FISHERY RESEARCH

SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

2009 ANNUAL PROGRESS REPORT
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Snake River Sockeye Salmon Captive Broodstock Program Hatchery Element

Project Progress Report

2009 Annual Report

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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 sockeye salmon included the establishment of a captive broodstock program at the Idaho Department of Fish and Game Eagle Fish Hatchery. Sockeye salmon broodstock and culture responsibilities are shared with the National Oceanic and Atmospheric Administration at two locations 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 of captive broodstock program fish releases (annual report to the Bonneville Power Administration for the research element of the program) are also reported separately. Captive broodstock program activities conducted between January 1, 2009 and December 31, 2009 for the hatchery element of the program are presented in this report.

In 2009, 833 anadromous sockeye salmon returned to the Sawtooth Valley. The weir on the upper Salmon River at the Sawtooth Fish Hatchery intercepted 249 sockeye salmon adults while the Redfish Lake Creek trap intercepted 584 sockeye. Fish were captured between July 23 and October 9, 2009. The adult sockeye salmon (250 females, 567 males, 16 unknown) originated from a variety of release strategies, as evidenced by mark types. One hundred forty-eight (66 females and 82 males) anadromous sockeye remained at Eagle Fish Hatchery and were incorporated into the spawn matrices.

Fifty-seven anadromous females and 105 brood year 2006 captive females were spawned at the Eagle Fish Hatchery in 2009. Spawn pairings produced approximately 290,968 eyed eggs with egg survival to eyed stage of development averaging 89.2%.

Eyed eggs (72,478), presmolts (59,538), smolts (173,055), and adults (1,349) were planted or released into Sawtooth Valley waters in 2009. Reintroduction strategies involved releases to Redfish Lake, Alturas Lake, Pettit Lake, Redfish Lake Creek, and the upper Salmon River.

During this reporting period, five broodstocks and eight unique production groups were in culture at Idaho Department of Fish and Game (Eagle Fish Hatchery and Sawtooth Fish Hatchery), NOAA Fisheries (Burley Creek Hatchery), and Oregon Department of Fish and Wildlife (Oxbow Fish Hatchery) facilities. Two of the five broodstocks were incorporated into the 2009 spawning design.

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INTRODUCTION

Numbers of Snake River sockeye salmon *Oncorhynchus nerka* have declined dramatically in recent years. 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 & 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 carried out 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. 1120, 1124, and 1481 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).

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 broodstock 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 research and evaluations. Although objectives and tasks from both components overlap and contribute to achieving the same goals, work directly related to sockeye salmon captive broodstock research and enhancement will appear under a separate cover. Research and enhancement activities associated with Snake River sockeye salmon are permitted under NOAA permit numbers 1120, 1124, and 1481. This report details fish culture information collected between January 1 and December 31, 2009.

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. The water system was modified in 2002; three of the five wells were abandoned. A new well was developed and brought online in April of 2003. 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. In 2008, construction on a new captive broodstock building and modifications to the water delivery system from wells #1 and #2 was completed. The new building allows the captive broodstock to double (from 400 to 800 per year class) and provide isolated holding for anadromous sockeye adults. Water chilling capability was added at Eagle FH 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. A Hatchery Manager II position and residence was added in 2002. Three additional on-site residences occupied by IDFG hatchery personnel provide additional security by limiting public access.

Facility layout at Eagle FH remains flexible to accommodate culture activities ranging from spawning and incubation through adult rearing. Egg incubation capacity at Eagle FH is approximately 500,000 green eggs using current practices. Incubation is accomplished in small containers specifically designed for the program (Heindel et al. 2005) allowing for separation of individual subfamilies. Incubators are designed to distribute both upwelling and down-welling flow to accommodate pre- and post-hatch life stages.

Several fiberglass tank sizes are used to culture sockeye from fry to the adult stage. These include: 1) 0.7 m diameter semisquare tanks (0.09 m^3); 2) 1.0 m diameter semisquare

tanks (0.30 m^3); 3) 2.0 m diameter semisquare tanks (1.42 m^3); 4) 3.0 m diameter circular tanks (6.50 m^3); and 5) 4.0 m diameter semisquare tanks (8.89 m^3). Typically, 0.7 m and 1.0 m tanks are used for rearing fry from ponding to approximately 10.0 g weight. Two-meter tanks are used to rear juveniles to approximately 50.0 g and to depot 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.

Sawtooth Fish Hatchery

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 have been utilized continuously since 1991 for various aspects of the sockeye captive broodstock program, including: 1) prespawn anadromous adult holding, 2) egg incubation, and 3) juvenile rearing for presmolt and smolt releases. In addition, hatchery personnel assist with many field activities, including: 1) net pen fish rearing, 2) fish trapping and handling, and 3) fish transportation and release.

Eyed eggs, received at Sawtooth FH from Eagle FH or NOAA, are incubated in vertical-stack incubators. Fry are ponded into fiberglass troughs, juveniles are transferred to concrete vats, and overwinter smolts are reared in 200-foot raceways. Typically, juvenile sockeye salmon reared at Sawtooth FH are released as presmolts or smolts. Prespawn anadromous adults captured at Redfish Lake Creek or Sawtooth FH weirs are transferred from trap directly onto fish transport tanks and transferred to Eagle FH. Sockeye may by temporarily held (two days maximum) in adult holding facilities at Redfish Lake Creek prior to transfer to the Eagle FH.

Generally, well water supplies water flow for incubation, rearing, and holding. Well water temperature varies by time of year from approximately 4.0°C minimum in March and April to 10.0°C maximum in September and October. When sockeye salmon are held for smolt releases, they may be moved to outside raceways that receive water from the Salmon River. Salmon River water temperature varies by time of year from approximately 2.0°C in January and February to 20.0°C in August and September. Backup and redundancy water systems are in place. Rearing protocols are established cooperatively between IDFG personnel and reviewed at the SBSTOC level.

Oxbow Fish Hatchery

The Oregon Department of Fish and Wildlife's (ODFW) Oxbow Fish Hatchery (Oxbow FH) was originally constructed in 1913 and was operated as a state-funded hatchery until 1952. In 1952, the facility was modified and expanded using funding from the Mitchell Act, a Columbia River Fisheries Development Program set up to enhance declining fish runs in the Columbia River basin. Oxbow FH receives 7.2°C water through gravity flow from Oxbow Springs. Flow rate is highly variable depending on the time of year with the lowest flows reaching 1,135.5 liters per minute (300 gpm) in the summer and fall. Water rights for Oxbow FH are 3.30 cubic meters per second (116.51 cfs). Calendar year 2009 represents the sixth year that Oxbow FH personnel and facilities have been utilized for sockeye smolt rearing with the captive broodstock program.

Eyed eggs, received at Oxbow FH from Eagle FH or NOAA, are incubated in vertical-stack incubators. Fry are ponded to fiberglass troughs. Juvenile sockeye (>1 g) are held in larger fiberglass troughs (4.53 cubic meters). Sockeye salmon are transferred to outside raceways (133 cubic meters) for final rearing to the smolt stage. Juvenile sockeye salmon reared at Oxbow FH are transferred back to Idaho and released as smolts into Redfish Lake Creek and the Salmon River. Rearing protocols are established cooperatively between IDFG and ODFW personnel and reviewed at the SBSTOC level.

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 1120 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 participants at the SBSTOC level.

During 2009, fish were fed commercial diets produced by Skretting Inc. (Bio-Oregon) or EWOS® Canada LTD (EWOS). The BY06 and BY07 sockeye captive broodstock were fed Bio-Oregon feeds in 2009. The BY08 sockeye captive broodstock were split into two identical groups with one group receiving Bio-Oregon feed and the second group receiving EWOS feed. Rations were weighed daily and followed suggested feeding rates provided by the manufacturer. Bio-Oregon developed a custom broodstock diet that included elevated levels of vitamins, minerals, and pigments. 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 temperatures were 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, age-4, and age-5 culture history.

Passive integrated transponder (PIT) tags were used to evaluate the overwinter survival and out-migration success of production groups released to Sawtooth Valley waters. These PIT tags were also used to track sockeye salmon retained in the program as broodstock fish. Broodstock sockeye salmon 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, landfilled, or rendered.

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 1.4 km downstream from the lake outlet. 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 snorkel surveys and again at approximately 0300 hrs to ensure that no adult sockeye salmon (program releases) were trapped.

Spawning Activities

Spawning 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). Before 1994, adult sockeye returns were spawned at the Sawtooth FH (Johnson 1993). Spawning activities in 2009 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 was required by Permit No. 1120 to discuss proposed broodstock spawning matrices with NOAA Northwest Fisheries Science Center (NWFSC) genetics staff.

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 they were large enough to PIT tag. In 2009, breeding plans relied on DNA microsatellite information versus pedigree information. Microsatellite data were generated from DNA samples at 13 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 d. 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 prior to facility incubation.

3) Anadromous adult formalin treatments: Anadromous adults transferred from the Stanley basin 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 to control 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 *Parvicapsula minibicornis* and 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 Fish Health Laboratory collected ovarian fluid samples from each female for analysis. 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.

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 were 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 barge-mounted holding tanks for mid-lake (pelagic) fish releases and net pen fish transfers. Truck-mounted tanks, used for long distance transfers, were available to the program with 946 L (250 gallon), 3,785 L (1,000 gallon), and 9,463 L (2,500 gallon) capacities. Transport density guidelines were in place not to exceed 89 gallons/Liter (0.75 pounds/gallon).

Eyed egg and Fish Supplementation

In 2009, sockeye salmon were reintroduced to Sawtooth Valley waters as eyed eggs, presmolts, smolts, and prespawn adults.

Eyed eggs were distributed to egg boxes manufactured by IDFG personnel specifically for this program. Plastic light baffle grids and plastic mesh netting partitioned egg box chambers and prevented eggs from falling into the bio-filter ring medium until after hatch. Plastic mesh netting surrounded all egg boxes and allowed fish to volitionally emigrate following yolk absorption. Individual egg boxes accommodated approximately 3,000 eggs. Following loading, egg boxes were lowered to the lake substrate in approximately 3 m of water over known or suspected areas of lakeshore spawning.

Sockeye salmon presmolts were distributed to Sawtooth Valley lakes in truck-mounted transportation tanks. Fish were transferred from truck-mounted tanks to oxygenated tanks mounted on watercraft for pelagic releases and net pen introductions. Transport tanks were tempered to receiving water temperatures prior to the release of fish.

Sockeye salmon smolts were distributed to Sawtooth Valley waters using truck-mounted transportation tanks. In 2009, sockeye salmon smolts were released in the outlet of Redfish Lake Creek downstream of the juvenile out-migrant weir and in the Salmon River upstream of the Sawtooth FH weir. Transport tanks were tempered to receiving water temperatures prior to the release of fish.

Prespawn adult sockeye salmon were distributed to Sawtooth Valley waters using truck-mounted transportation tanks. Adults have been introduced to Redfish Lake, Alturas Lake, and

Pettit Lake. 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, five broodstock and eight production groups were in culture at IDFG facilities representing brood years 2005, 2006, 2007, 2008, and 2009. 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 appear abbreviated (e.g., BY05 refers to brood year 2005).

BY05 Broodstock

Three hundred fifty-five unique subfamilies representing 121 females and 195 males were developed from BY05 spawn crosses at Eagle FH. To simplify tracking, families were grouped under one production group title: BY05. The BY05 production group was developed using male sockeye salmon from the BY01, BY02, and BY03 captive broodstock, female sockeye salmon from BY02 captive broodstock, as well as three anadromous males and two anadromous females (ANH05) that returned to the Sawtooth Valley in 2005. Specific crosses performed to develop this production group included: 1) BY02 females x BY01 males, 2) BY02 females x BY02 males, 3) BY02 females x BY03 males, 4) BY02 females x ANH05 males, 5) ANH05 females x BY02 males, and 6) ANH05 females x ANH05 males. Spawn crosses produced approximately 208,014 green and 145,207 eyed eggs. Brood year 2002 female fecundity was 1,706 green eggs per female and ANH05 female fecundity averaged 2,450 green eggs per female. Egg survival to the eyed stage of development for the BY05 production group averaged 69.81% (median 88.33%, Table 4). In 2005, the six anadromous adults transferred to Eagle FH and incorporated into the spawning matrix were all found to be negative for infectious hematopoietic necrosis virus (IHNV).

Approximately 1,212 eyed eggs (three identical groups of 404 eyed eggs; one group of 404 was later transferred to Burley Creek Fish Hatchery) were segregated from production groups described above to create the BY05 broodstock representing 115 unique females and 179 unique males. Starting inventory at Eagle FH was 11 fish. There was one mortality during 2009, nine fish matured (one female and eight males). Six fish (one female and five males) were released to Redfish Lake and the remaining mature sockeye (three males) were incorporated into the spawning matrix. Ending inventory of BY05 broodstock at Eagle FH was one fish (Table 1).

BY06 Broodstock

One hundred eighty-one females and 177 males were spawned at Eagle FH between October 5 and November 2, 2006 to generate 332,675 green eggs. Five hundred forty unique subfamilies were developed from BY06 spawn crosses at the Eagle FH. To simplify tracking, families were grouped under one production group title: BY06. The BY06 production group was developed using male sockeye salmon from the BY02, BY03, and BY04 captive broodstock and one anadromous male that returned to the Sawtooth Valley (ANH06), female sockeye salmon

from the BY03 captive broodstock and two anadromous females that returned to the Sawtooth Valley in 2006 (ANH06). Specific crosses performed to develop this production group included: 1) BY03 females x BY02 males, 2) BY03 females x BY03 males, 3) BY03 females x BY04 males, 4) BY03 females x ANH06 males, and 5) ANH06 females x BY03 males. Spawn crosses produced approximately 332,675 green and 258,342 eyed eggs. Brood year 2003 female fecundity was 1,833 green eggs per female and ANH06 female fecundity averaged 2,248 green eggs per female. Egg survival to the eyed stage of development for the BY06 production group averaged 77.66% (median 90.78%, Table 4). In 2007, the three anadromous adults transferred to Eagle FH and incorporated into the spawning matrix were all found to be negative for infectious hematopoietic necrosis virus (IHNV).

Approximately 1,200 eyed eggs representing 540 subfamilies (181 unique females and 178 unique males) were selected from specific spawn crosses described above and incubated for future broodstock needs. Eyed eggs were selected in triplicate with two groups (800 total) remaining at Eagle FH and the third group (400 total) transferred to NOAA's Burley Creek FH. Starting inventory at Eagle FH was 669 fish. There were 24 mortalities during 2009; 637 fish matured (280 females and 357 males). Three hundred eighty-five (175 females and 210 males) were released to Redfish Lake and the remaining mature sockeye were incorporated into the spawning matrix. Ending inventory of BY06 broodstock at Eagle FH was eight fish (Table 1).

BY07 Broodstock

One hundred forty-six females and 148 males were spawned at Eagle FH between October 4 and November 6, 2007 to generate 236,393 green eggs. Four hundred thirty-nine unique subfamilies were developed from BY07 spawn crosses at the Eagle FH. To simplify tracking, families were grouped under one production group title: BY07. The BY07 production group was developed using male sockeye salmon from the BY03, BY04, and BY05 captive broodstock, and the two anadromous males that returned to the Sawtooth Valley (ANH07). Female sockeye salmon represented in spawn crosses for 2007 included captive broodstock from BY03 (one female), BY04 (143 females), and the two anadromous females (ANH07) that returned to the Sawtooth Valley in 2007. Specific crosses performed to develop this production group included: 1) BY03 females x BY04 males, 2) BY04 females x BY03 males, 3) BY04 females x BY04 males, 4) BY04 females x BY05 males, 5) BY04 females x ANH07 males, 6) ANH07 females x BY04 males, and 7) ANH07 females x CRYO males.

Approximately 1,199 eyed eggs representing 382 subfamilies (146 unique females and 148 unique males) were selected from specific spawn crosses described above and incubated for future broodstock needs. Eyed eggs were selected in triplicate with two groups (799 total) remaining at Eagle FH and the third group (400 total) transferred to NOAA's Burley Creek FH. Starting inventory at Eagle FH was 449 eyed eggs/fry. During 2009, there were 10 mortalities and the ending inventory of BY07 broodstock at Eagle FH was 439 fingerlings (Table 1).

BY07 Production

Spawning activities at Burley Creek FH and Eagle FH in 2007 produced 368,164 eyed eggs, which were distributed or released to represent the BY07 production and broodstock groups.

Initial inventory at Sawtooth FH was 99,394 fingerlings. Sawtooth FH released smolts to Redfish Lake Creek (99,374 at 14.8 g/fish) in May 2009. Ending inventory at Sawtooth FH was zero fish (Table 2).

Initial inventory at Oxbow FH was 73,934 fingerlings. A total of 73,681 smolts, averaging 44.5 g/fish, were released to Redfish Lake Creek in May 2009. Ending inventory at Oxbow FH was zero fish (Table 2).

BY08 Broodstock

One hundred fifteen females and 180 males were spawned at Eagle FH between October 2 and November 6, 2008 to generate 241,220 green eggs. Three hundred forty-five unique subfamilies were developed from BY08 spawn crosses at the Eagle FH. To simplify tracking, families were grouped under one production group title: BY08. The BY08 production group was developed using male sockeye salmon from the BY04 (two males) and BY05 (144 males) captive broodstock, and 34 anadromous males that returned to the Sawtooth Valley (ANH08). Female sockeye salmon represented in spawn crosses for 2008 included captive broodstock from BY04 (one female), BY05 (75 females), and 39 anadromous females (ANH08) that returned to the Sawtooth Valley in 2008. Specific crosses performed to develop this production group included: 1) BY04 females x BY05 males, 2) BY05 females x BY04 males, 3) BY05 females x BY05 males, 4) BY05 females x ANH08 males, 5) ANH08 females x ANH08 males, and 6) ANH08 females x BY05 males. Spawn crosses produced approximately 241,220 green and 220,334 eyed eggs. Brood year 2004 female fecundity averaged 1,896 green eggs per female, BY05 female fecundity averaged 1,807 eggs per female, and ANH08 female fecundity averaged 2,661 green eggs per female. Egg survival to the eyed stage of development for the BY08 production group averaged 91.34% (median 97.48%, Table 4). In 2008, of the 73 anadromous adults transferred to Eagle FH and incorporated into the spawning matrix, all were found to be negative for infectious hematopoietic necrosis virus (IHNV).

Approximately 1,482 eyed eggs representing 340 subfamilies (115 unique females and 178 unique males) were selected from specific spawn crosses described above and incubated for future broodstock needs. Eyed eggs were selected in triplicate with two groups (988 total) remaining at Eagle FH and the third group (494 total) transferred to NOAA Fisheries. Starting inventory at Eagle FH was 988 eyed eggs/fry. During 2009, there were 230 mortalities and the ending inventory of BY08 broodstock at Eagle FH was 758 fingerlings (Table 1).

BY08 Production

Spawning activities at Burley Creek FH and Eagle FH in 2008 produced 420,703 eyed eggs, which were distributed or released to represent the BY08 production and broodstock groups.

Sawtooth FH released presmolts to Pettit (14,983 at 6.2 g/fish), Alturas (9,994 at 6.8 g/fish), and Redfish (34,561 at 6.0 g/fish) lakes in October 2009. The remaining juveniles were transferred to outside raceways in November and will be released in May 2010. Initial inventory at Sawtooth FH was 195,542 eyed eggs. Ending inventory at Sawtooth FH was 99,789 juveniles (Table 2).

Initial inventory for the BY08 production group at Oxbow FH was 86,938 eyed eggs/developing fry. Ending inventory at Oxbow FH was 80,209 juveniles (Table 2).

BY09 Broodstock

One hundred sixty-two females and 217 males were spawned at Eagle FH between September 18 and November 9, 2009 to generate 326,309 green eggs. Four hundred eight-six unique subfamilies were developed from BY09 spawn crosses at the Eagle FH. To simplify tracking, families were grouped under one production group title: BY09. The BY09 production group was developed using male sockeye salmon from the BY05 (three males) and BY06 (147 males) captive broodstock, and 67 anadromous males that returned to the Sawtooth Valley (ANH09). Female sockeye salmon represented in spawn crosses for 2009 included captive broodstock from BY06 (105 females) and 57 anadromous females (ANH09) that returned to the Sawtooth Valley in 2009. Specific crosses performed to develop this production group included: 1) ANH09 females x ANH09 males, 2) ANH09 females x BY05 males, 3) ANH09 females x BY06 males, 4) BY06 females x ANH09 males, 5) BY06 females x BY05 males, and 6) BY06 females x BY06 males. Spawn crosses produced approximately 326,309 green and 290,968 eyed eggs. Brood year 2006 female fecundity averaged 1,616 green eggs per female and ANH09 female fecundity averaged 2,749 green eggs per female. Egg survival to the eyed stage of development for the BY09 production group averaged 89.17% (median 95.65%, Table 4). In 2009, of the 124 anadromous adults transferred to Eagle FH and incorporated into the spawning matrix, all were found to be negative for infectious hematopoietic necrosis virus (IHNV).

Approximately 1,531 eyed eggs representing 476 subfamilies (159 unique females and 215 unique males) were selected from specific spawn crosses described above and incubated for future broodstock needs. Eyed eggs were selected in triplicate with two groups (988 total) remaining at Eagle FH and the third group (494 total) transferred to NOAA Fisheries.

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. Future genetic identification of BY09 broodstock will be determined by utilizing microsatellite DNA markers. Ending inventory for BY09 brood at Eagle FH was 1,031 eyed eggs/developing fry (Table 1). Spawn crosses represented in the Eagle FH BY09 broodstock are presented in Table 4.

BY09 Production

Eagle FH transferred 213,904 BY09 production eggs to Sawtooth FH on November 24 and December 2, 10, and 17, 2009. NOAA Fisheries transferred 4,940 BY09 production eggs to Sawtooth FH on November 24, 2009. Ending inventory at Sawtooth FH was 218,844 eyed eggs (Table 2).

A total of 104,963 BY09 eyed eggs from production spawn crosses at Burley Creek FH were transferred to Oxbow FH in November and December 2009. Egg incubation and juvenile rearing for this production group will continue at Oxbow FH until smolt transfer to Idaho in 2011. Ending inventory for this production group at Oxbow FH was 104,963 eyed eggs/developing fry (Table 2).

Eagle FH maintained a production group for a late summer presmolt release. A total of 19,820 eyed eggs remain in culture at Eagle FH to represent this BY09 presmolt group (Table 2).

Eyed eggs were released to Pettit Lake on November 10 and 24 and December 10, 2009. Pettit Lake received a total of 56,909 BY09 eyed eggs (9,043 from NOAA Fisheries and 47,866 from Eagle FH) during 2009.

Eyed eggs were released to Alturas Lake on December 17, 2009. Alturas Lake received a total of 15,568 BY09 eyed eggs (9,530 from NOAA Fisheries and 6,038 from Eagle FH) during 2009.

Eyed eggs were transferred to NOAA Fisheries' Burley Creek FH for an adult release production group. Eyed eggs (593 total) were transferred on November 23 and December 2, 9 and 16, 2009. This group will be reared to mature adults and transferred back to Redfish Lake for release. Ending inventory for this culture group at Burley Creek FH was 593 eyed eggs (Table 2).

Results for BY09 spawn crosses conducted by NOAA Fisheries will be reported separately by that agency.

Anadromous and Residual Sockeye Salmon Trapping

Two adult traps are used to capture returning anadromous sockeye salmon in the Sawtooth Valley. The first trap is located on Redfish Lake Creek approximately 1.4 km downstream from the lake outlet and was operated from July 3 to October 21, 2009. The second trap is located on the upper Salmon River at the Sawtooth FH weir and was operated from June 3 to September 20, 2009.

In 2009, 833 anadromous sockeye salmon returned to the Sawtooth Valley. The weir on the upper Salmon River at the Sawtooth FH intercepted 249 sockeye salmon adults while the Redfish Lake Creek trap intercepted 584 sockeye. Fish were captured between July 23 and October 9, 2009. The adult sockeye salmon (250 females, 567 males, 16 unknown) originated from a variety of release strategies, as evidenced by mark types (Table 3).

Residual sockeye trapping activities were not conducted in 2009 at Redfish Lake. Snorkeling to enumerate residual sockeye salmon spawners in Redfish Lake was conducted weekly from October 13 to November 10, 2009. The peak residual count for historic spawning sites on the south end of the lake was October 13 when two residuals were observed. The peak residual count for Sockeye Beach sites occurred on November 3 when four residuals were observed. The total number of residual sockeye salmon observed during snorkeling surveys conducted in 2009 was seven for Sockeye Beach and four for the south end of the lake.

One Chinook salmon *O. tshawytscha* adult was captured at the Redfish Lake Creek trap in 2009. This fish was released unharmed.

Year 2009 Spawning Activities

Results from 2009 Eagle FH spawning activities are reviewed below. Results from spawning activities conducted by NOAA personnel at Washington State facilities will appear separately by that agency. The year of development for specific broodstocks may appear abbreviated (e.g., BY05 refers to brood year 2005).

During the fall of 2009, three age-4 fish (three males) from BY05 broodstock and 219 age-3 fish (75 females and 144 males) from the BY06 broodstock matured at the Eagle FH and

were incorporated into the spawning matrix; an additional six BY05 (1 female and five males) age-4 sockeye and 385 (174 females and 211 males) age-3 sockeye matured and were released to Redfish Lake. In addition, 148 anadromous sockeye salmon (66 females, 82 males) that returned to the Sawtooth Valley in 2009 (ANH09) were transferred to the Eagle FH and were incorporated into the spawning design.

Approximately 1,546 eyed eggs representing 476 subfamilies (160 unique females and 215 unique males) were selected from specific spawn crosses described above and incubated for future broodstock needs. Eyed eggs were selected in triplicate with two groups (1,031 total) remaining at Eagle FH and the third group (515 total) transferred to NOAA Fisheries.

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. Future genetic identification of BY09 broodstock will be determined by utilizing microsatellite DNA markers. Spawn crosses represented in the Eagle FH BY09 broodstock are presented in Table 5.

Milt Cryopreservation

During 2009, no milt was cryopreserved.

Fish Health Investigations

The IDFG Eagle Fish Health Laboratory processed samples for diagnostic and inspection purposes from broodstock and production groups of sockeye salmon; anadromous adult sockeye salmon that were retained for hatchery spawning; and sockeye salmon smolts obtained from out-migrant traps. Ninety-nine laboratory accessions involving 651 individual fish were processed in 2009. Laboratory accessions included samples from Eagle Fish Hatchery (83 accessions), Sawtooth Fish Hatchery (10 accessions), Redfish Lake Creek (RFLC) out-migrant trap (two accessions), Pettit Lake Creek out-migrant trap (two accessions), and Alturas Lake Creek screw trap (two accessions). Total fish sampled (651) included 444 fish from Eagle FH (two BY05, 270 BY06, five BY07, three BY08, and 164 ANH08), 155 fish from Sawtooth FH (95 BY07, 60 BY08), 20 fish from the RFLC trap (BY07 out-migrant smolts), 19 fish from Pettit Lake Creek trap (BY07 out-migrant smolts), and 13 fish from the Alturas Lake screw trap (BY07 out-migrant smolts). Observations made from previous years prioritized the pathogens that were most important for these examinations. All adults used for 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 either presmolts or full-term smolts. The laboratory also summarized pathology findings to satisfy the needs of adjacent state agencies for issuance of sockeye salmon import and transport permits.

Viral Pathogens

Viral pathogens were not detected in any of the broodstock sockeye groups tested at Eagle FH in 2009. A total of 379 fish from calendar year 2009 broodstock crosses (BY05, BY06, and ANH09 spawners) were sampled without detection of viral pathogens. Additionally, two production sockeye groups reared at Sawtooth FH on both well water and Salmon River water were tested for viral pathogens in 2009. Sixty fish from the BY07 fish overwinter smolt release group (Salmon River rearing) and 60 fish from the BY08 fall presmolt release group (well water rearing) were tested in conjunction with standardized, prerelease fish health sampling protocols.

An additional 35 fish from the BY07 overwinter smolt group were tested post-mortem as required by routine fish health necropsy procedures. All virology samples from Sawtooth FH production sockeye groups resulted in negative detection of viral pathogens for 2009. Twenty BY07 out-migrating smolts from the Redfish Lake Creek trap, 19 BY07 out-migrating smolts from the Pettit Lake Creek trap, and 17 BY07 out-migrating smolts from the Alturas Lake Creek screw trap were also sampled with no viral pathogens detected.

Although the 164 returning anadromous adults in 2009 tested negative for viral pathogens, continued monitoring and heightened awareness of viral agents remains crucial to the success of the captive broodstock program. Calendar year 2004 marked the first (and only) detection of a viral pathogen in the Redfish Lake sockeye salmon stock when infectious hematopoietic necrosis virus (IHNV) was detected in 17 of 24 anadromous adults that were captured in 2004.

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 379 (162 females, 217 males) fish from calendar year 2009 broodstock crosses (BY05, BY06, and ANH09 spawners) at Eagle FH were sampled for BKD via enzyme-linked immunosorbent assay (ELISA) techniques in 2009. All Eagle broodstock crosses tested negative for the presence of this pathogen with the exception of one ANH09 female with an ELISA values of 0.117. Zero of 95 BY07/BY08 sockeye presmolts (Salmon River water smolt group) sampled post-mortem at Sawtooth FH were determined to be BKD positive by direct fluorescent antibody testing (DFAT) techniques. During prerelease inspections at Sawtooth FH, zero of twelve BY07 sockeye presmolts (five fish pools) were positive for BKD via ELISA. Bacterial Kidney Disease was detected in six of eleven (five fish) pools sampled representing six out-migrant sockeye smolt groups. The Redfish Lake hatchery out-migrant five fish pools had an ELISA optical density value of 0.117 and the second pool was negative, the Redfish Lake wild/natural out-migrant groups were 0.228 and 0.255, the Alturas Lake hatchery out-migrant groups were 0.194 and 0.147, the Alturas Lake wild/natural out-migrant groups were both negative, the Pettit Lake hatchery out-migrant group was 0.114 and the second group was negative, and the Pettit Lake wild/natural group was negative.

Aeromonas spp. and/or *Flavobacterium* spp. were detected in 29 of 164 anadromous adult sockeye salmon trapped in 2009. *Aeromonas salmoncida*, the causative agent of furunculosis, was not detected in anadromous adults in 2009. 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 trawl efforts in Redfish, Pettit, and Alturas lakes are routinely examined for *M. cerebralis*. Results from juvenile *O. nerka* sampled in 2009 tested for *M. cerebralis* via pepsin/trypsin digest (PTD) and polymerase chain reaction (PCR) testing methods are currently pending. Results for 2009 are pending, but positive results have been confirmed in returning anadromous adults tested for *M. cerebralis* via PTD testing; this is consistent with positive detections in seven of the last nine return years. The Eagle Fish Health Laboratory

continues to investigate infectivity of *M. cerebralis* in the river water supply of the Sawtooth FH using sentinel rainbow trout fry (Hogge et al. 2004). Results are used to assess the risk of rearing sockeye and Chinook salmon on river water during the winter months.

The myxosporean parasite *Parvicapsula minibicornis* was detected in 32 of 148 anadromous adult sockeye salmon that returned in 2009. Detection of *P. minibicornis* was made by PCR at the Eagle Fish Health Laboratory. Ninety-four of the 368 anadromous adults sampled since 2002 (initiation of sampling) have tested positive for this parasite. Detections of *P. minibicornis* in the Redfish Lake stock of anadromous sockeye salmon are consistent with results obtained by Dr. Jones for sockeye salmon of the Fraser River in British Columbia, Canada. *Parvicapsula minibicornis* has been demonstrated to be contracted in the estuary before adult sockeye salmon enter the Columbia River mainstem.

In 2009, all anadromous adult sockeye salmon were examined for the presence of *Ceratomyxa shasta* and all results were negative for the pathogen, indicating that the *C. shasta* lifecycle has not become established in the upper Salmon River.

In 2009, eggs and adult anadromous sockeye were treated 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 three to five times per week.

Eyed Egg and Fish Transfers

In all cases, the required State transfer permits were acquired before shipping. Specific details, by date, for all transfers are described below.

Eagle FH transferred eyed eggs to NOAA Fisheries on November 23 and December 2, 9, and 16, 2009. Each shipment contained eyed eggs for the NOAA Fisheries captive broodstock (515 eyed eggs) and adult release (517 eyed eggs) programs in Washington State. An additional 1,200 eyed eggs were transferred on December 9, 2009 for research associated with swim-up and feeding fry survival.

Eagle FH transferred 213,904 BY09 production eggs to the Sawtooth FH on November 24 and December 2, 10, and 17, 2009. NOAA's Burley Creek FH transferred 4,940 BY09 production eggs to Sawtooth FH on November 24, 2009. Fish that result from these transfers will be used for 2010 presmolt and 2011 smolt release strategies in Sawtooth Valley lakes and rivers.

A total of 104,963 eyed eggs were transferred from NOAA's Burley Creek FH to ODFW's Oxbow FH on November 25 (52,647) and December 7 (52,316) for a 2011 smolt release (Table 2).

Eyed Egg and Fish Reintroductions

Sockeye salmon eyed eggs and fish were transferred and/or released to various locations in 2009. In all cases, the required state transfer permits were acquired prior to shipping. Additionally, pursuant to Special Condition B. 9. of Permit No. 1120, IDFG received authorization from NOAA to carry out all production releases of sockeye salmon made in 2009 (Table 6). All sockeye salmon juveniles and captive-reared adults released to Sawtooth Valley waters in 2009 were adipose fin-clipped prior to release.

Adult Releases

Maturing adult sockeye salmon were released to Redfish Lake in September 2009 for volitional spawning. On September 8 and 9, 555 anadromous adults (mean weight 1.37 kg/fish) were released. On September 9, 60 sockeye reared at NOAA Fisheries were released (mean weight 1.46 kg/fish). On September 16, an additional 231 NOAA Fisheries reared captive adults were released (mean weight 1.86 kg/fish). Eagle FH released 391 sockeye from the captive broodstock program (mean weight 1.21 kg/fish) on September 11 and 16, 2009. Anadromous returning adults that were trapped after September 5 (112 total) were released directly to Redfish Lake or observed below the Redfish Lake Creek weir when it was removed (Table 6). Efforts were made to release fish of equal sex ratios.

Smolt Releases

Smolts were released to the Salmon River on May 7, 2009. A total of 99,374 BY07 smolts were released above the Sawtooth FH weir and 73,681 BY07 smolts were released below the smolt trap on Redfish Lake Creek. Rearing of these smolts was split between ODFW's Oxbow FH (73,681) and Sawtooth FH (99,374). All smolts reared at Oxbow FH and Sawtooth FH were adipose fin-clipped and coded-wire-tagged and all Oxbow FH smolts were marked with an additional right ventral (RV) fin clip. A smolt survival study began in 2009 by the Army Corps of Engineers, increasing the number of PIT-tagged fish in the Oxbow FH and Sawtooth FH release groups. A total of 10,937 smolts were tagged at Oxbow FH and 52,551 smolts were tagged at Sawtooth FH (Table 6).

Presmolt Releases

Presmolt releases to Sawtooth Valley lakes were conducted in October 2009 at mid-lake (pelagic) locations with the aid of the IDFG trawl boat and specially built tank. All presmolts were from BY08 and were reared at IDFG's Sawtooth FH. Presmolts from Sawtooth FH were adipose fin-clipped prior to release, with a representative number of fish PIT tagged for evaluation purposes. On October 7, 2009, Pettit Lake received 14,983 presmolts reared at the Sawtooth FH. Fish from this group were adipose fin-clipped (1,018 PIT tags) and had a mean weight of 6.2 grams per fish. On October 7, 2009, an additional 9,994 (1,019 PIT tagged) adipose fin-clipped presmolts (mean weight 6.8 grams/fish) were released to Alturas Lake. On October 7, 2009, 34,561 (1,016 PIT tagged) adipose fin-clipped presmolts (mean weight 6.0 grams/fish) were released to Redfish Lake (Table 6).

Eyed egg Planting

Program egg boxes were used to plant eyed eggs in Pettit and Alturas lakes in 2009. Egg box trays were loaded with approximately 3,000 eyed eggs per unit and transferred to release sites in water-filled coolers. On November 10, 2009, approximately 2,601 eyed eggs were transferred to eyed egg boxes and planted in Pettit Lake (2,601 eyed eggs from Eagle FH). A second group of eyed eggs was released to Pettit Lake on November 23, 2009 and included 9,043 eyed eggs from NOAA's Burley Creek FH and 9,107 eyed eggs from Eagle FH. A third group of eyed eggs was released to Pettit Lake on December 10, 2009 (36,158 eyed eggs from Eagle FH [Table 6]). On December 17, 2009, approximately 15,568 eyed eggs were released to Alturas Lake (9,530 from NOAA's Burley Creek FH and 6,038 from Eagle FH [Table 6]).

Table 1. Summary of losses and magnitude of mortality for five captive sockeye salmon broodstocks reared at IDFG facilities in 2009.

	Broodstock Groups				
	BY05	**BY06**	**BY07**	**BY08**	**BY09**
Starting Inventory (January 1, 2009)	11	669	449	988	1,546[a]
Eyed egg to Fry					
Undetermined[b]	n/a	n/a	n/a	191	n/a
Mechanical Loss					
Handling	0	0	0	0	n/a
Jump-out	0	0	0	0	n/a
Transportation	0	0	0	0	n/a
Non-infectious					
Lymphosarcoma	0	0	0	0	n/a
Nephroblastoma	0	0	0	0	n/a
Other[c]	1	24	10	39	n/a
Infectious					
Bacterial	0	0	0	0	n/a
Viral	0	0	0	0	n/a
Other	0	0	0	0	n/a
Maturation Spawners					
Mature Males	3	147	0	0	n/a
Mature Females	0	105	0	0	n/a
Maturation Non-Spawners					
Mature Males	0	0	0	0	n/a
Mature Females	0	0	0	0	n/a
Relocation					
Transferred In	0	0	0	0	n/a
Transferred Out	0	0	0	0	515
Planted/Released	6	385	0	0	n/a
Ending Inventory (December 31, 2009)	1	8	439	758	1,031

[a] December 2009 developing fry and egg numbers.
[b] Typical egg to fry mortality includes non-hatching eggs, abnormal fry, and swim-up loss.
[c] Includes culling associated with cultural abnormalities, non-matures, and all undetermined, non-infectious mortality

Table 2. Summary of losses and magnitude of mortality for three brood years of captive sockeye salmon production groups during 2009.

	Culture Groups							
	BY07 Sawtooth	**BY07 Oxbow**	**BY08 Sawtooth**	**BY08 Oxbow**	**BY09 Sawtooth**	**BY09 Oxbow**	**BY09 Burley**	**BY09 Eagle**
Starting Inventory (January 1, 2009)	99,394	73,934	195,542	86,938	218,844[a]	104,963[a]	593[a]	19,820[a]
Eyed egg to Fry								
Undetermined[b]	n/a	n/a	23,620	2,850	n/a	n/a	n/a	n/a
Mechanical Loss								
Handling	0	0	0	0	n/a	n/a	n/a	n/a
Jump-out	0	0	0	0	n/a	n/a	n/a	n/a
Transportation	0	0	0	0	n/a	n/a	n/a	n/a
Non-infectious								
Lymphosarcoma	0	0	0	0	n/a	n/a	n/a	n/a
Nephroblastoma	0	0	0	0	n/a	n/a	n/a	n/a
Other[c]	20	253	12,595	3,879	n/a	n/a	n/a	n/a
Infectious								
Bacterial	0	0	0	0	n/a	n/a	n/a	n/a
Viral	0	0	0	0	n/a	n/a	n/a	n/a
Other	0	0	0	0	n/a	n/a	n/a	n/a
Maturation								
Mature Males	0	0	0	0	n/a	n/a	n/a	n/a
Mature Females	0	0	0	0	n/a	n/a	n/a	n/a
Other	0	0	0	0	n/a	n/a	n/a	n/a
Relocation								
Transferred In	0	0	0	0	n/a	n/a	n/a	n/a
Transferred Out	0	0	0	0	n/a	n/a	n/a	n/a
Planted/Released	99,374	73,681	59,538	0	n/a	n/a	n/a	n/a
Ending Inventory (December31, 2009)	0	0	99,789	80,209	218,844	104,963	593	19,820

[a] December 2009 developing fry and egg numbers (combined NOAA and Eagle numbers).

[b] Typical egg to fry mortality includes non-hatching eggs, abnormal fry, and swim-up loss (April 1 inventory).

[c] Culling associated with cultural abnormalities, fish health sampling, and all undetermined, non-infectious mortality.

Table 3. Calendar year 2009 anadromous sockeye salmon adult return summary.

Summary category	Total number collected	Number trapped at RFLC[b] weir	Number trapped at SFH[a] weir	Number observed at RFLC[b] weir
All anadromous adults	833	568	249	16
Anadromous males	567	376	191	0
Anadromous females	250	192	58	0
Unmarked adults	86	76	10	0
AD-clipped adults[c]	32	11	21	0
AD-clipped/CWT adults[c]	139	19	120	0
AD/RV-clipped adults[c]	2	1	1	0
AD/RV-clipped/CWT adults[c]	471	459	12	0
AD/LV-clipped adults[c]	6	0	6	0
AD/LV-clipped/CWT adults[c]	81	2	79	0

[a] SFH = Sawtooth Fish Hatchery
[b] RFLC = Redfish Lake Creek
[c] AD = adipose fin clip; LV = left ventral fin clip; RV = right ventral fin clip; and CWT = coded-wire tag.

Table 4. Summary information for 2009 sockeye salmon spawning activities at Eagle Fish Hatchery.

Spawning Cross*		No. of Green Eggs Taken	No. of Eyed eggs	Mean Egg Survival to Eyed-Stage	Median Egg Survival to Eyed-Stage
Female	Male				
ANH09	ANH09	53,711	49,260	91.71%	96.12%
ANH09	BY05	4,143	3,729	89.02%	91.05%
ANH09	BY06	98,816	85,135	86.16%	95.95%
BY06	ANH09	34,867	30,036	86.14%	94.79%
BY06	BY05	2,306	2,114	91.67%	92.68%
BY06	BY06	132,466	120,694	91.11%	95.81%
	TOTALS	**326,309**	**290,968**	**89.17%**	**95.65%**

Note:* ANH09 refers to anadromous adults returning in 2009.
BY05 refers to captive adults produced in spawn year 2005.
BY06 refers to captive adults produced in spawn year 2006.

Table 5. Parent family and number of eyed eggs retained for brood year 2009 captive broodstock development at Eagle Fish Hatchery.

Family Cross*		No. of Eyed eggs Retained for Eagle Broodstock
Female	**Male**	
ANH09	ANH09	130
ANH09	BY05	10
ANH09	BY06	216
BY06	ANH09	145
BY06	BY05	8
BY06	BY06	522
	TOTAL	**1,031**

Note:* ANH09 refers to anadromous adults returning in spawn year 2009.
BY05 refers to captive adults produced in spawn year 2005.
BY06 refers to captive adults produced in spawn year 2006.

Table 6. Sockeye salmon releases made to Sawtooth Valley waters in 2009.

Release Location	Strategy (Brood Year)	Release Date	Number Released	Number PIT Tagged	Marks [a]	Release Weight (g)	Rearing Location
Salmon River (above SFH weir)	smolt (2007)	5/7/09	99,374	52,551	Ad/CWT	14.8	IDFG Sawtooth FH
Redfish Lake Cr	smolt (2007)	5/7/09	73,681	10,937	Ad/CWT/RV	44.5	ODFW Oxbow FH
Alturas Lake (direct lake)	presmolt (2008)	10/7/09	9,994	1,019	Ad	6.8	IDFG Sawtooth FH
Pettit Lake (direct lake)	presmolt (2008)	10/7/09	14,983	1,018	Ad	6.2	IDFG Sawtooth FH
Redfish Lake (direct lake)	presmolt (2008)	10/7/09	34,561	1,016	Ad	6.0	IDFG Sawtooth FH
Redfish Lake	adult (2005)	9/16/09	101	101	Ad	2,370	NOAA Burley Creek FH
	(2006)	9/9/09	60	60	Ad	1,463	NOAA Burley Creek FH
	(2006)	9/16/09	130	130	Ad	1,463	NOAA Burley Creek FH
Redfish Lake	adult (2005)	9/11/09	6	6	Ad	1,236	IDFG Eagle FH
	(2006)	9/11/09	316	316	Ad	1,208	IDFG Eagle FH
	(2006)	9/16/09	69	69	Ad	1,208	IDFG Eagle FH
	(ANH09)[b]	9/8/09	311	NA	Mix	1,259	Anadromous Release
	(ANH09)[b]	9/9/09	244	NA	Mix	1,516	Anadromous Release
	(ANH09)[b]	Sept. – Oct.	112	NA	Mix	1,372	Anadromous Release
Pettit Lake	eyed egg (2009)	11/10/09	2,601	-	-	-	IDFG Eagle FH
	(2009)	11/24/09	9,107	-	-	-	IDFG Eagle FH
	(2009)	11/24/09	9,043	-	-	-	NOAA Burley Creek FH
	(2009)	12/10/09	36,158	-	-	-	IDFG Eagle FH
Alturas Lake	(2009)	12/17/09	6,038	-	-	-	IDFG Eagle FH
	(2009)	12/17/09	9,530	-	-	-	NOAA Burley Creek FH

[a] Ad = adipose fin clip; CWT = Coded Wire Tag; RV = Right Ventral

[b] ANH09 refers to anadromous returning sockeye salmon in 2009; representing brood years 2004, 2005, and 2006.

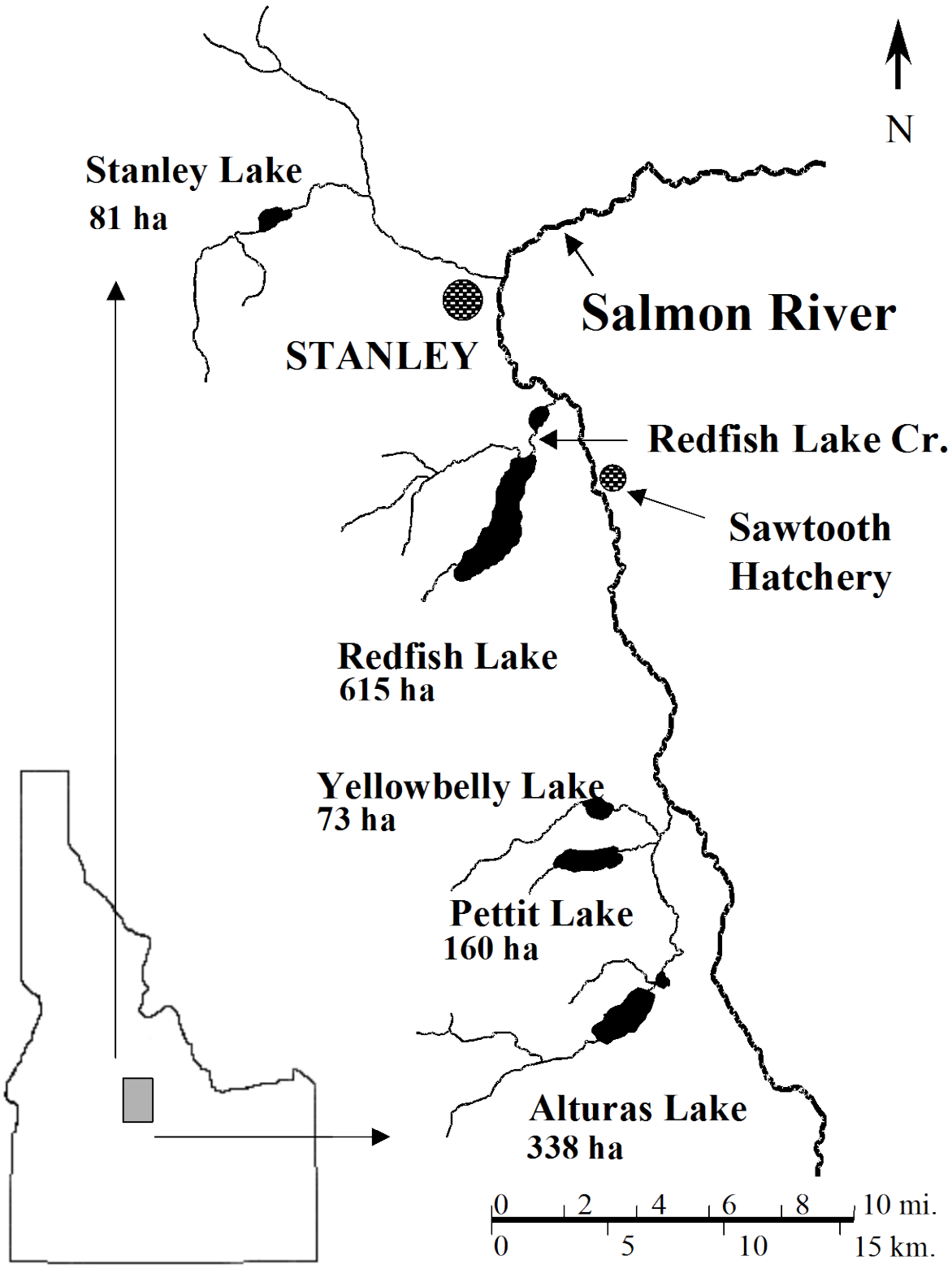

Figure 1. Sawtooth Valley study area.

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