bull trout will be similar to those described above. The Salmon River screw trap is likely to adversely affect bull trout through capture and handling.

Adult Weir Monitoring

Adult weir monitoring is done in conjunction with broodstock collection (discussed above in Section 2.5.1.1.1). Variables that will be monitored at the Redfish Lake Creek and Sawtooth Hatchery weirs are mortality (count of dead fish handled and live fish released at weirs), number and timing of adult sockeye arriving at each weir (measuring natural- and hatchery-origin returns), and the number of returning adults with PIT tags. These data are recorded as sockeye are processed (i.e., captured and handled) in the weirs. Bull trout may be adversely affected

through incidental capture and handling. Numbers of bull trout taken (from capture or handling) are the same as those resulting from broodstock collection (i.e., up to 50 adult bull trout per year at the Sawtooth Hatchery weir and fewer than 200 per year at the Redfish Lake Creek weir).

Spawning Surveys

Sockeye spawning surveys in Redfish Lake are conducted using telemetry equipment from powerboats. Due to the large size of lake where telemetry surveys occur, the chance of disturbing bull trout is discountable; telemetry surveys are not likely to adversely affect bull trout.

Spawning surveys for sockeye redds in some tributaries are conducted on foot. Bull trout have been observed during these surveys; however, bull trout spawn much higher in the tributaries than do sockeye. Bull trout encountered during sockeye redd surveys are therefore not anticipated to be actively spawning. Survey activities may momentarily disturb bull trout in the immediate area that the surveyor is transitioning, but the effect will be very short and will not perceptibly affect the bull trout. These surveys are therefore not likely to adversely affect bull trout.

Spawning surveys done by snorkeling require an investigator wearing a wet suit, mask, and snorkel tube while crawling or swimming in an upstream direction identifying, counting, and estimating the size of fish observed within a measured reach of the stream. Sockeye Beach, located near the Redfish Lake boat ramp, and a small section of the southeast corner of Redfish Lake are spawning grounds for residual and adult sockeye salmon. Night snorkel surveys are conducted at both locations to estimate numbers of spawning residual sockeye salmon, anadromous sockeye salmon, and hatchery sockeye salmon. Snorkel surveys in Redfish Lake are conducted weekly from the first week of October through the first week of November. At least three observers, equipped with waterproof flashlights, snorkel parallel to shore, 10 m apart, at depths ranging from 0.5 to 5 m. Spawning ground surveys in the south end of the lake are conducted in the 200-m shoal area near the two small southeast inlet streams. Residual sockeye salmon spawning ground snorkel surveys are also conducted in Pettit Lake during the same period of time. As the program continues to expand, snorkel surveys may be conducted in Alturas Lake. In the unlikely event that surveyors encounter bull trout, bull trout may be momentarily disturbed, but the disturbance will be very short in duration and bull trout will not be perceptibly affected; effects are expected to be insignificant. Snorkel surveys are therefore not likely to adversely affect bull trout.

Population Abundance Monitoring

Population monitoring using mid-water trawl or gillnetting methods may adversely affect bull trout if they are captured and handled during these surveys. The potential for incidental capture of bull trout during gillnetting is minimized by mesh size and net location. Gillnetting to sample juvenile sockeye in Pettit Lake is conducted using nets with mesh sizes of ½- , ¾-, or 1-inch, which are small enough to avoid capturing adult bull trout. The location of the net sets (in the middle of Pettit Lake) also minimizes incidental capture of bull trout. According to SBT project leaders conducting the gillnetting in Pettit Lake, fewer than 15 bull trout have been caught in vertical gill nets in Pettit Lake in the last 10 years, none of which have been juveniles (BPA and NMFS 2017, p. 91). Bull trout captured in this process have been those feeding on the juvenile

sockeye in the nets. Gill-netting may also be used to sample residual sockeye in Pettit Lake and has been used to sample sockeye in Redfish Lake. Gill-netting is done annually.

Abundance monitoring is also conducted using hydroacoustic methods. Echo sounding data are collected with a Hydroacoustic Technology, Inc. Model 240 split-beam system. Fifteen, six, and eight transects are sampled at Redfish, Pettit, and Alturas lakes, respectively. Surveys are conducted on two moonless nights during the last week of October. SBT begins the transects approximately 1.5 hours after sunset and maintains a boat speed of approximately 1.5 m/s during data collection. The data collected are used to estimate sockeye length (age class), density, and population abundance. Due to the large size of lakes where hydroacoustic monitoring occurs, the chance of disturbing bull trout is discountable; hydroacoustic monitoring is not likely to adversely affect bull trout.

2.5.1.1.4 Water Withdrawals

The only Program facilities that withdraw water where bull trout may occur are the Manchester Research Station and Sawtooth Fish Hatchery (see Section 2.4.1.1 for a discussion of bull trout distribution).

Manchester Research Station draws approximately 5.6 cfs of surface water from Puget Sound. Given the very large volume of water in Puget Sound, withdrawals of this volume will have insignificant effects to foraging or migrating bull trout in the vicinity of this facility.

Manchester Research Station also draws approximately 0.07 cfs of groundwater (Table 4). Given the very large volume of water in Puget Sound, withdrawals of this volume will have insignificant effects to bull trout or to the FMO habitat in Puget Sound adjacent to this facility. Therefore, Manchester Research Station water withdrawals associated with the Snake River sockeye program are not likely to adversely affect bull trout.

The effects to bull trout from water withdrawals at Sawtooth Fish Hatchery and weir are addressed in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and are not discussed in this Opinion.

2.5.1.1.5 Hatchery Effluent

All of the Snake River sockeye hatchery facilities discharge effluent. Effluent water could affect the health, productivity, and quality of receiving waters. Discharge water used at the Snake River sockeye program hatchery facilities, minus any leakage and evaporation, is discharged to the nearest water body. This discharge water has been run through facility structures, including rearing structures, and may contain hatchery wastes as a result. Hatchery facility waste products include uneaten food, fecal matter, soluble metabolites (e.g., ammonia), algae, parasitic microorganisms, drugs, and other chemicals (Kendra 1991, p. 43). Some of the chemical or physical parameters of hatchery effluent that have the greatest potential to impact receiving waters are temperature, nitrogen, phosphorus, dissolved oxygen, pH, and sediment (IDEQ 2003, entire). These parameters may have an adverse effect on bull trout.

The only hatchery facilities that discharge effluent into water bodies that contain bull trout or that may influence bull trout habitat are Manchester Research Stationand the Sawtooth Fish Hatchery.

Bull trout are not present in the Boise River, the American Falls Reservoir or any of its tributaries, Burley Creek, or Herman Creek; therefore,effluent from the Eagle Fish Hatchery, Springfield Hatchery, Burley Creek Hatchery, and Oxbow Hatchery will have no effect on bull trout.

Manchester Research Station discharges between 3.3 cfs-5 cfs into Puget Sound. Effluent seawater from rearing tanks is treated before being returned to the sound. Manchester Research Station complies with Washington Department of Fish and Wildlife quarantine certification standards. There are no Total Maximum Daily Loads (TMDL) for this facility because production has been below the level requiring an NPDES permit.

Given the small volume of discharge relative to the receiving waters, it is likely that any of the potential effects that hatchery effluent can have on bull trout would be isolated to the immediate areas of discharge. Effluent will be diluted within a very short time and area (50 yards downstream or less). Standard fish health management policies (Section 2.1.3.2.2) and conservation measures (Section 2.1.3.3) to reduce wastes, chemical use, and sediment would further reduce the effects of hatchery effluent to bull trout. Therefore, effects of hatchery effluent from Manchester Research Station may affect, but are not likely to adversely affect, bull trout.

The effects to bull trout from effluent discharged at the Sawtooth Fish Hatchery and weir are addressed in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and are not discussed in this Opinion.

2.5.1.1.6 Fish Disease Management

Some fish diseases (bacterial, viral, fungal, or parasitic) may be transmittable through infected wastes discharged in hatchery effluent. This potential disease vector is not fully understood and can be confounded by the natural occurrence of many of these diseases in salmonids.

Scientific literature that discusses bull trout disease susceptibility is limited. Bull trout may be inherently resistant to some diseases that are more devastating to other salmonids (USFWS 2002d, p. 22. Bull trout are relatively resistant to *R. salmoninarum* (bacterial kidney disease) (BKD) (Jones et al. 2007, p. 695), which is sometimes present in hatchery salmon; occurrences of this pathogen have been greatly reduced in recent years. There is evidence that bull trout are sensitive to Infectious Hematopoietic Necrosis (IHN) virus (Nelson 2012, pp. 19-21), which is widely distributed in Pacific Northwest waters and wild fishes. Hatchery programs control or prevent the spread of the IHN virus through the use of egg disinfection and careful management of water supplies for young fish. In studies conducted by Oregon State University researchers, Metolius (Deschutes) bull trout exposed to high and low doses of the infectious stages of *Myxobolus cerebralis* (the causative agent in whirling disease) showed no signs of infection as measured by presence of spores, clinical disease signs, or histopathology (USFWS 2002d, p. 22). Rainbow trout exposed simultaneously showed high infection prevalence and disease severity. USFWS Region 1 hatcheries have had no detected cases of whirling disease in salmon; therefore, transmission would be unlikely. In a similar study, no infections were detected in Metolius (Deschutes) bull trout exposed to infection by *Ceratamyosis shasta* (USFWS 2002d, p. 22). Disease studies conducted on bull trout from the Deschutes River

Basin showed them to be relatively resistant to all strains of IHN virus tested. Bull trout had detectable levels of antigen to BKD but no evidence of the disease (USFWS 2002d, p. 22).

As described in Sections 2.1.3.2.2 and 2.1.3.3.5, fish health monitoring and testing are conducted in accordance with established protocols and standards to limit the introduction of disease from hatchery fish to natural bull trout populations.

In addition, given the relatively minute volume of effluent these facilities produce relative to total volume of receiving water (as described above); implementation of program conservation measures, including pre-release/transfer pathogen screening; and the apparent resistance of bull trout to pathogens, it is likely that the effects to bull trout from pathogens in hatchery effluent will be insignificant.

2.5.1.1.7 Facility Maintenance

Routine maintenance of watered facilities such as pond cleaning, pump maintenance, pipelines, weirs, fish bypass screens, and debris removal from intake and outfall structures at the program's hatchery facilities may cause short-term reductions in water quality (e.g., suspended sediment, turbidity) in the areas directly adjacent to and downstream of the activity.

In-stream maintenance may include clearing of debris and bedload from hatchery intake screens and fish ladders, personnel wading the stream, and use of hand tools. In-stream maintenance may increase short-term turbidity but maintenance activities are usually small in scale and duration, and return conditions to what they were when structures were first constructed.

Bull trout occur at three program facilities: the Sawtooth Fish Hatchery and weir, the Redfish Lake Creek weir, Lower Granite Dam trap, and potentially at Manchester Research Station. Maintenance actions for these facilities are described in Section 2.1.3.2.4. Routine maintenance at the other hatchery facilities will have no effect on bull trout because bull trout do not occur in waterways in the vicinity of those facilities.

Facility maintenance may result in reductions in water quality that affect bull trout use of local habitat, harassment, and avoidance of the work area. Any of these actions have the potential for adverse effects to bull trout.

Sawtooth Fish Hatchery and Weir Maintenance

Effects to bull trout from maintenance of the Sawtooth Fish Hatchery and weir are addressed in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and are not discussed in this Opinion.

Redfish Lake Creek Weir Maintenance

At the Redfish Lake Creek weir, the weir support structures are permanent and remain in place year-round. Preparing the weirs for operation consists of lowering picket panels into guide slots on the weir's support structures without any in-stream use of heavy equipment. The adult traps at Redfish Lake Creek weir are in place from early July to late October. During this time, the weir is cleaned by hand as necessary to remove debris from the weir pickets. The hand-cleaning work is done on the upstream side of the weir.

The effects of these activities on habitat or water quality would be limited to sediment disturbance from up to five or six people walking in the stream. Given the clean gravel and

cobble substrate at the site, little or no turbidity is likely to occur. Some periphyton and macroinvertebrates would be dislodged during weir maintenance. Adult bull trout are migrating upstream during this timeframe and may be present during this work. Adult bull trout may alter behavior to avoid personnel walking in the waterway. However, the extent of habitat disturbance would be so localized and short in duration that the effect on bull trout would be insignificant. Maintenance of this weir would therefore be unlikely to adversely affect bull trout.

Lower Granite Dam Trap Maintenance

Maintenance at the Lower Granite Dam trap is similar to that described above for the weirs. The effects of these actions could include disturbance or harassment of bull trout if they are in or near the trap at the time the work is done. However, the majority of maintenance work is done when anadromous fish are not passing the dam (i.e., the winter months of approximately November-March). Bull trout could be present (migrating, holding) in the mainstem Columbia River at any time during the year; however, they have been documented only rarely in the Lower Granite Dam trap, and only between the months of May and July (Section 2.5.1.1.1). The risk of bull trout exposure to maintenance work at the trap is therefore insignificant and discountable. This work is not likely to adversely affect bull trout.

Manchester Research Station Maintenance

At Manchester Research Station, the pump station and pipeline are the only in-water components requiring maintenance. The pump station floats more than 20 feet off the bottom, so these activities do not produce any suspended substrate sediment. Small amounts of biological matter (e.g., algae) may be released from screens or pipes during maintenance, but dissipate quickly. Bull trout are present in Puget Sound at low densities and for short duration. This action is done infrequently and has insignificant effects to habitat. Given the amount of marine habitat available in Puget Sound, any bull trout present could easily avoid the area of the pump and lines during maintenance. Therefore, maintenance at this facility has insignificant and discountable effects and is not likely to adversely affect bull trout in Puget Sound.

2.5.1.2 Effects of Interrelated or Interdependent Actions

The Service has not identified any actions that are interrelated and interdependent with the on-going sockeye hatchery program.

2.5.2 Bull Trout Critical Habitat

2.5.2.1 Direct and Indirect Effects of the Ongoing Action

For more detailed information on the effects of each of the Operational Elements of the Hatchery Program see the bull trout effects section (section 2.5.1), above.

See Section 2.3.2.2 for a description of the PBFs of critical habitat potentially affected by the Program.

2.5.2.1.1 Broodstock Collection

The broodstock collection facilities are located in critical bull trout FMO habitat and have the potential to affect PBF 2 (migration habitat). As discussed above, broodstock collection involves

the operation of adult traps at Sawtooth Fish Hatchery (as early as mid-June to mid-October), Redfish Lake Creek (as early as mid-June to mid-October), and potentially at Lower Granite Dam trap (mid-June to mid-August). Fluvial bull trout in the streams migrate upstream toward spawning and overwintering habitat during these timeframes, and downstream in the fall past the Sawtooth facility. PBF 2 (migration habitat) could be affected by operation of adult traps. The delay in passage would be for a limited duration and would not be expected to prevent the ability of these fish to ultimately reach overwintering habitat; however, a migrational delay could present an adverse effect for migrating bull trout. Broodstock collection activities therefore may adversely affect PBF 2 (migration habitat).

2.5.2.1.2 Release of Snake River Sockeye

PBF 8 (water quality) could be affected by the release of hatchery fish because pathogens or pollutants could be present in either released hatchery fish or in the transport water. However, the risk of transporting water of compromised quality during the process of releasing sockeye is minimized through the following measures: (1) the Snake River sockeye program adheres to strict fish health protocols and procedures during the production stages; (2) well water is used to fill transport trucks and contains no pathogens; (3) and transported fish are not fed en route and thus produce minimal amounts of waste. The strict adherence to conservation measures minimizes the risk of pollutants being released with fish.

In addition, the volume of water released into Redfish Lake Creek during fish release is insignificant relative to creek flows. The volume of water released with sockeye is no more than 4,000 gallons per day. Flow data for Redfish Lake Creek is limited; but in 2014, flow in the creek in April and May, during the time that sockeye smolts are released, averaged approximately 100,400 gallons per minute (BPA and NMFS 2017, p. 85). The volume of released water is therefore no more than approximately 4 percent of flow in Redfish Lake Creek for just a few minutes and would have an insignificant effect on the flow or the water quality parameters in the creek.

Therefore, release of hatchery fish is expected to have insignificant effects to PBF 8 (water quality) in the receiving water bodies.

The release of sockeye smolts is likely to have a beneficial effect to PBF 3 (abundant food base). Adult bull trout may prey on released smolts as they outmigrate from the release sites.

2.5.2.1.3 Research, Monitoring, and Evaluation

Adult weir monitoring and juvenile outmigration monitoring have the potential to affect bull trout migration. Effects to critical habitat from these activities are similar to those described above under Broodstock Collection. Juvenile outmigration monitoring and adult weir monitoring at Redfish Lake Creek weir and the Sawtooth Fish Hatchery weir have the potential to affect PBF 2 (migration habitat). Operation of the adult weir is done at Sawtooth Fish Hatchery between as early as June 10 and as late as October 10; and at Redfish Lake Creek between the same timeframe. Fluvial bull trout in the streams migrate upstream toward spawning and overwintering habitat during these timeframes. PBF 2 (migration habitat) could be adversely affected by operation of adult and juvenile traps, gill netting, power boat trawling, and hook and line angling for adult bull trout, which could cause short delays in migration. These elements of RM&E may therefore adversely affect PBF 2 (migration habitat).

Hydroacoustic monitoring and telemetry will have no effect on the PBFs of critical habitat and spawning ground surveys will have no significant effect on the PBFs 2 and 8.

2.5.2.1.4 Water Withdrawals

Bull trout critical habitat is not designated in stream reaches from which water is withdrawn for the Eagle Fish Hatchery, Springfield Fish Hatchery, Manchester Research Station, Burley Creek Fish Hatchery, or Oxbow Fish Hatchery. Therefore, water withdrawals at these facilities have no effect on the PBFs of bull trout critical habitat. Similarly, ground water withdrawals will also have no effect on the PBFs.

Water withdrawals for the Sawtooth Hatchery from the Salmon River, which is designated as FMO critical habitat, is addressed in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and are not discussed in this Opinion.

2.5.2.1.5 Hatchery Effluent

Bull trout critical habitat is not designated in water bodies receiving effluent from the Eagle Fish Hatchery, Springfield Fish Hatchery, Manchester Research Station, Burley Creek Fish Hatchery, or Oxbow Fish Hatchery. Therefore, effluent from these facilities has no effect on bull trout critical habitat.

Effluent from the Sawtooth Hatchery is addressed in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and is not discussed in this Opinion.

2.5.2.1.5.6 Fish Disease Management

Some fish diseases (bacterial, viral, fungal, or parasitic) may be transmittable through infected wastes discharged in hatchery effluent. Bull trout critical habitat is not designated in water bodies receiving effluent from the Eagle Fish Hatchery, Springfield Fish Hatchery, Manchester Research Station, Burley Creek Fish Hatchery, or Oxbow Fish Hatchery. Therefore, the potential for the transmission of pathogens in effluent from these facilities will have no effect on bull trout critical habitat.

Fish disease management for the Sawtooth Hatchery is addressed in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and is not discussed in this Opinion.

There is also the potential for the transmission of disease pathogens during juvenile releases that could affect water quality (PBF 8) in bull trout critical habitat. As described in Sections 2.1.3.2.2 and 2.1.3.3.5, fish health monitoring and testing are conducted in accordance with established protocols and standards to limit the introduction of disease from hatchery fish to natural bull trout populations. In addition, implementation of program conservation measures, including pre-release/transfer pathogen screening, will reduce the risk for transferring pathogens to bull trout critical habitat during releases of hatchery juvenile sockeye to an insignificant level. Fish disease management is not likely to adversely affect the PBF 8 of bull trout critical habitat.

2.5.2.1.6 Facility Maintenance

Maintenance actions at Sawtooth Fish Hatchery weir and the Redfish Lake Creek weir have the potential to affect designated critical habitat because they are located in bull trout critical habitat.

Maintenance of Sawtooth Fish Hatchery weir is addressed in the in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017) and is not discussed in this Opinion.

Suspended sediment and turbidity resulting from maintenance activities at the Redfish Lake Creek weir could affect the following PBFs: 2 (migration habitat), 3 (abundant food base), and 8 (water quality). Sediment and turbidity in the water column can alter migration behavior as bull trout avoid the use of turbid water, and could result in a short migrational delay. Prey species for bull trout could also avoid the sediment plume and alter foraging opportunities for bull trout. Overall water quality would be temporarily reduced by the turbidity associated with sediment plumes. However, the low frequency, short duration, and low magnitude of the stressors (sediment plumes, personnel in the waterway) minimize these effects to bull trout critical habitat. Maintenance actions therefore pose an insignificant risk and are not likely to adversely affect designated critical habitat.

Maintenance at the remaining facilities will have no effect to critical habitat because no critical habitat is designated at those facilities.

2.5.2.2 Effects of Interrelated or Interdependent Actions

The Service has not identified any actions that are interrelated or interdependent with the on-going Snake River Sockeye Salmon Hatchery Program.

2.5.3 Summary of Effects

Adverse effects to bull trout and designated critical habitat are limited to the Upper Salmon River Basin and occur as harassment, injury, and mortality from capture, handling, surveying, and potential migrational delays. The potential for bull trout or designated critical habitat to be adversely affected outside the Upper Salmon River Basin as a result of program activities is insignificant or discountable.

Table 9. Summary of Effects to Bull Trout and Bull Trout Critical Habitat from the Snake River Sockeye Salmon Hatchery Program (from Assessment Table 13).

Project Element	Effect to Species	Effect to Bull Trout Critical Habitat
Broodstock Collection	LAA	LAA (PBF 2)
Release of Snake River Sockeye	NLAA	NLAA (PBFs 3 and 8)
Water Withdrawals	NLAA	NE
Hatchery Effluent	NLAA	NLAA (PBF 8)
Fish Disease Management	NLAA	NLAA (PBF 8)
Facility Maintenance	NLAA	NLAA (PBF 2, 3, and 8)
Research, Monitoring, and Evaluation	LAA	LAA (PBF 2)

LAA=Likely to Adversely Affect; NLAA=May Affect, Not Likely to Adversely Affect; NE = No Effect

Table 10. Summary of effects to bull trout and critical habitat from Snake River Sockeye Salmon Broodstock Collection and RM&E activities.

Activity	Method	Facility or Water Body	Dates of Activity	Agency Operators	Effects Determinations	
					Bull Trout	Critical Habitat
Adult Collection/Weir Monitoring (Broodstock Collection and RM&E)	Weir	Sawtooth Hatchery	mid-Jun to mid-Oct	IDFG	LAA	LAA (PBF 2)
		Redfish Lake Creek	mid-Jun to mid-Oct	IDFG	LAA	LAA (PBF 2)
	Seine	Sawtooth Hatchery	Sep	IDFG	LAA	LAA (PBF 2)
Juvenile Outmigration Monitoring (RM&E)	Weir	Redfish Lake Creek	Apr-Jun	IDFG	LAA	LAA (PBF 2)
	Angling	Redfish Lake Creek	Apr-Jun	IDFG	LAA	LAA (PBF 2)
	Screw Trap	Alturas Lake Creek	mid-Apr – mid-Jun	SBT	LAA	LAA (PBF 2)
	Screw Trap	Salmon River	Mar-Nov	IDFG	LAA	LAA (PBF 2)
	Weir	Pettit Lake Creek	mid-Apr – mid-Jun	SBT	LAA	LAA (PBF 2)

Activity	Method	Facility or Water Body	Dates of Activity	Agency Operators	Effects Determinations	
					Bull Trout	Critical Habitat
Spawning ground surveys (RM&E)	Power Boat Telemetry	Redfish Lake	mid-Oct – mid-Nov	IDFG	NLAA	NE
Spawning ground surveys (RM&E)	Pedestrian	Fishhook Creek, Redfish Lake Creek, Valley Creek, Litte Redfish Lake	mid-Oct – early Nov	IDFG	NLAA	NLAA (PBF 8)
Spawning ground surveys (RM&E)	Snorkeling	Redfish Lake, Pettit Lake	early-Oct - early-Nov	IDFG	NLAA	NLAA (PBF 8)
Population Abundance Monitoring (RM&E)	Power boat – trawling	Redfish Lake, Pettit Lake	mid to late Aug	IDFG	LAA	LAA (PBF 2)
	Hydroacoustic monitoring	Redfish Lake, Pettit Lake, Alturas Lake	Oct (last week)	SBT	NLAA	NE
	Gill-netting	Pettit Lake	mid-Jan – Mar	SBT	LAA	LAA (PBF 2)

LAA=Likely to Adversely Affect; NLAA=May Affect, Not Likely to Adversely Affect; NE = No Effect

2.6 Cumulative Effects

The implementing regulations for section 7 define cumulative effects to include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

2.6.1 Bull Trout

Within the action area, there are numerous State, Tribal, local, and private actions that potentially affect bull trout. Many of the categories of on-going activities with potential effects to bull trout and bull trout critical habitat were identified in the Status of the Species and Environmental Baseline sections of this Opinion. These activities include timber harvest, road building, grazing, water diversion, residential development, and agriculture. The Service assumes that future private and State actions will continue within the action area, and will increase as human population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, and residential development is also likely to grow. The effects of

new development caused by that demand are likely to reduce the conservation value of bull trout habitat within the action area.

City, state, and county governments have ongoing weed spraying programs, some with less-stringent measures to prevent water contamination. Unknown amounts of herbicides are sprayed annually (and sometimes several times a year) along road right-of-ways by state and county transportation departments. Private landholders also spray unknown chemicals in unknown amounts. Any private herbicide use could potentially combine with contaminants from other Federal and non-Federal activities, and could contribute to formation of chemical mixtures or concentrations that could kill or harm bull trout. In addition, fish stressed by elevated sediment and temperatures are more susceptible to toxic effects of herbicides. While the mechanisms for cumulative effects are clear, the actual effects cannot be quantified due to a lack of information about chemical types, quantity, and application methods used.

Ongoing actions that result in beneficial effects to fisheries resources include those actions aimed at protecting, enhancing, or restoring aquatic and riparian habitat in the basin. Activities carried out by State, Tribal, and local governments under the various salmonid recovery planning efforts will continue in the future throughout the listed species' range, including the action area. For example, the Salmon Recovery Funding Board will continue to provide grants to local organizations in watersheds in the action area to restore and protect salmon habitat, and State salmon recovery plans will continue to provide a recovery framework for various fish populations in the action area. Such future State, Tribal, and local government actions adhering to the plans will likely to be implemented through legislation, administrative rules, policy initiatives, or permitting. Government and private actions may include changes in land and water uses (including ownership and intensity) and habitat improvements, any of which could impact listed species or their habitat. Watershed assessments and other educational programs may further reduce the adverse effects associated with land uses in the action area by continuing to raise public awareness about the potentially detrimental effects of various land uses (e.g., timber harvest, roads, and grazing) on salmonid habitat.

Although these factors are ongoing to some extent and likely to continue in the future, past occurrence is not a guarantee of a continuing level of activity. That will depend on whether there are economic, administrative, and legal impediments or safeguards in place. Therefore, although the Service finds it likely that the cumulative effects of these activities will have adverse effects commensurate with or greater than those of similar past activities, it is not possible to quantify these effects.

2.6.2 Bull Trout Critical Habitat

Within the action area, there are numerous State, Tribal, local, and private actions that potentially affect bull trout critical habitat. Many of the categories of on-going activities with potential effects to bull trout critical habitat were identified in the Status and Environmental Baseline sections of this Opinion (sections 2.3.2 and 2.4.2). These activities include timber harvest, road building, grazing, water diversion, residential development, and agriculture. The Service assumes that future private and State actions will continue within the action area, and will increase as human population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, and residential development is also

likely to grow. The effects of new development caused by that demand are likely to reduce the conservation value of bull trout critical habitat within the action area.

City, state, and county governments have ongoing weed spraying programs, some with less stringent measures to prevent water contamination. Unknown amounts of herbicides are sprayed annually (and sometimes several times a year) along road right-of-ways by state and county transportation departments. Private landholders also spray unknown chemicals in unknown amounts. Any private herbicide use could potentially combine with contaminants from other Federal and non-Federal activities, and could contribute to formation of chemical mixtures or concentrations that could impact water quality (PBF 8). While the mechanisms for cumulative effects are clear, the actual effects cannot be quantified due to a lack of information about chemical types, quantity, and application methods used.

2.7 Conclusion

2.7.1 Bull Trout

The Service has reviewed the current status of bull trout, the environmental baseline in the action area, effects of the Snake River Sockeye Salmon Hatchery Program, and cumulative effects, and it is our conclusion that the ongoing action is not likely to jeopardize the continued existence of bull trout. The only program activities adversely affecting bull trout are broodstock collection and RM&E activities involving weirs, smolt traps, seines, gill-netting, angling, and trawling during which bull trout are incidentally captured and handled, potentially resulting in harm or mortality. These activities are implemented by IDFG and the SBT throughout the action area in the Salmon River Basin in bull trout FMO habitat. Snake River sockeye broodstock collection and RM&E do not occur in bull trout spawning and rearing habitat. Because adverse effects are limited to individual feeding, migrating, or overwintering bull trout, the Service does not expect adverse effects at the larger population, core area, recovery unit, or rangewide levels.

2.7.2 Bull Trout Critical Habitat

The Service has reviewed the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the Snake River Sockeye Salmon Hatchery Program, and cumulative effects, and it is our conclusion that the ongoing action is not likely to destroy or adversely modify designated critical habitat for bull trout. Incidentally capturing bull trout through the use of weirs, seines, gill-nets, angling, and smolt traps is likely to disrupt bull trout migratory movements and likely to adversely affect migratory corridors (PBF 2) of bull trout critical habitat. However, broodstock collection and RM&E activity will only impact bull trout FMO habitat; not spawning and rearing habitat. Because adverse effects are limited to discrete reaches of FMO habitat, we are not expecting adverse effects to bull trout critical habitat at the larger CHSU, CHU, or rangewide designation levels.

2.8 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species, respectively, without specific exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by NMFS and BPA, as the federal action agencies, for the exemption in section 7(o)(2) to apply. These requirements may become binding conditions of any authorizations or funding contracts issued to the program operators (i.e., IDFG and SBT). The NMFS and BPA have a continuing duty to regulate the activities covered by this incidental take statement. If NMFS or BPA (1) fail to assume and implement the terms and conditions, or (2) fail to require the program operators to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the authorization or funding contract documents, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS, BPA, IDFG, and SBT must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

2.8.1 Form and Amount or Extent of Take Anticipated

The Service has determined that broodstock collection and RM&E activities using weirs, smolt traps, seines, angling, gill-netting, and trawling are likely to result in the incidental take of bull trout in the form of harm (and potentially mortality) from stress and injury related to handling and delayed migration (see section 2.5.1.1 for details). Table 11 shows the Incidental Take Limits for the Snake River sockeye hatchery program. The low limits for lethal take shown in Table 11 are not unreasonable to expect, based on past reported capture rates (e.g., see Appendix B of the Assessment), the nature of many of the activities, and the associated stress from handling. We opted to provide some margin for unforeseen circumstances for activities where no or very low take has been reported in the past without providing for excessive take. The fact that mortality is possible in all circumstances is based on reported take for a number of the activities and the similar nature of handling and processing that occurs.

Table 11. Annual incidental take limits for Snake River Sockeye Salmon Hatchery Program broodstock collection and RM&E activities.

Activity	Method	Facility or Water Body	Agency Operators	Dates of Activity	Incidental Take Limits	
					Sub-lethal	Lethal
Adult Collection/Weir Monitoring (Broodstock Collection and RM&E)	Weir	Sawtooth Hatchery (Salmon River*	IDFG	mid Jun – mid Oct	50*	3
		Redfish Lake Creek	IDFG	mid Jun – mid Oct	300	6
	Seine	Sawtooth Hatchery	IDFG	Sep (2 days)	30	3
Juvenile Outmigration Monitoring (RM&E)	Weir smolt trap	Redfish Lake Creek	IDFG**	Apr-Jun	10	2
	Angling	Redfish Lake Creek	IDFG**	Apr-Jun	5	2
	Screw Trap	Alturas Lake Creek	SBT	mid-Apr – mid-Jun	2	1
	Screw Trap	Salmon River	IDFG	Mar-Nov	80	1
	Weir	Pettit Lake Creek	SBT	mid-Apr-mid-Jun	2	1
Population Abundance Monitoring (RM&E)	Power boat – trawling	Redfish Lake, Pettit Lake	IDFG**	mid to late Aug	2	1
	Gill-netting	Pettit Lake	SBT	mid-Jan - Mar	2	1

*Use of the Sawtooth Hatchery weir for collecting sockeye salmon occurs during the same timeframe as that trapping of spring Chinook salmon. Therefore the incidental take of bull trout for the Snake River sockeye program is covered in the Biological Opinion for the Hells Canyon and Salmon River Steelhead and Spring/Summer Chinook Salmon Hatchery Programs (USFWS 2017).

**IDFG is authorized to take bull trout during RM&E through their section 6 agreement with the Service. However, unless specifically designated as agents of the state, section 6 coverage does not extend to the federal action agencies. Therefore, the federal action agencies are covered under the Act for all incidental take shown in Table 11 by this incidental take statement as described herein.

NMFS and BPA will exceed the authorized level of take if the above incidental take limits are exceeded or if take occurs outside the water bodies or the timeframes shown in Table 11. If the authorized level of take is exceeded, contact and coordinate with the Service immediately to assess the feasibility of adjusting the particular activity to allow for its continued operation.

This Incidental Take Statement remains valid until September 27, 2023 when NMFS's section 10(a)(1)(A) permits issued to IDFG and NMFS's Northwest Fisheries Science Center expire.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the bull trout across its range.

Program broodstock collection and RM&E activities occur in FMO habitat in the water bodies shown in Table 11; as such only adult, subadult, and outmigrating juvenile bull trout will be subject to incidental take. Because adverse effects are limited to individual feeding, migrating, and overwintering bull trout, we are not expecting adverse effects at the larger population, core area, recovery unit, or rangewide levels. Conservation measures incorporated into the hatchery program are expected to reduce the level of incidental take.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measure is necessary and appropriate to minimize the take of bull trout caused by the proposed action.

- Minimize the potential for harm and mortality to bull trout from trapping related stress and injury and migration delays.

2.8.4 Terms and Conditions

- Implement the Snake River Sockeye Salmon Hatchery Program as described in the Assessment and this Opinion, including implementation of all applicable conservation measures, especially the measures described in sections 2.1.3.3.1 and 2.1.3.3.3 of this Opinion.

2.8.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Federal agencies or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)].

1. Annually by March 31, for the previous calendar year, the action agencies (or Program operators on behalf of the action agencies, as directed through authorizations or funding contracts) shall provide a report to the Service documenting the number of bull trout captured and handled during implementation of the activities shown in Table 11. The report shall include the date each bull trout was captured and released, as well as general information on life history stage and condition at capture (e.g., presence of injuries). Submit all reports to: U.S. Fish and Wildlife Service, Idaho Fish and Wildlife Office, 1387 S. Vinnell Way, Suite 368, Boise, Idaho 83709.
2. In the event that the number of bull trout incidentally killed by broodstock collection and RM&E activities exceeds the limits set forth in Table 11, immediately cease the activity resulting in death, and notify the Service's Idaho Fish and Wildlife Office (IFWO) (208-378-5243). Such notification must be followed up in writing to the IFWO within 3 working days, at which time the agency operator must provide a report of the

circumstances that led to the mortality, including: date, time, and precise location; disposition of the dead or injured bull trout[17]; and a description of the changes in activity protocols that will be implemented to reduce the likelihood of such injury or mortality from reoccurring. The incident should also be discussed in the annual report that is subsequently submitted.

2.9 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

1. Coordinate bull trout recovery with listed anadromous fish species recovery in the Salmon River Geographic Region.
2. In order to increase our understanding of bull trout movements in the mainstem lower Snake and Columbia rivers and interactions between subbasin bull trout populations, work with partners to collect genetic samples (e.g., fin clips) from all un-marked bull trout that are handled in the mainstem (e.g., Lower Granite Dam adult trap) or lower reaches of tributary subbasins to establish origin. In addition, these same fish should be PIT-tagged if possible so their movements can be determined from the wide array of PIT detection sites at the mainstem dams and within tributary subbasins (Barrows et al. 2016, pp. 199-200).

[17] Designated depository: The Idaho Museum of Natural History, Dr. C. R. Peterson, Curator of Fish, Campus Box 8007, Idaho State University, Pocatello, Idaho 83209.

2.10 Reinitiation Notice

This concludes formal consultation on the continued operation of the Snake River Sockeye Salmon Hatchery Program. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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