FISHERY RESEARCH

SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

ANNUAL PROGRESS REPORT
January 1, 2017—December 31, 2017

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Snake River Sockeye Salmon Captive Broodstock Program Hatchery Element

Project Progress Report

2017 Annual Report

By

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

EXECUTIVE SUMMARY

On November 20, 1991, the National Marine Fisheries Service listed Snake River Sockeye Salmon *Oncorhynchus nerka* as endangered under the Endangered Species Act of 1973. In 1991, the Idaho Department of Fish and Game, the Shoshone-Bannock Tribes, and the National Marine Fisheries Service initiated efforts to conserve and rebuild populations in Idaho.

Initial steps to recover Snake River Sockeye Salmon included the establishment of a captive broodstock program at the Idaho Department of Fish and Game's Eagle Fish Hatchery. Broodstock and fish culture responsibilities for the listed stock are shared with the National Oceanic and Atmospheric Administration's Manchester Research Station and Burley Creek Hatchery adjacent to Puget Sound in Washington State. Activities conducted by the Shoshone-Bannock Tribes and the National Oceanic and Atmospheric Administration are reported separately. Idaho Department of Fish and Game monitoring and evaluation activities associated with captive broodstock program fish releases are also reported separately (in an annual report to the Bonneville Power Administration for the Monitoring and Evaluation element of the program). Captive broodstock program activities conducted between January 1, 2017 and December 31, 2017 for the hatchery element of the program are presented in this report.

One hundred sixty-two anadromous Sockeye Salmon were trapped in the Sawtooth Valley between July 27 and September 30, 2017. The Sawtooth Fish Hatchery weir on the upper Salmon River intercepted 23 Sockeye Salmon adults; the Redfish Lake Creek trap intercepted 139 Sockeye Salmon (124 trapped and 15 seined from below the temporary trap). The adult Sockeye Salmon (72 females and 90 males) originated from a variety of release strategies, as evidenced by mark types. One hundred sixty-one anadromous Sockeye Salmon (72 females and 89 males) remained at Eagle Fish Hatchery and were incorporated into the spawning matrix. One natural male was released to Pettit Lake based on genetic profile.

Four hundred eighty-one female Sockeye Salmon (67 anadromous females, three BY13, 405 BY14, and six BY15 captive females) were spawned at the Eagle Fish Hatchery in 2017. Spawn pairings produced approximately 998,949 green eggs. Egg survival to eyed stage of development averaged 83.81% (837,213 eyed eggs). Additionally, the NOAA Fisheries Program produced 278,631 green eggs. Egg survival to the eyed stage of development was 82.53% (229,951 eyed eggs). Eyed eggs from both programs are combined to meet Springfield FH smolt production goals.

Presmolts (239,238), smolts (734,492) and adults (1,229) were released into Sawtooth Valley waters in 2017. Reintroduction strategies involved releases to Redfish Lake, Pettit Lake, and Redfish Lake Creek.

During this reporting period, six year classes (brood years) of captive broodstock and four unique production groups were in culture at Idaho Department of Fish and Game (Eagle Fish Hatchery, Springfield Fish Hatchery, and Sawtooth Fish Hatchery) facilities. Three of the six brood years of captive broodstock were incorporated into the 2017 spawning design.

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INTRODUCTION

Numbers of Snake River Sockeye Salmon *Oncorhynchus nerka (O. nerka)* declined over the course of the 20th century, dramatically so from the 1950s until and subsequent to the 1991 ESA listing of the stock. In Idaho, only the lakes of the upper Salmon River (Sawtooth Valley) remain as potential sources of production (Figure 1). Historically, five Sawtooth Valley lakes (Redfish, Alturas, Pettit, Stanley, and Yellowbelly) supported Sockeye Salmon (Bjornn et al. 1968; Chapman et al. 1990). Currently, only Redfish Lake receives a remnant anadromous run.

On April 2, 1990, the National Oceanic and Atmospheric Administration Fisheries Service (NOAA, formerly National Marine Fisheries Service) received a petition from the Shoshone-Bannock Tribes (SBT) to list Snake River Sockeye Salmon as endangered under the United States Endangered Species Act (ESA) of 1973. On November 20, 1991, NOAA declared Snake River Sockeye Salmon endangered.

In 1991, the SBT, along with the Idaho Department of Fish and Game (IDFG), initiated the Snake River Sockeye Salmon Sawtooth Valley Project (Sawtooth Valley Project) with funding from the Bonneville Power Administration (BPA). The goal of this program is to conserve genetic resources and to rebuild Snake River Sockeye Salmon populations in Idaho. Coordination of this effort is conducted under the guidance of the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC), a team of biologists representing the agencies involved in the recovery and management of Snake River Sockeye Salmon. National Oceanic and Atmospheric Administration Fisheries Service ESA Permit Nos. 1454, 1124, and Fishery Management and Evaluation Plan (FMEP) authorize IDFG to conduct scientific research on listed Snake River Sockeye Salmon.

Initial steps to recover the species involved the establishment of captive broodstocks at the Eagle Fish Hatchery (Eagle FH) in Idaho and at NOAA facilities in Washington State (for a review, see Flagg 1993; Johnson 1993; Flagg and McAuley 1994; Kline 1994; Johnson and Pravecek 1995; Kline and Younk 1995; Flagg et al. 1996; Johnson and Pravecek 1996; Kline and Lamansky 1997; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Hebdon et al. 2000; Flagg et al. 2001; Kline and Willard 2001; Frost et al. 2002; Hebdon et al. 2002; Hebdon et al. 2003; Kline et al. 2003a; Kline et al. 2003b; Willard et al. 2003a; Willard et al. 2003b; Baker et al. 2004; Baker et al. 2005; Willard et al. 2005; Baker et al. 2006; Plaster et al. 2006; Baker et al. 2007; Peterson et al. 2008; Baker and Green 2009a; Baker et al. 2009b; Peterson et al. 2010; Baker et al. 2011a; Baker et al. 2011b; Baker et al. 2012; Baker et al. 2013; Baker et al. 2014; Baker et al. 2015; Baker et al. 2016; and Baker et al. 2017).

PROGRAM GOALS

The immediate goal of the program is to utilize captive broodstock technology to conserve the population's unique genetics. Long-term goals include increasing the number of individuals in the population to address delisting criteria and to provide sport and treaty harvest opportunity.

Objectives and Tasks

1. Develop captive broodstocks from Redfish Lake Sockeye Salmon; culture broodstocks and produce progeny for reintroduction.

2. Determine the contribution hatchery-produced Sockeye Salmon make toward avoiding population extinction and increasing population abundance.

3. Describe *O. nerka* population characteristics for Sawtooth Valley lakes in relation to carrying capacity and broodstock program reintroduction efforts.

4. Utilize genetic analysis to discern the origin of wild and hatchery produced Sockeye Salmon to provide maximum effectiveness in their utilization within the broodstock program.

5. Transfer technology through participation in the technical oversight committee process, provide written activity reports, and participate in essential program management and planning activities.

Idaho Department of Fish and Game's participation in the Snake River Sockeye Salmon Captive Broodstock Program includes two areas of effort: 1) Sockeye Salmon captive broodstock culture, and 2) Sockeye Salmon monitoring and evaluation. Although objectives and tasks from both components overlap and contribute to achieving the same goals, work directly related to Sockeye Salmon captive broodstock monitoring and evaluation will appear under a separate cover. This report details fish culture information collected between January 1 and December 31, 2017.

FACILITIES

Eagle Fish Hatchery

Eagle FH is the primary Idaho site for the Sockeye Salmon captive broodstock program. Artesian water from three wells is currently in use. Artesian flow is augmented with three separate pump/motor systems. Water temperature remains a constant 13.5°C and total dissolved gas averages 100% after degassing. The main captive broodstock building receives water from wells #1 and #2 (up to 1,000 gallons per minute). Up to 300 gallons per minute (gpm) can be chilled to 8°C allowing the program to rear at a variety of water temperatures. Rearing capacity for the main building is approximately 1,600 fish per brood year. Isolated holding and spawning of anadromous Sockeye Salmon is conducted in the original hatchery building. Backup and system redundancy is in place for degassing, pumping, and power generation. An automated alarm system monitors flow at seven locations with two alarms tied to the chiller operations. Mountain Alarm provides alarm service for the facility. Three on-site residences provide housing for full-time hatchery personnel. A dormitory is available to house temporary staff.

Facility layout at Eagle FH accommodates culture activities ranging from egg incubation through adult rearing and spawning. Incubation capacity was increased to provide eyed eggs to the Springfield Fish Hatchery (Springfield FH) beginning in 2013. Egg incubation uses a combination of vertical stack incubators and small isolation upwellers. Thirty-six vertical stack incubators, each holding eight trays, will incubate up to 1,000,000 green eggs. Each tray contains four smaller baskets to maintain family group separation during incubation. An additional 250,000 green eggs are reared using isolated upwellers. Incubation in these small containers specifically designed for the program (Heindel et al. 2005) allow for separation of individual subfamilies. These incubators are designed to distribute both upwelling and downwelling flow to accommodate pre- and post-hatch life stages.

Fiberglass tanks of several sizes are used to culture Sockeye Salmon from fry to adult life stages, including: 1) 0.7 m diameter semi-square tanks (0.09 m^3); 2) 1.0 m diameter semi-square tanks (0.30 m^3); 3) 2.0 m diameter semi-square tanks (1.42 m^3); 4) 3.0 m diameter circular tanks (6.50 m^3); and, 5) 4.0 m diameter semi-square tanks (17.6 m^3). Typically, 0.7 m and 1.0 m tanks are used for rearing fry from ponding to approximately 10.0 g fish. Two-meter tanks are used to rear juveniles to approximately 50.0 g and group fish by lineage or release strategy prior to distribution to Sawtooth Valley waters. Three- and four-meter tanks are used to rear fish to maturity for future broodstock production (spawning). Flows to all tanks are maintained at no less than 1.5 exchanges per hour. Shade covering (70%) and jump screens are used where appropriate. Discharge standpipes are external on all tanks and assembled in two sections ("half-pipe" principle) to prevent tank dewatering during tank cleaning.

Springfield Fish Hatchery

Springfield Fish Hatchery is located in Bingham County, Idaho near the town of Springfield. Construction of the facility was completed in 2013 from funding provided by BPA through the Idaho Fish Accords. A confined aquifer underlying the Springfield FH site 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 supply the hatchery building, but can supply outdoor raceways. The remaining three wells (wells 4, 6, and 9) have discharge heads with valves that can be opened or closed to allow artesian flow to Crystal Springs Pond, a public fishing pond located on the 43-acre northern parcel. The ambient water temperature remains a constant 9.9°C and ambient temperature total dissolved gas (TDG) levels currently range from 100% - 101% after aeration and degassing. Additionally, a chiller supplies up to 110 gpm of water chilled to 5.0°C for use in incubation or early rearing. Backup and system redundancy is in place for degassing, pumped water delivery, chilled water supply, and power generation. Springfield FH facilities are designed to rear up to one million Sockeye Salmon smolts annually for release to the Stanley basin. Rearing protocols are established cooperatively between IDFG personnel and reviewed at the SBSTOC level.

Eyed eggs, received by Springfield FH from Eagle FH and NOAA Fisheries, are incubated in vertical stack incubators. Swim-up fry are ponded into fiberglass vats and reared indoors for five to six months. Juveniles are transferred (during ad clipping) to outdoor raceways in July and reared through release as smolts the following May. Juvenile Sockeye Salmon reared at Springfield FH are released as smolts into Redfish Lake Creek or upper Salmon River. No adult holding or spawning is planned at Springfield FH.

Sawtooth Fish Hatchery / Trap

Construction of the Sawtooth Fish Hatchery (Sawtooth FH) was completed in 1985 as part of the U.S. Fish and Wildlife Service Lower Snake River Compensation Plan and is located on the Salmon River, 3.5 km upstream from the confluence of Redfish Lake Creek. Sawtooth FH personnel and facilities were utilized continuously from 1991 through 2017 for various aspects of the Sockeye Salmon captive broodstock program, including 1) prespawn anadromous adult holding, 2) egg incubation, and 3) juvenile rearing for presmolt and smolt releases. Sawtooth FH personnel assist with many field activities, including 1) fish trapping and handling and 2) fish transportation and release.

Prespawn anadromous adults captured at the Sawtooth FH trap are transferred to Eagle FH or released upstream of the Sawtooth FH intake. Sockeye Salmon may be temporarily held (two days maximum) in adult holding facilities at Redfish Lake Creek prior to transfer to the Eagle FH.

Redfish Lake Creek Trap

The Redfish Lake Creek trap is located approximately 1.4 km downstream from the lake outlet. It is operated for adult trapping from early July through mid-October. Sockeye Program personnel staff the trap daily during the trapping season. On-site personnel provide security at the site and are responsible for transporting anadromous Sockeye to Eagle FH. During 2017, construction was underway to remove and replace the current weir structure on Redfish Lake Creek. A temporary weir site was located below Little Redfish Lake adjacent to the Chinook Bay Campground.

Prespawn anadromous adults captured at the Redfish Lake Creek trap are transferred to Eagle FH or released to Redfish Lake Creek above the weir. Sockeye Salmon may be temporarily held (two days maximum) in adult holding facilities at Redfish Lake Creek prior to transfer to the Eagle FH. During 2017, no fish were released above the weir due to low number of returning adults and construction of the new Redfish Lake Creek weir/trap.

METHODS

Fish Culture

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; Wedemeyer 2001) and 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 was carried out between NOAA and IDFG culture experts, as well as program cooperators at the SBSTOC level.

During 2017, fish were fed a commercial diet produced by EWOS® Canada LTD (EWOS). Rations were weighed daily and feeding rates follow manufacturer recommendations. The product's palatability and levels of natural pigments were enhanced by the addition of natural flavors from fish and krill.

Fish sample counts were conducted as needed to ensure that actual growth tracked with projected growth. In general, fish were handled as little as possible. Age-1 and age-2 Sockeye Salmon rearing densities were maintained at levels not exceeding 8.0 kg/m^3. Age-3 and age-4 rearing densities were maintained at levels not exceeding 14.0 kg/m^3.

Incubation and rearing water temperature was maintained between 7.0°C and 13.5°C. Chilled water (7.0°C to 10.0°C) was used during incubation and early rearing to equalize development and growth differences that resulted from a protracted spawning period. Rearing water temperature varied as a function of demand, but was generally maintained between 10.0°C and 12.0°C throughout much of the age-2, age-3, and age-4 culture history.

Passive integrated transponder (PIT) tags were used to track Sockeye Salmon retained in the program as broodstock fish; these fish were PIT tagged at approximately 15 months of age. The PIT tag procedures followed accepted, regional protocols (Prentice et al. 1990).

Chemical therapeutants may be used for the treatment of infectious diseases. Before initiating treatments, the use of chemical therapeutants was discussed with an IDFG fish health professional. Fish necropsies were performed on all program mortalities that satisfied minimum size criteria for the various diagnostic or inspection procedures performed. Carcasses were either incinerated, deposited in a landfill, or delivered to a rendering plant.

Anadromous and Residual Sockeye Salmon Trapping

Two adult traps were used to capture returning anadromous Sockeye Salmon in the Sawtooth Valley. The first trap was located on Redfish Lake Creek approximately 220 meters downstream from Little Redfish Lake outlet. This was a temporary weir/trap site due to the construction of a new weir/trap at the existing site. The second trap was located on the upper Salmon River at the Sawtooth FH weir.

Residual Sockeye Salmon trapping activities may be conducted in basin lakes. When necessary, trapping efforts consist of setting a series of trap nets along areas of known residual spawning activity. Nets are set in the late afternoon prior to snorkeling activities. Nets are checked while conducting evening snorkel surveys and again at approximately 0300 hrs to ensure that no adult Sockeye Salmon (program releases) were trapped.

Spawning Activities

Hatchery spawning of Snake River Sockeye Salmon has occurred at Eagle FH each year since 1994 (Johnson and Pravecek 1995; Johnson and Pravecek 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Kline and Willard 2001; Kline et al. 2003a; Kline et al. 2003b; Willard et al. 2003a; Baker et al. 2004; Baker et al. 2005; Baker et al. 2006; Baker et al. 2007; Baker and Green 2009a; Baker et al. 2009b; Baker et al. 2011a; Baker et al. 2011b; Baker et al. 2013; Baker et al. 2014; Baker et al. 2015; Baker et al. 2016; and Baker et al. 2017). Before 1994, adult Sockeye Salmon returns were spawned at the Sawtooth FH (Johnson 1993). Spawning activities in 2017 followed accepted, standard practices as described by Erdahl (1994) and McDaniel et al. (1994). Prior to spawning adults at Eagle FH, the Idaho Department of Fish and Game is required by NOAA Permit No. 1454 to discuss proposed broodstock spawning matrices with Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) members.

Historically, the broodstock program used pedigree information to pool eyed eggs developed from hatchery spawning into broodstock rearing groups. Identification of familial groups was maintained by tank segregation until juveniles were large enough to PIT tag. In 2017, breeding plans relied on DNA microsatellite information versus pedigree information. Microsatellite data were generated from DNA samples at 16 loci. Kinship coefficients and mean kinship coefficients were used to determine relative founder contribution in the population, genetic importance, and relative relatedness. Spawning plans also considered heterozygosity and genetic diversity among and within individuals. Genetic-based spawning plans provide a higher level of resolution than was possible with pedigree information, which can minimize the loss of heterozygosity and inbreeding.

Milt Cryopreservation

Cryopreservation of milt from male donors has been conducted in the captive broodstock program since 1991 with techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991). Beginning in 1996, cryopreserved milt was used to produce lineage-specific broodstocks for use in future spawn years. “Designer broodstocks” produced in this manner provided increased genetic variability for use in future brood years.

Fish Health Investigations

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

1) Antibiotic therapies: 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 body weight. In addition, fish may be fed oxytetracycline as needed to control outbreaks of pathogenic myxobacteria, as well as aeromonad and pseudomonad bacteria.

2) 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 upon receipt, prior to loading of incubators.

3) Anadromous adult formalin treatments: Anadromous adults transferred from the Sawtooth Valley are treated with formalin in a static bath for one hour at 167 parts per million (ppm) to control *Ichthyophthirius* spp. In addition, formalin treatments are administered as required to control *Saprolegnia.*

4) Egg formalin treatments: Developing eggs are treated three times per week with formalin to control *Saprolegnia*. This is a flow-through treatment administered at 1,667 ppm for 20 minutes.

Spawning adults were analyzed for common bacteria (bacterial kidney disease *Renibacterium salmoninarum*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.) and viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus). In addition to the above, anadromous adult Sockeye Salmon were screened for the causative agent of whirling disease *Myxobolus cerebralis*, furunculous *Aeromonas salmonicida*, and the North American strain of viral hemorrhagic septicemia. Tissue samples were collected from the kidney and spleen of each fish and the Eagle FH staff collected ovarian fluid samples from each female for analysis at the Eagle Fish Health Laboratory. Results of fish health analysis of spawners were used by IDFG and the SBSTOC to determine disposition of eggs and subsequent juveniles.

Fish health was 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 looked 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 was immediately reported to the program fish pathologist.

Presence of moribund fish was 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 were employed to isolate bacterial or viral pathogens and to identify parasite etiology (Thoesen 1994). Moribund fish were routinely analyzed for common bacterial and viral pathogens (e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc.). When a treatable pathogen was either detected or suspected, the program fish pathologist prescribed appropriate therapeutic drugs to control the problem. Select carcasses were appropriately preserved for pathology, genetic, and other analyses. After necropsy, carcasses that were not vital to further analysis were disposed of as per language contained in the ESA Section 10 permit for the program.

Eyed Egg and Fish Transfers

Eggs were shipped at the eyed stage between NOAA and IDFG facilities using a commercial air service. Iodophor-disinfected (100 ppm) eggs were packed at a conservative density in perforated tubes, then capped and labeled. Tubes were wrapped with hatchery water-saturated cheesecloth and packed in small coolers. Ice chips were added to ensure proper temperature maintenance, and coolers were sealed with packing tape. Personnel from IDFG and NOAA were responsible for shuttling coolers to and from air terminals. Eyed eggs destined for production at Springfield FH were placed in egg shipping tubes at approximately 2,000 eggs per tube. Eyed eggs were then placed in 40-quart transport coolers and tempered to 8°Celsius. Ice was added to the cooler to keep eggs cool during transport to production facilities.

Containers used to transport fish varied by task. In all cases, containers of the proper size and configuration were used. Appropriate temperature, oxygen, and chemical composition was maintained during the handling and transfer phases of transportation. Containers varied from five-gallon plastic buckets and coolers for short-term holding and inventory needs to truck-mounted tanks. Truck-mounted tanks, used for long distance transfers, were available to the program with 946 L (250 gallon), 3,785 L (1,000 gallon), 7,570 L (2,000 gallon), 11,355 L (3,000 gallon), and 18,926 L (5,000 gallon) capacities. Transport density guidelines were in place not to exceed 89 grams/liter (0.75 pounds/gallon).

Eyed Egg and Fish Supplementation

In 2017, Sockeye Salmon were reintroduced to Sawtooth Valley waters as hatchery-reared presmolts, smolts, and as both returning anadromous and hatchery captive-reared prespawn adults.

Sockeye Salmon presmolts were distributed to Sawtooth Valley waters using truck-mounted transportation tanks. This group was first acclimated from one to two weeks at Sawtooth FH before transfer and release to Redfish Lake. Presmolts were released to Redfish Lake during October 2017.

Sockeye Salmon smolts were distributed to Sawtooth Valley waters using truck-mounted transportation tanks. In 2017, Sockeye Salmon smolts were released to Redfish Lake Creek downstream of the juvenile out-migrant weir. Chilled water at Springfield FH was used to fill transport tanks to begin the tempering process during transport.

Prespawn adult Sockeye Salmon were distributed to Sawtooth Valley waters using truck-mounted transportation tanks. Adults were released to Redfish Lake and Pettit Lake in September 2017. To minimize stress, all prespawn adult releases were conducted at public access points at dusk. Transport tanks were tempered to receiving water temperatures prior to the release of fish.

RESULTS AND DISCUSSION

Fish Culture

During this reporting period, six brood years of captive broodstock and four production groups were in culture at IDFG facilities representing brood years 2012, 2013, 2014, 2015, 2016, and 2017. Summaries of losses while in culture during this reporting period are presented in Tables 1 and 2. Culture groups developed to meet future spawning needs are designated as "broodstock" groups. Culture groups developed primarily for reintroduction to Sawtooth Valley waters are designated as "production" groups. The year of development for specific culture groups may be abbreviated (e.g., BY12 refers to brood year 2012).

Brood Year 2012 Broodstock

One hundred twenty-one females and 149 males were spawned at Eagle FH between September 25 and November 9, 2012, yielding 243,223 green eggs. Two hundred forty-two unique subfamilies were developed from BY12 spawn crosses at the Eagle FH (Baker et al. 2013).

Approximately 2,460 eyed eggs representing 234 subfamilies (117 unique females and 146 unique males) were selected from specific spawn crosses (Baker et al. 2013) and incubated for future captive broodstock program needs. Eyed eggs were selected in four similar groups with two groups (514 and 460 eyed eggs) remaining at Eagle FH. Two groups were transferred to NOAA Fisheries (749 and 746 eyed eggs).

Starting inventory for the BY12 captive broodstock group at Eagle FH was seven fish. There were six mortalities/unproductive culls and one fish that matured. The one mature, male Sockeye was released into Redfish Lake on September 12. Ending inventory for the BY12 broodstock group was zero fish (Table 1).

Brood Year 2013 Broodstock

Two hundred twenty-four females and 200 males were spawned at Eagle FH between September 24 and November 5, 2013, yielding 465,878 green eggs. Four hundred forty-eight unique subfamilies were developed from BY13 spawn crosses at the Eagle FH (Baker et al. 2014).

Approximately 2,990 eyed eggs representing 380 subfamilies (190 unique females and 186 unique males) were selected from specific spawn crosses (Baker et al. 2014) and incubated for future broodstock needs. Eyed eggs were selected in four similar groups with two groups (752 and 745 eyed eggs) remaining at Eagle FH. Two groups (749 and 744 eyed eggs) were transferred to NOAA Fisheries for captive rearing.

Starting inventory for the BY13 captive broodstock group at Eagle FH was 10 fish. There were four mortalities and six maturing Sockeye during the year. Of the maturing Sockeye, three females and three males were incorporated into the spawning matrix at Eagle FH. Ending inventory for the BY13 captive broodstock group was zero adults (Table 1).

Brood Year 2014 Broodstock

Three hundred seventy-eight females and 393 males were spawned at Eagle FH between September 25 and November 18, 2014 yielding 744,538 green eggs. Seven hundred fifty-four unique subfamilies were developed from BY14 spawn crosses at Eagle FH (Baker et al. 2015).

Approximately 2,969 eyed eggs representing 735 subfamilies (371 unique females and 398 unique males) were selected from specific spawn crosses (Baker et al. 2015) and incubated for future captive broodstock program needs. Eyed eggs were selected in four similar groups with two groups (747 and 746 eyed eggs) remaining at Eagle FH. Two groups (739 and 737 eyed eggs) were transferred to NOAA Fisheries for captive broodstock rearing.

Starting inventory for the BY14 captive broodstock at Eagle FH was 1,243 fish. Mortality for the year was 247 fish and 978 matured during the year. Of the maturing Sockeye, 293 males and 405 females were incorporated into the spawning matrix, and 18 mature fish were culled as unproductive/nonspawners. An additional 262 mature captive broodstock were released to Redfish Lake for volitional spawning. Ending inventory for the BY14 captive broodstock group was 18 immature fish (Table 1).

Brood Year 2015 Broodstock

Three hundred ninety-six females and 427 males were spawned at Eagle FH between September 18 and November 12, 2015, yielding 651,399 green eggs. Seven hundred ninety unique subfamilies were developed from BY15 spawn crosses at Eagle FH (Baker et al. 2016).

Approximately 3,002 eyed eggs representing 782 subfamilies (395 unique females and 426 unique males) were selected from specific spawn crosses (Baker et al. 2016) and incubated for future captive broodstock needs. These eggs were split into duplicate groups, with one group (1,500 eggs) remaining at Eagle FH and the other group (1,502 eggs) transferred to NOAA Fisheries.

Starting inventory for the BY15 captive broodstock at Eagle FH was 1,254 fish. Mortality for the year was 58 fish and 131 matured during 2017. Of the 131 maturing fish 90 (84 males and 6 females) were incorporated into the spawning matrix and two fish were culled as unproductive/nonspawners. An additional 39 maturing females were released to Redfish Lake. Ending inventory for the BY15 captive broodstock was 1,065 fish (Table 1).

Brood Year 2015 Production

Starting inventory for the BY15 smolt production group at Springfield FH was 735,642 fingerlings. A total of 734,492 smolts were released from April 18 through April 29 (Table 2). Cumulative mortality from eyed egg to smolt for the Springfield FH smolt release group was 127,909 juveniles (85.2% survival).

Brood Year 2016 Broodstock

Five hundred one females and 518 males were spawned at Eagle FH between September 20 and November 9, 2016, yielding 847,975 green eggs. Nine hundred ninety-eight unique subfamilies were developed from BY16 spawn crosses at Eagle FH. (Baker et al. 2017).

Approximately 1,500 eyed eggs representing 991 subfamilies (496 unique females and 516 unique males) were selected from specific spawn crosses (Baker et al. 2017) and incubated for future captive broodstock needs. Due to IHNv positive anadromous spawners, broodstock eyed eggs were not selected for the NOAA Fisheries program.

Starting inventory for the BY16 captive broodstock at Eagle FH was 1,500 eyed eggs/developing fry. The BY16 captive broodstock group was marked/tagged (adipose clipped, PIT tagged, and genetically sampled) in December. Mortality for the year was 156 fry. Ending inventory for the BY16 captive broodstock was 1,344 fingerlings (Table 1).

Brood Year 2016 Production

A total of 1,037,369 BY16 eyed eggs from production spawn crosses at Eagle FH and Burley Creek FH were transferred to Springfield FH. Egg incubation and juvenile rearing for this production group will continue at Springfield FH until smolt releases in 2018. The BY16 production group was ad-clipped in July. On October 19 and 26, 239,298 BY16 presmolts (averaging 10.1 grams/fish) were released to Redfish Lake. The BY16 smolt production group reared at Springfield FH was PIT tagged (N = 49,990) in October. Ending inventory for this production group at Springfield FH was 662,797 fish.

Anadromous and Residual Sockeye Salmon Trapping

Two adult traps were used to capture returning anadromous Sockeye Salmon in the Sawtooth Valley in 2017. Due to the construction and replacement of the existing trap at Redfish Lake Creek, a temporary trap was used to trap anadromous adult Sockeye returning to Redfish Lake. The temporary trap was located adjacent to the Chinook Bay Campground approximately 220 meters downstream of Little Redfish Lake. The temporary picket weir and trap box was installed on July 19 and removed on October 18. The second trap, located on the upper Salmon River at the Sawtooth FH weir, was in operation from July 3 to September 14. Sockeye Salmon were also collected downstream of the temporary picket weir on Redfish Lake Creek using a seine on September 20.

A total of 162 anadromous Sockeye Salmon were trapped and collected in the Sawtooth Valley between July 27 and September 30 (Table 1). The weir on the upper Salmon River at the Sawtooth FH intercepted 23 Sockeye Salmon adults, the Redfish Lake Creek temporary trap intercepted 124 Sockeye adults, and 15 adults were collected by seine from Redfish Lake Creek downstream of the temporary weir. Adult Sockeye Salmon captured in the Sawtooth Valley originated from a variety of release strategies, as determined by mark types and genetic parentage analysis (Table 3).

Residual Sockeye Salmon trapping activities were not conducted during 2017.

In 2017, two anadromous Chinook Salmon adults were trapped at the Redfish Lake Creek trap. Both adults were hatchery reared and transferred to Sawtooth FH to be incorporated into the spawning program.

2017 Spawning Activities

Results from 2017 Eagle FH spawning activities are reviewed below. Results from spawning activities conducted by NOAA personnel at Washington State facilities will appear under

separate cover by that agency. The year of development for specific broodstocks may be abbreviated (e.g., BY13 refers to brood year 2013).

Four hundred eighty-one females and 450 males were spawned at Eagle FH between September 29 and November 7, 2017, yielding 998,949 green eggs. Nine hundred sixty-one unique subfamilies were developed from BY17 spawn crosses at Eagle FH. To simplify tracking, families were grouped under one production group title: BY17. The BY17 captive broodstock group was developed using male Sockeye Salmon from the BY13 (three males), BY14 (293 males) BY15 (84 males), and 70 anadromous males that were collected during 2017 trapping activities (ANH17). Female Sockeye Salmon represented in spawn crosses for 2017 included captive broodstock from BY13 (three females), BY14 (405 females), BY15 (six females), and 67 anadromous females (ANH17) that were collected during trapping activities in 2017. Specific crosses performed to develop this production group included: 1) ANH17 females x ANH17 males; 2) ANH17 females x BY13 males; 3) ANH17 females x BY14 males; 4) BY13 females x BY14 males; 5) BY13 females x BY15 males; 6) BY14 females x ANH17 males; 7) BY14 females x BY13 males; 8) BY14 females x BY14 males; 9) BY14 females x BY15 males; 10) BY15 females X BY14 males; and 11) BY15 females X BY15 males (Table 4). Spawn crosses produced approximately 998,949 green eggs and 837,213 eyed eggs. Brood year 2014 female fecundity averaged 2,019 green eggs per female and ANH17 female fecundity averaged 2,512 green eggs per female. Egg survival to the eyed stage of development for the BY17 production group averaged 83.81% (median 90.87%, Table 4). In 2017, of the 161 anadromous adults transferred to Eagle FH and incorporated into the spawning matrix, infectious hematopoietic necrosis virus (IHNv) was not detected.

Approximately 3,008 eyed eggs representing 955 subfamilies (479 unique females and 450 unique males) were selected from specific spawn crosses described above to represent BY17 captive broodstock. Two similar groups were selected (1,504 eyed eggs each), with one group transferred to NOAA Fisheries for incubation and rearing.

Historically, broodstock families were kept separated in individual tanks until PIT tagging and then pedigree information for the familial line was utilized to make spawn crosses. Genetic identification of BY17 captive broodstock will be determined by utilizing microsatellite DNA markers. Spawn crosses represented in the Eagle FH BY17 captive broodstock are presented in Table 5.

A total of 703,368 BY17 eyed eggs were transferred to Springfield FH for smolt production rearing. Production spawn crosses at Eagle FH provided 474,788 eyed eggs and Burley Creek FH provided 228,580 eyed eggs. An additional 354,543 BY17 eyed eggs were transferred to Sawtooth FH for smolt production rearing provided by the Eagle FH program. Egg incubation and juvenile rearing for the BY17 production groups will continue at Springfield and Sawtooth FH's until smolts are released in May 2019.

Milt Cryopreservation

During 2017, no milt was cryopreserved and no cryopreserved milt from previous years was used in BY17 spawn crosses.

Fish Health Investigations

The IDFG Eagle Fish Health Laboratory (EFHL) processed samples for diagnostic and inspection purposes from captive broodstock and production groups of Sockeye Salmon,

including anadromous adults that were retained for hatchery spawning and smolts obtained from out-migrant traps. One hundred sixty-five laboratory accessions involving 1,197 individual fish were processed in 2017. Laboratory accessions included samples from Eagle FH (97 accessions), Springfield FH (four accessions), Redfish Lake Creek (RFLC) out-migrant trap (one accession), and NOAA Fisheries (25 accessions). Total fish sampled (1,197) included; 674 fish from Eagle FH (one BY13, 461 BY14, 51 BY15 and 161 ANH17), 140 fish from Springfield FH (60 BY15 and 80 BY16), 20 fish from the RFLC trap (BY15 out-migrant smolts), and 363 fish from NOAA Fisheries. Observations made from previous years prioritized the pathogens that were most important for these examinations. All adults used for captive broodstock purposes were examined for viruses and bacterial kidney disease (BKD). Anadromous adults were examined for a broad array of pathogens, since these pose the greatest threat of introduction of an exotic pathogen to the captive broodstock program. All production lots were examined prior to release as full-term smolts. The EFHL also summarized pathology findings to satisfy the needs of adjacent state agencies for issuance of Sockeye Salmon transport permits.

Viral Pathogens

Viral pathogens were not detected in Sockeye Salmon (captive broodstocks, production groups, natural out-migrants, or anadromous adults) during calendar year 2017. Eagle Fish Health Lab began sampling NOAA Fisheries Captive Broodstock in 2015 (previously these samples were collected and analyzed by NOAA Fisheries staff) and continued sampling in 2017. Samples were collected from spawned captive broodstock at Burley Creek FH representing BY13 and BY14 (205 fish sampled) and from Manchester Research Station representing BY12, BY13, BY14, and BY15 (158 fish sampled). Two production groups from Springfield FH were sampled (140 fish across both Springfield groups) and analyzed at Eagle Fish Health Lab in 2017. All virology samples from these production groups resulted in negative detection of viral pathogens for 2017. Twenty BY15 out-migrating smolts from the Redfish Lake Creek were sampled with no viral pathogens detected.

Bacterial Pathogens

Fish health sampling for *Renibacterium salmoninarum*, the causative agent for bacterial kidney disease (BKD), is a standard fish health sampling protocol for broodstock, production, and out-migrant groups of Redfish Lake Sockeye Salmon. A total of 1,197 fish from calendar year 2017 were sampled for BKD via enzyme-linked immunosorbent assay (ELISA) techniques at Eagle Fish Health Lab. Captive broodstocks at Eagle FH and NOAA Fisheries tested negative for BKD. Two of 161 anadromous Sockeye tested were positive in 2017 (ELISA values = 0.297 [female] and 1.845 [female]). Based on the test results from the anadromous females spawned at Eagle FH, all eggs were culled from these two females following program protocols. Sockeye smolts from Springfield Fish Hatchery were sampled prior to release, and out-migrating smolts from Redfish Lake were sampled. Bacterial Kidney Disease was not detected in these smolt groups during 2017.

Aeromonas salmonicida, the causative agent of furunculosis, was not detected in anadromous adults in 2017. Furunculosis has been detected in anadromous adults in past return years indicating the continued need for oxytetracycline and erythromycin injections for adults at trapping.

Parasitic Pathogens

The myxosporean parasite *Myxobolus cerebralis*, the causative agent of whirling disease in salmonid fish, is present in the upper Salmon River. *Oncorhynchus nerka* samples obtained by emigrant smolt trapping and from trawl efforts in Redfish, Pettit, and Alturas lakes are routinely examined for *M. cerebralis*. Results from juvenile *O. nerka* sampled in 2017 tested for *M. cerebralis* via pepsin/trypsin digest (PTD) and polymerase chain reaction (PCR) were negative. Twenty juvenile *O. nerka* were sampled for *M. cerebralis* during 2017. Positive results have been confirmed in returning anadromous adults tested for *M. cerebralis* via PTD testing; this is consistent with positive detections in 14 of the last 16 return years. In 2017, one anadromous adult tested positive (27 total samples) for *M. cerebralis.*

In 2017, eggs and adult anadromous Sockeye Salmon were treated with formalin to control Saprolegnia. Eggs were treated at 1,667 ppm for 20 minutes three times per week. Anadromous adults were treated at 167 ppm for one hour after arrival at Eagle FH and three times per week during holding at Eagle FH.

Eyed Egg and Fish Transfers

In all cases, the required State transfer permits were acquired before transport of eggs or fish in the Snake River Sockeye Salmon program. Specific details, by date, for all transfers are described below.

Eagle FH and NOAA Fisheries transferred 702,368 eyed eggs to Springfield FH and 354,543 eyed eggs to Sawtooth FH for 2019 smolt release groups. Eyed eggs from NOAA Fisheries were first transferred to Eagle FH and then delivered the next day to Springfield FH with eyed eggs from Eagle FH. Springfield FH received three shipments of eyed eggs in 2017. The first shipment of 134,913 eyed eggs was transferred on November 29, 2017 from NOAA Fisheries production. The second shipment was transferred to Springfield FH on December 13, 2017 totaling 336,141 eyed-eggs (243,474 from Eagle FH and 92,667 from Burley Creek FH). The third shipment was transferred to Springfield FH on December 19, 2017 totaling 231,314 eyed eggs from Eagle FH production. Sawtooth FH received two shipments of eyed eggs in 2017. The first shipment of eyed eggs to Sawtooth FH was transferred on November 28, 2017 totaling 114,510 eyed eggs from Eagle FH production. The second shipment was transferred to Sawtooth FH on December 5, 2017 totaling 240,033 eyed eggs from Eagle FH production. Eagle FH transferred 829,331 and Burley Creek FH transferred 227,580 eyed eggs during 2017 (Table 2). Burley Creek FH received 1,504 eyed eggs from Eagle FH production for replacement captive broodstock for the NOAA Fisheries program. Brood Year 2017 eyed eggs were transferred to Burley Creek FH on November 28 (212 eyed eggs), December 5 (499 eyed eggs), December 12 (346 eyed eggs), and December 19 (447 eyed eggs).

Eyed Egg and Fish Reintroductions

Sockeye Salmon eyed eggs and fish were transferred and/or released to various locations in 2017. In all cases, the required state transfer permits were acquired prior to shipping. Additionally, pursuant to Special Condition B. 13. of Permit No. 1454, IDFG received authorization from NOAA Fisheries to conduct all production releases of Sockeye Salmon made in 2017 (Table 6). All Sockeye Salmon juveniles and adults released to Sawtooth Valley waters in 2017 were marked/tagged prior to release.

Adult Releases

In September, captive reared adult Sockeye Salmon from the Eagle FH and Burley Creek FH were also released into Pettit and Redfish lakes for volitional spawning (Table 6). Ninety-nine captive reared Sockeye Salmon (50 females and 49 males) from the NOAA Fisheries Burley Creek Hatchery were released on September 18 into Pettit Lake.

An additional 827 captive reared Sockeye Salmon (441 females and 386 males) from Burley Creek FH were released on September 12 and September 20 into Redfish Lake (mean weight 1.3 kg/fish). Three hundred two (193 females and 109 males) captive reared Sockeye Salmon reared at IDFG's Eagle FH were released to Redfish Lake (mean weight 1.5 kg/fish).

During 2017, one anadromous adult Sockeye was released to Pettit Lake. This was a natural adult that did not assign genetically to the Redfish Lake Sockeye group (more closely related to Pettit Lake kokanee). This anadromous Sockeye was released on September 18, 2017 (Table 6).

Smolt Releases

The BY15 production group reared at Springfield FH was released from April 18 – April 29, 2017. Smolts were released to Redfish Lake Creek (734,492 smolts averaging 44.3 grams/fish). All smolts reared at Springfield FH were adipose fin clipped. A smolt survival study initiated in 2009 continued in 2017, maintaining an increased number of PIT-tagged fish in the Springfield FH release group. A total of 49,937 PIT-tagged smolts were released from Springfield FH (Table 6).

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Table 1. Summary of losses and magnitude of mortality for Snake River Sockeye Salmon captive broodstock at Eagle Fish Hatchery during 2017.

	Captive Broodstock Groups					
	BY12	**BY13**	**BY14**	**BY15**	**BY16**	**BY17**
Starting Inventory (January 1, 2017)	7	10	1,243	1,254	1,500	3,008[a]
Eyed egg to Fry						
Undetermined[b]	n/a	n/a	n/a	n/a	107	n/a
Mechanical Loss						
Handling	0	0	0	0	0	n/a
Jump-out	0	0	0	0	0	n/a
Transportation	0	0	0	0	0	n/a
Noninfectious						
Lymphosarcoma	0	0	0	0	0	n/a
Nephroblastoma	0	0	0	0	0	n/a
Other[c]	6	4	247	58	49	n/a
Infectious						
Bacterial	0	0	0	0	0	n/a
Viral	0	0	0	0	0	n/a
Other	0	0	0	0	0	n/a
Maturation Spawners						
Mature Males	0	3	293	84	0	n/a
Mature Females	0	3	405	6	0	n/a
Maturation Nonspawners						
Mature Males	0	0	6	2	0	n/a
Mature Females	0	0	12	0	0	n/a
Relocation						
Transferred In	0	0	0	0	0	n/a
Transferred Out	0	0	0	0	0	1,504
Planted/Released	1	0	262	39	0	n/a
Ending Inventory (December 31, 2017)	0	0	18	1,065	1,344	1,504[a]

[a] December 2017 developing fry and egg numbers.
[b] Typical egg to fry mortality includes nonhatching eggs, abnormal fry, and swim-up loss.
[c] Includes culling associated with cultural abnormalities, nonmaturing, and all undetermined noninfectious mortality.

Table 2. Summary of losses and magnitude of mortality Snake River Sockeye Salmon production groups during 2017.

	Culture Groups			
	BY15 Springfield	**BY16 Springfield**	**BY17 Springfield**	**BY17 Sawtooth**
Starting Inventory (January 1, 2017)	735,642	1,037,369	703,368[a]	354,543[a]
Eyed egg to Fry				
Undetermined[b]	n/a	68,715	n/a	n/a
Mechanical Loss				
Handling	0	0	n/a	n/a
Jump-out	0	0	n/a	n/a
Transportation	0	0	n/a	n/a
Noninfectious				
Lymphosarcoma	0	0	n/a	n/a
Nephroblastoma	0	0	n/a	n/a
Other[c]	1,150	67,058	n/a	n/a
Infectious				
Bacterial	0	0	n/a	n/a
Viral	0	0	n/a	n/a
Other	0	0	n/a	n/a
Maturation				
Mature Males	0	0	n/a	n/a
Mature Females	0	0	n/a	n/a
Other	0	0	n/a	n/a
Relocation				
Transferred In	0	0	0	n/a
Transferred Out	0	0	n/a	n/a
Planted/Released	734,492	239,298	n/a	n/a
Ending Inventory (December 31, 2017)	0	662,797	703,368[a]	354,543[a]

[a] December 2017 developing fry and egg numbers (combined NOAA and Eagle numbers).
[b] Typical egg to fry mortality includes nonhatching eggs, abnormal fry, and swim-up loss (April 1 inventory).
[c] Culling associated with cultural abnormalities, fish health sampling, special studies, and all undetermined, noninfectious mortality.

Table 3. Calendar year 2017 anadromous Snake River Sockeye Salmon adult return summary.

Summary category	Total number trapped	Number trapped at RFLC[a] weir	Number trapped at SFH[b] weir	Number trapped at other[c] traps
All anadromous adults	162	139	23	0
Anadromous males	90	78	12	0
Anadromous females	72	61	11	0
Unmarked adults	11	11	0	0
AD-clipped adults[d]	151	128	23	0

[a] RFLC = Redfish Lake Creek.
[b] SFH = Sawtooth Fish Hatchery.
[c] Other = East Fork Salmon River Trap, Yankee Fork Trap, Hells Canyon Dam adult trap.
[d] AD = adipose fin clip.

Table 4. Summary information for 2017 Snake River Sockeye Salmon spawning activities at Eagle Fish Hatchery.

Spawning Cross*		No. of Green	No. of	Mean Egg Survival	Median Egg Survival
Female	Male	Eggs Taken	Eyed eggs	to Eyed-Stage	to Eyed-Stage
ANH17	ANH17	98,202	80,552	82.03%	90.14%
ANH17	BY13	1,483	1,418	95.62%	95.62%
ANH17	BY14	68,587	54,180	78.99%	90.99%
BY13	BY14	407	351	86.24%	86.26%
BY13	BY15	3,021	2,803	92.78%	93.61%
BY14	ANH17	85,704	74,882	87.37%	93.47%
BY14	BY13	5,807	4,061	69.93%	64.01%
BY14	BY14	566,079	469,330	82.91%	90.01%
BY14	BY15	160,209	140,792	87.88%	92.19%
BY15	BY14	6,686	6,197	92.69%	95.00%
BY15	BY15	2,764	2,647	95.77%	98.75%
	TOTALS	**998,949**	**837,213**	**83.81%**	**90.87%**

Note:* ANH17 refers to anadromous adults returning in 2017.
BY13 refers to captive adults produced in spawn year 2013.
BY14 refers to captive adults produced in spawn year 2014.
BY15 refers to captive adults produced in spawn year 2015.

Table 5. Parent family and number of Snake River Sockeye Salmon eyed eggs retained for brood year 2017 captive broodstock development at Eagle Fish Hatchery.

Family Cross*		No. of Eyed eggs Retained for Eagle Broodstock
Female	**Male**	
ANH17	ANH17	136
ANH17	BY13	1
ANH17	BY14	72
BY13	BY14	3
BY13	BY15	6
BY14	ANH17	153
BY14	BY13	11
BY14	BY14	861
BY14	BY15	241
BY15	BY14	14
BY15	BY15	6
	TOTAL	1,504

Note:* ANH17 refers to anadromous adults returning in spawn year 2017.
BY13 refers to captive adults produced in spawn year 2013.
BY14 refers to captive adults produced in spawn year 2014.
BY15 refers to captive adults produced in spawn year 2015.

Table 6. Snake River Sockeye Salmon releases made to Sawtooth Valley waters in 2017.

Release Location	Strategy (Brood Year)	Release Date	Number Released	Number PIT Tagged	Marks[a]	Release Weight (g)	Rearing Location
Redfish Lake Cr	smolt (2015)	4/18 – 4/29/17	734,492	49,937	Ad	44.3	IDFG Springfield FH
Redfish Lake	presmolt (2016)	10/19 & 10/26/17	239,298	0	Ad	10.1	IDFG Springfield FH
Redfish Lake	adult (2011)	9/20/17	2	2	Ad	2,047	NOAA Burley Cr.
	(2012)	9/12 & 9/20/17	12	12	Ad	2,678	NOAA Burley Cr.
	(2013)	9/12 & 9/20/17	127	127	Ad	2,057	NOAA Burley Cr.
	(2014)	9/12 & 9/20/17	686	686	Ad	1,091	NOAA Burley Cr.
	(2012)	9/11/17	1	1	Ad	792	IDFG Eagle FH
	(2014)	9/11 – 9/12/17	262	262	Ad	1,643	IDFG Eagle FH
	(2015)	9/11/17	39	39	Ad	731	IDFG Eagle FH
Pettit Lake	adult (2012)	9/13/16	21	21	Ad	1,806	NOAA Burley Cr.
	(2013)	9/13/16	79	79	Ad	873	NOAA Burley Cr.
Pettit Lake	adult (ANH17)[b]	9/18/17	1	1[c]	None	1,170	Anadromous

[a] Ad = adipose fin clip; CWT = Coded Wire Tag.
[b] ANH17 refers to anadromous returning Sockeye Salmon in 2017; representing brood years 2012, 2013, and 2014.
[c] Natural Sockeye; received a PIT tag before release.

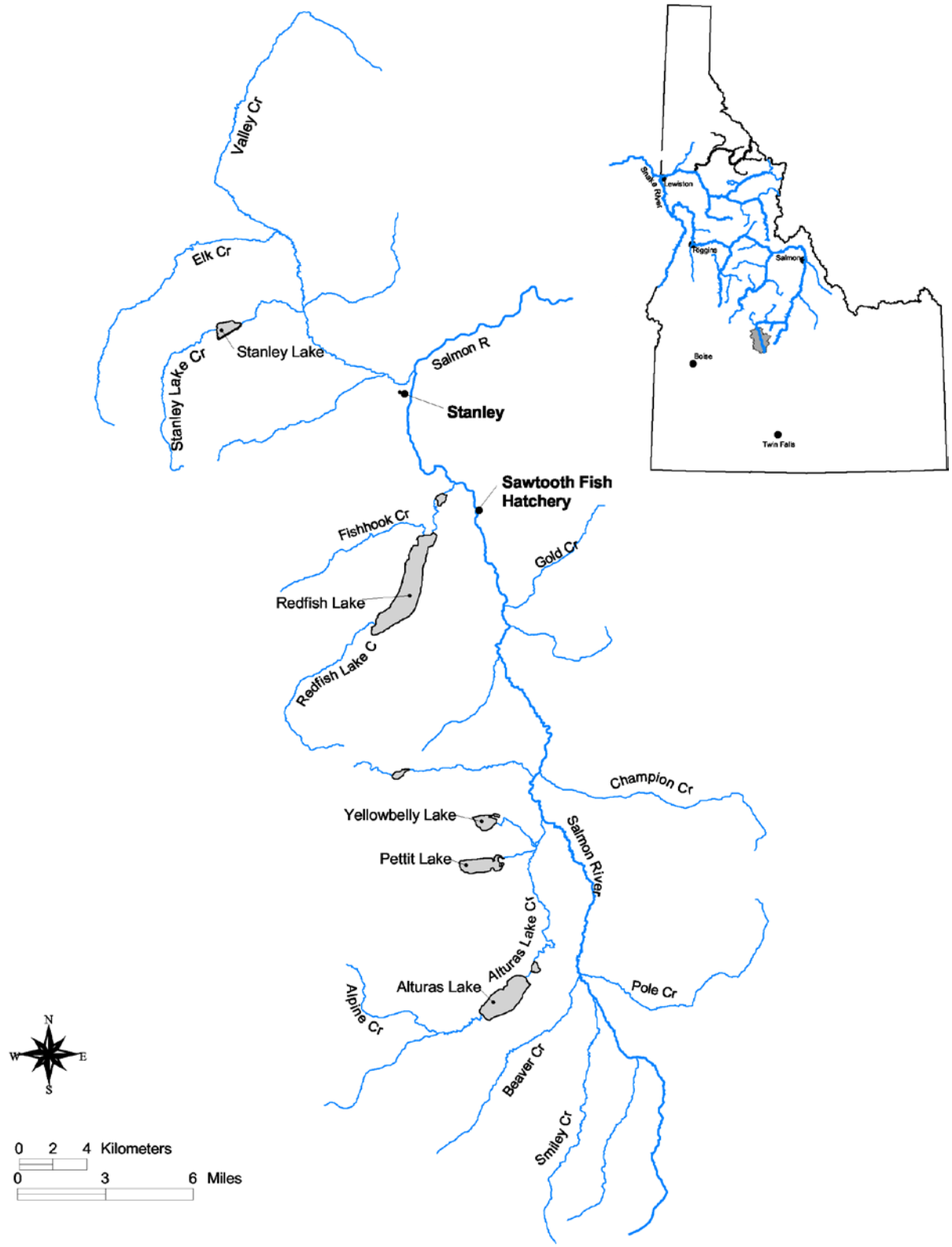

Figure 1. Sawtooth Valley study area.

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