FISHERY RESEARCH

SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

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Snake River Sockeye Salmon Captive Broodstock Program Hatchery Element

Project Progress Report

2007 Annual Report

By

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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, 2007 and December 31, 2007 for the hatchery element of the program are presented in this report.

In 2007, four anadromous sockeye salmon returned to the Sawtooth Valley. Traps on Redfish Lake Creek and the upper Salmon River at the Sawtooth Fish Hatchery intercepted one and three anadromous sockeye salmon adults, respectively. Fish were trapped between July 23 and August 26, 2007. The trapped adult sockeye salmon (two females and two males) originated from two unique release strategies and were transferred to Eagle Fish Hatchery on July 23 and 28 and August 1 and 26, 2007 and later incorporated into hatchery spawn matrices.

Two anadromous females and 144 captive females from brood year 2003 (one female) and 2004 (143 females) were spawned at the Eagle Fish Hatchery in 2007. Spawn pairings produced approximately 175,810 eyed-eggs with egg survival to eyed stage of development averaging 74.4%.

Eyed-eggs (51,008), presmolts (82,105), smolts (101,676), and adults (494) were planted or released into Sawtooth Valley waters in 2007. 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 six unique production groups were in culture at Idaho Department of Fish and Game (Eagle Fish Hatchery and Sawtooth Fish Hatchery) and Oregon Department of Fish and Wildlife (Oxbow Fish Hatchery) facilities. Three of the six broodstocks were incorporated into the 2007 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 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).

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, 2007.

FACILITIES

Eagle Fish Hatchery

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. Water chilling capability was added at Eagle FH in 1994. 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. Ten water level alarms are in use, 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 225,000 green eggs. 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, including: 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- and three-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 and juvenile sockeye are held in vats or in a series of 2.0 m fiberglass tanks installed in 1997. 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 held (3 days maximum) in adult holding facilities at Sawtooth FH prior to transfer to the Eagle FH for release and/or artificial spawning.

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 14.0°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 2006 represents the third 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 followed 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 conformed to the husbandry requirements detailed in ESA Section 10 Propagation Permit 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.

Fish were fed a commercial diet produced by Bio-Oregon, Inc. (Warrenton, Oregon). Through approximately 150.0 g weight, fish received a standard Bio-Oregon semi-moist formulation. 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. Beyond 150.0 g weight, fish received the Bio-Oregon custom broodstock diet. In 2007, there was a feed recall for melamine contamination in starter feeds. For this reason, Rangen, Inc (Buhl, Idaho) was used for starter feeds at Eagle FH.

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, 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. Production and broodstock sockeye salmon were PIT tagged at approximately nine months of age. The PIT tag procedures followed accepted, regional protocols (Prentice et al. 1990).

Chemical therapeutants were 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, land filled, 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 were not conducted in 2007. Trapping efforts consist of setting a series of four trap nets along the area commonly known as Sockeye Beach. 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). Before 1994, adult sockeye returns were spawned at the Sawtooth FH (Johnson 1993). Spawning activities in 2007 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 2007, breeding plans relied on DNA microsatellite information versus pedigree information. Microsatellite data were generated from DNA samples at 11 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 Bio-Diet soft-moist feed obtained from Bio-Oregon 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 bodyweight. In addition, fingerlings 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 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 Iodophor solution for ten minutes prior to facility incubation.

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 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 (1000 gal), and 9,463 L (2,500 gal) capacities. Transport density guidelines were in place to not exceed 89 g/L (0.75 lb/gal).

Eyed-Egg and Fish Supplementation

In 2007, 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 946 L (250 gal) barge-mounted tanks 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 2007, 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 six production groups were in culture at IDFG and ODFW facilities representing brood years 2003, 2004, 2005, 2006, and 2007. A summary of losses while in culture during this reporting period is 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., BY03 refers to brood year 2003).

BY03 Broodstock

Five hundred ninety-five spawn crosses representing 209 females and 148 males were developed for BY03 production spawn crosses at the Eagle FH. The BY03 production group was developed using male sockeye salmon from the BY99, BY00, and BY01 broodstocks; female sockeye salmon from the BY00 and BY01 broodstocks; and two anadromous female adults (ANH03) that returned to the Sawtooth Valley in 2003 and were retained for spawning. Specific crosses performed to develop production groups included: 1) ANH03 females x BY99 males, 2) ANH03 females x BY00 males, 3) ANH03 females x BY01 males, 4) BY00 females x BY99 males, 5) BY00 females x BY00 males, 6) BY00 females x BY01 males, and 7) BY01 females x BY00 males.

Approximately 837 eyed-eggs were segregated from production groups described above to create the BY03 broodstock representing 208 unique females and 146 unique males. No cryopreserved milt was used in the spawn design for 2003. Approximately 419 eyed-eggs were transferred to NOAA facilities on November 25 and December 10, 2003 where they will remain through maturation. The majority of BY03 broodstock adults produced at NOAA facilities will contribute to future spawning designs. Inventory reporting for these fish will appear under separate cover by NOAA. In 2007, microsatellite markers were utilized to determine genotypes for the BY03 broodstock to establish a spawning matrix based on kinship coefficients.

Starting inventory at Eagle FH was seven BY03 fish. During 2007, four fish matured at age-4 (one female and three males) and were incorporated into the spawning design. There was one mortality during 2007 and the ending inventory was two fish (Table 1).

BY04 Broodstock

Three hundred and thirty-seven spawn crosses representing 112 females and 102 males were developed from BY04 spawn crosses at the Eagle FH. The BY04 production group represents spawn crosses from 103 females and 87 males. Spawn crosses were developed using male sockeye salmon from the BY01 broodstock and cryopreserved milt, and female sockeye salmon from the BY00 and BY01 broodstocks and five (of 12 total) anadromous female adults that returned to the Sawtooth Valley in 2004 (ANH04). Specific crosses performed to develop production groups included: 1) ANH04 females x BY01 males, 2) BY00 female x BY01 males, 3) BY01 females x BY01 males, and 4) BY01 females x cryopreserved milt from males collected in 1996 (n = 3: RES92, ANBY93-B6, ANBY93-A4) and 1997 (n = 1: A+NBY94).

Approximately 507 eyed-eggs were segregated from production groups described above to create the BY04 broodstock representing 100 unique females and 87 unique males. Starting inventory at Eagle FH was 462 fish. During 2007, 416 fish matured (174 males and 242 females). One hundred and thirty-one mature sockeye were released (34 males and 97 females) to Redfish Lake for volitional spawning, the remaining 285 mature sockeye (140 males and 145 females) remained at Eagle FH and were incorporated into the 2007 spawning design. There were 39 mortalities during 2007 and the ending inventory of BY05 broodstock at Eagle FH was seven fish (Table 1).

BY05 Production

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, 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).

A total of 177,243 BY05 eyed-eggs from production spawn crosses at Eagle FH and NOAA's Burley Creek Fish Hatchery (Burley Creek FH) were transferred to Sawtooth FH in 2005. Initial inventory at Sawtooth FH was 47,039 fingerlings. Sawtooth FH released smolts to the Salmon R above the Sawtooth FH weir (46,765 at 21.7 g/fish) in May 2007. Ending inventory at Sawtooth FH was zero fish (Table 2).

A total of 58,379 BY05 eyed-eggs from production spawn crosses at the NOAA Burley Creek FH were transferred to the ODFW Oxbow FH in late 2005. Initial inventory for this production group at Oxbow FH was 54,851 eyed-eggs/developing fry. Ending inventory at Oxbow FH was zero fish (Table 2).

BY05 Broodstock

Approximately 1,212 eyed-eggs representing 330 subfamilies (121 unique females and 191 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 (808 total) remaining at Eagle FH and the third group (404 total) transferred to NOAA Fisheries.

Starting inventory at Eagle FH was 734 fingerlings. There were two mortalities during 2007, two males matured and were incorporated into the spawning matrix, and 329 smolts were released to the Salmon River above the Sawtooth FH weir. Ending inventory of BY05 captive broodstock at Eagle FH was 401 fish (Table 1).

BY06 Production

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).

A total of 181,373 BY06 eyed-eggs from production spawn crosses at Eagle FH and NOAA's Burley Creek Fish Hatchery (Burley Creek FH) were transferred to Sawtooth FH in 2006. Sawtooth FH released presmolts to Pettit (10,113 at 7.0 g/fish), Alturas (9,977 at 7.1 g/fish), and Redfish (62,015 at 6.7 g/fish) lakes in October 2007. The remaining juveniles were transferred to outside raceways in November and will be released in May 2008. Initial inventory at Sawtooth FH was 181,357 eyed-eggs. Ending inventory at Sawtooth FH was 73,945 developing juveniles (Table 2).

A total of 80,042 BY06 eyed-eggs from production spawn crosses at Burley Creek FH were transferred to ODFW's Oxbow FH in late 2006 for full-term smolt production (2008 release). Initial inventory for this production group at Oxbow FH was 80,042 eyed-eggs/developing fry. Ending inventory for this production group at Oxbow FH was 76,947 juveniles (Table 2).

BY07 Broodstock

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 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 BY07 broodstock will be determined by utilizing microsatellite DNA markers. Ending inventory for BY07 broodstock at Eagle FH was 799 eyed-eggs/developing fry (Table 1). Spawn crosses represented in the Eagle FH BY07 broodstock are presented in Table 5.

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 7 to October 30, 2007. The second trap is located on the upper Salmon River at the Sawtooth FH weir and was operated from June 3 to September 15, 2007.

In 2007, four anadromous sockeye salmon returned to the Sawtooth Valley. The weir on the upper Salmon River at the Sawtooth FH intercepted three sockeye salmon adults while the Redfish Lake Creek trap intercepted one sockeye. Fish were captured between July 23 and August 26, 2007. The adult sockeye salmon (two females, two males) originated from a variety of release strategies, as evidenced by mark types (Table 3).

Residual sockeye trapping activities were not conducted in 2007 at Redfish Lake. Snorkeling to enumerate residual sockeye salmon spawners in Redfish Lake was conducted weekly from October 9 to October 29, 2007. The peak of the residual count for Sockeye Beach occurred on October 29 when four residuals were observed, and October 16 for the south end of the lake when three residuals were observed. The total number of residual sockeye salmon observed during snorkeling surveys conducted in 2007 was eight for Sockeye Beach and five for the south end of the lake.

Six Chinook salmon *O. tshawytscha* smolts were captured at the Redfish Lake Creek trap in 2007. These fish were released unharmed.

2007 Production Spawning

Historically, the broodstock program used pedigree information to guide broodstock selection for hatchery spawning. Spawn crosses in 2007 relied on DNA microsatellite information versus pedigree information for development of annual spawn matrices. Microsatellite data were generated from 373 DNA samples (maturing BY03, BY04, BY05 and 2007 anadromous sockeye salmon) at 14 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.

The Idaho Department of Fish and Game is required by Permit No. 1120 to discuss proposed broodstock spawning matrices with NOAA Northwest Fisheries Science Center (NWFCS) genetics staff. In 2007, this was accomplished by distributing and discussing a proposed spawning matrix at the SBSTOC meeting held on September 19, 2007 in Newport, Oregon. Representatives from NOAA Conservation Biology and Resource Enhancement and Utilization Technologies divisions (NWFSC) reviewed and approved the proposed spawning matrix. No objections to the proposed spawning design were aired.

During the fall of 2007, four age-4 fish (one female and three males) from BY03 broodstock, 285 age-3 fish (145 females and 140 males) from the BY04 broodstock, and two age-2 fish (two males) from the BY05 broodstock matured at the Eagle FH and were incorporated into the spawning matrix. In addition, the four anadromous sockeye salmon (two females, two males) that returned to the Sawtooth Valley in 2007 (ANH07) were transferred to the Eagle FH and were incorporated into the spawning design.

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, two anadromous males that returned to the Sawtooth Valley (ANH07), and three males from cryopreserved milt. Female sockeye salmon from the BY03 and BY04 captive broodstock and two anadromous females that returned to the Sawtooth Valley in 2007 (ANH07) contributed to the BY07 production group. Specific crosses performed to develop this production group included: 1) BY03 female x BY04 males, 2) BY04 females x BY03 males, 3) BY04 females x BY04 males, 4) BY04 females x BY04 males, 5) BY04 females x ANH07 males, 6) ANH07 female x Cryo males, and 7) ANH07 females x BY04 males. Spawn crosses produced

approximately 236,393 green and 175,810 eyed-eggs. Brood year 2004 female fecundity was 1,614 green eggs per female and ANH07 female fecundity averaged 2,845 green eggs per female. Egg survival to the eyed stage of development for the BY07 production group averaged 74.37% (median 83.91%) (Table 4). In 2007, the four anadromous adults transferred to Eagle FH and incorporated into the spawning matrix were all found to be negative for infectious hematopoietic necrosis virus (IHNV).

Results for brood year 2007 spawn crosses conducted by NOAA will be reported under separate cover by that agency.

2007 Broodstock Spawning

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 799 eyed eggs remaining at Eagle FH and 400 eyed eggs 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 BY06 broodstock will be determined by utilizing microsatellite DNA markers. Spawn crosses represented in the Eagle FH BY07 broodstock are presented in Table 5.

Milt Cryopreservation

No milt from maturing sockeye salmon was cryopreserved in 2007.

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. Forty-eight laboratory accessions involving 572 individual fish were processed in 2007. Laboratory accessions included samples from Eagle Fish Hatchery (31 accessions), Sawtooth Fish Hatchery (15 accessions), and the Redfish Lake Creek (RFLC) out-migrant trap (2 accessions). Total fish sampled (572) includes 306 fish from Eagle FH (five BY03, 298 BY04, one BY05, two BY06), 250 fish from Sawtooth FH (171 BY05, 79 BY06), one BY03 fish from Redfish Lake, and 15 fish from the RFLC trap (out-migrant smolts). Observation made from previous years directed which pathogens were deemed 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 a pathogen exotic to the captive broodstock program. All production lots were examined prior to release either as 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 2007. A total of 294 fish from calendar year 2007 broodstock crosses (BY03, BY04, BY05, and ANH07 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 2007. One hundred twenty fish from the BY05 overwinter smolt release group (Salmon River rearing) and 60 fish from the BY06 fall presmolt release group (well water rearing) were tested in conjunction with standardized, prerelease fish health sampling protocols. An additional 51 fish from the BY05 overwinter smolt group and 19 fish from the BY06 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 2007. Fifteen BY05 out-migrating smolts from the Redfish Lake Creek trap were also sampled with no viral pathogens detected.

Although the four returning anadromous adults in 2007 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 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 bacterial kidney disease (BKD), caused by *Renibacterium salmoninarum*, is a standard fish health sampling protocol for broodstock, production, and out-migrant groups of Redfish Lake sockeye salmon. A total of 291 (146 females, 145 males) fish from calendar year 2007 broodstock crosses (BY03, BY04, BY05, ANH07 spawners) at Eagle FH were sampled for BKD via enzyme-linked immunosorbent assay (ELISA) techniques in 2007. All Eagle broodstock crosses tested negative for the presence of this pathogen. Zero of 70 BY05/BY06 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, one of 12 BY06 sockeye presmolts (five fish pools) was positive for BKD via ELISA.

Aeromonas spp and/or Flavobacterium spp were detected in three of four anadromous adult sockeye salmon trapped in 2007. Furunculosis has been detected in anadromous adults in past return years and indicates the continued need for Oxytetracycline and Erythromycin injections for adults at trapping.

Parasitic Pathogens

The myxosporean parasite *Myxobolus cerebralis,* which can cause salmonid whirling disease, 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 2007 tested for *M. cerebralis* via pepsin/trypsin digest (PTD) and polymerase chain reaction (PCR) testing methods are currently pending. Two of four returning anadromous adults tested positive for *M. cerebralis* via PTD testing, this is consistent with positive detections in five of the last seven 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 three of the four anadromous adult sockeye salmon that returned in 2007. Detection of *P. minibicornis* was made by PCR at the Eagle Fish Health Laboratory. Additional tissue samples (confirmatory analyses) were sent to the lab of Dr. Simon Jones, Department of Fisheries and Oceans, Canada and are

still pending. Thirty-three of the forty-two 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 2007, 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.

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 20, 27, and December 6, 2007. Each shipment contained eyed-eggs for the NOAA Fisheries captive broodstock (400 eyed-eggs) and adult release (496 eyed-eggs) programs in Washington State.

Eagle FH transferred 174,115 BY07 production eggs to the Sawtooth FH on November 20 and 27 and December 7, 2007. NOAA Burley Creek FH transferred 57,671 BY07 production eggs to Sawtooth FH on November 27 and December 7, 2007. Fish that result from these transfers will be used for fall 2008 presmolt and 2009 smolt release strategies in Sawtooth Valley lakes and rivers.

On November 16 and 24 and December 19, 2007, approximately 35,263, 20,259, and 25,436 eyed-eggs were transferred from the NOAA Burley Creek FH to ODFW Oxbow FH for a 2009 smolt release (Table 2).

Eyed Egg and Fish Reintroductions

Sockeye salmon eyed-eggs and fish were transferred and/or released to various locations in 2007. 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 2007 (Table 6). All sockeye salmon juveniles and adults released to Sawtooth Valley waters in 2007 were adipose fin-clipped prior to release.

Adult Releases

Maturing adult sockeye salmon were released to Redfish Lake in September 2007 for volitional spawning. On September 5, 363 NOAA Manchester Research Station/Burley Creek FH-reared BY02 (n = 2), BY03 (n = 53), and BY04 (n = 308) adults (mean weight 1.5 kg/fish) were released. On September 6 and 10, 131 BY04 sockeye reared at Eagle FH were released (mean weight 1.1 kg/fish). Efforts were made to release fish of equal sex ratios. No anadromous adults were released in 2007.

Smolt Releases

Smolts were released to the Salmon River on May 8, 2007. A total of 47,094 BY05 smolts were released above the Sawtooth FH weir and 54,582 BY05 smolts were released below the smolt trap on Redfish Lake Creek. Rearing of these smolts was split between ODFW Oxbow FH (54,582), Sawtooth FH (46,765), and Eagle FH (329). All smolts reared at Oxbow FH and Sawtooth FH were adipose fin-clipped and coded-wire tagged, a representative number PIT tagged (1,011 from Sawtooth FH and 1,011 from Oxbow FH), and all Oxbow FH smolts were marked with an additional right ventral (RV) fin clip.

Presmolt Releases

Presmolt releases to Sawtooth Valley lakes were conducted in October 2007 at mid-lake (pelagic) locations with the aid of a release barge on loan to IDFG from NOAA. All presmolts were from BY06 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 2, 2007, Pettit Lake received 10,113 presmolts reared at the Sawtooth FH. Fish from this group were adipose fin-clipped (993 PIT tags) and had a mean weight of 7.0 grams per fish. On October 3, 2007, an additional 9,977 (1,005 PIT tagged) adipose fin-clipped presmolts (mean weight 7.1 grams/fish) were released to Alturas Lake. On October 3, 2007, 62,015 (988 PIT tagged) adipose fin-clipped presmolts (mean weight 6.7 grams/fish) were released to Redfish Lake.

Eyed-egg Planting

Eyed-eggs were placed in egg boxes (app. 3,000 per box) in Pettit Lake in 2007. On November 27, 2007, approximately 51,008 eyed-eggs were transferred to eyed-egg boxes and planted in Pettit Lake (51,008 eyed-eggs from NOAA Burley Creek FH).

Table 1. Summary of losses and magnitude of mortality for five captive sockeye salmon broodstocks reared at IDFG facilities in 2007.

	Culture Groups				
	BY03	**BY04**	**BY05**	**BY06**	**BY07**
Starting Inventory (January 1, 2007)	7	462	734	800[a]	1,199[a]
Eyed-egg to Fry					
Undetermined[b]	n/a	n/a	0	114	n/a
Mechanical Loss					
Handling	0	0	1	0	n/a
Jump-out	0	0	0	0	n/a
Transportation	0	0	0	0	n/a
Noninfectious					
Lymphosarcoma	0	0	0	0	n/a
Nephroblastoma	0	0	0	0	n/a
Other[c]	1	39	1	13	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	139	1	0	n/a
Mature Females	1	143	0	0	n/a
Maturation Non-Spawners					
Mature Males	0	1	1	0	n/a
Mature Females	0	2	0	0	n/a
Relocation					
Transferred In	0	0	0	0	n/a
Transferred Out	0	0	0	0	400
Planted/Released	0	131	329	0	n/a
Ending Inventory (December 31, 2007)	2	7	401	673	799

[a] December 2007 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, non-maturing, and all undetermined, noninfectious mortality.

Table 2. Summary of losses and magnitude of mortality for six captive sockeye salmon *production* groups reared at IDFG facilities in 2007.

	Culture Groups					
	BY05 Sawtooth	**BY06 Sawtooth**	**BY07 Sawtooth**	**BY05 Oxbow**	**BY06 Oxbow**	**BY07 Oxbow**
Starting Inventory (January 1, 2007)	47,039	181,357	231,786[a]	54,851	80,042	80,958[b]
Eyed-egg to Fry						
Undetermined[c]	n/a	20,596	n/a	n/a	1,929	n/a
Mechanical Loss						
Handling	0	0	n/a	0	0	n/a
Jump-out	0	0	n/a	0	0	n/a
Transportation	0	0	n/a	0	0	n/a
Noninfectious						
Lymphosarcoma	0	0	n/a	0	0	n/a
Nephroblastoma	0	0	n/a	0	0	n/a
Other[d]	274	4,711	n/a	269	1,166	n/a
Infectious						
Bacterial	0	0	n/a	0	0	n/a
Viral	0	0	n/a	0	0	n/a
Other	0	0	n/a	0	0	n/a
Maturation Spawners						
Mature Males	0	0	n/a	0	0	n/a
Mature Females	0	0	n/a	0	0	n/a
Maturation Non-Spawners						
Mature Males	0	0	n/a	0	0	n/a
Mature Females	0	0	n/a	0	0	n/a
Relocation						
Transferred In	0	0	n/a	0	0	n/a
Transferred Out	0	0	n/a	0	0	n/a
Planted/Released	46,765	82,105	n/a	54,582	0	n/a
Ending Inventory (December 31, 2007)	0	47,039	231,786	0	76,947	80,958

[a] December 2007 developing fry and egg numbers (combined eyed-eggs from Eagle FH and Burley Creek FH).

[b] December 2007 developing fry and egg numbers (all eyed-eggs from NOAA Fisheries).

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

[d] Includes culling associated with cultural abnormalities, fish health sampling, and all undetermined, noninfectious mortality.

Table 3. Year 2007 anadromous sockeye salmon adult return summary.

Summary Category	Total Number Trapped	Number Trapped at Redfish Lake Cr.	Number Trapped at SFH[a] weir	Number Seined from Below SFH[a] weir
All Anadromous Adults	4	1	3	0
Anadromous Males	2	1	1	0
Anadromous Females	2	0	2	0
Unmarked Adults	3	0	3	0
AD-clipped Adults[b]	0	0	0	0
AD-clipped/CWT Adults[b]	0	0	0	0
AD/RVCWT-clipped Adults[b]	1	1	0	0
AD/LV/CWT-clipped Adults[b]	0	0	0	0

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

Table 4. Summary information for 2007 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				
ANH07	BY03	3,077	2,819	62.71%	70.80%
ANH07	CRYO	348	1	0.29%	0.00%
BY03	BY04	2174	385	17.71%	17.19%
BY04	BY03	5,807	4,520	77.84%	92.36%
BY04	BY04	220,187	164,186	74.57%	83.99%
BY04	BY05	2,049	1,641	80.09%	76.64%
BY04	ANH07	2,751	2,332	84.77%	92.79%
	TOTALS	**236,393**	**175,810**	**74.37%**	**83.91%**

Note:* ANH07 refers to anadromous adults returning in 2007.
BY03 refers to captive adults produced in spawn year 2003.
BY04 refers to captive adults produced in spawn year 2004.
BY05 refers to captive adults produced in spawn year 2005.

Table 5. Parent family and number of eyed-eggs retained for brood year 2007 captive broodstock development at Eagle Fish Hatchery.

Family Cross*		No. of Eyed-eggs Retained for Eagle FH Broodstock
Female	**Male**	
ANH07	BY04	12
ANH07	CRYO	1
BY03	BY04	6
BY04	BY03	18
BY04	BY04	746
BY04	BY05	6
BY04	ANH07	10
	TOTAL	**799**

Note:* ANH07 refers to anadromous adults returning in spawn year 2007.
BY03 refers to captive adults produced in spawn year 2003.
BY04 refers to captive adults produced in spawn year 2004.
BY05 refers to captive adults produced in spawn year 2005.

Table 6. Sockeye salmon releases made to Sawtooth Valley waters in 2007.

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 (2005)	5/8/07	46,765	1,025	Ad/CWT	21.7	IDFG Sawtooth FH
Salmon River (above SFH weir)	smolt (2005)	5/8/07	329	329	Ad	69.0	IDFG Eagle FH
Redfish Lake Cr	smolt (2005)	5/8/07	54,582	1,019	Ad/CWT/RV	51.6	ODFW Oxbow FH
Alturas Lake (direct lake)	presmolt (2006)	10/03/07	9,977	1,005	Ad	7.1	IDFG Sawtooth FH
Pettit Lake (direct lake)	presmolt (2006)	10/02/07	10,113	993	Ad	7.0	IDFG Sawtooth FH
Redfish Lake (direct lake)	presmolt (2006)	10/03/07	62,015	988	Ad	6.7	IDFG Sawtooth FH
Redfish Lake	adult						
	(2002)	9/05/07	2	2	Ad	1,500	NOAA Burley Creek FH
	(2003)	9/05/07	53	53	Ad	3,200	NOAA Burley Creek FH
	(2004)	9/05/07	308	308	Ad	1,300	NOAA Burley Creek FH
Redfish Lake	adult						
	2004	9/06/07	90	90	Ad	1,126	IDFG Eagle FH
	2004	9/10/07	41	41	Ad	1,087	IDFG Eagle FH
Pettit Lake	eyed-egg						
	(2007)	11/27/07	51,008	-	-	-	NOAA Burley Creek FH

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

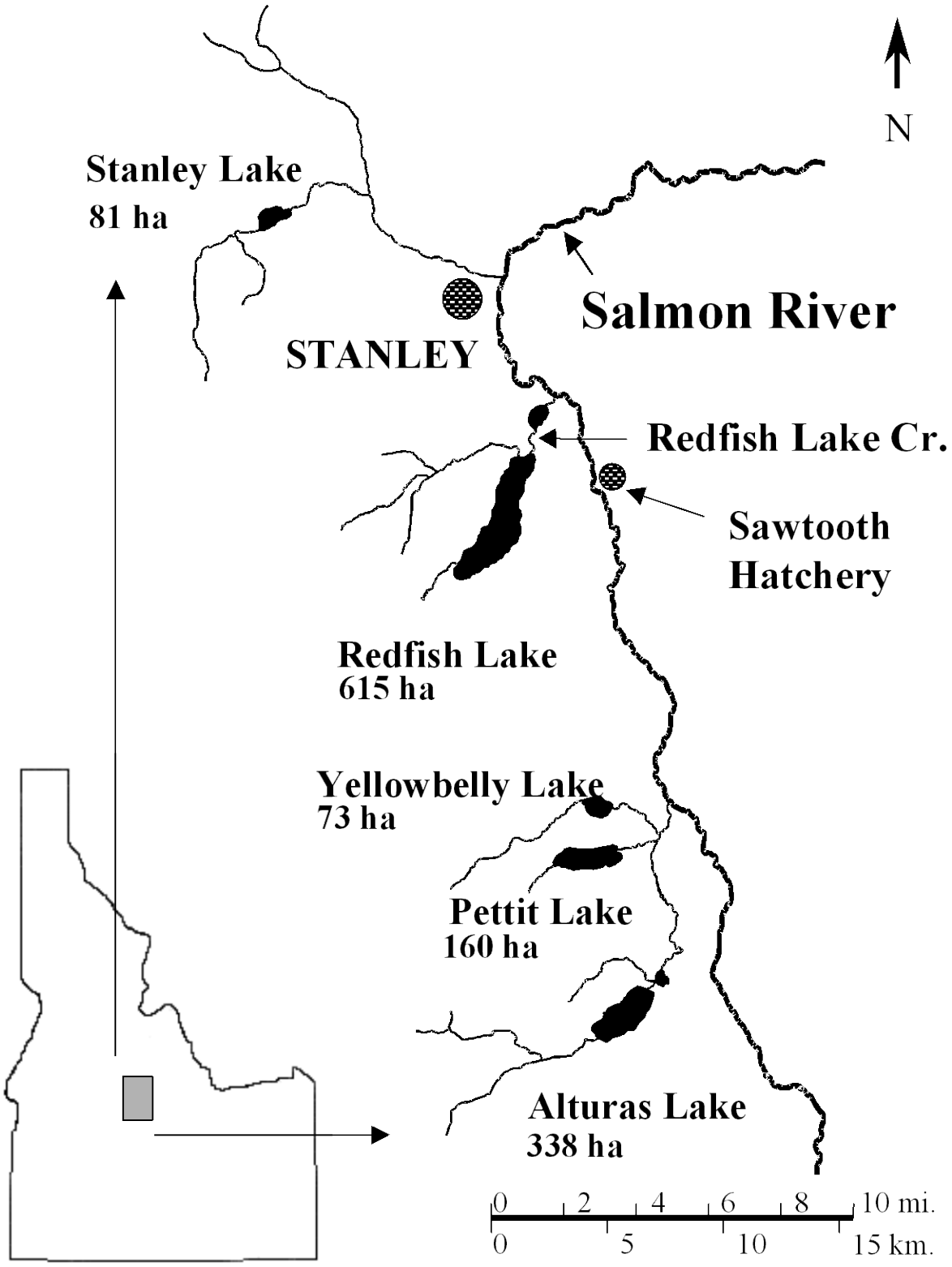

Figure 1. Sawtooth Valley study area.

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