HATCHERY AND GENETIC MANAGEMENT PLAN

Hatchery Program:	Snake River Sockeye Salmon Captive Broodstock, Research and Production
Species or Hatchery Stock:	Snake River Sockeye Salmon *Oncorhynchus nerka*
Agency/Operator:	State of Idaho – Department of Fish & Game
Watershed and Region:	Stanley Basin/Upper Salmon River, Custer County, Idaho
Date Submitted:	November 2010
Date Last Updated:	November 2022

EXECUTIVE SUMMARY

Precipitous declines of Snake River Sockeye salmon *Oncorhynchus nerka* led to their Federal listing as endangered in 1991 (56 FR 58619). In that same year, the Idaho Department of Fish and Game (IDFG), National Oceanic and Atmospheric Administration (NOAA), and the Shoshone-Bannock Tribes (SBT) initiated a captive broodstock program to maintain Snake River Sockeye salmon and prevent species extinction. The long-term program goal is to reestablish Sockeye salmon runs to Sawtooth Valley waters and to provide sport and treaty harvest opportunities. The near-term program goals are to increase the number of individuals in the population through captive broodstocks and traditional hatchery production at Springfield Fish Hatchery, and slow the loss of critical population genetic diversity and heterozygosity. The population abundance level established by NOAA Fisheries to achieve de-listing criterion is 2,500 Sockeye adults, of which 1,000 must be in Redfish Lake, 1,000 in Alturas Lake and 500 in Pettit Lake.

To meet this criterion, the program is using a three phased approach. In Phase 1, captive broodstocks were used to prevent extinction, increase adult abundance through various release strategies, and maintain the population's genetic integrity. Phase 2 is the recolonization phase. More natural origin adults will be included in the hatchery programs to reduce domestication selection, and anadromous adults of natural and hatchery origin will be released into Sawtooth Valley lakes to increase natural production. Phase 3 will be the local adaptation phase. The captive broodstocks will be phased out and Springfield Fish Hatchery broodstock will be provided by natural and hatchery-origin returns to basin lakes. Eventually, this will lead to an integrated program that achieves Hatchery Scientific Review Group (HSRG)-recommended PNI levels. The program is currently in Phase 2.

The purpose of the Snake River Sockeye hatchery program is to mitigate for fish losses caused by the construction and operation of the Federal Columbia River Power System (FCRPS). In the 2008 FCRPS Biological Opinion, NOAA-Fisheries established a juvenile Sockeye production target for this program of one million smolts, which is now being supplied by Springfield Fish Hatchery.

Since 2012, the Sockeye program continues to maintain captive broodstocks at Eagle Fish Hatchery, ID and Manchester Research Station, Manchester WA, collect anadromous adults for inclusion into these broodstocks, added a production hatchery at Springfield, ID, and continued RM&E efforts to ensure optimal program function. Adaptively managed, the program produces mainly hatchery-produced smolts and adults for reintroduction to Sawtooth Valley waters. Emphasis is placed on the annual development of genetically diverse broodstocks. Fish culture variables (e.g., broodstock mating designs, in-hatchery survival, maturation success, fecundity, egg survival to eye, and fish health) are continuously monitored. Natural production, SAR, and adult conversion to the basin are also monitored. In combination, these evaluations ensure maximum program success. Program methods and results undergo constant review through the Stanley Basin Sockeye Technical Oversight Committee, a team of technical experts assembled to review program results and to guide program direction.

After completion of Springfield Fish Hatchery in 2013, the Sockeye Program moved away from the "spread-the-risk" release strategy to focus on smolt and adult releases in the

Sawtooth Valley. However, other life-stages may be released to maintain Springfield Fish Hatchery inventory at target levels, if necessary. The current annual program production goals are as follows:

- 1,000,000 smolts planted at the outlet of Redfish Lake
- A minimum of 250 full-term hatchery adults released in Redfish Lake, and
- 100 full-term hatchery adults released in Pettit Lake

Through 2021, the IDFG and NOAA Fisheries hatchery programs have produced in excess of 1,955,000 pre-smolts, 7,139,000 smolts, 17,800 adults, and 1,108,000 eyed-eggs for reintroduction to Sawtooth Valley lakes and tributary streams. Between 1991 and 2021, approximately 402,415 unmarked Sockeye salmon smolts (estimated) emigrated from project lakes. The vast majority of these were produced by hatchery origin parents successfully spawning in the natural environment. An additional 607,066 (estimated) smolts have emigrated from basin lakes originating from hatchery origin pre-smolts during this period.

In 1999, the first hatchery-produced, anadromous Sockeye salmon returned to the program. In that year, seven age-3 adults (six males and one female) were trapped at project locations. In 2000, the program experienced its first significant return of hatchery-produced adults when 257 Sockeye salmon returned to collection facilities on Redfish Lake Creek and at the IDFG Sawtooth Fish Hatchery. Between 2010 and 2021, over 5,900 adult Sockeye salmon have returned to the project area.

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 (pHOS, pNOB, and PNI); (2) number of smolts 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.

Currently, Phase 1 of the program (captive broodstocking) has been achieved and the program has transitioned to Phase 2 of population recovery (recolonization). The increased production capacity necessary for this transition was provided by the Springfield Fish Hatchery (Bingham County, ID). Future recovery efforts in Alturas Lake will require further discussion and be consistent with the NOAA recovery plan for Snake River Sockeye salmon.

This *Hatchery and Genetic Management Plan* submittal is intended to be a "living document" meant to guide the current and near-term programmatic activities associated with Snake River Sockeye salmon. Program activities and recommendations will continue to change as recovery plans and species delisting criterion are established for this population.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 NAME OF HATCHERY OR PROGRAM

Hatchery: Eagle Fish Hatchery
Program: Snake River Sockeye Salmon Captive Broodstock, Research, and Production

Hatchery: NOAA Fisheries (Burley Creek Hatchery and Manchester Research Station)
Program: Snake River Sockeye Salmon Captive Broodstock, Research, and Production

Hatchery: Springfield Fish Hatchery
Program: Snake River Sockeye Salmon Captive Broodstock, Research, and Production

1.2 SPECIES AND POPULATION (OR STOCK) UNDER PROPAGATION, AND ESA STATUS

Snake River Sockeye salmon – *Oncorhynchus nerka*

The Snake River Sockeye salmon ESU was listed as Endangered under the federal Endangered Species Act in 1991 (56 FR 58619) and includes all anadromous and residual Sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated Sockeye salmon from the Redfish Lake captive brood propagation program (Figure 1).

1.3 RESPONSIBLE ORGANIZATION AND INDIVIDUALS

Primary Lead
Name (and title): Dr. Matthew Corsi, Research Manager
Agency or Tribe: State of Idaho – Department of Fish & Game
Address: 600 S. Walnut, P.O. Box 25, Boise, Idaho 83707
Telephone: (208) 854-8963
Fax: (208) 334-4885
Email: matthew.corsi@idfg.idaho.gov

Secondary Leads
Name (and title): Cassie Sundquist, Production Program Coordinator
Agency or Tribe: State of Idaho – Department of Fish & Game
Address: 600 S. Walnut, P.O. Box 25, Boise, Idaho 83707
Telephone: (208) 287-2780
Fax: (208) 334-4885
Email: cassie.sundquist@idfg.idaho.gov

Name (and title): David Venditti, Principal Fisheries Research Biologist
Agency or Tribe: State of Idaho – Department of Fish & Game
Address: 1800 Trout Road, Eagle, Idaho 83616
Telephone: (208) 939-6713
Fax: (208) 939-2415
Email: david.venditti@idfg.idaho.gov

On-Site Operations Leads

Name (and title): Dan Baker, Hatchery Manager II (Eagle Fish Hatchery)
Agency or Tribe: State of Idaho – Department of Fish & Game
Address: 1800 Trout Road, Eagle, Idaho 83616
Telephone: (208) 939-4114
Fax: (208) 939-2415
Email: dan.baker@idfg.idaho.gov

Name (and title): Brandon Filloon, Hatchery Manager II (Springfield Fish Hatchery)
Agency or Tribe: State of Idaho – Department of Fish & Game
Address: 1830 W. 950 S., Springfield, Idaho 83277
Telephone: (208) 328-9945
Fax: No Fax available
Email: brandon.filloon@idfg.idaho.gov

Name (and title): Erin Andyke, F&W Hatchery Manager (Oxbow Fish Hatchery)
Agency or Tribe: State of Oregon – Department of Fish & Wildlife (ODFW)
Address: 1200 SE Frontage Road, Cascade Locks, Oregon 97014
Telephone: (541) 374-8540
Fax: (541) 374-8827
Email: Oxbow.Hatchery@odfw.oregon.gov

Field Operations Lead

Name (and title): Eric Johnson, Senior Fisheries Research Biologist
Agency or Tribe: State of Idaho – Department of Fish & Game
Address: 1414 E. Locust Lane, Nampa, Idaho 83686
Telephone: (208) 939-6713
Fax: (208) 939-2415
Email: eric.johnson@idfg.idaho.gov

Primary Lead

Name (and title): Kurt Tardy, Fisheries Manager
Agency or Tribe: Shoshone-Bannock Tribes
Address: P.O. Box 306, Fort Hall, ID 83203
Telephone: 208-239-4562
Fax: 208-478-3986
Email: ktardy@sbtribes.com

Primary Lead

Name (and title): Dr. Barry Berejikian, Supervisory Research Fishery Biologist & Station Chief, Manchester Research Station
Agency or Tribe: NOAA Fisheries
Address: 7305 Beach Dr. East, Port Orchard, WA 98366-8204
Telephone: (360) 871-8301
Fax: (206) 842-8364
Email: barry.berejikian@noaa.gov

Primary Lead and Project Manager

Name (and title): Dr. Christopher Tatara, Supervisory Fishery Research Biologist
Agency or Tribe: NOAA Fisheries
Address: 7305 Beach Dr. East, Port Orchard, WA 98366-8204
Telephone: (360) 871-8304 office (360) 265-0862 cell
Fax: (206) 842-8364
Email: chris.p.tatara@noaa.gov

On-Site Operations Lead

Name (and title): Deborah Frost, Fishery Biologist
Agency or Tribe: NOAA Fisheries
Address: 11421 Bethel Burley Rd. SE, Port Orchard, WA 98367
Telephone: (360) 895-7757 office (360) 990-5629 cell
Fax: (360) 842-8364
Email: debbie.frost@noaa.gov

Figure 1. Snake River Sockeye ESU.

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

- **Bonneville Power Administration** – Funding agency and facilitator of Stanley Basin Sockeye Technical Oversight Committee

- **National Oceanic & Atmospheric Administration (NOAA) Fisheries** – Co-culture of Snake River Sockeye salmon at NOAA's Manchester Research Station and Burley Creek Fish Hatchery (Manchester, WA).

- **Shoshone-Bannock Tribes** – The Shoshone-Bannock Tribes conduct lake habitat investigations and Sockeye-specific monitoring and evaluation in Redfish, Alturas, and Pettit lakes.

- **Oregon Department of Fish & Wildlife (ODFW)** – ODFW provides personnel and rearing space for smolt production, acclimation, release, and adult trapping at the ODFW Oxbow Hatchery and Bonneville Hatchery (Cascade Locks, OR).

1.4 FUNDING SOURCE, STAFFING LEVEL, AND ANNUAL HATCHERY PROGRAM OPERATIONAL COSTS

- **Funding source** - Bonneville Power Administration (BPA)

- **Staffing** - The IDFG Sockeye program is divided into two programmatic components consisting of both hatchery and research elements. A total of eight permanent staff and up to 12 temporary staff address the annual personnel needs for the program.

- The NOAA Fisheries hatchery program is staffed by five permanent employees and one term employee.

- The Shoshone Bannack Tribes Sockeye program is staffed by 3 permanent employees and 2 contract staff.

- **Budget** - The current federal fiscal year (FY22) BPA contract for the IDFG program is approximately $2,861,000 (Eagle & Springfield hatcheries; personnel/operating/capital combined). The federal fiscal year (FY22) BPA contract for the NOAA Fisheries program is $1,103,000 (personnel/operating/capital combined) and the FY22 federal fiscal year BPA contract for the Shoshone –Bannock Tribes is $521,231.

- Oxbow Hatchery is primarily funded via a Pacific States Treaty (PST) contract for approximately $850,000/year and a nominal amount of state funds for $40,000/year. The state funds are directed towards sockeye smolt production. Oxbow Hatchery facilities are staffed with three employees with a fourth pending.

1.5 LOCATION(S) OF HATCHERY AND ASSOCIATED FACILITIES

Eagle Fish Hatchery – Eagle Fish Hatchery is located in Ada County, Idaho near the town of Eagle; latitude 43° 40’ 40” N and longitude 116° 24’ 11” W.

Sawtooth Fish Hatchery (IDFG) – Sawtooth Fish Hatchery (SFH) is in Custer County, Idaho near the town of Stanley; latitude 44° 8’ 59” N and longitude 114° 52’ 55” W. SFH is adjacent to the Salmon River (Salmon River subbasin) at river kilometer code 503.303.617; hydrologic unit code for the facility is 17060201.

Manchester Research Station (NOAA) – Manchester Research Station is in Kitsap County, Washington near the City of Port Orchard; latitude 47° 34’ 14” N and longitude 122° 33’ 11” W.

Burley Creek Fish Hatchery (NOAA) – Burley Creek Fish Hatchery is in Kitsap County, Washington near the City of Port Orchard; latitude 47° 26’ 36” N and longitude 122° 37’ 52” W.

Springfield Fish Hatchery (IDFG) – Springfield Fish Hatchery is located in Bingham County, Idaho, near the town of Springfield, latitude 43˚ 03’ 36” N and longitude 112˚ 39’ 29” W (Figure 2).

Oxbow Hatchery (ODFW) – Oxbow Hatchery is in Hood River County, Oregon near the town of Cascade Locks; latitude 45° 40’ 32” N and longitude 121° 51’ 31” W.

Bonneville Hatchery (ODFW) – Bonneville Hatchery is in Multnomah County, Oregon near the town of Cascade Locks; latitude 45° 38’ 02” N and longitude 121° 57’ 23” W.

Redfish Lake Creek weir (IDFG) – The weir is located in Custer County, Idaho near the town of Stanley; latitude 44° 09’ 1” N and longitude 114° 54’ 51” W.

Pettit Lake Creek weir (SBT) – Pettit Lake Creek weir is located in Blaine County, Idaho between the towns of Sawtooth City and Stanley, Idaho; latitude 43° 59’ 1.12” N and longitude 114° 51’ 38.93” W. The weir spans Pettit Lake Creek at river kilometer code 522.303.633.002.

1.6 GOAL OF PROGRAM

The management goal for the Snake River Sockeye salmon population is to increase the abundance of the natural population to a level that exceeds the Endangered Species Act delisting criterion set by NOAA-Fisheries. The criterion is for a spawning population of 2,500 natural-origin Sockeye salmon, of which 1,000 must be in Redfish Lake, 1,000 in Alturas Lake, and 500 in Pettit Lake. Additionally, population growth rate must be stable or increasing, and low to very low risk ratings for highly viable populations and moderate risk rating for viable populations (NOAA 2015). To meet this criterion, the program is using a three-tiered approach: (1) increasing the number of adult Sockeye returns; (2) incorporating more natural-origin returns in hatchery spawning designs and increasing natural spawning escapement; and (3) moving towards the development of an integrated program that achieves HSRG recommended Proportionate Natural Influence (PNI) levels.

This HGMP submittal is intended to be a "living document" meant to guide the current and near-term programmatic activities associated with Snake River Sockeye salmon. Program activities and recommendations will continue to change as recovery plans and species delisting criterion are established for this population.

1.7 PURPOSE OF PROGRAM

The purpose of the Snake River Sockeye hatchery program is to mitigate for fish losses caused by the construction and operation of the Federal Columbia River Power System (FCRPS). In the 2008 FCRPS Biological Opinion, NOAA-Fisheries established a juvenile Sockeye production target for this program of one million smolts.

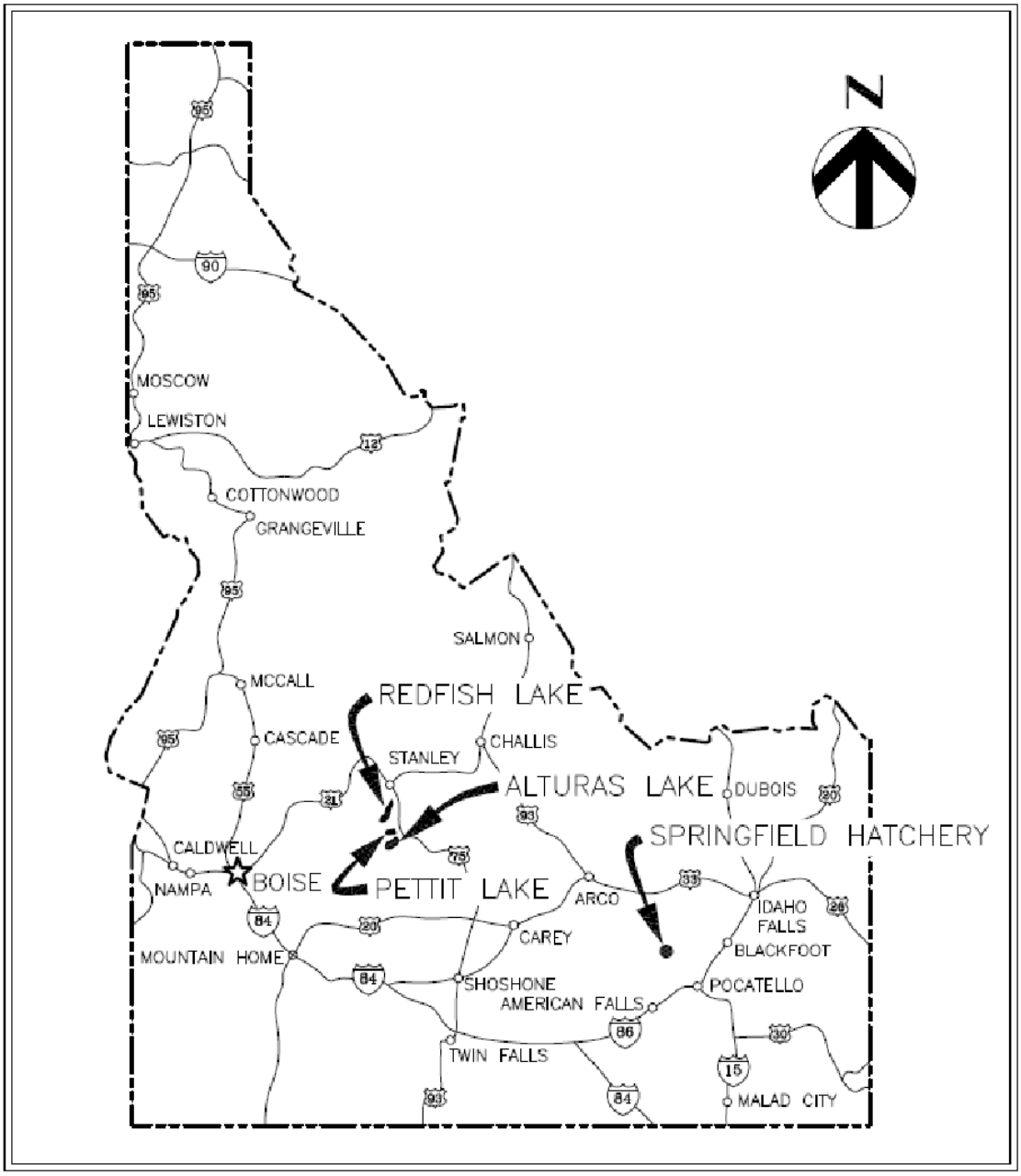

Figure 2. Location of Springfield Fish Hatchery and Sockeye salmon smolt and/or adult release locations in the Sawtooth Valley.

1.8 PROGRAM DESCRIPTION

The current program incorporates the use of state-of-the-art hatchery facilities, captive broodstock technology, cutting-edge genetic support, and a comprehensive research, monitoring, and evaluation plan outlined in the Snake River Sockeye Salmon Recovery Plan (NOAA Fisheries 2015) to maintain the genetic resource and to continue rebuilding numbers of fish in

the natural environment. Annually, the program produces eggs and fish for reintroduction into natal waters (Redfish and Pettit lakes, Redfish Lake Creek, and the upper Salmon River).

To guard against catastrophic loss at any one brood facility, the captive broodstock components of the program are duplicated at facilities in both Idaho (Eagle Fish Hatchery) and Washington (Manchester Research Station, Burley Creek Fish Hatchery). Eggs produced from annual spawning events at both locations are transferred to Springfield Fish Hatchery for continued culture and release, following acclimation at the IDFG Sawtooth Fish Hatchery. Additionally, 3,000 eyed-eggs from spawning events at Eagle Fish Hatchery are retained to source the next generation of captive brood fish at both Eagle and Burley Creek hatchery facilities; 1,500 eyed-eggs remain at Eagle Fish Hatchery and 1,500 are shipped Burley Creek Fish Hatchery. Eyed-eggs distributed to both programs represent all spawn crosses made at Eagle Fish Hatchery.

Consistent with language contained in the ESA Recovery Plan for Snake River Sockeye (NOAA 2015), Springfield Fish Hatchery Master Plan (IDFG 2010), and the Idaho Fish Accords, the program is currently producing up to 1 million full-term smolts annually at Springfield Fish Hatchery for release to Sawtooth Valley waters. Eyed-eggs for this program are sourced from the captive broodstocks at Eagle Fish Hatchery and Manchester Research Station.

In addition to smolt releases into Sawtooth Valley waters, 50,000 eyed-eggs will be transferred to Oxbow Hatchery to be reared to smolt, acclimated at Bonneville Hatchery, and released into Tanner Creek. Returning adults will be trapped at Bonneville Hatchery.

This small release group will provide the Snake River Sockeye Salmon Captive Propagation project the benefit of increased smolt to adult survival from releases below Bonneville Dam. Smolt to adult return rates (SARs) from the Bonneville Hatchery releases are anticipated to be in the 1% to 4% range, compared to observed SARs of between 0% to 0.02% from fish reared at Springfield Fish Hatchery. In addition, the release of smolts from below Bonneville Dam will allow the Snake River Sockeye Salmon Captive Propagation project to calculate the impacts of migratory corridor survival on productivity as recommended by the Independent Scientific Review Panel (ISRP) in the 2022 review of anadromous fish habitat and hatchery programs. These data will also be available to help parameterize a future life-cycle model for Snake River Sockeye salmon.

As described in the *Springfield Sockeye Hatchery Combined Step 2 and Step 3* submittal (NPCC 2012), the existing captive brood program will eventually be transitioned to conventional hatchery production that uses anadromous adults as broodstock. The primary objectives of Phases 2 and 3 will be (1) gene banking and (2) providing anadromous adults to re-colonize available habitat. These anadromous adults will allow managers to phase out the use of Redfish Lake captive broodstocks to produce the eggs and juveniles required for re-colonization activities.

Proposed program activities in Phase 2 are described below for Redfish and Pettit lakes; future reintroduction actions in Alturas Lake will be consistent with NOAA's recovery plan for Snake River Sockeye salmon (NOAA Fisheries 2015). The key criteria used to manage the program in this phase are:

- Minimum proportion of natural-origin adults used as broodstock (pNOB) will be 10%;

- Anadromous adults included broodstock;
    - Anadromous returning Sockeye will be selected over Eagle Fish Hatchery captive broodstock, if individuals are closely related (i.e., full sibling).
- Average minimum natural-origin escapement of 500 adult Sockeye;
- Average minimum natural-origin and hatchery-origin escapement of 1,300 adult Sockeye;
- Harvest rate of less than 3% of natural-origin returns.

These criteria will be the decision rules for the program. Hatchery management and decision-making will be consistent with achieving the criteria.

All hatchery operations and monitoring activities are funded by the Bonneville Power Administration.

1.9 LIST OF PROGRAM PERFORMANCE STANDARDS

3.1 - Legal Mandates

3.2 - Harvest

3.3 - Conservation of natural spawning populations

3.4 - Life History Characteristics

3.5 - Genetic Characteristics

3.6 - Research Activities

3.7 - Operation of Artificial Production Facilities

3.8 – Socio-Economic Effectiveness

1.10 LIST OF PROGRAM PERFORMANCE INDICATORS DESIGNATED BY BENEFITS AND RISKS

Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced in Tables 1, 2, and 3 correspond to numbers in Section 1.9.

Modified Performance Standards were created for Springfield Hatchery. The monitoring and evaluation plan is designed to ensure that the program achieves these standards established for natural production and in-hatchery culture practices and operations (Table 3).

Table 1. Performance indicators addressing the benefits of the current program.

Performance Standard	Performance Indicator	Monitoring & Evaluation
3.1 – Legal Mandates		

Performance Standard	Performance Indicator	Monitoring & Evaluation
3.1.3: Program addresses ESA responsibilities.	Project has conducted NOAA Fisheries Section 10 consultation and has provided an HGMP; sponsors along with NOAA staff have developed a Recovery Plan.	Required data generated annually and provided to NOAA Fisheries as required.
3.3 – Conservation of Wild/Naturally Spawning Populations		
3.3.1: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	Annual number and age of anadromous and captive spawners known; residual spawner counts conducted throughout spawning season.	Monitor annual spawner counts and redd production; monitor natural smolt production and parental contribution; annual trawling for population abundance.
3.3.2: Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	All production releases are marked to identify juveniles and adults to specific release strategies; genetic evaluations established to identify both captive and natural production strategies.	Mark groups and genetic technologies (i.e., PBT) allow evaluation of program contribution to target population (both natural and captive populations).

Table 2. Performance indicators addressing risks associated with the current program.

Performance Standard	Performance Indicator	Monitoring & Evaluation
3.2 – Harvest		
3.2.2: Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	All production releases are marked to identify juveniles and adults to specific release strategies; genetic evaluations established to identify natural production strategies.	Adipose fin clip quality checks are performed at marking. PBT tagging rate is determined by parental genotyping success estimated annually (typically >98%). PIT tags estimate emigration survival.
3.4 – Life History Characteristics		
3.4.1: Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Broodstock are sourced throughout the return and/or spawning period as appropriate; replacement brood sourced from all spawn crosses and from equalized individual and family representation.	Annual spawning and brood sourcing consistent with Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) and NOAA Northwest Fisheries Science Center genetics staff recommendations.
3.4.2: Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Artificial propagation program contributes to increased number of naturally produced juveniles in nursery lakes.	Sockeye Monitoring and Evaluation (M&E) element documents increasing numbers of naturally produced juveniles over time.
3.4.3: Life history characteristics of the natural population do not change as a result of this artificial production program.	Artificial propagation program does not change life history characteristics of natural population.	Hatchery and M&E elements monitor the following characteristics annually: juvenile migration timing, juvenile size at emigration, adult return timing, adult return age and

Performance Standard	Performance Indicator	Monitoring & Evaluation
		sex composition and size at return, spawn timing and distribution, fecundity and egg size.
3.4.4: Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and near-shore rearing.	IDFG and cooperators conduct annual investigations to address habitat carrying capacity, population dynamics, and system productivity.	Population estimates are determined by trawling and hydroacoustics. Limnological studies quantify food resources. Production releases approved annually and consistent with SBSTOC recommendations.
3.5 – Genetic Characteristics		
3.5.1: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Founder genetic profiles known and compared to genetic profiles developed each successive generation.	Intensive annual genetic monitoring of captive and anadromous contributors (Eagle Fish Genetics Laboratory).
3.5.2: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.	Patterns of genetic variation do not change significantly as a result of artificial population.	Intensive annual genetic monitoring of captive and anadromous contributors (Eagle Fish Genetics Laboratory).
3.5.3: Artificially produced origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning populations.	Captive broodstock program initiated to preserve and augment natural spawning population.	Annual production of listed fish to natural environment (see annual reports and/or release tables).
3.5.4: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Program currently provides acclimation of all smolt release groups at Sawtooth Fish Hatchery to temper water chemistry differences between Springfield Fish Hatchery and Redfish Lake Creek and maximize homing. See Sec. 10.6	n/a
3.7 – Operation of Artificial Production Facilities		
3.7.1: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, and INAD.	- Annual reports indicating level of compliance with applicable standards and criteria. - Periodic audits indicating level of compliance with applicable standards and criteria.	See CBFish.org for annual reporting. Reports are available upon request. Facilities have completed a Best Management Practices (BMP) document that is updated as appropriate.
3.7.2: Effluent from artificial production facility will not detrimentally affect natural populations.	- Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, including pertinent State of Idaho water quality plans	See CBFish.org for annual reporting. Reports are available upon request.

Performance Standard	Performance Indicator	Monitoring & Evaluation
	relating to temperature, nutrient loading, chemicals, etc.	
3.7.3: Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	- Water withdrawals compared to applicable passage criteria. - Water withdrawals compared to NOAA, USFWS, and IDFG juvenile screening criteria. - Number of adult fish aggregating and/or spawning immediately below water intake point. - Number of adult fish passing water intake point. - Proportion of diversion of total stream flow between intake and outfall.	Water withdrawal permits have been obtained to establish water rights for each hatchery facility. Intake system designed to deliver permitted flows. Operators monitor and report as required. Hatcheries participating in the programs will maintain all screens associated with water intakes in surface water areas to prevent impingement, injury, or mortality to listed salmonids.
3.7.4: Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	- Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence. - Juvenile densities during artificial rearing. - Samples of natural populations for disease occurrence before and after artificial production releases.	Certification of fish health conducted prior to release (major bacterial, viral, parasitic pathogens); IDFG's Eagle Fish Health Lab professionals sample and certify all release and/or transfer groups. A small number of natural emigrants screened for pathogens.
3.7.5: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.	n/a	n/a
3.7.6: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	- Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.	Artificial propagation program does not significantly alter spatial and/or temporal distribution of any naturally produced population.
3.7.7: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	- Mortality rates in trap. - Pre-spawning mortality rates of trapped fish in hatchery or after release.	Facility will maintain all weirs/traps associated with program to either reduce or eliminate stress, injury, or mortality to listed salmonids. Mortality rates are documented.
3.7.8: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	- Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present. - Number of fish in stomachs of sampled artificially produced fish, with estimate of natural fish composition.	Sockeye salmon are not piscivorous.

Performance Standard	Performance Indicator	Monitoring & Evaluation
3.8 – Socio-Economic Effectiveness		
3.8.2: Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	n/a	n/a
3.8.3: Non-monetary societal benefits for which the program is designed are achieved.	n/a	n/a

Table 3. Performance standards, indicators, benefits and risks and proposed monitoring and evaluation for the Sockeye program.

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
3.6 Hatchery Operations and Facilities Research and Evaluation			
Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Broodstock are sourced throughout the return and/or spawning period as appropriate; brood sourced from all spawn crosses and from equalized individual and family representation.	Achieving the broodstock indicator ensures that the hatchery population reflects the characteristics of the natural population to the extent possible by including natural-origin fish as broodstock, collecting fish randomly throughout the entire portion of the run, and including both jacks and adults into the broodstock. As these indicators become less representative of the natural population, the more divergent the two populations become, thereby reducing natural population productivity and diversity. Poor mating protocols may reduce genetic diversity and thereby reduce overall population productivity and reproductive success in the natural environment.	Annual spawning and brood sourcing will be consistent with Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) and NOAA Northwest Fisheries Science Center genetics staff recommendations. Fish for broodstock will be collected throughout the entire run period. Males and jacks will be incorporated in ratios reflective of the natural population over time. Intensive annual genetic monitoring of captive and anadromous contributors at the Eagle Fish Genetics Laboratory. Genetic variation is protected by selecting broodstock that represent the genetic diversity of the entire run, selecting fish over the entire length of the run, selecting individuals from each release strategy, equalizing sex ratios and by equalizing family contribution.
Adult Holding and Spawning Survival Rate	> 95% survival	High survival rates ensure that hatchery operations are not inadvertently selecting for certain genetic or behavioral characteristics.	Hatchery culture staff will enumerate loss by life stage for each brood year. Data to be reported in annual operating reports.
Egg-to-Fry Survival Rate	>85% survival		
Fry-to-Parr Survival Rate	> 90% survival		
Parr-to-Smolt Survival Rate	> 95% survival		
Release Timing, Fish Health, Size and Condition of Released Fish	Fish size, release date and range are similar to natural fish to the extent possible given that their survival rate achieves objectives.	Releasing healthy fish at the correct size and time increases overall survival and reduces the release numbers needed to achieve conservation and harvest objectives. Releasing fish that are too large may increase competition with natural fish populations. A	Springfield Fish Hatchery smolts are acclimated at Sawtooth Fish Hatchery for one to two weeks (see Section 10.6) prior to release into Redfish Lake Creek in response to water chemistry (hardness) differences. Natural fish populations will be monitored in rearing lakes and as they migrate from the system. Data will

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
	Released fish certified by pathologist to be disease-free.	mismatch between release timing and environmental conditions required for good survival may reduce overall hatchery and natural fish performance.	be collected on fish abundance, size and migration timing. Culture staff will track juvenile HOR size, growth rates, health and abundance. These data will be reported in annual reports.
Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	HOR identification rate of >98%	Being able to identify HOR fish allows managers to determine program success and reduce/control negative impacts to natural populations.	HOR juveniles will be marked with a combination of PIT-tags and/or adipose clips; continued use of genetic monitoring tools (parentage based tagging).
Fish release numbers and location do not reduce NOR juvenile production in lakes and other areas	Fish release location consistent with SBSTOC recommendations	HOR fish compete with NOR populations for both food and space and therefore have the potential to reduce natural production. Selecting proper release locations and timing limits this effect.	The SBSTOC will make yearly recommendations of the number of HOR juvenile Sockeye and adults released into the system. These recommendations will be based on the results of research designed to determine lake(s) productivity and juvenile production potential for a given year.
Similar hatchery-origin and natural-origin smolt-to-adult survival rate (SAR)	SAR of HOR ≈ SAR NOR fish	The higher the SAR, the lower the level of hatchery production required to achieve program goals. Smaller hatchery releases result in reduced competition with natural-origin fish which should increase their survival.	Smolts released or captured at monitoring facilities will be marked with a combination of PIT-tags and or adipose clips; use of parentage-based tagging. Adult production will be enumerated in fisheries, carcass surveys, dams and weirs. Smolt-to-adult survival rates will be developed for both hatchery- and natural-origin fish migrating from Redfish Lake, Pettit Lake and Alturas Lake. Data will be made available to regional data centers for analysis and storage. For an example see the DART link below: http://www.cbr.washington.edu/trends/index.php
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread, or amplification of fish pathogens. Follow co-managers' fish health disease policy	Necropsies of fish to assess health, nutritional status, and culture conditions. Performance indicators	Having fewer and less severe disease outbreaks reduces the disease risks that hatchery populations and operations pose to natural populations.	Staff will conduct health inspection of cultured fish. Pathologist implements corrective actions as needed.

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
	will be based on test performed.		
Water diversions and withdrawals do not impact access to spawning and rearing areas	All in-river structures and diversions designed to meet NOAA Fisheries passage criteria	Water diversions and structures can kill juvenile fish through impingement on screens, block or delay access to key habitat, and reduce the amount of this habitat through dewatering of the stream channel	Fish passage facilities and water diversions that have the potential to negatively impact fish will be monitored throughout the year. Screens are constantly inspected for impinged fish and cleaned as needed. Biologists working at weirs and other facilities monitor for fish delay and injury as part of their daily work.
Hatchery effluent discharge requirements are met (Clean Water Act)	Various based on regulations	Achieving high quality hatchery effluent maintains water quality in the receiving stream. Good water quality is essential for the production of all anadromous fish species. Hatchery effluent that degrades water quality may decrease the survival and overall productivity of the natural population.	All hatchery facilities will operate under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit.
Natural Production and Harvest Monitoring			
Achieve Natural Spawner Abundance Targets	Triggers achieved	Program success is determined by the number of NOR adults on the spawning grounds. The higher this value, the more likely the population will be able to maintain itself over time. Triggers also are used to determine when HOR releases are reduced or eliminated, thereby decreasing risk of the program to the natural population.	Determined by monitoring adult escapement to Redfish, Pettit and Alturas lakes*. *All actions will be consistent with the ESA Recovery Plan for Snake River Sockeye Salmon (Oncorhynchus nerka), (NOAA 2015).
Incorporate sufficient number of NOR adults into broodstock collection	pNOB of at least 10%	Achieving the pNOB standard (10%) ensures that the hatchery population does not diverge from the natural component.	The origin (hatchery or natural) of adult fish will be enumerated and classified using genetic analysis and marking information at weirs located on target streams. All natural-origin fish not used for broodstock will be released upstream of the weirs to spawn. Broodstock will consist of at least 20% NOR adults.
Adult run-timing (HOR and NOR)	HOR and NOR run-timing curves are similar over time	For integrated programs, the run-timing of hatchery and natural runs should match, as this is an indicator that the two populations are expressing similar life-histories, and that both	NOR and HOR run-timing data will be collected at weirs located at Redfish Lake and the Sawtooth Fish Hatchery. An additional weir is located at the outlet of

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
		are being exposed and adapting to the full range of environmental conditions present in the basin. A mismatch in run-timing between the two populations (HOR and NOR) indicates that hatchery practices are selecting for life-histories dissimilar to those being expressed by the natural population. The two populations may become more divergent over time resulting in greater genetic impacts to NOR populations from hatchery fish spawning in the natural environment. This could include a loss in productivity, diversity and spatial structure.	Pettit Lake to better enumerate adult production and timing for this system.
Juvenile abundance over time in Pettit, Alturas and Redfish lakes	Increasing trend	Increasing juvenile abundance over time indicates that natural production levels and system productivity are improving.	Juvenile traps will be operated at the outlets of Redfish, Pettit and Alturas lakes. Trap operations and costs are covered by on-going monitoring efforts.
Achieve ESA defined harvest rates on NOR adults	Variable	Managing the system to NOT exceed identified harvest levels maximizes the number of NOR adults returning to spawning areas.	In-season harvest rates are monitored as part of a regional efforts conducted by federal, state, and tribal entities
Achieve the Proportion of Hatchery-Origin Spawners (pHOS) targets	pHOS decreases over the three phases of the program	Limiting the proportion of hatchery fish on the spawning grounds (pHOS) reduces possible genetic impacts to the natural population. The more dissimilar the two populations, the larger the risk hatchery strays pose. In a well-integrated program, the proportion of natural-origin fish in the hatchery brood (pNOB) must exceed the proportion of hatchery fish on the spawning grounds (pHOS). This is to ensure that natural selection has a greater influence than domestication selection on the population.	Weir counts will be used to determine/manage pHOS. Adult weirs currently in operation on Redfish Lake Creek and Pettit Lake Creek are essentially 100% efficient. Because of this, pHOS and pNOS can be estimated or managed directly as adults are passed to enter the lakes.
Proportionate Natural Influence (PNI)	> 0.67 (Phase 3)	Achieving the PNI goal >0.67 ensures that the natural, rather than the hatchery environment, is driving local adaptation. Fish better adapted to the natural environment are more productive and more resilient to environmental change.	Natural escapement rates of HOR and NOR will be monitored and controlled both at the hatchery and the spawning grounds. Natural escapement HOR/NOR ratios will be achieved by operating adult weirs at Redfish Lake, Sawtooth Fish Hatchery, and Pettit Lake.

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
		Low PNI (<0.50) is an indicator that the hatchery environment is driving local adaptation. Fish adapted to this environment are less likely to perform well in the wild and therefore reduce the productivity and diversity of the natural component of the combined population.	Intensive annual genetic monitoring of captive and anadromous contributors to be performed at Eagle Fish Genetics Laboratory. The program has not yet entered Phase 3 of the recovery plan.
Reproductive success of naturally spawning HOR and NOR adults	HOR adult recruits per spawner = NOR adult recruits per spawner	Having HOR recruit per spawner (R/S) values = NOR indicates that the program is producing fish adapted to the natural environment as these HOR spawners produce as many returning adults as their NOR counterparts.	Genetic analysis (e.g. PBT) will be used to determine reproductive success of various hatchery release strategies and the natural population
Straying of program fish to other subbasins or areas	< 5% other subbasins or areas	Good homing fidelity of HOR fish to the hatchery or targeted areas is important for eliminating the genetic risks hatchery fish pose to wild fish from interbreeding. The higher the homing fidelity, the lower the risk. High homing rates also ensure that broodstock are available for culture so that wild populations do not need to be excessively used to achieve production targets.	Regional monitoring and evaluation efforts used to track stray rates out-of-subbasin stray rates

1.11 EXPECTED SIZE OF PROGRAM

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish)

Language contained in the 2008 FCRPS Biological Opinion and Idaho Fish Accords calls for the acquisition of suitable rearing space to expand the smolt rearing component of the program to produce between 500,000 and 1 million full-term smolts annually. The Springfield Fish Hatchery provides rearing space for 1 million smolts, thus achieving this objective. Eggs for this program are produced by the captive broods at IDFG and NOAA facilities, along with anadromous adults trapped at Sawtooth Valley weirs. Eyed egg production goals are provided in Table 4.

Table 4. Annual distribution of Snake River Sockeye eggs under current operations.

Facility (Strategy)	Current Number of Eyed Eggs
IDFG Eagle (Replacement Brood)	1,500
NOAA Facilities (Replacement Brood)	1,500
Basin Lakes (Egg Boxes)	0[a]
IDFG Springfield (Pre-Smolt Releases)	0[b]
IDFG Springfield (Smolt Releases)	1,150,000
ODFW Oxbow (Smolt Releases)	50,000
Total	**1,203,000**

[a] Eggs from females with a moderate ELISA value are outplanted to Basin Lakes

[b] Pre-smolts may be released to reduce inventory at Springfield Fish Hatchery

In Phase 2 and Phase 3 of the program, it is expected that all broodstock will eventually be collected at weirs, and the use of adults from the captive broodstocks in annual spawning events will be phased out. Initially (Phase 2; current operations), the total number of broodstock needed to achieve smolt release targets is 1,150 (Table 5). The minimum target level of NORs represented in the broodstock in Phase 2 is 10%. When the program transitions to Phase 3 (local adaptation, future operations), an increasing number of natural-origin adults will be incorporated in hatchery spawning plans (35% minimum). Concurrently during Phase 3, the proportion of hatchery-origin anadromous adults released to spawn naturally will be limited (<16% of total adults released to Redfish Lake). Accordingly, fitness of the composite population will be driven by the natural component and conform to Columbia River HSRG guidelines for an average PNI value of 67% or higher (IDFG 2010).

Table 5. Broodstock needed for the Snake River Sockeye program.

Broodstock Origin	Proposed Annual Broodstock
Hatchery Origin (HOR)	1,035
Natural Origin (NOR)	115
Total	**1,150**

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

The proposed number of juvenile and adult Sockeye released to Sawtooth Valley lakes in Phase 2 can be found in Table 6. In addition, eyed-eggs from females with moderate ELISA values (0.250 – 0.399) can be placed in egg boxes and deployed in Pettit or Redfish lakes. If fry survival at Springfield Fish Hatchery is on track to exceed the 1 million smolt target, pre-smolt releases into Redfish or Pettit lakes can be used to reduce inventory to target levels. Because HOR releases in Phase 3 will depend on the results from Phase 2, they are not typically discussed in this HGMP. Information on Phase 3 operations are available in IDFG (2010).

Table 6. Proposed Sockeye release numbers and the date, source, size and location of hatchery-reared Snake River Sockeye (Phase 2).

Age Class	Source	Target Number	Size (fpp)	Release Date	Location
Redfish Lake					
Smolts	Springfield	1,000,000	8 – 20	May 1-20	Redfish Lake Subbasin
Redfish Lake Captive Adults	Eagle/NOAA	250 Minimum	0.35	September/ October	Redfish Lake
Pettit Lake[a]					
Redfish Lake Captive Adults	Eagle/NOAA	100 Minimum	0.35	September/ October	Pettit Lake
Alturas Lake[b]					
TBD	Alturas Naturals	NA	0.35	September/ October	Alturas Lake

a - Source of captive brood is Pettit Lake or Redfish Lake-origin fish
b - Source of captive brood unknown and pending further review. To be determined by IDFG, SBSTOC and NOAA consultation.

The number of HOR adults released each year will depend upon HOR and NOR run-size to the basin (Table 7). A set of management triggers will be used to determine when phases occur and the actions to be taken in each (IDFG 2010). In addition, the source and number of fish to be released in Alturas Lake each year will be determined based on the Snake River Sockeye Recovery Plan (NOAA 2015).

Table 7. Adult Sockeye hatchery broodstock requirements and natural escapement targets for Redfish and Pettit lakes at various HOR and NOR run-sizes (Alturas releases pending Recovery Plan).

Run-Size	Hatchery Broodstock			Natural Escapement Targets		
HOR + NOR	No. HOR	pNOB (10%)	Total	Redfish Lake	Pettit Lake	Alturas Lake
1,150	1,035	115	1,150	0	0	0
1,500	1,035	115	1,150	350	0	0
2,000	1,035	115	1,150	850	0	0
2,500	1,035	115	1,150	1,350	0	0
3,000	1,035	115	1,150	1,850	0	0
3,500	1,035	115	1,150	2,350	0	0
4,000	1,035	115	1,150	2,850	0	0
4,500	1,035	115	1,150	3,350	0	0
5,000	1,035	115	1,150	3,800	50	0
5,500	1,035	115	1,150	3,850	500	0
6,000	1,035	115	1,150	4,000	850	0
6,500	1,035	115	1,150	4,200	1,150	0
7,000	1,035	115	1,150	4,400	1,450	0

1.12 CURRENT PROGRAM PERFORMANCE, INCLUDING ESTIMATED SMOLT-TO-ADULT SURVIVAL RATES, ADULT PRODUCTION LEVELS, AND ESCAPEMENT LEVELS. INDICATE THE SOURCE OF THESE DATA.

Program performance gauged by smolt-to-adult (SAR) return rates has varied considerably over the duration of the program. In addition to "standard" hatchery production releases of full-term smolts to basin waters, the program also uses a "natural production" release strategy where pre-spawn adults are outplanted. Progeny produced from adults that spawn naturally in basin lakes are better adapted to lake environments and avoid potential domestication concerns that are associated with artificial production environments.

To date, natural production smolt groups have typically produced the highest SARs in the program, with full-term hatchery smolts producing the second-highest SAR values (Tables 8, 9, and 10).

Table 8. Returns and SAR for BY 2014.

Brood Year	Adult returns by year and age				Total BY Returns	SAR
	2014	2017 (age 3)	2018 (age 4)	2019 (age 5)		
Estimated or actual smolt emigration (total number of emigrants)	653,371	0	112	15	127	0.019%
Actual emigration from Springfield-reared smolt release	540,665	0	0	0	0	0.000%
Actual emigration from ODFW-reared smolt release	94,356	0	100	2	102	0.108%
Estimated emigration from natural production in Redfish Lake	17,959	0	12	11	23	0.128%
Estimated emigration from natural production in Alturas and Pettit lakes (combined)	391	0	0	2	2	0.512%

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Table 9. Returns and SAR for BY 2015.

Brood Year	Adult returns by year and age				Total BY Returns	SAR
	2015	2018 (age 3)	2019 (age 4)	2020 (age 5)		
Estimated or actual smolt emigration (total number of emigrants)	741,032	0	2	1	3	0.0004%
Actual emigration from Springfield-reared smolt release	734,492	0	1	0	1	0.0001%
Estimated emigration from natural production in Redfish Lake	4,232	0	0	1	1	0.024%
Estimated emigration from natural production in Alturas and Pettit lakes (combined)	2,308	0	1	0	1	0.043%

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Table 10. Returns and SAR for BY 2016.

Brood Year	Adult returns by year and age				Total BY Returns	SAR
	2016	2019 (age 3)	2020 (age 4)	2021 (age 5)		
Estimated or actual smolt emigration (total number of emigrants)	820,635	0	141	7	148	0.018%
Estimated emigration from Redfish Lake pre-smolt releases	126,139	0	2	0	2	0.002%
Actual emigration from Springfield-reared smolt release	658,692	0	16	0	16	0.002%
Estimated emigration from natural production in Redfish Lake	29,325	0	85	5	90	0.307%
Estimated emigration from natural production in Alturas and Pettit lakes (combined)	6,479	0	38	2	40	0.617%

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

NOAA (2015) established abundance delisting criteria for this population to be 1,000 naturally-produced adults returning to Redfish Lake, 1,000 naturally-produced adults returning to Alturas Lake, and 500 naturally-produced adults returning to Pettit Lake.

1.13 DATE PROGRAM STARTED (YEARS IN OPERATION), OR IS EXPECTED TO START

The Snake River Sockeye salmon ESU was listed under the federal Endangered Species Act in 1991 and includes all anadromous and residual Sockeye from the Snake River Basin, Idaho, as well as artificially propagated salmon from the Redfish Lake captive brood propagation program.

1.14 EXPECTED DURATION OF PROGRAM

The expected program duration is unknown; the Idaho Fish Accords provide O&M funding for full-term smolt production through at least Federal Fiscal Year 2028. Future funding for captive brood components at both IDFG and NOAA facilities, as well as continued RM&E, is contingent on future BiOp language and CBFWA funding solicitation cycles.

1.15 WATERSHEDS TARGETED BY PROGRAM

Watershed of return: Upper Salmon River, Idaho; 3rd field Hydrologic Unit Code: Salmon, #17060201.

1.16 INDICATE ALTERNATIVE ACTIONS CONSIDERED FOR ATTAINING PROGRAM GOALS, AND REASONS WHY THOSE ACTIONS ARE NOT BEING PROPOSED

The Upper Snake River Sockeye population is currently supported by a complex program that relies upon facilities in Idaho and Washington to sustain what was a critically imperiled population. Success of this program has paved the way for larger-scale localized broodstock collection that is the foundation of the program. A number of alternative strategies for the Snake River Sockeye program were examined by IDFG as part of prior planning efforts. In selecting the alternative presented in planning documents (IDFG 2010, NPCC 2012), among other factors, the IDFG considered the ability of different approaches to meet conservation and broodstock goals, reduce long-term costs, and provide sufficient localized broodstock to restore populations adapted to the specific conditions of lakes in the Sawtooth Valley. Alternative approaches evaluated included:

- **Maintain current captive broodstock program**. Under this strategy, the program would continue as it is currently operated. Broodstock would be collected in the basin and reared at Eagle Fish Hatchery, Oxbow, Burley and Sawtooth fish hatcheries. Releases back to the Sawtooth Valley could consist of eggs, pre-smolts, smolts and captive brood adults as determined by the SBSTOC.

- **Eliminate captive broodstock program and rely on natural production only**. With this strategy, broodstock no longer would be collected at the Sawtooth Fish Hatchery weir or at the Redfish Lake Creek weir. Returning adults would be allowed to volitionally access habitat upstream of the Sawtooth Fish Hatchery. The population would rely upon current habitat conditions in Redfish, Pettit and Alturas lakes.

- **Five Lake Recovery Strategy**. Returning adult Sockeye would be introduced to five lakes in the Sawtooth Valley: Redfish, Pettit, Alturas, Stanley and Yellowbelly.

These alternatives were rejected as they did not meet identified conservation goals, were too costly, had a high risk of failure or required more resources for implementation than are currently available.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS

If present and potentially affected, USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Section 2.2.1 and Section 15 below.

2.1 LIST ALL ESA PERMITS OR AUTHORIZATIONS IN HAND FOR THE HATCHERY PROGRAM

- Section 10(a)(1)(A) Permit 1124-6R: Authorizes IDFG to annually take endangered Snake River (SR) Sockeye salmon while conducting Redfish Lake, Pettit Lake, and Alturas Lake kokanee/Sockeye research—as well as other research projects that have received authorization under section 4(d) of the ESA. Permit 1124-6R covers Sockeye take for: upper Salmon River emigrant traps to monitor natural and hatchery Chinook salmon; mid-water trawling in Sawtooth Valley lakes to monitor the expansion of the Sockeye reintroduction program into various nursery lakes; and provisions for transporting Sockeye within the basin and for rescuing and salvaging Sockeye salmon (Permit expires 12/31/22).

- Section 10(a)(1)(A) Permit 1454: Authorizes IDFG a direct take of endangered Sockeye salmon from Redfish Lake, tributaries of the upper Salmon River, and Lower Granite Dam as part of a captive broodstock program to produce large numbers of juvenile fish for restoring anadromous Sockeye runs to the Snake River. Permit 1454 also includes take of juvenile Sockeye in the upper Salmon River associated with the IDFG's Research, Monitoring and Evaluation efforts. Permit 1454 replaced expired Permit 1120 (Permit expires 09/27/2023).

- Fisheries Evaluation and Management Plan (FMEP) for IDFG General Fishing Rules: Authorizes IDFG annual incidental take of ESA-listed anadromous fish (endangered Snake River Sockeye salmon, threatened Snake River steelhead, threatened Snake River spring/summer and fall Chinook salmon) under the jurisdiction of NOAA Fisheries while implementing the State of Idaho's recreational fishing programs. The Fisheries Evaluation and Management Plan replaced the expired Section 10(a)(1)(B) Permit 1481.

- Section 10(a)(1)(A) Permit 1341-6R: Authorizes SBT to annually take endangered Snake River (SR) Sockeye salmon while conducting Pettit Lake and Alturas Lake kokanee/Sockeye research. Permit 1341-6R covers Sockeye take for emigrant traps to monitor Sockeye salmon and kokanee production in, and migratory timing and survival from, Alturas and Pettit lakes (Permit expires 12/31/26).

- Section 10(a)(1)(A) Permit 1455: Authorizes the NOAA Fisheries' Northwest Fisheries Science Center to take endangered Snake River Sockeye Salmon (*Oncorhynchus nerka*) for scientific research and to enhance the propagation of listed species to prevent the extinction and provide options for the recovery of the listed population. It also authorizes the development of techniques necessary to rear Sockeye salmon from fertilized eggs through maturity in captivity and spawn the mature fish and rear their progeny for release into natural habitat. Permit 1455 replaced expired Permit 1148 (Permit expires 09/27/2023).

2.2 PROVIDE DESCRIPTIONS, STATUS, AND PROJECTED TAKE ACTIONS AND LEVELS FOR NMFS ESA-LISTED NATURAL POPULATIONS IN THE TARGET AREA

2.2.1 Description of NMFS ESA-listed salmonid population(s) affected by the program

The Snake River Sockeye salmon ESU was listed under the federal Endangered Species Act in 1991 and includes all anadromous and residual Sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated Sockeye salmon from the Redfish Lake captive brood propagation program.

The Interior Columbia Technical Recovery Team (ICTRT) designated at least three historical populations within the Sawtooth Valley lakes: Redfish Lake (including Little Redfish), Alturas Lake, and Stanley Lake. The Redfish Lake Sockeye population includes both anadromous and residualized Sockeye that spawn synchronously with the anadromous fish. Two other lakes – Pettit Lake and Yellowbelly Lake – may have supported independent populations; however; currently available information did not allow the ICTRT to determine their status with certainty.

In addition, three other lakes or groups of lakes in the Snake River drainage supported Sockeye populations: Warm Lake (in the South Fork Salmon drainage); Payette, Upper Payette and Little Payette lakes (Payette River drainage); and Wallowa Lake (Grande Ronde drainage). The distance between these lakes or groups of lakes is consistent with observed distances between extant ESUs of lake-spawning Sockeye, suggesting that each of these groups would likely have been separate major population groups and may have been separate ESUs.

Historically, it was estimated that as many as 40,000 Sockeye returned to the Sawtooth Valley lakes each year (NPCC 2004). The recovery goal for abundance is 1,000 naturally produced adults returning to Redfish Lake, 1,000 naturally-produced adults returning to Alturas Lake and 500 naturally-produced adults returning to Pettit Lake. This ESU has a very high risk of extinction (NOAA 2008).

Identify the NMFS ESA-listed population(s) that will be directly affected by the program

Snake River Sockeye is an ESA listed population. The Snake River Sockeye salmon ESU includes all anadromous and residual Sockeye from the Snake River Basin, Idaho, as well as artificially propagated Sockeye salmon from the Redfish Lake Captive Broodstock Program (IDFG and NOAA facilities).

Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program

ESA-listed populations that may be incidentally affected include threatened Snake River spring/summer Chinook salmon (*O. tshawytscha*), threatened Snake River steelhead (*O. mykiss*), and threatened bull trout (*Salvelinus confluentus*).

Areas of potential impact are generally restricted to juvenile and adult trapping facilities on Redfish Lake Creek, the upper Salmon River weir associated with the Sawtooth Fish Hatchery, as well as juvenile trapping facilities on both Alturas Lake Creek and Pettit Lake Creek (operated

by the Shoshone-Bannock Tribes). Trapping of outmigrant Sockeye juveniles is typically conducted from April through June and anadromous adult trapping generally occurs from mid-July through mid-October in most years.

A brief review of the life history traits of listed salmonids in the Upper Salmon River Basin (Chinook salmon, steelhead, bull trout) suggest that ecological interactions between Snake River Sockeye salmon and co-occurring listed salmonids are of relatively minor concern. Juvenile Sockeye salmon typically rear their entire juvenile life history phase in a nursery lake environment; juvenile Chinook, steelhead, and fluvial populations of bull trout generally adopt a stream- or riverine-type rearing environment. Life history variation with co-occurring listed salmonids would have little or no effect on common genetic, competition, predation, as well as residual life history concerns that are often the case in a multi-species recovery area.

2.2.2 Status of NMFS ESA-listed salmonid population(s) affected by the program

Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

The following portions of Section 2.4.1.1 of the current 2020 FCRPS Biological Opinion provides the following summary of the recent status of the Snake River Sockeye salmon ESU:

> *2.4.1.1.1 Background*
>
> On November 20, 1991, NMFS listed the SR Sockeye salmon ESU as an endangered species (56 FR 58619). The endangered status was reaffirmed on June 28, 2005 (70 FR 37160) and again on April 14, 2014 (79 FR 20802). The most recent status review, in 2016, concluded that this ESU should retain its endangered status (81 FR 33468). Critical habitat was designated on December 28, 1993 (58 FR 68543). The summary that follows describes the status of SR Sockeye salmon. Additional information can be found in the recovery plan (NMFS 2015c) and the most recent status review for this species (NMFS 2016b).
>
> The ESU includes all anadromous and residual Sockeye salmon from the Snake River basin, and artificially propagated Sockeye salmon from the Redfish Lake Captive Broodstock Program (NMFS 2015c, 70 FR 37160).122 The ICTRT defined Sawtooth Valley Sockeye salmon as the single MPG within the SR Sockeye salmon ESU. The MPG contains one extant population (Redfish Lake) and two to four extirpated, historical populations (Alturas, Pettit, Stanley, and Yellowbelly lakes). At the time of listing in 1991, the only extant population (the Redfish Lake population) had about 10 fish returning per year (NMFS 2015c). Table 2.4-1 lists the populations and hatchery programs that are part of the ESU.
>
> *2.4.1.1.4 Abundance, Productivity, Spatial Structure, and Diversity*
>
> In its recovery plan and most recent status review, NMFS noted that approximately two-thirds of the returning adults each year were captured at the Redfish Lake Creek weir, with the remaining adults captured at the Sawtooth Hatchery weir on the mainstem Salmon River upstream of the Redfish Lake Creek confluence.

Although total SR Sockeye salmon returns to the Sawtooth Basin were high enough to allow for some level of spawning in Redfish Lake, the hatchery program's priority remained genetic conservation and building sufficient returns to support sustained outplanting and recolonization of the species' historical range (NMFS 2015c, 2016b).

Adult returns of Sockeye salmon to the Sawtooth Basin showed a general pattern of increase through 2014 (Table 2.4-2) (Johnson et al. 2020). In the 7 years before 2015, adult returns varied from a low of 242 in 2012 (including 52 natural-origin fish) to a high of 1,516 in 2014 (including 453 natural-origin fish). The large increases in returning adults in those years reflected improved survival during downstream migration through the mainstem Salmon, lower Snake, and Columbia Rivers and in the ocean, as well as increases in juvenile production since the early 1990s (NMFS 2016b).

In 2015, the trend of adult returns was interrupted. Although the largest estimated number of SR Sockeye salmon adults in recent history (4,093) arrived at Bonneville Dam that year, elevated water temperatures resulted in only 1 percent survival from Bonneville to Lower Granite Dam. Agencies and stakeholders quickly implemented a transportation program in which Sockeye salmon were captured at Lower Granite Dam and trucked to the Sawtooth Valley to avoid the high temperatures. Fortunately, the "safety net" captive broodstock program was able to provide adults to maintain the SR Sockeye salmon hatchery program (NMFS 2013c). In addition to the high temperature issue, the hatcheries had operational issues during 2015 to 2017 that resulted in high mortalities. It now appears that the operational issues are resolved or close to resolution. The low return of adults to the Sawtooth Valley in 2015 and the hatchery juvenile production issues in 2015 to 2017 (see Section 2.4.2.2) likely contributed, along with recent poor ocean conditions, to the lower 2017 to 2019 SR Sockeye salmon returns compared to previous years. There is also increasing evidence that competition with extremely large numbers of hatchery produced pink salmon, combined with a warm ocean, are substantially reducing the productivity (and abundance) of southerly populations of west coast Sockeye salmon—especially in odd years, when adult pinks are far most abundant (Connors et al. 2020).

Long-term recovery objectives for this ESU are framed in terms of natural production. Substantial progress has been made with the captive broodstock hatchery program, but natural production levels of anadromous returns remain extremely low for this ESU.

Provide the most recent 12-year progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The number of natural and hatchery-origin Sockeye trapped at the Redfish Lake Creek trap (Table 11), Sawtooth Fish Hatchery trap (Table 12), and Lower Granite trap (Table 13) is summarized below.

Table 11. Mark history of anadromous Sockeye adults returning to the Redfish Lake Creek trap, 2010 to present.

Return Year	Total Return	Mark Unk.	No Marks	PIT Only	CWT Only	Ad Only	Ad/ PIT	Ad/ CWT	CWT/ PIT	Ad/ CWT/PIT	Ad/ RV	Ad/RV/ CWT	Ad/RV/ CWT/PIT	Ad/ LV	Ad/LV/ CWT	Ad/LV/ CWT/PIT
2010	670	15	149	0	0	53	3	328	0	5	0	59	10	1	46	1
2011	560	18	111	0	38	49	1	57	7	15	2	228	34	0	0	0
2012	118	11	53	0	32	9	0	0	13	0	0	0	0	0	0	0
2013	226	2	49	0	128	4	0	20	15	8	0	0	0	0	0	0
2014	1545	63	440	3	904	8	0	13	107	6	0	0	0	0	0	0
2015	50	0	8	0	24	3	1	10	0	4	0	0	0	0	0	0
2016	554	24	33	0	0	425	66	4	0	2	0	0	0	0	0	0
2017	153	14	10	1	0	106	22	0	0	0	0	0	0	0	0	0
2018	114	2	11	2	0	98	1	0	0	0	0	0	0	0	0	0
2019	15	0	11	1	0	3	0	0	0	0	0	0	0	0	0	0
2020	105	1	90	1	0	13	0	0	0	0	0	0	0	0	0	0
2021	50	0	4	0	0	45	1	0	0	0	0	0	0	0	0	0

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Table 12. Mark history of anadromous Sockeye adults returning to the Sawtooth Fish Hatchery trap, 2010 to present.

Return Year	Total Return	Mark Unk.	No Marks	PIT Only	CWT Only	Ad Only	Ad/ PIT	Ad/ CWT	CWT/ PIT	Ad/CWT/ PIT	Ad/ RV	Ad/RV/ CWT	Ad/RV/ CWT/PIT	Ad/ LV	Ad/LV/ CWT	Ad/LV/ CWT/PIT
2010	666	18	28	0	0	37	0	47	0	1	0	1	0	39	493	2
2011	557	0	34	0	20	29	6	303	4	158	1	1	1	0	0	0
2012	139	4	17	17	69	7	4	4	13	4	0	0	0	0	0	0
2013	46	0	30	0	4	6	0	4	0	2	0	0	0	0	0	0
2014	34	0	10	0	12	6	0	2	1	3	0	0	0	0	0	0
2015	6	0	3	0	0	0	0	2	0	1	0	0	0	0	0	0
2016	42	0	0	0	0	35	7	0	0	0	0	0	0	0	0	0
2017	23	0	0	0	0	16	7	0	0	0	0	0	0	0	0	0
2018	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2019	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	47	0	34	0	0	12	1	0	0	0	0	0	0	0	0	0
2021	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Table 13. Mark history of anadromous Sockeye adults collected at Lower Granite Dam, 2010 to present.

Return Year	Total Collected	No Marks	CWT Only	Ad Only	Ad/PIT	Ad/CWT	Ad/CWT/ PIT	CWT/ PIT	Ad/LV
2010	19	2	0	10	0	0	0	0	7
2011	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0
2015	35	3	19	1	0	9	2	1	0
2016	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0
2021	185	9	0	167	9	0	0	0	0

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Provide the most recent 12 years of annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Data summarizing the total egg take, fecundity and survival to the eyed-egg stage for annual spawning events (spawn years 2010–2021) at the Eagle and NOAA Burley Creek fish hatcheries are presented in Tables 14 and 15.

Table 14. Redfish Lake Sockeye Captive Broodstock Program, Eagle Hatchery spawning results for anadromous and hatchery-produced adults.

Spawn Year	Female Origin	Total Green Eggs Taken	Total Eyed Eggs Produced	Mean Fecundity	Percent Egg Survival to Eyed Stage
2010	Captive-Reared Broodstock	140,466	113,221	1,596	80.6%
	Anadromous Broodstock	131,573	115,601	2,799	87.9%
2011	Captive-Reared Broodstock	171,448	131,109	1,994	76.5%
	Anadromous Broodstock	142,948	118,413	2,749	82.8%
2012	Captive-Reared Broodstock	160,234	136,552	1,761	85.2%
	Anadromous Broodstock	82,989	75,402	2,766	90.9%
2013	Captive-Reared Broodstock	361,045	297,737	1,984	82.5%
	Anadromous Broodstock	104,833	84,564	2,496	80.7%
2014	Captive-Reared Broodstock	224,296	181,864	1,420	81.1%
	Anadromous Broodstock	520,242	425,334	2,365	81.8%
2015	Captive-Reared Broodstock	562,515	437,208	1,567	77.7%
	Anadromous Broodstock	88,884	66,917	2,402	75.3%
2016	Captive-Reared Broodstock	546,553	403,443	1,438	73.8%
	Anadromous Broodstock	301,422	267,934	2,491	88.9%
2017	Captive-Reared Broodstock	830,677	701,063	2,006	84.4%
	Anadromous Broodstock	168,272	136,150	2,512	80.9%
2018	Captive-Reared Broodstock	752,064	606,857	1,989	80.7%
	Anadromous Broodstock	109,408	83,559	2,233	76.4%
2019	Captive-Reared Broodstock	990,489	795,167	2,144	80.3%
	Anadromous Broodstock	15,273	6,837	2,182	44.8%
2020	Captive-Reared Broodstock	849,514	546,652	2,077	64.3%
	Anadromous Broodstock	109,048	91,064	1,983	83.5%
2021	Captive-Reared Broodstock	718,879	364,570	1,959	50.7%
	Anadromous Broodstock	154,934	134,378	2,213	86.7%
Total		**8,238,006**	**6,321,596**		**76.7%**

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Table 15. Redfish Lake Sockeye Captive Broodstock Program, NOAA Fisheries spawning results for hatchery-produced adult Sockeye salmon.

Spawn Year	Female Brood Year and Origin	Total Green Eggs Taken	Total Eyed Eggs Produced	Mean Fecundity	Percent Egg Survival to Eyed Stage
2010	Captive Reared Broodstock	263,208	161,022	2,040	61.2%
2011	Captive Reared Broodstock	176,233	142,537	1,296	80.9%
2012	Captive Reared Broodstock	169,356	138,142	1,821	81.6%
2013	Captive Reared Broodstock	253,030	165,361	1,325	65.4%
2014	Captive Reared Broodstock	258,532	183,010	1,576	70.8%
2015	Captive Reared Broodstock	574,463	362,637	1,623	63.1%
2016	Captive Reared Broodstock	566,838	373,194	1,512	65.8%
2017	Captive Reared Broodstock	278,631	228,951	17,414	82.2%
2018	Captive Reared Broodstock	520,839	425,693	3,694	81.7%
2019	Captive Reared Broodstock	616,455	481,315	1,824	78.1%
2020	Captive Reared Broodstock	457,987	353,996	1,755	77.3%
2021	Captive Reared Broodstock	513,477	405,570	1,533	79.0%
Total		**4,649,049**	**3,421,428**		**73.6%**

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Provide the most recent 12-year estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The number and resulting percentages of Sockeye salmon of various origins released to spawn naturally in Sawtooth Valley lakes are provided in Table 16. This table summarizes natural spawning during the period 2010–2021.

Table 16. Number and percentage of adults by origin type released to spawn in Sawtooth Valley lakes, 2010-2021.

Year	Lake	Natural origin anadromous	Hatchery origin anadromous	Hatchery origin captive	% Natural origin anadromous	% Hatchery origin anadromous	% Hatchery origin captive
2010	Redfish	79	1,129	369	5.0%	71.6%	23.4%
2011	Redfish	60	928	558	3.9%	60.0%	36.1%
	Alturas	1	0	0	100.0%	0.0%	0.0%
2012	Redfish	12	161	622	1.5%	20.3%	78.2%
2013	Redfish	34	150	162	9.8%	43.4%	46.8%
2014	Redfish	265	808	1,000	12.8%	39.0%	48.2%
	Pettit	0	0	98	0.0%	0.0%	100.0%
2015	Redfish	0	0	494	0.0%	0.0%	100.0%
	Pettit	5	0	95	5.0%	0.0%	95.0%

Year	Lake	Natural origin anadromous	Hatchery origin anadromous	Hatchery origin captive	% Natural origin anadromous	% Hatchery origin anadromous	% Hatchery origin captive
2016	Redfish	0	326	780	0.0%	29.5%	70.5%
	Pettit	0	0	100	0.0%	0.0%	100.0%
2017	Redfish	0	0	1,129	0.0%	0.0%	100.0%
	Pettit	1	0	99	1.0%	0.0%	99.0%
2018	Redfish	1	0	531	0.2%	0.0%	99.8%
	Pettit	0	0	99	0.0%	0.0%	100.0%
2019	Redfish	0	0	510	0.0%	0.0%	100.0%
	Pettit	3	0	97	3.0%	0.0%	97.0%
2020	Redfish	0	0	893	0.0%	0.0%	100.0%
	Pettit	37	0	101	26.8%	0.0%	73.2%
2021	Redfish	3	58	1065	0.3%	5.2%	94.6%
	Pettit	3	0	97	3.0%	0.0%	97.0%
Total	**Redfish**	**454**	**3560**	**8113**	**3.7%**	**29.4%**	**66.9%**
Total	**Pettit**	**49**	**0**	**786**	**5.9%**	**0.0%**	**94.1%**
Total	**Alturas**	**1**	**0**	**0**	**100.0%**	**0.0%**	**0.0%**

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Hatchery activities at Sawtooth Fish Hatchery are addressed in Chinook/steelhead HGMP's; see Appendix 1 (Table 2) for detailed numeric take. Sockeye-specific hatchery and research activities that address take of listed salmonids in the target areas are summarized in Appendix 1 (Table 1) and addressed in NOAA Section 10 Permits for the program and a Fisheries Management and Evaluation Plan (see Section 2.1):

- Section 10(a)(1)(A) Permit 1124-6R
- Section 10(a)(1)(A) Permit 1341-6R
- Section 10(a)(1)(A) Permit 1454
- Section 10(a)(1)(A) Permit 1455

- Fisheries Management and Evaluation Plan (FMEP) for IDFG General Fishing Rules

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish.

As outlined in NOAA Section 10 permits, annual progress reports documenting take levels for listed stocks are provided to NOAA Fisheries under current permits. The known take of ESA-listed Snake River Sockeye for broodstock is listed in Table 17.

Table 17. Redfish Lake Sockeye salmon returns to traps on Redfish Lake Creek and the Upper Salmon River at the Sawtooth Fish Hatchery.

Return Year	Natural Origin Return	Hatchery Origin Return
2010*	178	1144
2011	145	954
2012	52	190
2013	79	191
2014	453	1063
2015*	14	77
2016	33	539
2017	11	151
2018	13	100
2019	14	3
2020	125	26
2021*	13	227

* Includes fish trapped and hauled from Lower Granite Dam

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

All adult Sockeye are trapped and handled at either the Redfish Lake Creek or Sawtooth Fish Hatchery weirs. The take of returning adults varies annually (Table 17) and is regulated through annual consultation with the Stanley Basin Sockeye Technical Oversight Committee. Following capture, Sockeye may be released to spawn naturally or retained to be used as broodstock.

Annual abundance and biomass estimates of juvenile Sockeye salmon are obtained using a mid-water trawl. Our permitted annual lethal take for trawl sampling is 250 Sockeye salmon, however, actual take over the last ten years (2012-2021) has averaged 26 fish (range 8 to 51 fish).

The Shoshone-Bannock Tribes conduct emigration monitoring on Alturas and Pettit lakes while IDFG conducts emigration monitoring on Redfish Lake. The 10-year average (2012-2021) efficiency of the Redfish Lake Creek juvenile trap is 28% and over the last 10 years catches range from 811—9,691 smolts, annually. Between 50 and 100 smolts are marked with an upper caudal clip daily and released upstream of the weir to estimate trap efficiency. The average number of smolts marked annually since 2012 is 1,485 fish (range 511—3,931 fish). The

efficiency of the Pettit Lake juvenile trap is approximately 27% (K. Tardy, Shoshone-Bannock Tribes, personal communication) and catches 1 – 2,450 fish annually (median annual catch = 378 fish). From 2012-2020 all smolts trapped (n=3,239) were marked with a fin clip or a fin clip and PIT tag. In 2021, 878 of the 2,450 smolts trapped (36%) where marked with either a fin clip or fin clip and PIT tag. The screw trap on Alturas Lake Creek is operated April through June (Tardy et al. 2018) and annual catches range from 0 to 265 smolts (average = 84). From 2012-2020 all smolts trapped (n=839) were marked with either fin clip or fin clip and PIT tag.

Permitted take for all Sockeye salmon life stages are summarized in Appendix 1 (Table 1).

Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Additional mortality and/or take associated with this program that deviates from existing permit conditions will be communicated to NOAA Fisheries per permit requirements.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1 DESCRIBE ALIGNMENT OF THE HATCHERY PROGRAM WITH ANY ESU-WIDE HATCHERY PLAN OR OTHER REGIONALLY ACCEPTED POLICIES

The Snake River Sockeye Salmon Captive Broodstock, Research, and Production program is exclusive to this ESU; no additional programs currently address Snake River Sockeye recovery. Recent major regional policies and plans that are linked to this program include:

- U.S. v. Oregon Columbia River Fish Management Plan – 2018-2027
- NPCC Fish and Wildlife Program
- NPCC Salmon Subbasin Management Plan
- Idaho Fish Accords
- FCRPS 2020 Biological Opinion
- IDFG 2019-2024 Fisheries Management Plan

3.2 LIST ALL EXISTING COOPERATIVE AGREEMENTS, MEMORANDA OF UNDERSTANDING, MEMORANDA OF AGREEMENT, OR OTHER

MANAGEMENT PLANS OR COURT ORDERS UNDER WHICH PROGRAM OPERATES.

This HGMP is consistent with all agreements, plans, and policies referenced in Section 3.1.

3.3 RELATIONSHIP TO HARVEST OBJECTIVES

3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last 12 years, if available

Snake River Sockeye salmon are listed as Endangered under the ESA, therefore, there are no specific harvest objectives for this program. Substantive information on fisheries benefitting from the program is lacking. However, the current FCRPS 2020 Biological Opinion provides the following information on harvest associated with Snake River Sockeye salmon:

> *2.4.2.3 Recent Ocean and Lower River Harvest*
>
> Few SR Sockeye salmon are caught in ocean fisheries, and ocean-fishing mortality on SR Sockeye salmon is assumed to be zero (NMFS 2018a). Non-Indian fisheries in the Columbia River mainstem below the Highway 395 Bridge, which crosses the Columbia River between Kennewick and Pasco, Washington, are limited to a harvest rate of 1 percent and Treaty Indian fisheries to 5 to 7 percent, depending on the run size of upriver Sockeye salmon stocks. NMFS' recently completed biological opinion on the 2018 to 2027 U.S. v. Oregon Management Agreement concluded that the effects of harvest on SR Sockeye salmon, when considering the current reliance on hatchery programs, will allow continued gains in viability scores.

3.4 RELATIONSHIP TO HABITAT PROTECTION AND RECOVERY STRATEGIES

Habitat protection for Snake River Sockeye salmon is addressed in the NPCC Salmon Subbasin Management Plans. Habitat protection programs that generally benefit all migratory anadromous salmonids in Idaho (and downstream habitats) are assumed to provide similar benefits to migrating Sockeye salmon.

All aspects of the program are operated in accordance with guidance laid out in *ESA Recovery Plan for Snake River Sockeye Salmon (Oncorhynchus nerka)* (NOAA 2015) and *Springfield Sockeye Hatchery Master Plan for the Snake river Sockeye Program Volume 1: Master Plan* (IDFG 2010). Additionally, the program is consistent with existing Biological Opinions and language in the program's NOAA Section 10 Permits.

3.5 ECOLOGICAL INTERACTIONS

Salmonid and non-salmonid fishes or other species that could:

1) *negatively impact program;*

Snake River Sockeye salmon typically spend one to three years in a nursery lake prior to emigrating from Sawtooth Basin lakes as smolts in spring. This extended period of juvenile lake residence contrasts with the typical life history strategies of listed Chinook salmon, steelhead, and bull trout (see Section 2.2.1). While diet overlap with other listed salmonids is certainly feasible, albeit unlikely, intra-specific competition for limited food resources may play a role in the mortality of juvenile Sockeye. More importantly, freshwater predation from listed salmonids and avian predators is a greater concern and likely occurs as smolts congregate and emigrate from lake environments.

2) *be negatively impacted by program;*

Large concentrations of migrating Sockeye salmon may attract predators (fish, avian) and could contribute indirectly to the predation of listed salmonids. In addition, the presence of large numbers of hatchery Sockeye salmon may alter the behavioral patterns of wild salmonids (Sockeye and others) and potentially influence their susceptibility and vulnerability to predation.

3) *positively impact program;*

Increased numbers of listed salmonids that escape to spawn in lakes may actually contribute to lake nutrient levels, ultimately benefiting listed Sockeye salmon by increasing lake productivity.

4) *be positively impacted by program.*

Sockeye emigrating from Basin lakes may actually benefit co-occurring listed salmonids populations; increased concentrations of migrating fish may overwhelm predator populations and provide a beneficial, protective effect to co-occurring fish.

SECTION 4. WATER SOURCE

4.1 PROVIDE A QUANTITATIVE AND NARRATIVE DESCRIPTION OF THE WATER SOURCE (SPRING, WELL, SURFACE), WATER QUALITY PROFILE, AND NATURAL LIMITATIONS TO PRODUCTION ATTRIBUTABLE TO THE WATER SOURCE

Eagle Fish Hatchery - Eagle Fish Hatchery is the primary Idaho site for the Sockeye salmon captive broodstock program. Artesian water from three wells is delivered with three separate pump/motor systems. Water rights for fish propagation at Eagle Fish Hatchery total 6.57 cfs. Water temperature remains a constant 13.5°C and total dissolved gas averages 100% after degassing. In 2008, construction of a new captive broodstock building and modifications to the water delivery system from wells #1 and #2 was completed. The new building increased the

captive broodstock capacity from 400 to 1,500 per year class and freed up existing space for isolated holding of anadromous Sockeye adults. Water chilling capability was added at Eagle Fish Hatchery in 1994 with a second chiller added in 2008. Chiller capacity accommodates incubation, a portion of fry rearing, and a portion of adult holding needs. Backup and system redundancy is in place for degassing, pumping, and power generation. The alarm system was modified in 2008 and currently includes seven alarms tied to the water system and two alarms tied to chiller operation, with alarms linked through an emergency service contractor.

Burley Creek Fish Hatchery - The hatchery is supplied with 500 gallons per minute (gpm) of pathogen free 10°C well water pumped from five available wells. Pumping capacity ranges between 500 and 1000 gpm. Water sourcing rotates between the wells to minimize screen impaction, provide a maintenance opportunity, and extend the useful life expectancy of each well. The current water right is for 500 gpm and a 2008 hydrogeological study indicates the aquifer can sustain withdrawals of 1000 gpm. The water is passed through packed columns on a central degassing tower to remove excess nitrogen and raise dissolved oxygen levels before it is distributed to the rearing tanks. The water supplied to incubation and fry rearing vessels can be diverted through a chiller to decrease the water temperature by 5°C. Supplementary oxygen can be supplied to the rearing tanks for life support in the event of water flow disruption. At a 7 lbs/gpm loading rate the facility can maintain between 3,500 lbs of fish on (500 gpm) and 7,000 lbs of fish (1,000 gpm). The ground water is rich in manganese, but otherwise meets all potable water standards. The hatchery is equipped with water flow, power failure, fire, and burglar alarms.

Manchester Research Station -- The Manchester Research Station is located on Clam Bay, a small bay adjoining the central basin of western Puget Sound. Clam Bay is a major tidal mixing zone between Sinclair and Dyes Inlets to the West and the waters of central Puget Sound to the east. Annual seawater temperatures range between 7-14°C with salinity averaging 28 ppt. The high-quality seawater environment makes the Manchester Research Station an excellent site for the culture of anadromous salmonids during the marine portion of their life cycle.

Two 60 hp centrifugal pumps supplies about 2,400 gpm of seawater through a 2,300 ft long pipeline from the end of the pier to the Station's land-based facilities. Seawater supply is shared for multiple purposes, but up to 1,500 gpm is allocated for culture of Sockeye salmon captive broodstocks.

The seawater supplied to the station is processed to prevent naturally occurring pathogens from entering the rearing tanks. Primary filtering consists of six 20.4 ft^2 sand filters containing number 20-grade sand or glass micro beads that filter out all organic and inorganic material more than 20 microns in diameter. Secondary water filtration occurs in two cartridge filter systems capable of filtering out all material more than 5 microns in diameter. The water then passes through UV irradiation (50,000 to 90,000 microwatts/second) to inactivate remaining pathogenic material. Sensors monitor water flow and pressure through the seawater filtration system.

Before entering fish rearing tanks, the processed seawater is passed through a packed column degasser to boost dissolved oxygen levels and off-gas excess nitrogen, which can be present in pumped water situations. In addition, each tank is directly supplied with oxygen to maintain life support in the event of an interruption in water flow. Tanks where maturing fish are held are

supplied with combinations of ambient and chilled water. At a 7 lb/gpm loading rate the facility can maintain a maximum of 10,500 lbs of fish on 1,500 gpm seawater.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery receives water from the Salmon River and from four wells. River water enters an intake structure located approximately 0.8 km upstream of the hatchery facility. River water intake screens comply with NOAA Fisheries criteria. Flows pass from the collection site to a control box located in the hatchery building where they are screened to remove fine debris then distributed to indoor vats, outside raceways, or adult holding raceways. The hatchery's surface water right is 43 cfs. Incubation and early rearing water is supplied by two primary wells. A third well provides tempering water to control the build-up of ice on the river water intake during winter months. The fourth well provides domestic supply for the facility. The hatchery's groundwater right is 11.6 cfs. River water temperatures range from 0.0ºC in the winter to 20.0ºC in the summer. Well water temperatures range from 3.9ºC in the winter to 11.1ºC in the summer.

Springfield Fish Hatchery – The Springfield Fish Hatchery receives water from a confined aquifer underlying the site that supplies high quality groundwater for hatchery operations. The facility has a water right for 50 cfs. There are nine artesian wells located on the northern parcel. Six of the wells (wells 5, 7, 8, 10, 11, and 12) supply groundwater for hatchery production operations. These six wells feature a dual-head design that allows water delivery by both artesian flow and pumping. Due to elevation differences, artesian flow cannot be delivered to the hatchery building, but may supply outdoor raceways. The ambient water temperature remains a constant 10°C. The total dissolved gas (TDG) levels currently range from 100% - 102% after aeration and degassing. A 50 ton chiller supplies up to 100 gpm of 5°C for use in incubation or early rearing which is used to slow the development rate of eggs and fry in order to produce smolts that meet targets for fish size and release dates. Backup and system redundancy is in place for degassing, pumped water delivery, chilled water supply, and power generation. An automated alarm system monitors pump operation at all six production well locations, head box water levels, and flows to the early rearing and incubation water supply piping. The alarm system also monitors the backup generators and the chilled water supply system. Fish production at the Springfield Fish Hatchery has an authorized discharge allocation of 1.63 tons/year of phosphorus and 347 tons/year of suspended sediment.

Oxbow Hatchery - The Oregon Department of Fish and Wildlife's (ODFW) Oxbow Hatchery was originally constructed in 1913 and was a state-funded hatchery until 1952. In 1952, the facility was modified and expanded using Mitchell Act funding, a Columbia River fisheries development program set up to enhance declining fish runs in the Columbia River Basin. Oxbow Hatchery receives 7.2°C water through gravity flow from Oxbow Springs. The flow rate is highly variable depending on the time of year, with the lowest flows of 1,135.5 liters per minute (300 gpm) in the summer and fall. Water rights for the Oxbow Hatchery are 19.02 cfs).

Bonneville Hatchery - The Oregon Department of Fish and Wildlife's (ODFW) Bonneville Hatchery operates on a combination of well water (12,800 gpm) and Tanner Creek surface water supply (10,400 gpm with seasonal fluctuations). Water flow for production averages 19,680 gallons per minute (gpm) for the year. The water meets or exceeds the recommended IHOT water quality guidelines for temperature, ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zinc. To ensure uninterrupted water supply to the hatchery the water intakes are equipped with flow alarms, to alert hatchery

staff to emergency situation. Also, continued water supply is ensured by redundant power supply provided by Bonneville Dam. The water supply does not impose any production limitations.

4.2 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR THE TAKE OF LISTED NATURAL FISH AS A RESULT OF HATCHERY WATER WITHDRAWAL, SCREENING, OR EFFLUENT DISCHARGE.

Eagle Fish Hatchery – Eagle Fish Hatchery maintains a water right of 6.57 cfs. This water right is supplied from three pump-assisted artesian wells. The hatchery effluent is discharged through screened pipes into a flow-through settling pond.

Burley Creek Fish Hatchery - Burley Creek Fish Hatchery maintains a water right for 500 gpm and **t**he ground water use provides no risk of take to listed natural fish. The effluent from the hatchery is depurated through a settling basin, and screened to reduce risks to listed natural fish. In 2022, a new ozone depuration system will become available.

Manchester Research Station - The Station complies with NOAA Fisheries surface water intake screen requirements and operates an ozone treatment and depuration system for effluent.

Sawtooth Fish Hatchery - Intake screens at all facilities are in compliance with NOAA Fisheries screen criteria by design of the Corp of Engineers.

Springfield Fish Hatchery – The Springfield Fish Hatchery has a water right of 50 cfs to be supplied from pump-assisted artesian wells. The hatchery effluent is discharged from rearing units that are screened and checked daily for escapement of fish. There are no listed fish in the system that may be affected by effluent discharge.

Oxbow Hatchery – The Oregon Department of Fish and Wildlife's Oxbow Hatchery is operated within the limitations established in the National Pollutant Discharge Elimination System (NPDES) permit, to comply with the federal Clean Water Act and water quality standards for hatchery effluents. The intake is not screened to comply with NOAA Fisheries screening criteria because there are no anadromous fish upstream of the intake.

Bonneville Hatchery – The Oregon Department of Fish and Wildlife's Bonneville Hatchery is operated within the limitations established in the National Pollutant Discharge Elimination System (NPDES) permit, to comply with the federal Clean Water Act and water quality standards for hatchery effluents. The intake screens comply with NOAA Fisheries screening criteria.

SECTION 5. FACILITIES

5.1 BROODSTOCK COLLECTION FACILITIES (OR METHODS)

Eagle Fish Hatchery – Eagle Fish Hatchery maintains a captive broodstock of Snake River Sockeye salmon from Redfish Lake. Currently two identical groups of eyed eggs (1,500 eggs each) are selected for Eagle Fish Hatchery and NOAA Fisheries for replacement of broodstock. The captive broodstock are reared in tanks ranging from one meter to four meters in size. Two-, three-, and four-meter tanks are also used to hold anadromous Sockeye that have been collected from Redfish Lake Creek trap or Sawtooth Fish Hatchery trap. Trapped anadromous Sockeye are transferred to Eagle Fish Hatchery within 48 hours of being collected.

Redfish Lake Creek Trap/Weir - A permanent weir was installed on Redfish Lake Creek approximately 1.0 kilometers below the mouth of Redfish Lake. The weir allows the capture of juvenile and adult Sockeye salmon. The weir is operated for juvenile collection April through June, and for adults from July through October annually. Anadromous Sockeye trapped here are either transferred daily to Eagle Fish Hatchery, where it is determined which fish to incorporate into the captive broodstock population based on genetic relatedness, or released directly upstream of the trap to continue their migration to Redfish Lake. Transported Sockeye not incorporated into the captive broodstock are held until early September and then released into Redfish Lake for volitional spawning.

Sawtooth Fish Hatchery – Adult collection at the Sawtooth Fish Hatchery is facilitated by a permanent weir that spans the Salmon River. Weir panels are installed to prevent the upstream migration of adult Sockeye salmon. Fish are allowed to volitionally migrate into the adult trap where they are manually sorted into transportation vehicles. Anadromous Sockeye trapped at the Sawtooth Fish Hatchery weir are transferred daily to Eagle Fish Hatchery, where it is determined which fish to incorporate into the captive broodstock population based on genetic relatedness. Sockeye not incorporated into the broodstock are held until early September and then released into the appropriate lake (Redfish, Pettit, or Alturas) for volitional spawning based on GSI stock determination.

Adult Sockeye salmon are occasionally reluctant to enter the Sawtooth Fish Hatchery ladder and trap, and hold in the pool immediately below the weir. In these instances, Sockeye salmon may be collected by herding them into shallow water along the shoreline with a large seine. Adults are then dip-netted into waiting transport vehicles, transported to Eagle Fish Hatchery and processed as described above.

Pettit Lake Creek Weir/Trap – the permanent weir and trap on Pettit Lake Creek is installed annually approximately 0.4 kilometers downstream from the lake outlet. The facility consists of a bridge supported weir with removable picket panels to channel adult Sockeye salmon into the trap box. Trapped anadromous adults are processed and released directly upstream of the trap to continue their migration to Pettit Lake.

Burley Creek Fish Hatchery— NOAA collects no broodstock from the wild and generates its broodstock from eyed eggs received annually from IDFG's Eagle Fish Hatchery. IDFG

incorporates anadromous returning adults into its broodstock collection and spawning program (refer to IDFG broodstock collection facilities for further details).

Manchester Research Station— This facility does not collect broodstock and is used exclusively for marine rearing of the ocean life history phase of Sockeye transferred as age-2 smolts from Burley Creek Fish Hatchery.

Springfield Fish Hatchery – This facility does not collect broodstock and is used to rear Sockeye salmon to the smolt life history stage before being transported back to the Sawtooth Valley lakes.

Bonneville Hatchery – This facility will collect adults that return to Tanner Creek. These adults will be transported to Eagle Fish Hatchery for PBT evaluation prior to release into Sawtooth Valley lakes. No adults collected at Bonneville Hatchery will be incorporated into the captive broodstock. If returns exceed the adult holding capacity at Bonneville Hatchery prior to transport to Eagle Hatchery, adults may be temporarily moved to and held at one or more of the adjacent ODFW hatcheries (Oxbow or Cascade Locks) until they can be transported to Eagle Hatchery.

5.2 FISH TRANSPORTATION EQUIPMENT (DESCRIPTION OF PEN, TANK TRUCK, OR CONTAINER USED)

IDFG Fish Transportation – Adult and juvenile Sockeye salmon are transferred at different loading densities. Transport protocols recommend a transport density of 0.5 lb/gallon (maximum 0.75 lb/gallon) for adults and 0.75 lb/ (maximum of 1 lb/gallon) for juveniles. The tanks are also equipped with an oxygen system, re-circulating fresh flows, and air scoops for tank ventilation. Additional information is available in annual NOAA Permit reports and/or BPA project completion reports.

Sockeye salmon are transferred using a variety of containers. In all cases, containers of the proper size and configuration will be used and appropriate temperature, oxygen, and chemical composition maintained during the handling and transfer phases of transportation. Containers will vary from five-gallon plastic buckets and coolers for short-term holding and inventory needs, to truck mounted, insulated tanks, to barge-mounted holding tanks for mid-lake (pelagic) fish releases. Truck-mounted tanks, used for long distance transfers, will include 1,500 L (400 gallon), 3,785 L (1,000 gallon), 11,355 L (3,000 gallon), and 18,926 L (5,000 gallon) capacities.

Eggs transported between facilities are placed into open-mesh perforated plastic Aquaseed® egg tubes (27-cm long by 6-cm diameter) up to approximately 2,500 eggs per tube. For transport from Eagle Hatchery to Springfield and Oxbow hatcheries, approximately 20 tubes are placed in a 32-quart cooler and filled with same temperature water for transport. Ice is added to slowly temper eggs to receiving hatchery's incubation temperature. Eggs transported from Eagle Hatchery to Springfield Hatchery are transported by vehicle (pickup or similar; approximately four hours). Egg transfers to Oxbow Hatchery may use either vehicle (pickup or similar) transport (approximately six hours) or common carrier flight (about one hour) to Portland, Oregon. If eggs are flown to Portland, the packing procedures described below will be used. Captive broodstock eggs transferred from Eagle Hatchery to NOAA Fisheries are packed in similar tubes and wrapped in wet paper toweling to contain moisture and placed in a small, insulated shipping container. A small amount of ice is placed in a top layer of toweling to keep

the eggs cool and moist during shipment. Shipment to Seattle, Washington is by a common carrier flight of about two hours duration.

NOAA Fisheries Transportation - All transportation emphasizes fish health and safety. Adults and juveniles are transported in 200 to 2,100 gallon insulated HDPE or fiberglass transport tanks and temperature is not allowed to rise more than 2^{o}C. The transport containers are supplied with continuous oxygen that maintains dissolved oxygen at full saturation and are loaded at no more than 0.5 lb fish/gallon of water. All tanks used for transport on trips of a 4 hour or longer duration are equipped with air scoops. The oxygen reservoir contains at least double the quantity of oxygen needed to make the entire trip.

Eggs transported to between facilities are placed into open-mesh perforated plastic Aquaseed® egg tubes (27-cm long by 6-cm diameter) up to approximately 2,500 eggs per tube. Each packed tube is wrapped in wet paper toweling to contain moisture and placed in a small, insulated shipping container. A small amount of ice is placed in a top layer of toweling to keep the eggs cool and moist during shipment. Shipment to Boise, Idaho is by a common carrier flight of about two hours duration.

Oxbow (ODFW) Fish Transportation – Juvenile Sockeye salmon may be transferred in a variety of tankers with range of size between 500 and 2,000 gallons. Transport density will target 0.5 lbs./gallon but will not exceed 1 lb./gallon. The tanks are also equipped with an oxygen system, a back-up oxygen system, and re-circulating fresh flows.

Bonneville (ODFW) Fish Transportation – Adult Sockeye salmon may be transferred in a variety of tanks with range of size between 500 and 2,000 gallons. Transport density will target 0.5 lb/gallon and will not exceed 0.75 lb/gallon. The tanks are also equipped with an oxygen system, re-circulating fresh flows, and air scoops for tank ventilation.

5.3 BROODSTOCK HOLDING AND SPAWNING FACILITIES

Eagle Fish Hatchery - Broodstock for the Eagle Fish Hatchery program are obtained from one of two sources. The primary Sockeye broodstock is maintained as a captive broodstock (reared from egg to mature adult) at Eagle Fish Hatchery. Eggs for each generation of captive broodstock are selected to represent the entire spawning population with equal representation for both males and females. The second broodstock source is collected from returning anadromous Sockeye. A portion of the returning anadromous Sockeye are incorporated into the spawning design with the captive reared Sockeye. Prior to spawning, the two broodstocks are held in isolation from each other to prevent possible viral or bacterial contamination into the captive broodstock. Broodstock groups are held in two-, three-, and four-meter tanks until spawning. Additional information is available in annual NOAA Permit reports and/or BPA project completion reports.

Burley Creek Fish Hatchery - Adults beginning maturation are identified and separated from immature fish at the Manchester Research Station and are transferred annually to the Burley Creek Fish Hatchery to complete maturation in freshwater and be used as broodstock.

At Burley Creek Fish Hatchery, a 2,034-ft^2 building holds ten 19-ft long by 4-ft wide by 4-ft deep grey fiberglass raceways used for holding maturing salmon. The tensioned-fabric structure

is located on a 31-ft x 88-ft concrete pad. The cover of the arching structure is a clear PVC fabric. The fabric allows sunlight to illuminate the structure and provides near-natural lighting to the maturing fish. Past observations showed that Sockeye salmon reared under natural sunlight adopted more of their natural red coloring than that of their indoor-maturing counterparts. The walls are a white opaque PVC fabric that visually isolates the raceways for security and restricts the glow from car headlights at night. Each raceway is fitted with center dividers to create a mild water velocity the fish can swim against and facilitate handling operations. A combination of adult release and captive broodstock fish are held in this structure each summer for final maturation.

Three metal sided pole buildings with several high windows and supplemental day-time lighting are also used. These buildings hold an additional four of the raceways described above along with nineteen 3.7 m diameter pools. Parts of these rearing vessels are covered with a dark tarp to provide shelter for the fish to seek refuge. During final maturation fish density is allowed to increase to 1.0 lb/ft$^{3.}$

Spawning at Burley Creek Fish Hatchery is done under cover inside a metal sided pole building. Gamete quality and sampling is conducted in an adjoining heated laboratory equipped with a refrigerator, microscopes, and balances that weigh to the nearest 0.001 g.

5.4 INCUBATION FACILITIES

Eagle Fish Hatchery – Eggs are incubated at Eagle Fish Hatchery using specially designed upwellers that hold one-half of a female's eggs (up to 1,200 eggs). Approximately 750 individual upwellers can be operated at Eagle Fish Hatchery. Upwellers are two liters in volume and are supplied with a flow of approximately one liter per minute. To accommodate increased production for the Springfield Fish Hatchery smolt program, heath stacks were installed in one incubation room. A total of 252 incubation trays are available for incubating eggs. Each tray can hold eggs from two females and is sectioned into four quadrants to isolate eggs from individual females and individual crosses (subfamilies) for each female. The ambient water temperature is 13.5°C, but incubation water is chilled to supply water between 8.0° and 11.0°C. The majority of eggs are transferred to other production facilities after they reach the eyed-egg stage (approximately 400 – 450 Celsius Temperature Units at transfer). A representative group of 1,500 eyed-eggs is maintained at Eagle Fish Hatchery to represent the next generation of captive broodstock. Additional information is available in annual NOAA Permit reports and/or BPA project completion reports.

Burley Creek Fish Hatchery - A 1,940 ft^2 incubation room sided with fiberglass reinforced paneling to facilitate disinfection houses twelve 15-ft long aluminum troughs that can each hold 32 plastic iso-buckets for incubation (Novotny et al. 1985). Eggs are incubated in iso-buckets that are specially designed down-wellers that hold one female's eggs (up to 3,000 eggs). Approximately 360 individual down-wellers can be operated at Burley Creek Fish Hatchery. Each 2-L bucket is supplied with approximately 0.6 lpm of well water. The ambient water temperature is 10.0°C, but incubation water is chilled to supply water between 7.0° and 10.0°C. All production eggs are transferred to other production facilities after they reach the eyed-egg stage (approximately 400 CTU's at transfer). A representative group of 1,500 eyed-eggs is transferred from Eagle Fish Hatchery to Burley Creek Fish Hatchery for the captive broodstock

and adult release programs annually. Additional information is available in annual NOAA Permit reports and/or BPA project completion reports (see Section 2.2.1).

Sawtooth Fish Hatchery – The Salmon River Spring Chinook HGMP describes incubation facilities at the Sawtooth Fish Hatchery.

Springfield Fish Hatchery – Eggs are disinfected with iodophor in an egg preparation room and then loaded into vertical flow incubators upon receipt and remain in these units through hatch and development to the swim-up fry stage. There are 48 incubator stacks, each holding eight incubator trays. Each stack can be supplied with ambient and chilled water. Incubator trays are loaded with approximately 5,000 eggs per tray. Pathogen-free groundwater is provided at a flow rate of 4 to 5 gpm to each stack.

Oxbow Hatchery – Eyed-eggs are received at the Oxbow Hatchery and incubated through hatching in vertical, Heath-style, incubator trays. Incubators can accommodate up to 26 stacks of 16 trays. Loading densities are approximately 4,000 eggs/tray. Flow through each incubation tray is fixed at 4 gpm.

5.5 REARING FACILITIES

Eagle Fish Hatchery – Eagle Fish Hatchery maintains a captive broodstock for Redfish Lake Sockeye salmon. Approximately 1,500 eyed-eggs are selected to represent each individual year class (brood year). Early rearing takes place in a number of small rearing containers from 30-gallon tanks to two-meter (430 gallon) semi-square tanks. Rearing densities do not exceed 8 kg/m^3 during the first two years of development. Smolts are transferred to three-meter (1,425 gallon) tanks and final maturation occurs in three and four meter (3,600 gallon) tanks.

Additional information is available in annual NOAA Permit reports and/or BPA project completion reports.

Burley Creek Fish Hatchery—NOAA's freshwater swim-up fry to smolt rearing is conducted at Burley Creek Fish Hatchery near Burley, WA (approximately 21 km south of the Manchester Research Station). This freshwater hatchery is designed as a protective rearing facility for salmonid captive broodstocks. The facility includes a 3,200-ft^2 rearing area in building 2 that contains nine 12-ft diameter grey and twelve 5-ft diameter blue circular tanks. The adjoining 2,760-ft^2 building 3 currently contains four 12-ft grey circular tanks and four 19-ft raceways. This building can be reconfigured to hold twenty 18-ft grey rearing troughs should the need arise. A fourth 4,048 ft^2 building is now in the procurement process and should be able to contain an additional twenty 19-ft long grey raceways or twelve 12-ft diameter grey circular tanks. These spaces and the 12-ft circular tanks are also used for some smolt to pre-spawning adult rearing.

All buildings are equipped with abundant windows that provide natural lighting for proper photoperiod entrainment. Artificial lights are designed to slowly ramp up and down to prevent startling the fish.

All tanks and raceways used for Sockeye captive broodstock rearing are completely covered with a taut 2.5 x 2.5 cm or smaller mesh nylon netting to prevent fish from jumping out. The energy absorbing properties of the nylon mesh minimized injuries that could occur to fish when they

leaped against it. In addition to the mesh, half of each tank is covered with solid black fabric that provides a covered refuge area fish can move under when they are disturbed. Raceways are one-quarter to one-third covered with dark plastic tarps. All circular tanks are half covered with black shade cloth.

A mild current (< 35 cm/sec) is generated in the circular rearing tanks by their shape, center drain, and inlet. This current provides a partial self-cleaning action in the tank and a very slight exercise potential. At least once a week, bottom material that is not swept out of the tank by the current is removed by brushing.

Manchester Research Station - A land-based seawater captive broodstock rearing complex has 13,773 ft^2 of floor space containing twenty 20-ft diameter circular grey fiberglass tanks for fish rearing. Skylights and translucent panels provide natural lighting. Artificial light is designed to slowly ramp up and down to prevent startling the fish.

All tanks used for Sockeye captive broodstock rearing are completely covered with a taut 1-inch x 1-inch or smaller mesh nylon netting to prevent fish from jumping out. A solid black fabric covers half the netting to provide fish a refuge to hide beneath. Center standpipes on all 13' and larger circular tanks are constructed to hold at least 6 inches of water depth in the tank when the external standpipe is pulled to lower tank water level. This design minimizes the chance of fish being accidentally dewatered during tank draining or flushing.

The shape of the tanks generates a mild current that carries non-settleable solids out of the tank. Settled solids are removed by brushing as needed.

Sawtooth Fish Hatchery – The Salmon River Spring Chinook HGMP describes rearing facilities at the Sawtooth Fish Hatchery.

Springfield Fish Hatchery – Early rearing takes place inside the hatchery building in linear fiberglass tanks. A total of 22 fiberglass tanks are available for indoor early rearing. Each unit has a maximum useable volume of 467 cu. ft. (53 ft. length x 41 in. width x 31 in. depth). When the Sockeye Salmon pre-smolts reach a target size of approximately 90 - 100 fpp, they are transferred to Mass Automated Marking System (MATS) marking units via an electric fish pump. The fish are adipose fin clipped, enumerated, and measured inside the MATS units, then immediately discharged to the outdoor raceways. This typically occurs in early July. The fish then begin the secondary rearing phase of their production cycle, which ends with smoltification and subsequent release into Sawtooth Valley waters. Pathogen-free groundwater will be supplied to the upstream end of each rearing tanks through a valved connection for flow control. Typical flow rates to each tank will be 167 gpm, at a temperature of 10˚C. Each tank has screens for segregating and retaining fish, and standpipes for water level control. A grated floor trench runs the length of the room at the downstream end of the tanks to collect overflow/drain water and route it into the hatchery drain pipe system. A spate cleaning waste drain pipe is also in the floor trench to collect and convey cleaning wastes to a pollution abatement pond.

All fish are adipose clipped by Pacific States Marine Fisheries Commission (PSMFC) personnel using a MATS trailer. Fish are pumped from the indoor rearing tanks to the trailer, then discharged to outdoor rearing raceways immediately after marking.

After marking, juvenile fish will reside in linear concrete outdoor raceways. A total of 22 raceways are available. Each unit has a maximum usable volume of 2,560 cu. ft. (80 ft. length x 8 ft. width x 4 ft. depth). Fish remain in these rearing units until they are transported to Sawtooth Fish Hatchery for acclimation and subsequent release into Redfish Lake Creek. The typical flow rate to each raceway is 800 gpm of 10˚C groundwater.

The concrete raceways have screens to segregate fish and aluminum dam boards to control depth. A downstream kettle serves as the quiescent zone to allow suspended solids to settle. A vacuum system transfers the waste to the pollution abatement pond.

Oxbow Hatchery– The Oregon Department of Fish and Wildlife's early rearing facilities at the Oxbow include twenty (20) Canadian Troughs (3 x 3 x 20) with rounded bottoms. Rearing volume is estimated at 150 ft.3 each. Fish will be reared at densities below 1 lb. of fish/gallon and a flow index <1.0 lb./inch/gallon

5.6 ACCLIMATION/RELEASE FACILITIES

Eagle Fish Hatchery – Eagle Fish Hatchery is operated as a captive broodstock facility; typically no releases occur from this facility. In years of high anadromous returns, a portion of the anadromous returning Sockeye will be incorporated into the captive broodstock program. In this scenario, a portion of the captive broodstock may be released to Sawtooth Valley lakes, so green eggs in excess of program goals are not taken.

NOAA Fisheries – NOAA Fisheries rears Sockeye salmon to mature adults (Age 3, 4, and 5) annually. These adults are reared at both the Burley Creek Fish Hatchery and Manchester Research Station. Mature adults are transferred to Idaho in September and released to Redfish or Pettit lakes (no additional acclimation period).

Sawtooth Fish Hatchery – Currently Sawtooth Fish Hatchery no longer rears Sockeye juveniles for release to Sawtooth Valley waters. Sawtooth Fish Hatchery does currently acclimate Sockeye smolts transferred from Springfield Fish Hatchery for one to two weeks before release to Redfish Lake Creek (see Section 10.6).

Springfield Fish Hatchery – The Springfield Fish Hatchery rears Sockeye juveniles from eyed eggs to the smolt stage. Smolts are transferred from Springfield Fish Hatchery to Sawtooth Fish Hatchery for a 1-2 week acclimation period (see Section 10.6) prior to being released directly into Redfish Lake Creek.

Bonneville Hatchery – Oxbow Hatchery will rear sockeye (eyed-egg to smolt) for the program. Oxbow reared smolts will be transferred to Bonneville Hatchery for at least two weeks of acclimation and released into Tanner Creek (tributary to the Columbia River).

5.7 DESCRIBE OPERATIONAL DIFFICULTIES OR DISASTERS THAT LED TO SIGNIFICANT FISH MORTALITY

Eagle Fish Hatchery – There have been no events at Eagle Fish Hatchery that have resulted in high Sockeye mortality.

Burley Creek Fish Hatchery – There have been no events at Burley Creek Fish Hatchery that have resulted in high Sockeye mortality.

Manchester Research Station – There have been no events at Manchester Research Station that have resulted in high Sockeye mortality.

Springfield Fish Hatchery – There have been no events at Springfield Fish Hatchery that have resulted in high Sockeye mortality. However, widespread morbidity and mortality were observed in BY2013 and BY2014 Springfield Fish Hatchery reared smolts released directly into Redfish Lake Creek in 2015 and 2016, respectively. Additionally, smolt survival to Lower Granite Dam for these brood years were also markedly lower than had been observed previously (Trushenski et al. 2019; Johnson et al. 2017). A series of experiments were undertaken to determine the cause of this high mortality. It was determined that the instantaneous transition from "hard" Springfield water to "soft" Redfish Lake Creek water was the primary causative factor. Stepwise acclimation from Springfield Fish Hatchery to Sawtooth Fish Hatchery "medium hardness" then to Redfish Lake Creek proved to be the most biologically and logistically effective means of addressing this issue. Post-release survival of subsequent brood years of smolts acclimated in this manner showed significantly higher survival than those released directly into the creek (Trushenski et al. 2019). Post-release survival of acclimated Springfield Fish Hatchery reared smolts to Lower Granite Dam remained high for BY2016 and BY2017, but adult returns of these fish have been extremely low (Tables 8, 9, 10). We will begin another series of experiments similar to Trushenski et al. (2019) in 2022 to evaluate the physiological development of these fish and look for developing pathological concerns that may be leading to latent mortality as these fish enter the estuary and open ocean.

5.8 INDICATE AVAILABLE BACK-UP SYSTEMS, AND RISK AVERSION MEASURES THAT WILL BE APPLIED, THAT MINIMIZE THE LIKELIHOOD FOR THE TAKE OF LISTED NATURAL FISH THAT MAY RESULT FROM EQUIPMENT FAILURE, WATER LOSS, FLOODING, DISEASE TRANSMISSION, OR OTHER EVENTS THAT COULD LEAD TO INJURY OR MORTALITY.

Eagle Fish Hatchery – Eagle Fish Hatchery is staffed with three full time employees that live on station and share alarm monitoring duty. A commercial monitoring service provides the alarm service at Eagle Fish Hatchery that incorporates six low water alarms and three chilled water alarms. The water supply at Eagle Fish Hatchery is provided by three 50hp submersible pumps, each with generator back-up in case of power failure. The water system is tied together so any of the three pumps can provide water to all parts of the facility. In the case of complete power/generator failure, artesian water flow of around 250 gallons per minute can be supplied to

rearing units. Each three-meter and four-meter tank is also backed-up with an oxygen system, with full oxygen bottles in place. A second population of Snake River Sockeye is maintained offsite at the NOAA Fisheries facility in the event of complete system failure and loss of fish at Eagle Fish Hatchery.

When anadromous Sockeye are transferred to Eagle Fish Hatchery, complete isolation is maintained between the anadromous Sockeye and the captive broodstock at Eagle Fish Hatchery. Staff working with anadromous Sockeye are not allowed to enter the captive broodstock building. Disinfecting footbaths (Iodine, Virkon, or other approved agent) and equipment disinfection is maintained in all working areas.

Burley Creek Fish Hatchery – Security measures to protect fish and property include water flow, fire, and intruder alarms. These are monitored through a security system linked to home and cellular telephones. A back-up generator is automatically activated during power failures. Resting wells can be readily turned on in the event of well or well pump failure. Manually operated life support oxygen can be turned on to every fish rearing container to help protect fish life during the event of a water flow stoppage, but oxygen is also continuously flowing to supplement the oxygenation provided by the degassing tower.

Manchester Research Station- A constant source of processed seawater ensures successful captive survival. A 40 hp standby pump is in place and can manually be brought on line in the event the primary 60 hp pump fails. The pipeline always has one replacement line available should a primary line fail. Two 330 kW generators can supply electrical power to the pumps and water processing system in the event of a power failure. Manually operated life support oxygen can be turned on to every fish rearing container to help protect fish life during the event of water flow stoppage, but oxygen is also continuously flowing to supplement the oxygenation provided by the degassing tower. An alarm system monitors the pumps and electrical supply and is tied into an automatic dialer system linked to cellular and home telephones.

Sawtooth Fish Hatchery – The Salmon River Spring Chinook HGMP describes system back-up and risk aversion measures at the Sawtooth Fish Hatchery.

Springfield Fish Hatchery – The Springfield Fish Hatchery has three FTE permanent staff members that live on station and cover shifts for alarm duties and other production checks, and up to four temporary staff for various seasonal fish culture duties. An alarm system is installed that will alert staff to low water and pump failures. Six production wells equipped with pumps on the facility have generator back-up in case of power failure. The water system is integrated so that any well can provide water to all parts of the facility. Artesian water flow can be supplied to outdoor rearing units in the case of complete power/generator failure. Indoor rearing tanks have a backup oxygen delivery system. The incubation room is equipped with four-inch piping to allow a temporary water pump to supply water out of the artesian head tank into the incubation room at approximately 500 gpm in the case of complete power/generator failure.

Oxbow Hatchery – The Oregon Department of Fish and Wildlife's Oxbow Hatchery headbox supplying the rearing ponds is alarmed to notify hatchery staff if water supply is interrupted. Little Herman Creek is the sole water source used during rearing and is gravity fed. Hatchery staff is on-call 24 hrs/day to address emergency or unexpected events. All ponds and head tanks are alarmed to notify hatchery staff if an equipment failure occurs. Fish health monitoring and

disease prevention standards consistent with ODFW and IHOT protocols are applied at Oxbow Hatchery.

Bonneville Hatchery – The Bonneville Fish Hatchery has 10 FTE permanent staff members that live on station and share alarm monitoring duty. The intake settling pond, rearing pond headboxes, and adult holding ponds are alarmed to notify hatchery staff if water supply is interrupted. Water supply for the hatchery comes from two sources Tanner Creek (gravity fed) and six wells that are located and maintained by the USACE Bonneville Dam. Hatchery staff is on-call 24 hrs/day to address emergency or unexpected events. Fish can be directly released into Tanner Creek by pulling pond screens and dam boards if an emergency release is warranted. Fish health monitoring and disease prevention standards consistent with ODFW and IHOT protocols are applied at Bonneville Hatchery.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1 SOURCE

Redfish Lake Sockeye is considered a closed population. The population was listed as endangered on November 11, 1991. The Sockeye captive broodstock program was started to protect and preserve the genetic diversity of the remaining population. The captive broodstock was partially founded by collecting out-migrating natural smolts from Redfish Lake. Approximately 886 smolts were collected representing three migration years (1991, 1992, and 1993). These juveniles were transferred to Eagle Fish Hatchery and reared to full maturation in captivity. Sixteen anadromous returning adults were also used to found the captive broodstock. These individuals were collected from 1991 through 1998 and spawned at Eagle Fish Hatchery. Finally, 26 residual Sockeye were collected from Redfish Lake and incorporated into the captive broodstock. Therefore, natural-origin returning anadromous Sockeye are all considered to be a result of different hatchery release strategies and are related to fish in the captive broodstock. Natural returning anadromous Sockeye are incorporated into the Eagle Fish Hatchery spawning matrix. Depending on number of returning adults, zero to 100% can be incorporated into the spawn matrix. Cryopreserved milt from these original founders is maintained at Eagle Fish Hatchery and has been incorporated in spawning matrices. However, cryopreserved milt has not been used since 2004 and likely will not be used in the future.

6.2 SUPPORTING INFORMATION

6.2.1 History

Historically, the broodstock program used allele-sharing coefficients to build an inbreeding-avoidance matrix. This approach guided breeding decisions by not spawning pairs of fish with a high allele-sharing index because such individuals have a higher probability of being related. Crosses were selected using this approach and the resulting eyed-eggs were pooled into rearing groups. Identity of familial groups was maintained by tank segregation until they were large enough to PIT-tag. Currently, genetic management relies upon a pedigree-based approach.

Maturing broodstock are first genotyped at 382 SNPs using target sequences described by Hasselman et al. (2018). Resulting genotypes are then used to conduct parentage analysis on the maturing broodstock so that individuals can be placed within the existing long-term pedigree of the captive population. The updated pedigree is then analyzed to select individual broodstock in a manner that minimizes mean kinship (MK) and maximizes the retention of genetic diversity. Pedigree-based programs that select individuals for breeding with low MK values have been demonstrated to maximize genetic diversity, minimize the rate of adaptation to the captive environment, minimize the rate of random genetic drift, and minimize long-term accumulation of inbreeding (Lacy 2009, Ballou and Lacy 1995, Montgomery et al. 1997, Fernandez and Toro 1999).

6.2.2 Annual size

The production goals at Eagle Fish Hatchery are achieved by maintaining a captive broodstock. Anadromous returning Sockeye are routinely incorporated into the captive broodstock. Anadromous fish are genotyped for parentage analysis. Prioritization of anadromous fish into broodstock is guided by the same principles as the captive broodstock such that selected anadromous individuals have low MK values to maximize the retention of genetic diversity. As an additional precaution, crosses using anadromous Sockeye are also guided by identifying and avoiding any full- or half-siblings among the maturing spawners. Currently, the captive broodstock maintained at Eagle Fish Hatchery meets production goals. Anadromous Sockeye incorporated into the captive broodstock will displace the number of captive reared Sockeye needed. In this scenario, captive broodstock are released to Redfish Lake.

6.2.3 Past and proposed level of natural fish in broodstock

The Redfish Lake Sockeye population is considered to be a closed population. All returning anadromous Sockeye (natural or hatchery) are considered to be a result of the hatchery program. For this reason, all returning anadromous Sockeye are genotyped to determine which Sockeye to incorporate into the captive broodstock. Even though the captive broodstock program currently meets all production goals, a portion of the returning anadromous Sockeye are incorporated into the spawning design. As production goals increase to meet smolt production numbers, the number of returning anadromous adults incorporated into the hatchery broodstock will increase. Table 18 displays the number of natural and hatchery-origin Sockeye that were trapped in the Sawtooth Valley and numbers incorporated into the broodstock from 2010 through 2021.

Table 18. Hatchery and natural Sockeye returns to the Sawtooth Valley and naturals incorporated into the captive broodstock, 2010-2021.

Return Year	Total Anadromous Trapped	Natural Origin Trapped	Hatchery Origin Trapped	Natural Origin Incorporated into Broodstock	Hatchery Origin Incorporated into Broodstock
2010	1,322	178	1,144	75	14
2011	1,099	145	954	79	23
2012	242	52	190	37	22
2013	270	79	191	44	38
2014	1,516	453	1,063	183	249

Return Year	Total Anadromous Trapped	Natural Origin Trapped	Hatchery Origin Trapped	Natural Origin Incorporated into Broodstock	Hatchery Origin Incorporated into Broodstock
2015	91	14	77	10	75
2016	572	33	539	32	209
2017	162	11	151	8	129
2018	113	13	100	10	95
2019	17	14	3	10	3
2020	151	125	26	82	25
2021	240	13	227	5	146
Total	**5,795**	**1,130**	**4,665**	**575**	**1,025**

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

As the program transitions into using only anadromous returns for broodstock needs, natural-origin adults will be incorporated into the broodstock at an initial rate of 10 percent.

The IDFG has identified current and future broodstock needs reliant on an increased and consistent return of anadromous adults; additional detail is provided in the ESA Recovery Plan for Snake River Sockeye Salmon (NOAA 2015) and Snake River Sockeye Springfield Fish Hatchery Step 2/Step 3 Review (NPCC 2012).

6.2.4 Genetic or ecological differences

Not applicable; see Section 1.2.

6.2.5 Reasons for choosing

Not applicable; see Section 1.2.

6.3 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR ADVERSE GENETIC OR ECOLOGICAL EFFECTS TO LISTED NATURAL FISH THAT MAY OCCUR AS A RESULT OF BROODSTOCK SELECTION PRACTICES.

All returning anadromous Sockeye salmon trapped in the Sawtooth Valley are genotyped. This genetic information is used to determine which fish to include into the captive broodstock population and also to develop spawning matrices used to avoid full-sib and half-sib crosses in the population.

The IDFG has identified current and future broodstock needs reliant on an increased and consistent return of anadromous adults; additional detail is provided in NOAA (2015) and IDFG (2010).

Not including adults collected at Bonneville Hatchery into the captive broodstock is a risk aversion measure to minimize potential adverse genetic effects of relaxing natural selection on migratory ability by releasing juveniles and trapping adults in the lower Columbia River. Releasing returning adults into basin lakes for volitional spawning will ensure their progeny are exposed to selection during migration to and from the Sawtooth Valley, preventing amplification of potentially maladaptive traits arising from changes in juvenile and adult migrations.

SECTION 7. BROODSTOCK COLLECTION

7.1 LIFE-HISTORY STAGE TO BE COLLECTED (ADULTS, EGGS, OR JUVENILES)

Historically, juvenile outmigrants, residual adult spawners, and anadromous adult spawners were used to create founding broodstocks (1991-1998).

Currently (Phase 2), captive broodstocks are created annually by spawning both captive and anadromous adults. With the implementation of the Springfield Fish Hatchery program, it is envisioned that eventually (Phase 3) only anadromous-origin adults returning to Sawtooth Valley weirs will be used as broodstock. This action achieves the objective of creating a locally adapted broodstock over time.

7.2 COLLECTION OR SAMPLING DESIGN

All returning anadromous Sockeye salmon are collected at two locations in the Sawtooth Valley (Sawtooth Fish Hatchery trap on the Salmon River and Redfish Lake Creek trap). Genetic samples are taken from all returning anadromous Sockeye for real-time analysis. A spawning design is developed that incorporates a portion of the returning anadromous Sockeye and is approved by the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) annually. Adults that assign to the Pettit or Alturas lake groups via PBT or GSI are released into Pettit or Alturas lake as assigned and are not used in the captive broodstocks.

7.3 IDENTITY

Only one population of Redfish Lake Sockeye is present in the Sawtooth Valley. Recent genetic analyses indicate some individuals in Pettit Lake are the result of introgression between contemporary releases of Redfish Lake Sockeye and an out-of-basin kokanee stock from Lake Whatcom, WA introduced into the lake in the 1960s (Eaton et al. 2021). Hatchery-origin fish are identified using a variety of marks and tags based on rearing strategies.

7.4 PROPOSED NUMBER TO BE COLLECTED

Current Sockeye production goals are met with Sockeye maintained at Eagle and Burley Creek fish hatcheries in the captive broodstock program. Anadromous returning Sockeye are routinely incorporated into the Eagle Fish Hatchery captive broodstock spawning design, but this number varies depending on how many Sockeye return and recommendations by the SBSTOC.

With the development of the Springfield Fish Hatchery facility and implementation of the Master Plan, the program will begin shifting to the use of locally adapted broodstock. Both NOR and HOR adults (and jacks) will be collected at weirs located in the Sawtooth Valley. The goal is to eventually collect 1,150 anadromous adults for use as broodstock.

Additional detail on broodstock collection and utilization is provided in the NOAA's Snake River Sockeye Salmon Recovery Plan (NOAA 2015) and Springfield Fish Hatchery Master Plan for the Snake River Sockeye Program (IDFG 2010).

7.4.1 Program goal (assuming 1:1 sex ratio for adults)

Currently (Phase 2), 1,640 captive broodstock spawners (820 females and 820 males) are required to meet the production goal of one million smolts (approx. 1,115,000 eyed-eggs). Anadromous Sockeye incorporated into the captive broodstock will reduce the number required (Table 19). Captive broodstock in excess of the number required will be released to Redfish and/or Pettit lakes for volitional spawning. Future Alturas Lake actions will be consistent with NOAA's recovery plan for Snake River Sockeye salmon (NOAA 2015).

Once recruit-per-spawner levels, and therefore adult return levels, needed to facilitate population recovery are met, the Springfield Fish Hatchery program would then transition to Phase 3, implementing a sliding-scale model that integrates broodstock and escapement management driven by natural production (IDFG 2010; NPCC 2012). It is estimated that 1,150 adults will be used, on average, as broodstock for the program (NOR = 115, HOR = 1,035).

7.4.2 Broodstock collection levels for the last twelve years or for most recent years available

Table 19. The number of anadromous broodstock incorporated into the Redfish Lake Sockeye production program 2010 - 2021.

Year	Anadromous Adults Kept for Broodstock				Prespawn Mortality Females	Prespawn Mortality Males
	Females	Males	Jacks	Jills		
2010	47	42	0	0	2	6
2011	52	47	3	0	2	3
2012	29	27	2	1	1	3
2013	35	36	4	7	1	2
2014	198	175	37	22	3	2
2015	42	39	1	0	0	2
2016	117	117	3	4	0	0
2017	66	70	0	1	5	15
2018	49	56	0	0	2	0
2019	7	6	0	0	0	0
2020	55	52	6	0	0	2
2021	68	79	2	2	0	1

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

7.5 DISPOSITION OF HATCHERY-ORIGIN FISH COLLECTED IN SURPLUS OF BROODSTOCK NEEDS

Hatchery-origin Sockeye collected in surplus of hatchery broodstock needs are released to Sawtooth Valley lakes for volitional spawning; a summary of releases for natural spawning are found in Table 16. These releases will include adults collected at Bonneville Hatchery.

7.6 FISH TRANSPORTATION AND HOLDING METHODS

IDFG Transportation – Anadromous Sockeye trapped returning to the Sawtooth Valley are transported to Eagle Fish Hatchery and temporarily held before release or incorporation into the spawning design. Sockeye are held in 3- and 4-meter rearing tanks for up to 6 weeks if released or up to 12 weeks if incorporated into the spawning design. Anadromous returning adults are not transferred to NOAA Fisheries for broodstock incorporation.

NOAA Fisheries Transportation - NOAA transports broodstock as smolts from freshwater rearing at Burley Creek Fish Hatchery for seawater rearing at the Manchester Research Station. NOAA transports pre-spawning broodstock adults from seawater rearing at the Manchester Research Station to Burley Creek Fish Hatchery for final freshwater maturation. The transit time between the Manchester and Burley facilities is usually less than 30 minutes in the containers described in section 5.2. Up to 1,000 maturing adults are then transported 14-16 hours from Burley Creek Fish Hatchery to Redfish and Pettit lakes for adult releases by IDFG personnel. The rest are held for spawning. Fish are handled with extreme care during transport and processing procedures. Prior to transport fish are fasted for 48 hours to reduce metabolic demand and stress. The containers are loaded at no more than 0.5 lb/gallon. Drivers are equipped with cell phones and have backup personnel ready to respond in event of equipment failure.

ODFW Transportation – The Oregon Department of Fish and Wildlife's Sandy Hatchery Spring Chinook HGMP (ODFW 2013) describes their fish transportation methods, and the Bonneville Hatchery Tule Fall Chinook Salmon Program HGMP (ODFW 2017) describes adult holding facilities at Bonneville Hatchery. A standard fish transport truck of 1,500-2,000 gallons and regional drivers would be used to move the fish.

7.7 DESCRIBE FISH HEALTH MAINTENANCE AND SANITATION PROCEDURES APPLIED

Fish health protocols used in the captive broodstock program follow accepted, standard practices. For an overview of standard methods, see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; McDaniel et al. 1994; Bromage and Roberts 1995; Pennell and Barton 1996; and Wedemeyer 2001. Protocols conform to the fish health requirements detailed in ESA Section 10 Propagation Permit Number 1454 for IDFG rearing of ESA-listed Snake River Sockeye salmon.

Additionally, considerable coordination was carried out between NOAA and IDFG fish health experts, as well as participants in the SBSTOC.

NOAA Fisheries Facilities - See description above and in Section 9.2.7.

Springfield Fish Hatchery – Once received, eyed eggs are disinfected with iodophor in small batches in an isolated egg preparation room before loading into vertical flow incubators. Due to concerns with horizontal disease transmission, the incubators are configured in eight tray stacks (48 stacks total) with isolation baffles in between each stack.

Additional detail is provided in Sections: 9.1.6; 9.2.7; and 10.9.

Eagle Fish Hatchery – See description above and in Section 9.2.7.

7.8 DISPOSITION OF CARCASSES

As per NOAA Section 10 Permit guidelines, all carcasses resulting from captive broodstock activities at Eagle Fish Hatchery and NOAA Fisheries hatcheries are transported to the local rendering plant or landfill for disposal.

7.9 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR ADVERSE GENETIC OR ECOLOGICAL EFFECTS TO LISTED NATURAL FISH RESULTING FROM THE BROODSTOCK COLLECTION PROGRAM.

Artificial production programs and associated RM&E components are developed to minimize genetic and ecological risks to target population. The program complies with NOAA Section 10 permitting language and program oversight is further dictated by Stanley Basin Sockeye Technical Oversight Committee member recommendations.

SECTION 8. MATING

This section describes fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1 SELECTION METHOD

Annual spawning guidelines are approved after SBSTOC and NOAA Northwest Fisheries Science Center review and recommendations.

Eagle Fish Hatchery – Eagle Fish Hatchery maintains a captive broodstock of Redfish Lake Sockeye salmon. Eyed-eggs are selected to represent all spawners (equally) for each individual brood year. Anadromous returning Sockeye are incorporated into the captive broodstock spawning design annually. Anadromous Sockeye and captive broodstock not required to meet

green egg production goals are released to Redfish Lake to spawn naturally. Genetic information is analyzed for all individuals in the broodstock, and spawn crosses are random (full- and half-sibs are identified and excluded from being crossed).

Burley Creek Fish Hatchery - All captive broodstock females that survive to maturity and ripen in September, October, or November are spawned. All available males (producing motile milt) ripening in this same time frame are used at least once in spawning, and many are used twice. Genetic information is analyzed for all broodstock individuals, and spawn crosses are random (full- and half-sibs are identified and excluded from being crossed). All progeny from healthy parents are shipped to Springfield Fish Hatchery as eyed eggs for use in reintroduction activities.

Current and future spawn matrices will be reliant upon the successful return of anadromous adults for broodstock development.

8.2 MALES

Eagle Fish Hatchery – No back-up males or pooled samples are used in spawn crosses. Every attempt is made to spawn males equally with no preference to age of male. A spawning matrix is used with the eggs from each female split into two equal subfamilies. Each subfamily is crossed with a unique male. Assuming a one-to-one sex ratio, each male would be used on average two times.

Burley Creek Fish Hatchery— A factorial spawning protocol is used with the eggs from each female split into two equal subfamilies. Each subfamily is crossed with a unique male. Assuming a one-to-one sex ratio, each male is used at least once, usually twice, and rarely three times. Every attempt is made to use all maturing males at least once.

8.3 FERTILIZATION

Eagle Fish Hatchery – A factorial spawning design is used at Eagle Fish Hatchery, with the eggs from one female split into two equal subfamilies. Each subfamily is crossed with milt from one male (1:2 ratio). The individual spawn crosses are randomly selected, but avoiding half-sib and full-sib crosses between individuals. Milt is collected from the desired male in a whirl-pak. A small sample is collected to determine milt quality, oxygen is added to the sample and it is temporarily stored in a cooler (two male milt samples are collected for each female spawned). The green eggs from the female and the two bags of milt are transferred to the fertilization station where the eggs are weighed and split into two equal subfamilies. Each subfamily is crossed with one bag of milt. The milt is poured directly into the ziplock bag of eggs, the milt bag is then rinsed with approximately 5 mls of activator (1% saline solution) and added to the fertilized eggs. The eggs/milt are gently mixed to insure good fertilization. After two minutes, excess solution is drained from the eggs and the eggs are added to an incubator containing 100 ppm Argentine for a 20 minute surface disinfection. After 20 minutes, the incubator of fertilized eggs is placed in one egg basket located in vertical stack incubators. Each egg tray contains four egg baskets (two females per egg tray). Each stack of eight egg trays is supplied with 5 gallons per minute of chilled well water.

Burley Creek Fish Hatchery-- Gamete crosses are structured to maintain genetic diversity. Eggs from each female are divided into two lots. Each lot of eggs is paired with a different male

to decrease the risk of all eggs of one female being crossed with an infertile male. Males and females are randomly selected, as the increased effective size (N_e >500) of this recovering population preserves genetic diversity.

During the captive broodstock spawning season, which typically begins around October 1 and lasts until mid-November, females are checked for ripeness on a weekly basis, and more frequently as the fish mature. In most years, especially at the onset of the spawning season, males tend to have low milt volumes when live spawned, and sometimes the milt lacks sufficient motility. Hormone implants consisting of 50-100µg gonadotropin releasing hormone analog (GnRHa) pellets are injected into the dorsal musculature of males to expedite spermiation to coordinate spawning timing between males and females (Swanson 1995). The GnRHa implants subsequently increase the volume of milt produced and ensure the availability of a sufficient number of spermiating males to pair with ovulating females during spawn. At the end of the spawning season, a few late ripening females may also be implanted to ensure that their eggs reach the eyed stage in time to be transported for release to the Sawtooth Valley lakes before ice-over.

Female fish that are ready to spawn, as determined by egg expression and ventral softness, are anesthetized, killed, and their PIT tag, fork length, and weight recorded. The females are bled by severing the caudal peduncle to the depth of the caudal blood vessels. The bleeding procedure limits the amount of blood that accumulates with the eggs and might interfere with fertilization. Females are bled for 5-10 minutes and then abdominally incised with a sterile spawning knife. The free-flowing eggs are then gently stripped and collected into a disinfected collection bowl and transferred to a 2-liter white paper bulk food container. The eggs from each female are weighed, divided into two lots, and kept cool until they are fertilized. All spawned females are analyzed for common bacterial and viral pathogens by analysis of tissue and fluid samples. Ovarian fluid from all females and kidney and spleen tissue from 60 males are collected for virology analysis. Kidney tissue from each female is collected for bacterial kidney disease (BKD) analysis by enzyme-linked immunosorbent assay (ELISA) testing. The samples are chilled until they can be transported to the IDFG Fish Health Lab at Eagle Fish Hatchery.

Males are selected based upon their ripeness and sperm motility. All selected males are used at least once in spawning, most are used twice, and a few might be used three times if needed. Males are live-spawned by ventral compression, and the milt collected into 2-ml Whirl-pak bags. Milt motility is qualitatively assessed using a microscope (40x) and classified as “excellent” (near 100% motility) “good” (80% motility), “fair” (about 50% motility), “poor” (less than 20% motility), or “no good” (0% motility). To ensure consistency, the qualitative milt analyses are typically performed by the same individual. Bags of milt are sealed and chilled until used on the day they are collected. Once spawning is completed for the season, all males are killed and tissue samples are collected from 60 fish for bacterial analysis.

Eggs are fertilized following “dry method” procedures (Piper et al 1982). Milt from a single male is added to each half of a female’s eggs in the food containers. The eggs and milt are gently mixed for one full minute. Enough water is added to just cover the eggs and activate the sperm, and the eggs are lightly agitated to distribute the activated milt. The containers are left undisturbed for approximately five minutes for fertilization to take place. The eggs from each female are then recombined into a single lot and transferred to their individual isobucket for water hardening in a 1 ppm free iodine solution (buffered to obtain a pH of 6.5-7.0) for 20

minutes. After 20 minutes, water flow is introduced to rinse the iodophore and provide fresh water for the duration of incubation.

8.4 CRYOPRESERVED GAMETES

Eagle Fish Hatchery – Cryopreserved milt from original founders is maintained at Eagle Fish Hatchery. Occasionally the cryopreserved milt has been used in random spawn crosses in the program. Since the program started, fifty-five crosses have been made with cryopreserved milt. Of these crosses, twenty have produced viable eggs, with an overall survival to the eyed-egg stage of 14.3%. Cryopreserved milt was last used in 2004. We will continue to maintain these samples, but any future use would be approved through the SBSTOC and NOAAF Seattle Science Center.

Burley Creek Fish Hatchery - Cryopreserved gametes are neither taken nor used at Burley Creek Fish Hatchery.

8.5 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR ADVERSE GENETIC OR ECOLOGICAL EFFECTS TO LISTED NATURAL FISH RESULTING FROM THE MATING SCHEME

Annual spawning guidelines are approved after SBSTOC and NOAA Northwest Fisheries Science Center review and recommendations.

A factorial mating scheme is applied to reduce the risk of losing Redfish Lake Sockeye population genetic diversity. Additionally, SNP analysis is used to determine broodstock selection based on relatedness of individual Sockeye in the spawning population. This allows spawn crosses to be made with randomly selected males and females, while avoiding half-sib and full-sib crosses.

Future programmatic risk aversion measures to minimize adverse genetic and ecological effects are provided in NOAA (2015) and IDFG (2010).

SECTION 9. INCUBATION AND REARING

Specify any management goals (e.g., egg to smolt survival) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

Data for this section is provided for the Eagle Fish Hatchery and NOAA hatchery programs in Tables 20 and 21, respectively, and covers the period 2008-2021. Table 22 summarizes information from all programs for the period and includes Eagle, NOAA, Oxbow (discontinued), Sawtooth (discontinued), and Springfield fish hatchery programs.

9.1 INCUBATION

9.1.1 Number of eggs taken and survival rates by life stage through smolts

Table 20. Survival of hatchery Sockeye eggs/juveniles from, 2008-2021 (Eagle Fish Hatchery program).

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Standard	Fry – Parr Survival (%)	Rearing Survival Performance Standard	Parr–Smolt Survival (%)	Rearing Survival Performance Standard
2008	241,220	91.34%	85.12%	> 85%	95.72%	> 90%	93.79%	> 95%
2009	326,309	89.23%	78.37%	> 85%	96.41%	> 90%	98.33%	> 95%
2010	272,039	84.11%	57.44%	> 85%	98.17%	> 90%	98.14%	> 95%
2011	314,396	79.37%	94.83%	> 85%	98.98%	> 90%	98.36%	> 95%
2012	243,223	87.14%	94.15%	> 85%	99.13%	> 90%	98.90%	> 95%
2013	465,878	82.06%	93.79%	> 85%	99.36%	> 90%	98.49%	> 95%
2014	744,538	81.55%	94.98%	> 85%	99.01%	> 90%	97.72%	> 95%
2015	651,399	77.39%	87.00%	> 85%	99.16%	> 90%	96.14%	> 95%
2016	847,975	79.17%	92.87%	> 85%	98.28%	> 90%	97.74%	> 95%
2017	998,949	83.81%	93.35%	> 85%	98.86%	> 90%	99.35%	> 95%
2018	861,472	80.14%	96.29%	> 85%	98.83%	> 90%	98.89%	> 95%
2019	1,005,762	79.74%	98.20%	> 85%	98.71%	> 90%	99.52%	> 95%
2020	958,562	66.53%	96.27%	> 85%	98.75%	> 90%	Pending	> 95%
2021	873,813	57.10%	Pending	> 85%	Pending	> 90%	Pending	> 95%

Source: Annual project reports to Bonneville Power Administration and annual project reports to NOAA Fisheries for ESA Section 10 activities.

Table 21. Survival of hatchery Sockeye eggs/juveniles from NOAA Fisheries, 2008-2021.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Standard	Fry – Fingerling Survival (%)	Rearing Survival Performance Standard	Fingerling – Smolt Survival (%)	Rearing Survival Performance Standard
2008	179,942	74.53%	65.96%	> 85%	97.08%	> 90%	98.10%	> 95%
2009	159,502	81.38%	47.87%	> 85%	91.09%	> 90%	90.89%	> 95%
2010	263,208	63.03%	79.73%	> 85%	99.86%	> 90%	86.50%	> 95%
2011	176,233	80.88%	91.35%	> 85%	99.81%	> 90%	97.21%	> 95%
2012	170,009	81.26%	93.65%	> 85%	99.64%	> 90%	98.14%	> 95%
2013	242,592	68.16%	91.23%	> 85%	99.93%	> 90%	98.16%	> 95%

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Standard	Fry – Fingerling Survival (%)	Rearing Survival Performance Standard	Fingerling – Smolt Survival (%)	Rearing Survival Performance Standard
2014	238,898	76.61%	93.09%	> 85%	99.78%	> 90%	98.54%	> 95%
2015	533,474	67.98%	96.47%	> 85%	99.79%	> 90%	98.62%	> 95%
2016	557,694	66.92%	96.42%	> 85%	97.69%	> 90%	98.78%	> 95%
2017	278,631	82.17%	93.62%	> 85%	100.00%	> 90%	98.86%	> 95%
2018	520,839	81.73%	94.88%	> 85%	99.86%	> 90%	98.81%	> 95%
2019	617,690	77.89%	95.80%	> 85%	99.79%	> 90%	99.37%	> 95%
2020	457,987	77.29%	95.93%	> 85%	97.29%	> 90%	Pending	> 95%
2021	514,180	79.02%	Pending	> 85%	Pending	> 90%	Pending	> 95%

Source: Annual project reports to Bonneville Power Administration and annual project reports to NOAA Fisheries for ESA Section 10 activities.

Table 22. Survival of hatchery Sockeye eggs/juveniles from production facilities, 2008-2021. Includes production from Oxbow, Sawtooth, and Springfield fish hatcheries.

Year	Eyed Eggs Received	Eyed-Ponding Survival (%)	Egg Survival Performance Standard	Fry – Fingerling Survival (%)	Rearing Survival Performance Standard	Fingerling – Smolt Survival (%)	Rearing Survival Performance Standard
2008	282,481	96.55%	> 85%	88.3%	> 90%	99.2%	> 95%
2009	343,627	92.97%	> 85%	80.6%	> 90%	99.5%	> 95%
2010	313,245	76.18%	> 85%	91.2%	> 90%	99.2%	> 95%
2011	344,398	87.63%	> 85%	95.8%	> 90%	97.9%	> 95%
2012	345,163	94.05%	> 85%	91.5%	> 90%	99.4%	> 95%
2013	544,672	89.42%	> 85%	88.0%	> 90%	98.7%	> 95%
2014	779,044	85.32%	> 85%	96.0%	> 90%	99.6%	> 95%
2015	862,398	91.50%	> 85%	93.5%	> 90%	99.5%	> 95%
2016	1,037,310	93.38%	> 85%	93.5%	> 90%	99.1%	> 95%
2017	1,056,904	95.21%	> 85%	89.6%	> 90%	97.9%	> 95%
2018	1,107,768	89.73%	> 85%	95.0%	> 90%	99.2%	> 95%
2019	1,276,200	96.20%	> 85%	97.0%	> 90%	94.6%	> 95%
2020	972,338	96.13%	> 85%	97.9%	> 90%	Pending	> 95%
2021	897,828	Pending	> 85%	Pending	> 90%	Pending	> 95%

Source: Annual project reports to Bonneville Power Administration and annual project reports to NOAA Fisheries for ESA Section 10 activities.

9.1.2 Cause for, and disposition of surplus egg takes

Eagle Fish Hatchery and NOAA Fisheries maintain a captive Sockeye salmon broodstock developed and maintained to protect the genetic diversity of the Redfish Lake Sockeye. A small group of Sockeye are reared to maturity at Eagle Fish Hatchery and NOAA Fisheries for spawning. A representative sample of eyed-eggs is maintained at Eagle Fish Hatchery and NOAA Fisheries fish hatchery facilities for the next generation (currently 1,500 eyed-eggs per program). The remaining eyed-eggs produced are transferred to Springfield Fish Hatchery for production rearing. Eyed eggs in excess of program needs (higher survival or higher fecundities) can be released to Pettit Lake as eyed eggs or reared through presmolts at Springfield Fish Hatchery and released to Redfish and Pettit lakes to reduce inventory at Springfield Fish Hatchery. Eggs from females with moderate ELISA values (0.250 – 0.399) or determined by GSI or PBT to be from the Pettit Lake are released to egg boxes in Pettit Lake. Anadromous adults are also incorporated into the spawning design at Eagle Fish Hatchery. Adults in excess of current program needs are released to Sawtooth Valley lakes for volitional spawning.

9.1.3 Loading densities applied during incubation

Eagle Fish Hatchery – Eagle Fish Hatchery uses vertical flow incubators (four sub-families per tray) for egg incubation through the eyed-egg stage. Trays are sectioned into four quadrants using egg baskets to maintain isolation between sub-families and females. Vertical flow incubator trays are grouped into stacks of eight with each stack receiving a flow of 5 gallons per minute well water. Incubator baskets are loaded with between 400 and 1,200 eggs each.

Burley Creek Fish Hatchery-- Incubators are approximately four liters and maintain a flow approximately 0.6 liter per minute. Incubators are loaded with between 500-2,000 eggs each.

Springfield Fish Hatchery – Springfield Fish Hatchery uses vertical flow incubators at 5,000 eggs per tray. Pathogen-free groundwater is supplied at a flow rate of 4 to 5 gpm to each stack of trays.

Oxbow Hatchery – Oxbow Hatchery uses vertical, Heath-style, incubator trays with loading densities of approximately 4,000 eggs/tray. Flow through each incubation tray is fixed at 4 gpm.

9.1.4 Incubation conditions

Eagle Fish Hatchery – Eggs are incubated between 7°C and 11°C. Dissolved oxygen is maintained around 9.0 ppm (saturation) on well water flow (no silting concerns).

Burley Creek Fish Hatchery-- Individual lots of eggs spawned at Burley Creek Fish Hatchery are placed into isolation buckets in incubation troughs and covered with heavy black plastic to eliminate light. The eggs are left undisturbed during the sensitive period beginning 48 hours after fertilization until they reach the eyed stage (44 days at 7^{o} C). The eggs are then packed into plastic mesh tubes, wrapped in wet toweling, packaged into coolers, and shipped to Eagle Fish Hatchery for transferring to Springfield Fish Hatchery.

Captive broodstock eggs that are received from IDFG and the subsequent fry are incubated in the above described isolation buckets and periodically checked for mortalities. Early growth is regulated by temperature to bring emergence timing into closer synchrony with the wild Sockeye salmon, reducing the need for limiting post-ponding feeding.

Springfield Fish Hatchery – A small number of eggs may be incubated as low as 5˚C, however, most are incubated between 7 ˚C and 10˚C on well water flow.

Oxbow Hatchery – Oxbow Hatchery incubates eggs at 7.2˚C on spring water flow.

9.1.5 Ponding

Eagle Fish Hatchery – Cumulative temperature units are monitored to determine ponding timing. The actual pond date varies and final ponding is determined by physical observation of the button-up fry. No yolk sac is visible on the button-up fry when ponding occurs. Historically, ponding occurs at approximately 950 CTUs.

Burley Creek Fish Hatchery-- At swim-up stage, just as the yolk sac is completely absorbed, BioOregon Mash feed is introduced to initiate first feeding. To assure that fry are feeding and thriving, they remain in the containers and are transferred to larger flow-through containers until they reach approximately 0.6 g, at which time they are transferred from the containers into 1.5-m diameter tanks. The water temperature is normally increased to ambient well water temperature (~10º C) on or around 1 April.

Springfield Fish Hatchery – Swim up fry are transferred in February/March to the early rearing tanks. The early rearing room is adjacent to the incubation room, and contains a total of 22 fiberglass troughs configured in 11 pairs. Aisles provide access between each pair of early rearing troughs. Groundwater is supplied to each tank at a typical flow rate of 167 gpm. A flow control valve and standpipes provide water control measures. Cleaning waste is collected at the effluent end of the tanks and conveyed via a pipe to the effluent pollution abatement pond.

Oxbow Hatchery – Fry are ponded in February/March to early rearing tanks based on visual inspection of the amount of yolk remaining (80-90% utilized and contained within the body cavity), and on reaching a specified number of accumulated temperature units (about 950 CTUs).

9.1.6 Fish health maintenance and monitoring

Fish health protocols used in the captive broodstock program follow accepted, standard practices. For an overview of standard methods, see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; McDaniel et al. 1994; Bromage and Roberts 1995; Pennell and Barton 1996; and Wedemeyer 2001. Protocols conform to the fish health requirements detailed in ESA Section 10 Propagation Permit Number 1454 for IDFG rearing of ESA-listed Snake River Sockeye salmon. Additionally, considerable coordination was carried out between NOAA and IDFG fish health experts, as well as participants in the SBSTOC.

When required, the captive broodstock rearing program has used various disinfectants, antibiotics, vaccinations, and antifungal treatments to control pathogens. When used, the dosage, purpose of use, and method of application were as follows:

- **Antibiotic therapies**: When required, erythromycin treatments are administered orally in feed to produce a dose of 100 mg/kg of bodyweight for up to 28 days. When oral administration is not feasible (as with anadromous adults), an intraperitoneal injection of erythromycin is given to fish at a dose of 20 mg/kg of bodyweight. In addition, fish may be fed oxytetracycline as needed to control outbreaks of pathogenic myxobacteria, as well as aeromonad and pseudomonad bacteria.

- **Egg disinfection**: Newly fertilized eggs are water hardened in 100 mg/L solution of buffered Iodophor for 20 minutes to inactivate viral and bacterial pathogens on the egg surface and in the perivitelline space. In addition, eyed-eggs transferred to IDFG facilities are disinfected in a 100 mg/L buffered Iodophor solution for ten minutes prior to facility incubation.

- **Formalin Treatments**: Beginning two days after fertilization, the eggs are treated with a formalin drip into the hatchery head tank at 1,667 ppm for 20 minutes on alternating days for control of *Saprolegnia* spp. At Burley Creek Fish Hatchery, the formalin dose (1,667 ppm) is pumped into the incubation room water source pipe. Eyed eggs are shocked and dead or unfertilized eggs are removed to reduce the risk of fungus spreading to healthy eggs.

- **Vaccinations:** Approximately 2 to 3 weeks before the transfer of smolts to seawater, the fish receive a vaccination of *Vibrio* spp. This is administered by a one minute immersion in a bath that is 1 part vaccine to 9 parts water. The vaccine is a bivalent mix of *V. ordalii* and *V. anguillarum*.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation

Eagle Fish Hatchery – Eagle Fish Hatchery incubates eggs on well water; there is no risk associated with siltation or pathogens in the current water supply. Incubating eggs are treated with a 20 minute formalin bath at 1,667 ppm three times per week to control fungus on the eggs. Eggs from spawned females are isolated in individual incubation baskets and not mixed with eggs from other females during incubation.

Burley Creek Fish Hatchery - Eggs are incubated with well water to minimize the risk of catastrophic loss due to siltation or surface water-borne pathogens. To control fungus, incubating eggs are treated with a 20-minute formalin dose (1,667 ppm, two to three times per week), which is pumped into the incubation room water source pipe.

Springfield Fish Hatchery – Eggs are incubated on well water after treatment with iodophor and regular treatments of a 100 ppm iodophor flush or formalin to control fungus on the eggs.

Oxbow Hatchery – Eggs are incubated on spring water and disinfection procedures are implemented to prevent pathogen transmission between fish stocks.

9.2 REARING

9.2.1 Provide survival rate data (average program performance) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years or for years dependable data are available.

Table 23 summarizes survival information for these life stages from all programs for the period and includes Eagle, NOAA, Oxbow (discontinued), Sawtooth (discontinued), and Springfield fish hatchery programs.

Table 23. Survival of hatchery Sockeye eggs through smolt for Snake River production, 2008-2021 (all programs combined).

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Standard	Fry – Fingerling Survival (%)	Rearing Survival Performance Standard	Fingerling – Smolt Survival (%)	Rearing Survival Performance Standard
2008	421,162	84.16%	96.40%	> 85%	88.31%	> 90%	99.19%	> 95%
2009	485,811	86.65%	92.79%	> 85%	80.65%	> 90%	99.50%	> 95%
2010	535,247	73.74%	76.12%	> 85%	91.27%	> 90%	99.15%	> 95%
2011	490,629	79.91%	87.67%	> 85%	95.85%	> 90%	97.90%	> 95%
2012	413,232	84.72%	94.05%	> 85%	91.55%	> 90%	99.36%	> 95%
2013	708,470	77.30%	89.43%	> 85%	88.06%	> 90%	98.73%	> 95%
2014	983,436	80.35%	85.35%	> 85%	95.98%	> 90%	99.55%	> 95%
2015	1,184,873	73.15%	91.50%	> 85%	93.53%	> 90%	99.53%	> 95%
2016	1,405,669	74.31%	93.38%	> 85%	93.55%	> 90%	99.11%	> 95%
2017	1,277,580	83.45%	95.20%	> 85%	89.64%	> 90%	97.86%	> 95%
2018	1,382,311	80.74%	89.74%	> 85%	95.03%	> 90%	99.22%	> 95%
2019	1,623,452	79.04%	96.20%	> 85%	96.96%	> 90%	94.58%	> 95%
2020	1,416,549	70.01%	96.13%	> 85%	97.88%	> 90%	Pending	> 95%
2021	1,387,993	65.22%	Pending	> 85%	Pending	> 90%	Pending	> 95%

Source: Annual project reports to Bonneville Power Administration and annual project reports to NOAA Fisheries for ESA Section 10 activities.

9.2.2 Density and loading criteria (goals and actual levels)

Eagle Fish Hatchery – A variety of rearing containers are used for different sizes of Sockeye. Tanks range in size from 24 gallons to 3,645 gallons. Flow indices are maintained between 1.0

and 1.5. Fry through smolt size are maintained below 8 kg/meter^3. Maturing adults are maintained below 16 kg/meter^3.

Burley Creek Fish Hatchery-- Based on practical experience and published literature, loading densities for ESA captive broodstocks were set to not exceed 7 lbs/gpm, except for non-feeding maturing adults with oxygen supplementation. In practice, loading densities at BCH in freshwater tanks ranged from 0.5 lb/gpm to 7 lb/gpm. Raceway loading densities at BCH reached a maximum of 8 lb/gpm with non-feeding maturing adults and supplemental oxygen. Generally, juvenile-to-adult rearing density in the tanks was maintained at less than 0.5 lb/ft^3 during most of the culture period; however, fish density may increase to 1.0 lb/ft^3 at maturity.

Manchester Rearing Station--Seawater loading densities reached a maximum of 7 lb/gpm. Sockeye rearing densities in seawater are always maintained at 0.5 lb/ft^3 or less.

Springfield Fish Hatchery – Fry size at transfer into the 22 fiberglass tanks is 0.11 grams. Size at transfer to outdoor raceways is approximately 4.5 grams. Both indoor rearing and outdoor rearing have maximum flow indices of 1.0 and a maximum density index of 0.3.

Oxbow Hatchery – Juvenile rearing at Oxbow will start with the use of two 160 ft^3 troughs (.04 lbs/ft^3) and then be split into six troughs (.26 lbs/ft^3) before moving to an outside rearing raceway. Once moved to outdoor raceways the entire group of fish will be in one container at low densities. The density index will not exceed .05 and the flow index will not exceed .53 during this rearing phase.

Bonneville Hatchery – There are two adult holding ponds at Bonneville each have a volume of 35,055 ft^3. Adult holding densities in the ponds are maintained at 0.5 lb/ft^3 or less. Maximum density index for juvenile acclimation 0.3.

9.2.3 Fish rearing conditions

Fish culture methods used in the captive broodstock program follow accepted, standard practices. For an overview of standard methods, see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; McDaniel et al. 1994; Bromage and Roberts 1995; Pennell and Barton 1996; and Wedemeyer 2001. Protocols conform to the husbandry requirements detailed in ESA Section 10 Propagation Permit Number 1454 for IDFG rearing of ESA-listed Snake River Sockeye salmon. Additionally, considerable coordination is carried out between NOAA and IDFG culture experts, as well as participants in the SBSTOC.

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Average growth information from the Eagle, NOAA, and Springfield fish hatchery programs are summarized in Tables 24a, 24b, and 24c, respectively.

Table 24a. Average monthly growth rate of Snake River Sockeye at Eagle Fish Hatchery in their first two years in the hatchery environment.

Rearing Period	Fork Length (mm)	Weight (gms)	Condition Factor	Growth Rate (avg mm/mo)	Hepatosomatic Index	Body Moisture Content
January	NA	NA	NA	NA	NA	NA
February	22.1	0.1	NA	10.3	NA	NA
March	32.4	0.3	NA	14.1	NA	NA
April	46.5	1.0	NA	14.5	NA	NA
May	61.0	2.2	NA	14.0	NA	NA
June	75.0	4.1	NA	14.9	NA	NA
July	89.9	7.1	NA	18.4	NA	NA
August	108.3	12.4	NA	15.9	NA	NA
September	124.2	18.5	NA	14.5	NA	NA
October	138.7	25.9	NA	13.1	NA	NA
November	151.8	33.9	NA	12.5	NA	NA
December	164.3	43.0	NA	11.7	NA	NA
January	176.0	52.9	NA	13.0	NA	NA
February	189.0	65.8	NA	17.0	NA	NA
March	206.0	84.6	NA	21.0	NA	NA
April	227.0	113.3	NA	13.0	NA	NA
May	240.0	134.6	NA	17.0	NA	NA
June	257.0	165.1	NA	27.0	NA	NA
July	284.0	222.0	NA	25.0	NA	NA
August	309.0	285.8	NA	26.0	NA	NA
September	335.0	362.2	NA	26.0	NA	NA
October	361.0	454.7	NA	19.0	NA	NA
November	380.0	532.9	NA	25.0	NA	NA
December	405.0	645.8	NA	NA	NA	NA

Source: Historical sample count data from Eagle Fish Hatchery. Length recorded as "Fork Length", condition factor not calculated.

Table 24b. Average monthly growth rate of Snake River Sockeye at NOAA Fisheries in their first two years in the hatchery environment.

Rearing Period	Fork Length (mm)	Weight (gms)	Condition Factor	Growth Rate (avg mm/mo)	Hepatosomatic Index	Body Moisture Content
February	NA	0.2	NA	10	NA	NA
March	42	0.6	0.8	10	NA	NA
April	54	1.4	0.9	10	NA	NA
May	66	2.7	0.9	10	NA	NA

June	79	4.7	1.0	10	NA	NA
July	93	8.2	1.0	10	NA	NA
August	108	13.2	1.0	10	NA	NA
September	123	20.1	1.1	12	NA	NA
October	137	28.6	1.1	12	NA	NA
November	150	38.4	1.1	12	NA	NA
December	163	50.3	1.2	13	NA	NA
January	176	64.4	1.2	15	NA	NA
February	188	79.5	1.2	15	NA	NA
March	209	112.7	1.2	15	NA	NA
April	216	124.6	1.2	15	NA	NA
May	231	155.5	1.3	15	NA	NA
June	255	214.6	1.3	15	NA	NA
July	279	285.9	1.3	15	NA	NA
August	308	394.1	1.3	15	NA	NA
September	309	407	1.4	13	NA	NA
October	315	425	1.4	13	NA	NA
November	326	475	1.4	13	NA	NA
December	330	500	1.4	13	NA	NA

Source: Historical ration projections and limited size sample data from Burley Creek Fish Hatchery and Manchester Research Station. Length recorded as "Fork Length", condition factor calculated as weight (g) / fork length^3 (cm) *100.

Table 24c. Average monthly growth rate of Snake River Sockeye at Springfield Fish Hatchery from ponding to smolt.

Rearing Period	Fork Length (mm)	Weight (gms)	Condition Factor	Growth Rate (avg mm/mo)	Hepatosomatic Index	Body Moisture Content
January	N/A	N/A	N/A	N/A	N/A	N/A
February	27.2	0.2	0.8	3.7	N/A	N/A
March	40.7	0.5	0.8	13.5	N/A	N/A
April	58.3	1.5	0.8	17.6	N/A	N/A
May	70.6	2.7	0.8	12.2	N/A	N/A
June	83.4	4.6	0.8	12.8	N/A	N/A
July	92.2	6.0	0.8	8.9	N/A	N/A
August	105.0	8.9	0.8	12.8	N/A	N/A
September	110.6	10.8	0.8	5.6	N/A	N/A
October	112.2	12.0	0.8	1.6	N/A	N/A
November	117.7	13.9	0.9	5.5	N/A	N/A
December	123.4	17.3	0.9	5.6	N/A	N/A
January	134.2	21.5	0.9	10.8	N/A	N/A
February	142.1	26.3	0.9	8.0	N/A	N/A

March	153.4	33.5	0.9	11.2	N/A	N/A
April	164.9	37.9	0.8	11.5	N/A	N/A
May	N/A	N/A	N/A	N/A	N/A	N/A
June	N/A	N/A	N/A	N/A	N/A	N/A
July	N/A	N/A	N/A	N/A	N/A	N/A
August	N/A	N/A	N/A	N/A	N/A	N/A
September	N/A	N/A	N/A	N/A	N/A	N/A
October	N/A	N/A	N/A	N/A	N/A	N/A
November	N/A	N/A	N/A	N/A	N/A	N/A
December	N/A	N/A	N/A	N/A	N/A	N/A

9.2.5 Indicate monthly fish growth rate and energy reserve data (average program performance), if available

See Tables 24a, 24b, and 24c in Section 9.2.4 for monthly growth information; energy reserve data is not available.

Eagle Fish Hatchery and NOAA Fisheries Fish Hatchery Facilities - The fish are grown according to the profile described in Figure 3 which is based upon periodic sample-weights of past brood years.

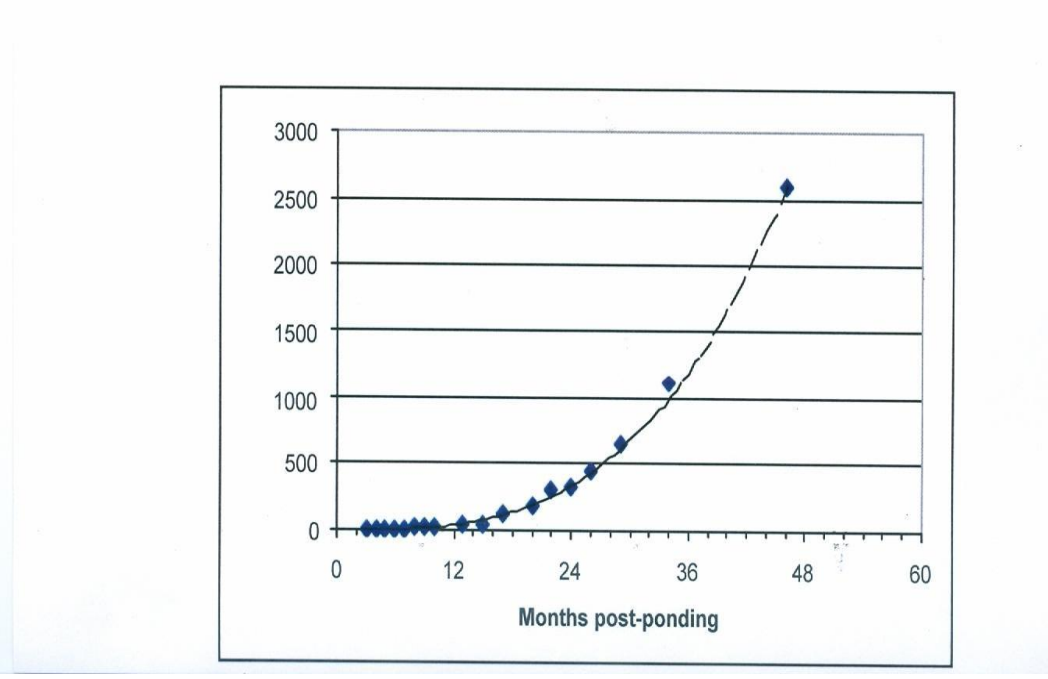

Figure 3. Generalized growth profile, by weight, of Sockeye salmon based on past brood years for Eagle and NOAA fish hatchery facilities.

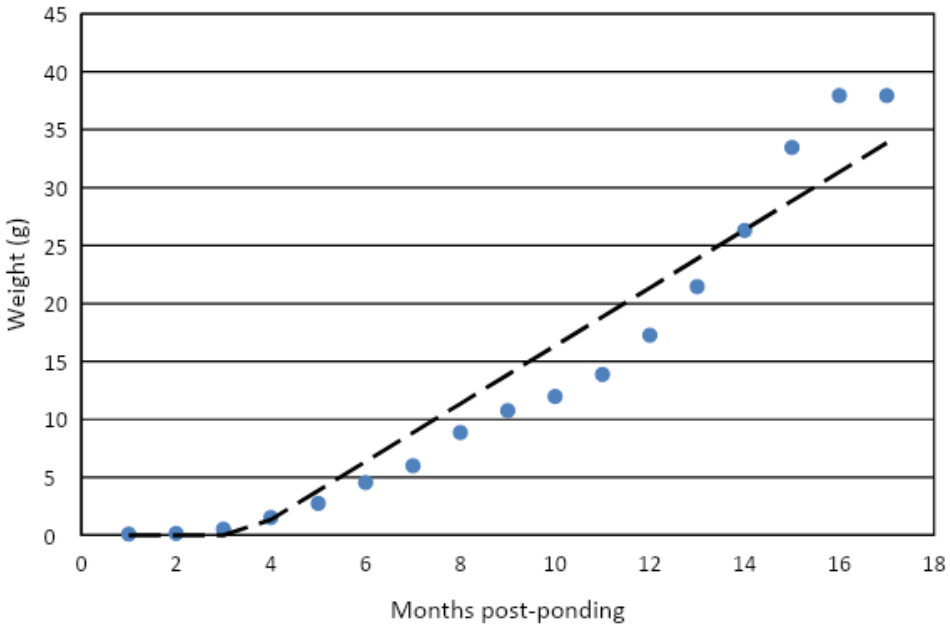

Figure 4. Generalized growth profile, by weight, of Sockeye salmon based on past brood years for Springfield Fish Hatchery.

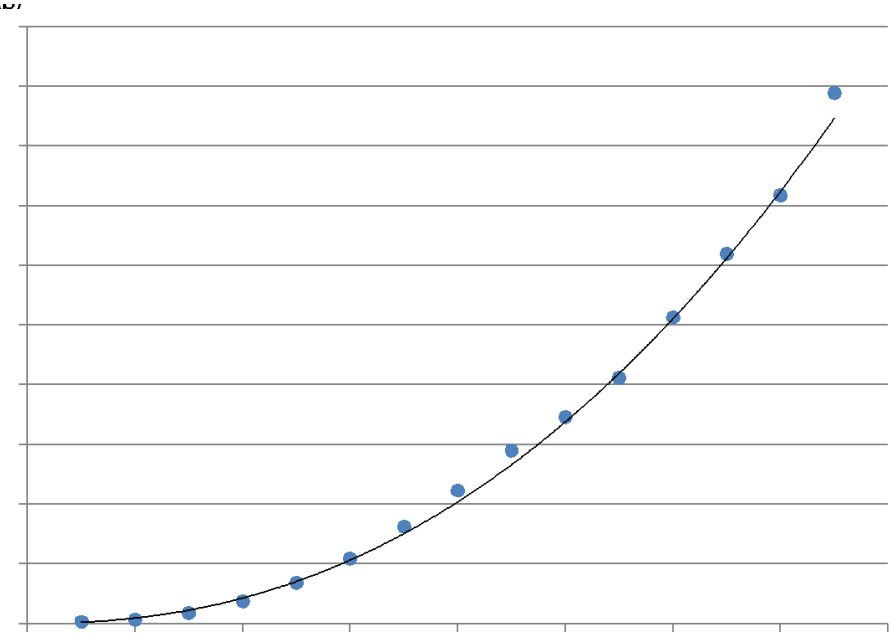

Figure 5. Generalized growth profile, by weight, of Sockeye salmon based on past brood years for Oxbow Hatchery.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (average program performance).

Information on food types, feeding rate, and conversion for the Eagle, NOAA, and Springfield fish hatcheries are provided in Tables 25a, 25b, and 25c, respectively. Pound of feed per gpm of inflow is not recorded for any of the programs.

Table 25a. Feeding regime for Sockeye production at Eagle Fish Hatchery.

Rearing Period	Food Type	Application Schedule (# feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. fed per gpm of inflow	Food Conversion During Period
Swim-up to 0.25g	Starter #0	8	3.5	0.002	1
0.25 to 0.55 g/f	Starter #1	8	3.3	0.004	1
0.55 to 3.0 g/f	Starter #2	8	2.5	0.008	1.1
3.0 to 5.0 g/f	1.2	4	2.25	0.011	1.1
5.0 to 8.0 g/f	1.5	12 hr. belt feeder	2.08	0.008	1.2
8.0 to 18.0 g/f	2	12 hr. belt feeder	1.76	0.015	1.2
18 to 40 g/f	2.5	12 hr. belt feeder	1.44	0.017	1.2
40 to 100 g/f	3	12 hr. belt feeder	1.3	0.0325	1.3
100 to 800 g/f	4	12 hr. belt feeder	1.1	0.088	1.4
> 800 g/f	6	12 hr. belt feeder	0.8	0.096	1.5

Table 25b. Feeding regime for Sockeye production at NOAA Burley Creek Fish Hatchery and Manchester Research Stations.

Rearing Period	Food Type	Application Schedule (# feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. fed per gpm of inflow	Food Conversion During Period
Swimup to 0.2 g/f	Starter Mash	8	3.1	NA	0.8
0.2 to 0.8 g/f	Starter #0	6	3	NA	0.8
0.8 to 1.5 g/f	Starter #1	4	2.7	NA	0.8
1.5 to 3 g/f	Starter #2	4	2.6	NA	1
3 to 5 g/f	1.2	2	2.5	NA	1
5 to 8 g/f	1.5	2	2.4	NA	1
8 to 18 g/f	2	2	2.1	NA	1
18 to 40 g/f	2.5	2	1.7	NA	1
40 to 75 g/f	3	2	1.1	NA	1
75 to 400 g/f	4	2	0.8	NA	1.2
400 to 1000 g/f	6	4	0.6	NA	1.2
1000+ g/f	9	4	0.6	NA	1.2

Source: BioOregon feed recommendations followed for feed size and percent Body Weight per day. Food conversion based on historical ration projections, pounds fed per gpm not calculated.

Table 25c. Feeding regime for Sockeye production at Springfield Fish Hatchery.

Rearing Period	Food Type	Application Schedule (# feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. fed per gpm of inflow	Food Conversion During Period
Swim-up to 0.56g	Starter #0	8	3.95-2.0	NA	0.6
0.56 to 0.1.51 g/f	Starter #1	6	2.00-1.40	NA	0.6
1.51 to 4.51 g/f	Starter #2	4	1.40-1.11	NA	0.7
4.51 to 7.56 g/f	1.2	2	1.2-1.02	NA	0.75
7.56 to 22.68 g/f	1.5	1-2	1.09-0.76	NA	0.8
>22.68 g/f	2	1-2	0.85-0.68	NA	0.9

EWOS feed.

Table 25d. Feeding regime for Sockeye production at Oxbow Fish Hatchery.

Rearing Period	Food Type	Application Schedule (# feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. fed per gpm of inflow	Food Conversion During Period
Swim-up to 0.56g	Bio Vita	8	3%	NA	1.5%
0.56 to 0.1.51 g/f	Bio Vita	6	2%	NA	1%
1.51 to 4.51 g/f	Bio Vita	4	1%	NA	1%
4.51 to 7.56 g/f	Bio Vita	1	0.6%	NA	1%

Eagle Fish Hatchery-- Fish are reared on commercial feeds produced by EWOS. Beginning at swim-up, fry are fed a dry starter mash. As they grow, the fish are transitioned through standard pelleted dry grower feeds and progressed through "brood" ration sizes (6 mm). The pellet size fed follows the feed manufacturer's recommendations, based on current guidelines for commercial aquaculture and guidance provided in Fowler (1989). However, feed sizes are mixed when transitioning from one size to the next to ensure that the smallest fish in the population are able to feed. Daily ration ranges from 3.5% body weight per day for swim-up fry to 0.8% for adults depending on fish size and water temperature.

NOAA Fisheries Facilities-- Fish are reared on commercial feeds produced by BioOregon.[1] Beginning at swim-up, fry are fed a dry starter mash. As they grow, the fish are transitioned through standard pelleted dry grower feeds and progressed through "brood" ration sizes (6 mm, 9 mm). The pellet size fed follows the feed manufacturer's recommendations, based on current guidelines for commercial aquaculture and guidance provided in Fowler (1989). However, pellet size is adjusted from the recommendation to ensure that the smallest fish in the population are able to feed. Daily ration ranges from 3.5% body weight per day for swim-up fry to 0.4% for adults depending on fish size and water temperature (Iwama 1996).

Feeding of swim-up fry is initiated with *ad lib* hand feeding in their isobuckets. When the fish are transferred to the 1.5-m grow out tanks and the 12-ft diameter circular tanks, their diet is hand fed. At Manchester Research Station, their diet is rationed by automatic feeders. Prior to loading the feeders, a portion of the day's ration is broadcast over the surface to observe the

fish's feeding response. Feeding frequency varies with day length, feeder type and fish size, as suggested by Fowler (1989).

Springfield Hatchery – Fish at Springfield Fish Hatchery are reared on commercial fish feed produced by EWOS, and are fed by hand for the entire production cycle. Feed amounts are calculated for daily diets according to projections based on specific fish growth and desired size at marking and release. The number of times the fish are fed begins with hourly feedings and then is reduced as needed to ensure the maximum amount of feed is being utilized per feeding. Employees observe the feeding behavior of the fish at all times to ensure feed is not being wasted. Feed and growth projections are adjusted to align with a target acclimation transfer size of 38 grams per fish (12 fpp). In order to not exceed the target size at release, feed rations are reduced during the winter months. Feed rations are then gradually increased in the spring.

Oxbow/Bonneville Hatchery – Fish at Oxbow Fish Hatchery are reared on commercial fish feed produced by Bio Oregon, and are fed by hand for the entire production cycle. Feed amounts are calculated for daily diets according to projections based on specific fish growth and desired size at marking and release. The number of times the fish are fed begins with hourly feedings and then is reduced as needed to ensure the maximum amount of feed is being utilized per feeding. Employees observe the feeding behavior of the fish at all times to ensure feed is not being wasted. Feed and growth projections are adjusted to align with a target acclimation transfer size (18 fpp).

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures

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. American Fisheries Society (AFS) "Bluebook" procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology (Thoesen 1994). 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, and other analyses. After necropsy, carcasses that are not vital to further analysis are disposed of as per language contained in the ESA Section 10 permit for the program.

NOAA Fisheries Facilities- Biosecurity practices are in place to prevent the spread of diseases from local fish to the ESA stocks and from one stock to another within the ESA program. Housing fish within fully enclosed buildings and rearing them on treated water is essential to ensure pathogens from wild fish do not reach the ESA captive broodstocks. In recent years, we

prohibited the holding of salmonids 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. Disinfected items include 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, PIT tags read, and necropsied. A fish biologist performs necropsies to determine cause of death and obtain tissue samples. The samples are sent to the Idaho Department of Fish and Game (IDFG) Fish Health Lab in Eagle, Idaho. 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 fresh 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, if a treatable pathogen is detected, the IDFG fish pathologist would prescribe appropriate therapeutic drugs, e.g., oxytetracycline or erythromycin. Azithromycin (an erythromycin derivative) may also be used to treat BKD in *R. salmoninarum*-infected populations. Medication can be either mixed with feed or injected, with dosage based on fish weight. Prior to transfer to seawater, fish receive an inoculation of *Vibrio anguillarum* and *V. ordalii* bacterin vaccine. Ovarian fluid from spawning females and tissue samples from spawning males are also screened for IHNV and VHSV. Tissue sample are collected from all spawning females and sixty spawning males for BKD ELISA processing. All samples are sent to IDFG Eagle Fish Health Lab for analysis.

Springfield Fish Hatchery – Fish health is monitored daily for feeding response, external condition, behavior and 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.

If a sudden increase in mortality or moribund fish occurs, it is immediately reported to the fish pathologist for further diagnosis. The fish pathologist is on site to perform quarterly fish health

samples. When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate therapeutic drugs to control the problem.

Oxbow and Bonneville Fish Hatcheries – Fish health is monitored daily for feeding response, external condition, behavior and 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. ODFW Fish Health specialist examine fish monthly.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable

Smolt development is not normally a monitoring metric for the Sockeye program. However, in light of low SARs for acclimated Springfield Fish Hatchery smolts (Table 10), we will conduct a series of physiological and pathological studies in 2022 to address potential factors contributing to latent mortality of these smolts. Smolts will be sampled approximately every two weeks from early March to release. Physiological parameters measured will be similar to Trushenski et al. (2019) and will be taken from smolts at Springfield Fish Hatchery, Sawtooth Fish Hatchery (during acclimation; see Sec. 10.6), and at release into Redfish Lake Creek. A sentinel group will be held at Springfield Fish Hatchery and will be sampled concurrently with those at Sawtooth Fish Hatchery to determine if acclimation interferes with smolt development. This sentinel group and another held in live boxes in Redfish Lake Creek will be subjected to seawater challenges approximately two weeks post-release to roughly coincide with estuary arrival. Pathology samples will be used to identify potential fish health concerns that may develop post-release. Results from this work will be used to guide future investigations.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program

Eagle, Springfield, and Oxbow hatcheries - Natural rearing methods are addressed in RM&E component of the program (pre-spawn adult releases, eyed-egg releases); no in-hatchery "natural" rearing methods beyond natural photoperiod are currently used at the Eagle, Springfield, or Oxbow hatcheries during the maturation process.

Burley Creek Fish Hatchery - Natural lighting is a "natural" rearing method applied to fish during the maturation process at Burley Creek Fish Hatchery.

Manchester Research Station - Seawater rearing is the "natural" rearing environment for Sockeye salmon during the ocean portion of their life cycle.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation

Currently, Redfish Lake Sockeye salmon may be released at all life stages to minimize the risk of domestication. However, releases at the eyed-egg or pre-smolt stage are contingent upon inventory at these stages in excess of smolt production goals.

Manchester Research Station - Seawater rearing during the marine portion of their life cycle should aid in promoting the retention of anadromous traits in these fish.

SECTION 10. RELEASE

This section describes fish release levels, and release practices applied through the hatchery program.

10.1 PROPOSED FISH RELEASE LEVELS

The Springfield Fish Hatchery Sockeye program produces up to 1 million smolts for release into Redfish Lake Creek. Additionally, a minimum of 350 adults will be targeted for release, including 250 into Redfish Lake and 100 into Pettit Lake (Table 6, Sec. 1.11.2). Information generated for Alturas Lake *O. nerka* suggests the possible presence of remnant, native population genetically unique from anadromous and residual populations found in Redfish Lake (Eaton and Tardy 2022). Additionally, historical as well as recent empirical information suggests this population spawns in an earlier time window than Redfish Lake *O. nerka* and are stream spawners. Spatial structure and diversity are critical elements of the proposed recovery strategy. Because maintaining this diversity and capturing the benefits of local adaptation are critically important, the IDFG recommends proceeding cautiously when it comes to identifying an appropriate donor stock for Alturas Lake recovery efforts. Ultimately, actions will need to be consistent with NOAA's recovery plan for Snake River Sockeye salmon (NOAA 2015). The Springfield Fish Hatchery smolts will take the place of all pre-smolt releases and smolt releases into the Salmon River.

Bonneville Hatchery will release approximately 35,000 Snake River sockeye salmon smolts into Tanner Creek (at Bonneville Hatchery). Smolts will be ad clipped and 100% wire tagged. Returning adults will be collected at Bonneville Hatchery.

10.2 SPECIFIC LOCATION(S) OF PROPOSED RELEASE(S)

- Stream, river, or watercourse: Redfish Lake
  Release point: 44° 06' 57" N, -114° 55' 45" W
  Major watershed: Salmon River
  Basin or Region: Upper Salmon River Basin

- Stream, river, or watercourse: Alturas Lake
  Release point: 43° 54’ 45”N, -114° 51’ 42” W
  Major watershed: Salmon River
  Basin or Region: Upper Salmon River Basin

- Stream, river, or watercourse: Pettit Lake
  Release point: 43° 58’ 45” N, -114° 52’ 47” W
  Major watershed: Salmon River
  Basin or Region: Upper Salmon River Basin

- Stream, river, or watercourse: Redfish Lake Creek Trap
  Release point: 44° 09’ 01” N, -114° 54’ 50” W
  Major watershed: Salmon River
  Basin or Region: Upper Salmon River Basin

- Stream, river, or watercourse: Sawtooth Fish Hatchery Trap
  Release point: 44° 09’ 12” N, -114° 53’ 01” W
  Major watershed: Salmon River
  Basin or Region: Upper Salmon River Basin

- Stream, river, or watercourse: Tanner Creek
  Release point: 45° 37’ 56” N, -121° 57’ 25” W
  Major watershed: Columbia River
  Basin or Region: Columbia River Basin

10.3 ACTUAL NUMBERS AND SIZES OF FISH RELEASED BY AGE CLASS THROUGH THE PROGRAM

Actual release numbers by life stage released into Sawtooth Valley lakes between 2008 and 2021 are summarized in Table 26.

Table 26. Number and size of juvenile hatchery Sockeye salmon released into the Snake River and adults released into Sawtooth Valley lakes, 2010-2021.

Release year	Eggs/ Unfed Fry	Average size	Pre-smolt	Average size	Smolt	Average size	Adults	Average size
2010	59,683	NA	65,851	90.8	179,278	27.86	1,582	0.31
2011	42,665	NA	50,054	61.35	191,048	19.6	1,548	0.32
2012	0	NA	11,354	64.85	166,652	15.1	795	0.34
2013	NA	NA	NA	NA	273,080	16.21	346	0.45
2014	NA	NA	NA	NA	296,389	16.21	2,171	0.43
2015	NA	NA	NA	NA	423,103	10.81	594	0.47
2016	NA	NA	NA	NA	635,021	10.66	1,206	0.39
2017	NA	NA	239,288	45.4	734,492	10.25	1,229	0.32

Release year	Eggs/ Unfed Fry	Average size	Pre-smolt	Average size	Smolt	Average size	Adults	Average size
2018	NA	NA	NA	NA	658,692	11.64	631	0.40
2019	NA	NA	NA	NA	882,386	12.97	610	0.32
2020	3,268	NA	112,275	45.86	937,108	12.17	1,031	0.33
2021	NA	NA	NA	NA	1,013,340	12.27	1,226	0.30

Note: Table includes all Sockeye releases into the Sawtooth Valley.
Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

10.4 ACTUAL DATES OF RELEASE AND DESCRIPTION OF RELEASE PROTOCOLS

Eyed-eggs – Eyed-eggs in excess of program needs, coming from females with moderate ELISA values, or from parent(s) determined to be from Pettit Lake by PBT or GSI are released to Pettit Lake in November and December (range November 10 – December 17). Eyed-eggs are placed in incubation boxes and released based on Celsius temperature units.

Pre-smolts – Pre-smolts in excess of program needs are released to Redfish and/or Pettit lakes in October (range early to mid-October). Late summer and fall release strategies have been evaluated but the October release provides the highest overwinter survival (Johnson et al. 2020). This is a forced release from transport vehicles following acclimation at Sawtooth Fish Hatchery.

Smolts – Smolts are released to Redfish Lake Creek in May. Release dates are based on historical out-migration timing and peak flow rates. All Sockeye smolt releases are forced releases from transport vehicles after acclimation at Sawtooth Fish Hatchery (See Sec. 10.6).

Smolts at Bonneville Hatchery will be released into Tanner Creek in April/May. Release dates will be based on smolt development measures collected from Springfield Hatchery smolts in 2022 and behavioral cues observed by Bonneville Hatchery staff. Smolt releases may be allowed volitional release for one week and prior to a forced releases from an outside pond at Bonneville Hatchery.

Adults – Adults are released to Pettit and Redfish lakes in September (range September 2-16). Time of release occurs two weeks prior to the observed spawn timing of anadromous Sockeye. Releases are forced releases from transport vehicles. In the future program, adult releases to Alturas Lake will occur in August (if warranted; see section 10.1 above).

10.5 FISH TRANSPORTATION PROCEDURES, IF APPLICABLE

Eyed-eggs – Eyed-eggs may be released from Eagle Fish Hatchery to Redfish or Pettit lakes. Eggs are loaded in specially designed egg boxes and transported in water filled coolers. Coolers are loaded with water matching the incubation temperature of the eggs. Ice is added to the cooler to begin the tempering process while in transit. Transit time is approximately four hours. Coolers are tempered to lake temperature before egg boxes are placed into the lakes.

Pre-smolts – If needed to reduce inventory at Springfield Fish Hatchery, pre-smolts will be released from Springfield Fish Hatchery. Pre-smolts will be transferred to Sawtooth Fish Hatchery in early October for a seven to ten day acclimation period before release to Sawtooth Valley lakes. Transport tanks are supplied with oxygen and recirculation fresh flows. Transit times range from four to five hours between Springfield and Sawtooth fish Hatcheries for acclimation. Loading densities do not exceed 0.5 pounds per gallon. Transport time from Sawtooth Fish Hatchery to Redfish Lake are typically 30-60 minutes.

Smolts – Currently, smolts for the Sockeye program are reared at IDFG's Springfield Fish Hatchery. Transport tanks range from 500 gallons to 5,000 gallons. Tanks are supplied with oxygen and recirculating systems. Transit time for the Springfield reared smolts is approximately 4 hours. Smolts are acclimated at Sawtooth Fish Hatchery for a period of one to two weeks (see Sec. 10.6). After acclimation, smolts are transported from Sawtooth Fish Hatchery to Redfish Lake Creek and released. Transport tanks range from 500 gallons to 5,000 gallons. Tanks are supplied with oxygen and recirculating systems. Transit time from Sawtooth Fish Hatchery to release is approximately 30-60 minutes. Smolts will be transferred from Oxbow Hatchery to Bonneville Hatchery using 1,500-2,000 gallon tank trucks equipped with back-up oxygen cylinder tanks.

Adults – Adults for the Sockeye program are reared at Eagle Fish Hatchery and NOAA's Manchester Research Facility. Transport tanks range from 400 gallons to 3,000 gallons. Tanks are supplied with oxygen and recirculating systems. Transit time for adults reared at Eagle Fish Hatchery (captive and/or anadromous) is approximately three to four hours. Transit time for the NOAA reared adults is approximately 15 to 18 hours.

Additional anadromous adults for the program will be collected at Bonneville Hatchery and transported to Eagle Fish Hatchery prior to release in Redfish and Pettit lakes. Transport tanks range from 400 gallons to 3,000 gallons. Tanks are supplied with oxygen and recirculating systems. Transit time for adults collected at Bonneville Hatchery will be approximately six to eight hours.

Additional detail on transportation procedures can be found in Sections: 5.2; and 7.6.

10.6 ACCLIMATION PROCEDURES (METHODS APPLIED AND LENGTH OF TIME)

All smolts produced at the Springfield Fish Hatchery are acclimated to Salmon River water at Sawtooth Fish Hatchery for a period of one to two weeks, prior to release into Redfish Lake Creek. Smolts are acclimated to temper them from the hard water conditions present at Springfield Fish Hatchery (234-244 mg $CaCO_3$/L) to the soft water present in Redfish Lake Creek (11-12 mg $CaCO_3$/L). Acclimation is achieved by holding smolts at Sawtooth Fish Hatchery in outdoor raceways supplied with intermediate hardness (36-64 mg $CaCO_3$/L) Salmon River water (Trushenski et al. 2019). Sufficient raceway space is reserved at Sawtooth Fish Hatchery to maintain a Density Index at or below 0.3, and fish are fed a maintenance diet of EWOS 2mm feed during acclimation.

All smolts produced at the Oxbow Hatchery will be acclimated to Tanner Creek water at Bonneville Hatchery for a period of one to two weeks, prior to release into Tanner Creek.

10.7 MARKS APPLIED, AND PROPORTIONS OF THE TOTAL HATCHERY POPULATION MARKED, TO IDENTIFY HATCHERY ADULTS

Currently, all juvenile and adult Sockeye released from the Sockeye captive broodstock program are marked/tagged to identify hatchery reared fish. Pre-smolts and smolts are 100% adipose clipped and a representative sample is PIT-tagged for evaluation purposes. Full-term captive reared adults are 100% adipose clipped and PIT-tagged before release. All hatchery reared Sockeye are genetically marked using parentage based tagging (PBT).

PBT is a versatile tool used for mass marking of salmon. PBT involves the annual genotyping of hatchery broodstock and fish released to spawn naturally in the lake. Progeny from these parents (either collected as juveniles or adults) are sampled, genotyped, and assigned back to their parents. This identifies their brood year and age for run reconstruction as well as being tied to other indices such as fish health and hatchery rearing.

10.8 DISPOSITION PLANS FOR FISH IDENTIFIED AT THE TIME OF RELEASE AS SURPLUS TO PROGRAMMED OR APPROVED LEVELS

Not applicable.

10.9 FISH HEALTH CERTIFICATION PROCEDURES APPLIED PRE-RELEASE

Sockeye salmon captive broodstock are 100% sampled for a variety of pathogens. No eyed-eggs are transferred to other facilities or released, without approval from the IDFG Fish Health supervisor and State transport permits are approved before transferring eyed-eggs out of state. Juveniles, pre-smolts and smolts, are sampled (60 fish sample) 45 to 60 days before release. All transport permits are approved before juveniles are transferred. All mortality from captive reared adult release groups is sampled. This disease history is used to obtain approval before transfer and release.

ODFW utilizes the same sampling protocols prior to juvenile fish releases. Samples are processed through the ODFW fish health lab.

10.10 EMERGENCY RELEASE PROCEDURES IN RESPONSE TO FLOODING OR WATER SYSTEM FAILURE

Eagle Fish Hatchery - Eagle Fish Hatchery is staffed with three full time employees that live on station and share alarm monitoring duty. A commercial security provider monitors the alarm system at Eagle Fish Hatchery and notifies permanent staff by text and physically calls staff for alarm confirmation. Eagle Fish Hatchery incorporates six low water alarms and three chilled water alarms. The water supply at Eagle Fish Hatchery is provided by three 50hp submersible pumps, all with generator back-up in case of power failure. The water system is tied together so any of the three pumps can provide water to all parts of the facility. In the case of complete power/generator failure, artesian water flow of around 250 gallons per minute can be supplied to

rearing units. Each three-meter and four-meter tank is also backed-up with an oxygen system, with full oxygen bottles in place.

Burley Creek Fish Hatchery – An emergency generator is automatically activated in the event of a power failure. NOAA facilities personnel and fish culturists respond to all power and water flow alarms within 30 minutes of notification and have the skills and supplies required to restore water flow to fish culture facilities. Five wells are operational but all five are not in continuous use. In the event of a well or pump failure, water is drawn from an alternate well until repairs can be made for the affected well. This facility is not prone to flooding affecting well-water supply.

Manchester Research Facility – The system is outfitted with two back-up 40-hp pumps in case of primary pump failures. An alarm system monitors the pump and electrical supply and is tied into an automatic dialer system linked to cellular telephones. Redundant emergency generators are automatically serially activated in the event of a power failure. NOAA facilities personnel and fish culturists respond to all power and water flow alarms within 30 minutes of notification and have the skills and supplies required to restore water flow to fish culture facilities. This facility is not prone to flooding affecting seawater delivery.

Sawtooth Fish Hatchery – The Salmon River Spring Chinook HGMP provides a description of system back-up and risk aversion measures at Sawtooth Fish Hatchery.

Springfield Fish Hatchery – Springfield Fish Hatchery is staffed with three full time employees that live on station and share alarm monitoring duty. There is a SCADA system through Mission Communications that monitors over 30 different alarms for the six production wells, backup generators, chilled water supply, head box water levels, and incubation water levels throughout the facility. There is also system redundancy in place for degassing, pumped water delivery, chilled water supply, and power generation. The water system is integrated so that any well can provide water to all parts of the facility. Due to an elevation difference, artesian water flow can only be supplied to outdoor rearing units in the case of complete power/generator failure. Indoor rearing tanks have a backup oxygen delivery system. The incubation room is equipped with four inch piping to allow a temporary water pump to supply water out of the artesian head tank into the incubation room at approximately 500 gpm.

Oxbow Hatchery – The HGMP for ODFW's Oxbow Hatchery provides a description of system back-up and risk aversion measures. Oxbow Hatchery water supply is gravity flow spring water, so the chance of instantaneous water loss is near zero. However, in the unlikely event this did happen, juveniles would be trucked approximately one-half mile and released directly into the Columbia River.

10.11 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR ADVERSE GENETIC AND ECOLOGICAL EFFECTS TO LISTED FISH RESULTING FROM FISH RELEASES

Annual egg and fish releases are conducted pursuant to NOAA Section 10 permitting guidelines and are approved after SBSTOC review and recommendation.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 MONITORING AND EVALUATION OF PERFORMANCE INDICATORS PRESENTED IN SECTION 1.10

A brief description of the methods used to monitor and evaluate hatchery program performance indicators are presented below. Habitat, harvest, fish passage survival, and natural production M&E activities are described in further detail in IDFG (2010) and annual permit and progress reports. Additional detail on performance indicators are presented in Tables 1, 2, and 3.

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each Performance Indicator identified for the program.

3.2.2 Performance Standard: Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Performance Indicator: All production releases are marked to identify juveniles and adults to specific release strategies; genetic evaluations established to identify natural production strategies.

Monitoring and Evaluation plan: Mark quality and tag retention checks are performed at marking, post-marking, and immediately prior to release. Production fish from Springfield Fish Hatchery are currently marked as follows: smolts and pre-smolts are adipose fin-clipped, and a subset of smolts are PIT tagged. Oxbow Hatchery smolts will be adipose fin-clipped and coded wire tagged to further aid in identifying program adults at collection.

A PBT program marks all juveniles produced in the program and identifies its parents, release strategy, and release location. PIT-tags will be used to develop estimates of juvenile and adult survival to and from the spawning grounds.

3.3.1 Performance Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Performance Indicator: Annual number and age of anadromous and captive spawners known; residual spawner counts conducted throughout spawn season.

Monitoring and Evaluation plan: We will monitor annual spawner counts and redd production, monitor natural smolt production, parental contribution and conduct annual trawling for population abundance. Night snorkeling is also conducted to estimate the number of residual spawners.

3.3.2 Performance Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.

Performance Indicator: All production releases are marked to identify juveniles and adults to specific release strategies; genetic evaluations established to identify both captive and natural production strategies.

Monitoring and Evaluation plan: Mark groups and genetic technologies allow evaluation of program contribution to the target population (both natural and captive populations). Mark quality and tag retention checks are performed at marking, post-marking, and immediately prior to release. Production juveniles from Springfield Fish Hatchery are adipose fin clipped. All juveniles produced in the program are genetically tagged as part of a PBT program. This program provides information on the fish's parents, release strategy, and release location. Production juveniles reared at Oxbow Hatchery and released at Bonneville Hatchery will be adipose fin clipped and will receive a coded wire tag (CWT) to identify adult returns to the project.

3.4.1 Performance Standard: Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.

Performance Indicator: Broodstock are sourced throughout the return and/or spawning period as appropriate; replacement brood sourced from all spawn crosses and from equalized individual and family representation.

Monitoring and Evaluation plan: Protection of genetic variation is achieved by selecting broodstock that represent the genetic diversity of the entire run, selecting fish over the entire length of the run, selecting individuals from each release strategy, equalizing sex ratios and by equalizing family contribution. Annual spawning and brood sourcing is consistent with the Stanley Basin Sockeye Technical Oversight Committee and NOAA Northwest Fisheries Science Center recommendations.

3.4.2 Performance Standard: Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.

Performance Indicator: Artificial propagation program contributes to increasing number of naturally produced juveniles in nursery lakes.

Monitoring and Evaluation plan: The research M&E element will document increasing numbers of naturally produced juveniles resulting from natural spawning occurring within the basin lakes using weirs with juvenile collection capacity near the outlet of Redfish and Pettit lakes and a rotary screw trap downstream from the outlet of Alturas Lake.

3.4.3 Performance Standard: Life history characteristics of the natural population do not change as a result of this artificial production program.

Performance Indicator: Artificial propagation program does not change life history characteristics of natural population.

Monitoring and Evaluation plan: Hatchery and M&E elements monitor the following characteristics annually: juvenile migration timing, juvenile size at emigration, adult return timing, adult return age, adult sex composition, adult size at return, spawn timing and distribution, fecundity and egg size (e.g., Baker et al. 2018 and Johnson et al. 2021). Additional reports can be found at CBFish.org.

3.4.4 Performance Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and near-shore rearing.

Performance Indicator: IDFG and cooperators conduct annual investigations to address habitat carrying capacity, population dynamics, and system productivity.

Monitoring and Evaluation plan: The carrying capacity of the basin lakes is determined by performing mid-water trawling and hydroacoustics to estimate O. *nerka* populations as well as limnological studies to quantify available food resources. Production releases are approved annually and are consistent with SBSTOC recommendations.

3.5.1 Performance Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Performance Indicator: Founder genetic profiles known and compared to genetic profiles developed each successive generation.

Monitoring and Evaluation plan: Intensive annual genetic monitoring of captive and anadromous contributors is conducted at the Eagle Fish Genetics Laboratory. Minimizing mean kinship of in the broodstock, maintaining a large captive population, and avoiding full- and half-sibling crosses helps maintain the genetic diversity of the population.

3.5.2 Performance Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Performance Indicator: Patterns of genetic variation do not change significantly as a result of artificial population.

Monitoring and Evaluation plan: Intensive annual genetic monitoring of captive and anadromous contributors is conducted at the Eagle Fish Genetics Laboratory. Protection of genetic variation is achieved by selecting broodstock that represent the genetic diversity of the entire run, selecting fish over the entire length of the run, selecting individuals from each release strategy, equalizing sex ratios and by equalizing family contribution.

3.5.3 Performance Standard: Artificially produced origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning populations.

Performance Indicator: Captive broodstock program initiated to preserve and augment natural spawning population.

Monitoring and Evaluation plan: The annual production of listed fish that are contributed to the natural environment is described in Section 12.1.

3.6.1 Performance Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.

Performance Indicator: Scientifically based experimental design, with measurable objectives and hypotheses.

Monitoring and Evaluation plan: The program is reviewed regularly by the Independent Scientific Review Panel (ISRP) to ensure that the procedures and study design used meet scientific rigor and that appropriate measurables and objectives are identified.

3.6.2 Performance Standard: The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.

Performance Indicator: Monitoring and evaluation framework including detailed timeline.

Performance Indicator: Annual and final reports.

Monitoring and Evaluation plan: See Sec. 1.10 (Table 3) for full performance standard details. Additionally, all aspects of the program including monitoring and evaluation methods and timelines are documented in the ESA Recovery Plan for Snake River Sockeye Salmon (*Oncorhynchus nerka*) (NOAA 2015) and the Springfield Sockeye Hatchery Master Plan for the Snake River Sockeye Program Volume 1: Master Plan (IDFG 2010). Program reports are completed annually and are available online (CBFish.org).

3.7.1 Performance Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, and INAD.

Performance Indicator: Annual reports indicating level of compliance with applicable standards and criteria.

Performance Indicator: Periodic audits indicating level of compliance with applicable standards and criteria.

Monitoring and Evaluation plan: When applicable, facility is operated in compliance with all fish health guidelines and facility operations standards; see CBFish.org for annual reporting. In addition, all facilities have completed a Best Management Practices (BMP) document that is updated as management and programmatic needs change.

3.7.2 Performance Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Performance Indicator: Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, including pertinent State of Idaho water quality plans relating to temperature, nutrient loading, chemicals, etc.

Monitoring and Evaluation plan: Facility is operated in compliance with all NPDES and Idaho Department of Water Resources discharge and monitoring requirements; monthly, quarterly, and annual discharge and monitoring reports are provided as required by law and/or permitting requirements. Permits and compliance reports (current and historical) are available upon request.

3.7.3 Performance Standard: Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.

Performance Indicator: Water withdrawals compared to applicable passage criteria.

Performance Indicator: Water withdrawals compared to NOAA, USFWS, and IDFG juvenile screening criteria.

Performance Indicator: Number of adult fish aggregating and/or spawning immediately below water intake point.

Performance Indicator: Number of adult fish passing water intake point.

Performance Indicator: Proportion of diversion of total stream flow between intake and outfall.

Monitoring and Evaluation plan: In general, water withdrawal permits have been obtained to establish water rights for each hatchery facility, intake systems are designed to deliver permitted flows, and facility monitors and reports as required. Facility and associated satellite facilities, if applicable, will maintain all screens associated with water intakes in surface water areas to prevent impingement, injury, or mortality to listed salmonids.

Numbers of adult fish aggregating and/or spawning immediately below facility water intakes (where relevant) are monitored annually by IDFG research personnel in accordance with species-specific annual redd counts. Numbers of adult fish passing water intake points as well as facility flow information (monthly, annually) are provided in annual facility reports.

3.7.4 Performance Standard: Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.

Performance Indicator: Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence.

Performance Indicator: Juvenile densities during artificial rearing.

Performance Indicator: Samples of natural populations for disease occurrence before and after artificial production releases.

Monitoring and Evaluation plan: IDFG fish health professionals sample and certify all release and/or transfer groups prior to liberation. In addition, the IDFG samples a small number of natural outmigrants annually to monitor pathogen status in natural *O. nerka* populations.

Raceway/tank flow and density indices during artificial rearing stages are maintained at or below IHOT guidelines (monthly monitoring).

3.7.5 Performance Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.

Performance Indicator: Number and location(s) of carcasses or other products distributed for nutrient enrichment.

Performance Indicator: Statement of compliance with applicable regulations and guidelines.

Monitoring and Evaluation plan: Nutrient enhancement projects, where/when applicable, are outlined in IDFG research, management, and/or hatchery permits and annual production reports. Nutrient enhancement projects comply with all IDFG Eagle Fish Health Lab disease, processing, and handling guidelines prior to carcass distribution.

3.7.6 Performance Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.

Performance Indicator: Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.

Monitoring and Evaluation plan: Monitoring and evaluation plans will vary depending on the management goals of the program (integrated broodstock, segregated broodstock, localized broodstock, etc.). In general, facility trapping sites document the temporal distribution of both wild/natural and artificially-produced adults that return to trapping locations. Current and historical trap data is provided in annual production reports and/or is available upon request.

3.7.7 Performance Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Performance Indicator: Mortality rates in trap.

Performance Indicator: Pre-spawning mortality rates of trapped fish in hatchery or after release.

Monitoring and Evaluation plan: In general, facility maintains all weirs/traps associated with program to either reduce or eliminate stress, injury, or mortality to listed salmonids. Mortality rates in trap, as well as pre-spawning mortality rates of trapped fish in hatchery are monitored and reported in annual production reports. Mortality rates of hatchery fish released to spawn naturally (when applicable) are not monitored beyond initial transport mortalities at release site; numbers of adult spawners above and below weirs/traps are monitored annually by IDFG research personnel in accordance with species-specific annual redd counts.

3.7.8 Performance Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Performance Indicator: Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present.

Performance Indicator: Number of fish in stomachs of sampled artificially produced fish, with estimate of natural fish composition.

Monitoring and Evaluation plan: Juvenile size-at-release targets are designed to strike a balance between the range of naturally produced fish in Sawtooth Valley environments and those shown to provide highest survival to return (Johnson et al. 2020); piscivory is not a concern for this stock/species. Future size-at-release studies may be necessary to determine the range most beneficial to both hatchery and wild populations; see CBFish.org for annual reporting.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program

Funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the BPA Fish and Wildlife program.

11.2 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR ADVERSE GENETIC AND ECOLOGICAL EFFECTS TO LISTED FISH RESULTING FROM MONITORING AND EVALUATION ACTIVITIES

Risk aversion measures for research activities associated with the evaluation of the Snake River Sockeye Salmon Captive Broodstock Program Research Element are specified in our ESA Section 7 Consultation and Section 10 Permit Nos. 1454, 1455, 1124-6R, and 1341-6R and FMEP. A brief summary of the kinds of actions taken is provided.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and screw traps are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not boat close to the vicinity of completed redds.

Marking and tagging activities are designed to protect ESA-listed species and allow for evaluation of the different release strategies utilized. Pre-smolts and smolts are adipose fin-clipped and marked genetically (PBT) to differentiate them from their wild/natural counterparts.

SECTION 12. RESEARCH

12.1 OBJECTIVE OR PURPOSE

Snake River Sockeye Salmon Captive Broodstock Program Research Element (IDFG)

The development of reintroduction plans for Snake River Sockeye Salmon has traditionally followed a "spread-the-risk" philosophy incorporating multiple release strategies and multiple lakes over the course of the program (Hebdon et al. 2004). Both adults and juveniles produced in excess of broodstock needs have been re-introduced into Sawtooth Valley waters to provide opportunities to increase the abundance of the population with returning anadromous adults. An extensive monitoring and evaluation program identified that captive and anadromous adult and full-term smolt releases produced the highest adult recruitment (Johnson et al. 2020). The program has phased out eyed egg and presmolt releases (except when juveniles are produced in excess of target smolt goals or eggs do not meet ELISA criteria). The current focus is on rearing a larger number of juveniles at the Springfield Fish Hatchery along with adult releases into Redfish and Pettit lakes.

Research and evaluation activities associated with Snake River Sockeye salmon are permitted under the ESA (NOAA) Section 10 Incidental Take Permits (IDFG Nos. 1124-6R, 1341-6R, 1454, and associated FMEP's). Research data collected includes O. *nerka* population monitoring in Sawtooth Valley lakes using both hydroacoustic and mid-water trawling techniques, sport fishery evaluation on Redfish Lake, smolt out-migration monitoring and evaluation at lake outlets, radio telemetry studies of mature adult Sockeye salmon released to Sawtooth Valley lakes for natural spawning, and predator investigations in tributaries to Redfish and Alturas lakes. For methodology associated with each of these research activities see program documentation at CBFish.org (e.g., Johnson et al. 2021).

12.2 COOPERATING AND FUNDING AGENCIES

- NOAA Fisheries and Shoshone Bannock Tribes are cooperating agencies.
- Bonneville Power Administration is the funding agency for the program.

12.3 PRINCIPLE INVESTIGATOR OR PROJECT SUPERVISOR AND STAFF

Additional personnel associated with the program along with contact information are provided in Sec. 1.3.

- Matthew Corsi - Fisheries Research Manager, Idaho Department of Fish and Game
- Cassie Sundquist – Production Program Coordinator, Idaho Department of Fish and Game
- David Venditti – Principal Fisheries Research Biologist, Idaho Department of Fish and Game

- Dan Baker - Eagle Fish Hatchery Manager, Idaho Department of Fish and Game
- Brandon Filloon – Springfield Fish Hatchery Manager, Idaho Department of Fish and Game
- Eric Johnson - Senior Research Fisheries Biologist, Idaho Department of Fish and Game

12.4 STATUS OF STOCK, PARTICULARLY THE GROUP AFFECTED BY PROJECT, IF DIFFERENT THAN THE STOCK(S) DESCRIBED IN SECTION 2

Not applicable; natural and propagated populations are identical (see Section 2).

12.5 TECHNIQUES: INCLUDE CAPTURE METHODS, DRUGS, SAMPLES COLLECTED, TAGS APPLIED

Snake River Sockeye salmon captive broodstock program research staff work to assemble annual juvenile Sockeye salmon out-migration and adult return data sets. Juvenile traps built into weirs and screw traps are used to capture emigrating juvenile Sockeye salmon. Generally, a subsample of target species captured are anesthetized (using buffered tricaine methane sulfonate) and handled. A portion of captured juveniles may be fin-clipped (for genetic analysis) or PIT-tagged (see Peterson et al. 2010 for Snake River Sockeye salmon captive broodstock program research studies detail). Juveniles reared at Oxbow Hatchery will receive a CWT prior to release. Adult information is assembled from a variety of information sources including: dam and weir counts, redd surveys, and spawning surveys. IDFG and cooperator staff may sample adult O. *nerka* carcasses to collect tissue samples for subsequent genetic analysis. Additionally, otoliths, scales, or fins may be collected for age analysis.

12.6 DATES OR TIME PERIOD IN WHICH RESEARCH ACTIVITY OCCURS

All smolt out-migration data collection (used to estimate abundance and survival to Lower Granite Dam) at the basin lake trap sites begins by approximately April 1st and typically runs through November 1st of each calendar year. The PSMFC PIT-Tag Information System is queried year round to retrieve juvenile PIT-tag information.

The Redfish Lake sport fishery creel data collection begins on Memorial Day weekend (at the end of May) and operates until the close of the kokanee fishery on August 7 each year. Data analysis occurs within one month of the final creel interview and is submitted in a final NOAA FMEP report for IDFG's General Fishing Rules by April 15 of each year.

Adult Sockeye salmon return to the Sawtooth Valley trap locations (Sawtooth Fish Hatchery and Redfish Lake Creek trap) beginning on approximately the 20th of July. The run is complete by mid to late October and the traps are removed from these waters. See Section 5.1 (this HGMP) on occasional adult seining activities immediately downstream of the Sawtooth Fish Hatchery weir. Collected age distribution data is analyzed immediately at the conclusion of the run and presented at the winter SBSTOC meeting in January.

Mid-water trawling is conducted when the Sawtooth Valley lakes stratify by water temperature in the fall and when the out-migration of anadromous smolts from the lakes is complete. Trawling is typically accomplished over a three-night period (one night per lake) during the new moon phase in either August or September. Data analysis occurs immediately thereafter, and genetic samples are analyzed typically within two or three months after trawling occurs. This data is submitted in a final NOAA Section 10 Incidental Take Permit report by January 31 of each year.

12.7 CARE AND MAINTENANCE OF LIVE FISH OR EGGS, HOLDING DURATION, TRANSPORT METHODS

Research activities that involve handling eggs or fish apply the same protocols reviewed in Section 9 above. Hatchery staff generally assists with all cooperative activities involving the handling of eggs, live fish, holding or transport.

For juvenile fish that are captured and tagged using the inclined bar traps and screw traps, all are anesthetized prior to tagging and held approximately 8-10 hours to monitor tag/handling mortality, and then released at dusk.

12.8 EXPECTED TYPE AND EFFECTS OF TAKE AND POTENTIAL FOR INJURY OR MORTALITY

Specific hatchery and research activities that address take of listed salmonids in the target areas are addressed in NOAA Section 10 Permits for the program:

- Section 10(a)(1)(A) Permit 1124-6R
- Section 10(a)(1)(A) Permit 1341-6R
- Section 10(a)(1)(A) Permit 1454
- Section 10(a)(1)(A) Permit 1455
- Fisheries Management and Evaluation Plan (FMEP) for IDFG General Fishing Rules

12.9 LEVEL OF TAKE OF LISTED FISH: NUMBER OR RANGE OF FISH HANDLED, INJURED, OR KILLED BY SEX, AGE, OR SIZE, IF NOT ALREADY INDICATED IN SECTION 2 AND THE ATTACHED "TAKE TABLE" (TABLES 1&2)

See Sections 2; 12.8; and Appendix 1 (Tables 1 and 2).

12.10 ALTERNATIVE METHODS TO ACHIEVE PROJECT OBJECTIVES

Alternative methods to achieve research objectives have not been developed.

12.11 LIST SPECIES SIMILAR OR RELATED TO THE THREATENED SPECIES; PROVIDE NUMBER AND CAUSES OF MORTALITY RELATED TO THIS RESEARCH PROJECT

Not applicable.

12.12 INDICATE RISK AVERSION MEASURES THAT WILL BE APPLIED TO MINIMIZE THE LIKELIHOOD FOR ADVERSE ECOLOGICAL EFFECTS, INJURY, OR MORTALITY TO LISTED FISH AS A RESULT OF THE PROPOSED RESEARCH ACTIVITIES

Additional detail on adverse effects can be found in Section 11.2 above. See also sections: 6.3; 7.9; 8.5; 9.1.7; and 9.2.10.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

SECTION 15 PROGRAM EFFECTS ON OTHER (NON-ANADROMOUS SALMONID) ESA-LISTED POPULATIONS

A species list is attached and anadromous salmonid effects are addressed in Section 2 of this HGMP.

15.1 LIST ALL ESA PERMITS OR AUTHORIZATIONS FOR ALL NON-ANADROMOUS SALMONID PROGRAMS ASSOCIATED WITH THE HATCHERY PROGRAM

ESA Section 6 Cooperative Agreement for Bull Trout Take Associated with IDFG Research

IDFG annually prepares a bull trout conservation program plan and take report that describes their management program for bull trout to meet the provisions contained in Section 6 of the ESA and to comport with the spirit of Section 10(a)1(A). This plan identifies the benefits to bull trout resulting from management and research conducted or authorized by the state, provides documentation of bull trout take conducted and authorized by IDFG and provides an estimate of take for the coming year. Each year the report is submitted to USFWS, which then makes a determination whether this program is in accordance with the ESA. The plan/report is due annually to USFWS by March 31. A summary of recent take in the Salmon River subbasin is further discussed in Section 15.3 of this HGMP.

ESA Section 7 Biological Opinions

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for such species. BPA and NOAA determined that bull trout (*Salvelinus confluentus*) was the only federally listed, non-anadromous species that may be affected by the operation of the Snake River Sockeye salmon hatchery program. The U.S. Fish and Wildlife Service (USFWS) concluded that operation of the Snake River Sockeye salmon hatchery program was unlikely to jeopardize the continued existence of, or destroy or adversely modify designated critical habitat for, bull trout through consultation with BPA and NOAA (Biological Opinion 01EIFW00-2017-F-0819). This finding is valid until the ESA Section 10(a)(1)(A) Permits 1454 and 1455 expire in 2023. A summary of recent take of bull trout in the Salmon River subbasin is further discussed in Section 15.3 of this HGMP.

ESA consultation and permitting for anadromous species, which are within the jurisdiction of NOAA Fisheries, is addressed through the Biological Opinion on the Snake River Sockeye Salmon Hatchery Program (NMFS Consultation #NWR-2013-10541).

15.2 DESCRIPTION OF NON-ANADROMOUS SALMONID SPECIES AND HABITAT THAT MAY BE AFFECTED BY HATCHERY PROGRAM

This program releases juvenile hatchery Sockeye into the Salmon River subbasin where bull trout are the only non-anadromous aquatic ESA-listed species present. Bull trout life history, status and habitat use in Salmon River subbasin is summarized below. Bonneville Power Administration and IDFG conducted a Biological Assessment as required for NEPA review of the Springfield Plan; copies of this document are available electronically on the BPA Environment, Fish & Wildlife website.

General Species Description, Status and Habitat Requirements

Bull trout (members of the family *Salmonidae*) are a species of char native to Nevada, Oregon, Idaho, Washington, Montana, and western Canada. While bull trout occur widely across the western United States, they are patchily distributed at multiple spatial scales from river basin to local watershed and individual stream reach levels. Due to widespread declines in abundance, bull trout were initially listed as threatened in Idaho in 1998, and listed throughout their coterminous range in the United States in 1999. On January 13, 2010, the USFWS proposed to revise its 2005 designation of critical habitat for bull trout, encompassing a substantial portion of the Salmon River subbasin (5,045 stream miles are proposed as critical habitat in the Salmon River subbasin).

Habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management (such as over-harvest and bounties), and the introduction of non-native species such as brown, lake and brook trout are the major threats to Bull Trout. Some populations are small and isolated from each other, making them more susceptible to local extinctions. However, recent work in Idaho concluded that despite declines from historical levels, Idaho bull trout are presently widely distributed, relatively abundant, and apparently stable (High et al. 2008, Meyer et al. 2014; Table 27). High et al. (2008) concluded that over half of the Idaho bull trout population (0.64 million fish) occurred in the Salmon River Recovery Unit, although overall density was relatively low (4.4 bull trout/100 m).

Table 27. Intrinsic rates of population change (*r*) with 90% confidence limits (CLs) for bull trout in Idaho with available data. Shaded estimates of *r* indicate statistically significant trends (i.e., those that do not overlap zero). Missing estimates indicate cases where data were insufficient for that period of record. (From: Meyer et al. 2014).

Bull Trout population	Data type	Pre-1994 Estimate	Pre-1994 Lower CL	Pre-1994 Upper CL	Post-1994 Estimate	Post-1994 Lower CL	Post-1994 Upper CL	All years Estimate	All years Lower CL	All years Upper CL
Lower Kootenai River	Redd count				0.00	−0.03	0.02	0.01	−0.01	0.03
Coeur d'Alene Lake	Redd count				0.05	0.02	0.09	0.05	0.02	0.09
Lake Pend Oreille	Redd count	−0.03	−0.05	0.00	0.00	−0.02	0.02	0.00	−0.01	0.01
Priest Lakes	Redd count				−0.06	−0.11	−0.02	—[a]		
North Fork Clearwater River	Redd count				0.18	0.13	0.23	—[a]		
Lochsa River	Redd count				0.10	0.05	0.15	—[a]		
	Snorkeling	0.25	−0.15	0.65	0.18	0.11	0.25	0.17	0.12	0.22
	Screw trap				0.01	−0.04	0.07	0.01	−0.04	0.07
Selway River	Snorkeling	0.00	−0.37	0.36	0.04	−0.02	0.10	−0.02	−0.07	0.02
South Fork Clearwater	Screw trap				0.16	0.08	0.24	—[a]		
River	Snorkeling	−0.25	−0.35	−0.15	−0.07	−0.12	−0.01	−0.11	−0.14	−0.08
Little Salmon–Lower	Snorkeling	0.05	−0.06	0.16	−0.04	−0.09	0.00	−0.01	−0.03	0.02
Salmon River	Weir	−0.01	−0.04	0.01	0.06	0.03	0.09	0.01	0.00	0.02
South Fork Salmon	Screw trap				0.17	0.11	0.22	0.14	0.09	0.20
River	Snorkeling	−0.02	−0.20	0.16	0.20	0.10	0.30	0.16	0.11	0.21
Middle Fork Salmon River	Snorkeling	0.00	−0.11	0.12	−0.15	−0.23	−0.08	−0.15	−0.19	−0.12
Mid-Salmon River (Chamberlain)	Snorkeling	0.05	−0.11	0.22	0.20	0.16	0.24	0.16	0.13	0.20
Lemhi River	Snorkeling	−0.09	−0.28	0.10	0.05	−0.04	0.14	0.08	0.03	0.13
Upper Salmon River	Snorkeling	0.11	−0.17	0.39	0.04	−0.11	0.19	0.15	0.08	0.22
	Weir	0.00	−0.09	0.10	0.05	0.02	0.09	0.06	0.04	0.08
	Creel				0.09	0.02	0.16	—[a]		
	Screw trap				0.10	0.01	0.19	—[a]		
Anderson Ranch Reservoir	Electrofishing				0.18	0.04	0.31	—[a]		
Weiser River	Snorkeling				0.35	0.01	0.69	—[a]		
Little Lost River	Electrofishing				−0.04	−0.09	0.02	—[a]		

[a]Estimates are equivalent to post-1994 estimates due to a lack of pre-1994 data.

Bull trout exhibit a wide variety of life history types, including resident (residing in small headwater streams for their entire lives); fluvial (migrating to larger river systems); adfluvial (migrating to lakes or reservoirs); and anadromous (migrating to estuarine or marine waters) (Goetz et al. 2004). All of these life history strategies are present in the Salmon River subbasin, except anadromy. Fluvial and resident bull trout populations have been commonly observed throughout the current range of bull trout in the Salmon River subbasin, and adfluvial populations are present, associated with several natural lakes (USFWS 2002).

Bull trout spawning and rearing requires cold water temperatures (generally below 16°C during summer rearing), and less than about 10°C during spawning (Dunham et al. 2003). Juvenile bull trout require complex rearing habitats (Dambacher and Jones 1997, Al-Chokhachy et al. 2010). Migratory adult and subadult bull trout are highly piscivorous (Lowery et al. 2009), and migratory adults need unobstructed connectivity to diverse habitats where forage fish species are plentiful and water temperatures are relatively cool (less than about 18°C maximum) during migration (Howell et al. 2009).

Population Status and Distribution by Core Area

Bull trout are well distributed throughout most of the Upper Snake Recovery Unit in 206 identified local populations located within 22 Core Areas (USFWS 2015). The Salmon River watershed comprises 60% of the local populations in the Recovery Unit (USFWS 2015). The Upper Salmon River B-run steelhead program releases hatchery juveniles into Squaw Creek, East Fork Salmon River and Pahsimeroi River. Broodstock are collected in the same areas at trapping facilities. These activities occur primarily in two bull trout core areas, the Upper Salmon River and Pahsimeroi River core areas. Juvenile steelhead released in these core areas migrate downstream through three other Salmon River bull trout core areas, including the Middle

Salmon-Panther Creek, Middle Salmon-Chamberlain River, and Little-Lower Salmon River core areas. The following information on these five core areas, and local population status and habitat use within, is summarized from the bull trout recovery plan (USFWS 2015) unless otherwise cited.

Upper Salmon River Core Area

Bull trout are widely distributed in the Upper Salmon River with 18 known local populations and one potential local population. Both resident and migratory 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 also known to be present in Redfish Lake.

The bull trout 5-year status review conducted in 2015 determined the Upper Salmon River Core Area had an increasing population status, and no primary threats identified within the Core Area (Table E-2 in USFWS 2015).

Pahsimeroi River Core Area

Bull trout in the Pahsimeroi River are found in most of the tributaries that drain the eastern, southern and southwestern portion of the core area and comprise 9 local populations in the Core Area. Local populations include the upper Pahsimeroi River, and Big, Patterson, Falls, Morse, Morgan (includes the lower Pahsimeroi River), Tater, and Ditch creeks. The creeks in the upper Pahsimeroi River were considered a population stronghold in this core area during the subbasin review process. The mainstem Pahsimeroi River serves as a migratory corridor for fish access to the mainstem Salmon River though connectivity from the headwaters to mouth of the river are seasonal at best and contains significant irrigation infrastructure.

The Pahsimeroi River Core Area did not contain population status or trend data in the Upper Snake River RUIP (USFWS 2015). In addition, Connectivity was identified as a primary threat within the Core Area.

Middle Salmon River-Panther Core Area

Bull trout are widely distributed in this core area, including 20 local populations and 2 potential local populations. Both resident and migratory populations are present.

The bull trout Recovery Plan completed in 2015 (USFWS 2015) determined the Middle Salmon River-Panther Core Area had a decreasing trend and a likely stable abundance trend based upon partner input. More recent analysis displayed a stable abundance trend in the Core Area (Brett Bowersox, IDFG personal communication; Table E-2 in USFWS 2015). No primary threats were identified within the Core Area (USFWS 2015).

Middle Salmon River-Chamberlain Core Area

A substantial portion of the Middle Salmon River-Chamberlain Core Area is encompassed by the Frank Church and Gospel Hump Wilderness areas. Bull trout are found in nine local populations in this core area, and are widely distributed.

The bull trout Recovery Plan completed in 2015 (USFWS 2015) determined the Middle Salmon River-Chamberlain Core Area had an increasing population abundance status, and increasing short-term trend, and no primary threats identified (Table E-2 in USFWS 2015).

Little-Lower Salmon River Core Area

The Little-lower Salmon River Core Area contains six local populations. Local populations in this core area include the Rapid River and Slate, John Day, Boulder, Hard, Lake/Lower Salmon, and Partridge creeks. The mainstem Salmon River provides habitat for migration and adult and subadult foraging, rearing, and wintering. Resident and migratory populations are known to be present. Annual runs of fluvial bull trout in the Rapid River drainage have been monitored since 1973, and bull trout abundance data has been collected since 1992 at the Rapid River Hatchery trap. Upstream migrant spawner counts at the trap have ranged from 91 to 461 over the last 20 years (IDEQ 2006).

The bull trout Recovery Plan completed in 2015 (USFWS 2015) determined the Little-Lower Salmon River Core Area had a stable population abundance status, stable population trend, and no primary threats identified within the Core Area (Table E-2 in USFWS 2015).

15.3 ANALYSIS OF EFFECTS

Direct Effects

Direct effects arise through collection of Sockeye salmon broodstock and conducting monitoring and evaluation studies throughout the year. These effects were analyzed in Biological Opinion 01EIFW00-2017-F-0819 and determined to not jeopardize the continued existence of, or destroy or adversely modify critical habitat for, bull trout in the upper Salmon River basin.

Competition is also possible between residualized juvenile Sockeye and subadult bull trout. Efforts are ongoing to reduce and minimize residualism rates of hatchery Sockeye. Release of juvenile hatchery Sockeye also likely provides increased forage (a beneficial effect) for migratory adult and subadult bull trout, which are highly piscivorous.

Indirect Effects

Indirect effects may arise through hatchery operations such as water withdrawals, effluent discharge, routine operations and maintenance activities, non-routine operations and maintenance activities (e.g., intake excavation, construction, emergency operations, etc.). Hatchery operations are not expected to affect bull trout population productivity. These activities have occurred for many years in the Salmon River subbasin, apparently without hindering positive population growth rates since 1994, as evidenced by results of High et al. (2008), and are not expected to limit bull trout population growth in the future.

Cumulative Effects

Cumulatively, the effects of the Snake River Sockeye salmon hatchery program and associated monitoring and evaluation efforts results in increased forage for migratory adult and subadult bull trout and small direct effects to individuals that are captured incidental to program activities. These incidental captures also contribute knowledge on bull trout population distribution and abundance that can be used to evaluate bull trout population trends over time.

Take

Annual bull trout take in the form of capture, handling, and bio-sampling is permitted under Biological Opinion 01EIFW00-2017-F-0819. Bull trout take is quantified and reported to the US Fish and Wildlife Service annually by March 31.

15.4 ACTIONS TAKEN TO MITIGATE FOR POTENTIAL EFFECTS

Actions being taken to minimize adverse effects on bull trout include:

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. Continue research to improve post-release survival of Sockeye to potentially reduce numbers released to meet management objectives.

3. Continue fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

4. Monitor 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.

15.5 REFERENCES

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Appendix 1

Take Tables, Definitions, Age Class Designations

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Sockeye Salmon ESU/Population: Snake River Sockeye Salmon Activity: Captive Broodstock Program				
Location of hatchery activity: Sawtooth Valley Hatchery program operator: Idaho Department of Fish & Game				
	Annual Take of Listed Fish By Life Stage (Number of Fish) [i]			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c) Redfish Lake weir Pettit Lake weir Lower Granite Dam		65,000		
Capture, handle, tag/mark/tissue sample, transport and release d) Redfish Lake weir Sawtooth Fish Hatchery weir Pettit Lake weir Lower Granite Dam Other Snake basin weirs[j]		10,000	Entire Run	
Removal (e.g. broodstock) e) Redfish Lake weir Sawtooth Fish Hatchery weir Lower Granite Dam Other Snake basin weirs[j]			1,150	
Intentional lethal take f)		750 (up to 1%)	1,150	
Unintentional lethal take g)		1,500 (up to 2%)	115 (up to 10%)	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.
i. All numbers are variable on annual returns to the Sawtooth Valley. Take listed is based on post-Springfield production levels (1 million smolts).
j Includes the East Fork Salmon, West Fork Salmon, Pahsimeroi Fish Hatchery weirs and Hell's Canyon Dam trap.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.

2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).

3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Table 2. Estimated take of listed salmonids resulting from hatchery programmatic maintenance activities; estimates for both Chinook salmon and steelhead are presented (Ck = Chinook salmon, Sthd = steelhead).

Listed species affected: Spring Chinook Salmon, Summer Steelhead **ESU/Population: Snake River/Upper Salmon River** **Activity: Hatchery programmatic maintenance (see Section 2.2.3 for detail)**				
Location of hatchery activity: Sawtooth Fish Hatchery **Hatchery program operator: Idaho Department of Fish & Game**				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Maintenance Activity:	Ck/Sthd Egg/Fry	Ck/Sthd Juvenile/Smolt	Ck/Sthd Adult	Ck/Sthd Carcass
Hatchery Diversion Dam, Intake Source				
Observe or harass a)				
Capture, handle, and release c)		50/10		
Unintentional lethal take g)		1/1		
Intake Canal & Bypass Screen				
Observe or harass a)				
Capture, handle, and release c)		50/10		
Unintentional lethal take g)		1/1		
Adult Fish Weir – Main Hatchery				
Observe or harass a)				
Capture, handle, and release c)		50/10		
Unintentional lethal take g)		1/1		
Lower Granite Dam – Trap and Haul				
Observe or harass a)				
Capture, handle, and release c)				
Unintentional lethal take g)				
Redfish Lake Weir – Normal Operations				
Observe or harass a)				
Capture, handle, and release c)		75/20	10/5	
Unintentional lethal take g)		1/1	1/1	
Pettit Lake Weir – Normal Operations				
Observe or harass a)				
Capture, handle, and release c)		10/5		
Unintentional lethal take g)		1/1		

ATTACHMENT 1. DEFINITION OF TERMS REFERENCED IN THE HGMP TEMPLATE

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as "supplementation".

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with natural origin recruit (NOR).

Natural origin recruit (NOR) - See natural fish.

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation

(random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

ATTACHMENT 2. AGE CLASS DESIGNATIONS BY FISH SIZE AND SPECIES FOR SALMONIDS RELEASED FROM HATCHERY FACILITIES.

(generally from Washington Department of Fish and Wildlife, November, 1999).

Species	Age Class	Number of fish/pound	Size Criteria (grams/fish)
Chinook	Yearling	<=20	>=23
	Fingerling (Zero)	20 to 150	3 to <23
	Fry	>150 to 900	0.5 to <3
	Unfed Fry	>900	<0.5
Coho	Yearling [1]	<20	>=23
	Fingerling	>20 to 200	2.3 to <23
	Fry	>200 to 900	0.5 to <2.3
	Unfed Fry	>900	<0.5
Chum	Fed Fry	<=1000	>=0.45
	Unfed Fry	>1000	<0.45
Sockeye	Yearling [2]	<=20	>=23
	Fingerling	>20 to 800	0.6 to <23
	Fall Releases	<150	>2.9
	Fry	>800 to 1500	0.3 to <0.6
	Unfed Fry	>1500	<0.3
Pink	Fed Fry	<=1000	>=0.45
	Unfed Fry	>1000	<0.45
Steelhead	Smolt	<=10	>=45
	Yearling	<=20	>=23
	Fingerling	>20 to 150	3 to <23
	Fry	>150	<3
Cutthroat Trout	Yearling	<=20	>=23
	Fingerling	>20 to 150	3 to <23
	Fry	>150	<3
Trout	Legals	<=10	>=45
	Fry	>10	<45

[1] Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
[2] Sockeye yearlings defined as meeting size criteria and 1 year old.