FISHERY RESEARCH

SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

2005 ANNUAL PROGRESS REPORT
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Snake River Sockeye Salmon Captive Broodstock Program Hatchery Element

Project Progress Report

2005 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, 2005 and December 31, 2005 for the hatchery element of the program are presented in this report.

In 2005, six anadromous sockeye salmon returned to the Sawtooth Valley. Traps on Redfish Lake Creek and the upper Salmon River at the Sawtooth Fish Hatchery intercepted two anadromous sockeye salmon adults each. Additionally, two sockeye salmon were seined from below the Sawtooth Fish Hatchery weir. Fish were captured/collected between July 24 and September 14, 2005. The captured/collected adult sockeye salmon (three females and three males) originated from a variety of release strategies and were transferred to Eagle Fish Hatchery on August 5, 8, 10, and September 14, 2005 and later incorporated into hatchery spawn matrices.

Two anadromous females and 119 captive females from brood year 2002 were spawned at the Eagle Hatchery in 2005. Spawn pairings produced approximately 145,207 eyed-eggs with egg survival to eyed stage of development averaging 69.8%.

Eyed-eggs (51,239), presmolts (72,108), smolts (78,330), and adults (173) were planted or released into Sawtooth Valley waters in 2005. Reintroduction strategies involved releases to Redfish Lake, Alturas Lake, Pettit Lake, Redfish Lake Creek, and the upper Salmon River.

During this reporting period, six 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 2005 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 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 1233 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).

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 1233. This report details fish culture information collected between January 1 and December 31, 2005.

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 were 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 300,000 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 downwelling 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 depoted (3 days maximum) in adult holding facilities at Sawtooth 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

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 2005 represents the second 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 Oregon Department of Fish and Wildlife (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 semimoist formulation. Rations were weighed daily and followed suggested feeding rates provided by the manufacturer. Bio-Oregon developed a custom broodstock diet that includes 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.

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 prophylactically and 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 Adult 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.

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). Before 1994, adult sockeye returns were spawned at the Sawtooth FH (Johnson 1993). Spawning activities in 2005 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 2005, breeding plans relied on DNA microsatellite information versus pedigree information. Microsatellite data were generated from DNA samples at seven 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: Prophylactic 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 are fed Oxytetracycline as needed to control outbreaks of pathogenic aeromonads, pseudomonads, and myxobacteria bacteria as needed.

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.

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 ovarian fluid samples were collected from each female for analysis by the Eagle Fish Health Laboratory. Results of fish health analysis of spawners were used by IDFG and the SBSTOC to determine disposition of eggs and subsequent juveniles.

Fish health was monitored daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists looked for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, and 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). Dead 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 prophylactic and 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 gal), 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 2005, 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 biofilter 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 2005, 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, six broodstock and six production groups were in culture at IDFG and ODFW facilities representing brood years 2000, 2001, 2002, 2003, 2004, and 2005. 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., BY00 refers to brood year 2000).

BY00 Broodstock

Approximately 900 eyed-eggs were segregated from spawn crosses made in 2000 to create the BY00 broodstock representing ten families (54 unique subfamilies). Approximately 346 eyed-eggs and 42 fry were transferred to NOAA facilities where they will remain through maturation. The majority of BY00 broodstock adults produced at NOAA facilities will contribute to future spawning designs. Inventory reporting for these fish will appear under separate cover by NOAA.

Initial inventory for the BY00 broodstock at Eagle FH was four fish. No fish matured from this group during 2005. At the end of this reporting period, three BY00 broodstock remained in culture at the Eagle FH (Table 1).

BY01 Broodstock

Approximately 870 eyed-eggs were segregated from spawn crosses made in 2001 to create the BY01 broodstock representing 11 families (50 unique subfamilies). Approximately 435 eyed-eggs were transferred to NOAA facilities where they will remain through maturation. The majority of BY01 broodstock adults produced at NOAA facilities will contribute to future spawning designs. Inventory reporting for these fish will appear under separate cover by NOAA.

Initial inventory for the BY01 broodstock at Eagle FH was 20 fish. Fifteen males matured as age-4 fish in 2005 (all males were represented in spawn crosses). At the end of this reporting period, two BY01 broodstock remained in culture (Table 1).

BY02 Broodstock

Approximately 840 eyed-eggs were segregated from production groups described above to create the BY02 broodstock representing 79 unique females and 106 unique males. Cryopreserved milt from AN91 males was used to cross with BY99 females. Fourteen crosses were attempted with cryopreserved milt from three AN91 males; none of the crosses were successful in fertilization. Approximately 420 eyed-eggs were transferred to NOAA facilities on November 27 and December 11, 2002 where they will remain through maturation. The majority of BY02 broodstock adults produced at NOAA facilities will contribute to future spawning designs. Inventory reporting for these fish will appear under separate cover by NOAA.

Initial inventory for the BY02 broodstock at Eagle FH was 320 fish. During 2005, 300 BY02 fish matured (120 females and 180 males) at age-3. At the end of this reporting period, seven fish were in culture at Eagle FH (Table 1).

BY03 Production

Five hundred ninety-five spawn crosses representing 209 females and 148 males were developed from 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 and female sockeye salmon from the ANH03, BY00, and BY01 broodstocks. Specific crosses performed to develop production groups included: 1) ANH03 females x BY99 males, 2) ANH03 females x BY00 males, 3) BY00 females x BY99 males, 4) BY00 females x BY00 males,

5) BY00 females x BY01 males, 6) BY01 females x BY99 males, and 7) BY01 females x BY00 males.

Initial inventory at Sawtooth FH was 39,912 presmolts. Smolts reared at the Sawtooth FH were released to Salmon River and Redfish Lake Creek on May 10, 2005 (Table 5). Ending inventory at Sawtooth FH was zero fish (Table 2).

Initial inventory at Oxbow FH (ODFW) was 39,681 presmolts. Decreased flows from the spring-fed water supply at Oxbow FH resulted in the transfer of 38,818 presmolts (34.9 g/f mean) to Sawtooth FH on April 6, 2005, approximately one month in advance of previous plans. Brood year 2003 Oxbow smolts completed the final month of rearing in Salmon River water at the Sawtooth FH and were released (38,608 total) on May 10, 2005. Ending inventory at Oxbow FH was zero BY03 production fish (Table 2).

BY03 Broodstock

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 2005, 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 401 BY03 fish. Eight males matured at age-2 and were incorporated into the spawning design. The ending inventory was 386 fish (Table 1).

BY04 Production

Three hundred 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).

A total of 155,000 BY04 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 2004. Egg incubation and juvenile rearing for this production group will continue at Sawtooth FH through release as presmolts or smolts. Sawtooth FH released presmolts to Pettit (15,289 at 5.4 g/fish), Alturas (16,949 at 5.7 g/fish), and Redfish (39,870 at 6.1 g/fish) lakes in October 2005. The remaining juveniles were transferred to outside raceways on October 15, 2005 and will be released in May 2006. Initial inventory at Sawtooth FH was 152,517 eyed-eggs. Ending inventory at Sawtooth FH was 39,707 developing juveniles (Table 2).

A total of 50,002 BY04 eyed-eggs from production spawn crosses at the NOAA Burley Creek FH were transferred to the ODFW Oxbow FH in late 2004. Egg incubation and juvenile rearing for this production group will continue at Oxbow FH until smolt transfer to Idaho in 2006. Initial inventory for this production group at Oxbow FH was 49,723 eyed-eggs/developing fry. Ending inventory at Oxbow FH was 46,753 (Table 2).

BY04 Broodstock

Approximately 507 eyed-eggs were segregated from production groups described above to create the BY04 broodstock representing 100 unique females and 87 unique males. In 2006, microsatellite markers will be utilized to determine genotypes for the BY04 broodstock to establish a spawning matrix based on kinship coefficients.

Starting inventory at Eagle FH was 506 eyed-eggs. Ending inventory of BY04 broodstock at Eagle FH was 478 juveniles (Table 1).

BY05 Production

One hundred twenty-one females and 195 males were spawned at Eagle FH between October 7 and November 1, 2005 to generate 208,014 green eggs. Three hundred fifty-five unique subfamilies were developed from BY05 spawn crosses at the 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 and three anadromous males that returned to the Sawtooth Valley (ANH05), female sockeye salmon from the BY02 captive broodstock and two anadromous females that returned to the Sawtooth Valley in 2005 (ANH05). 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).

Eagle FH transferred 128,457 BY05 production eggs to the Sawtooth FH on November 30 and December 7, 2005. Approximately 48,786 eyed-eggs were transferred from Burley Creek FH to the Sawtooth FH on November 23 and November 30, 2005. Initial inventory at Sawtooth FH was 177,243 eyed-eggs (Table 2).

Eyed-eggs were released to Pettit Lake on November 30, 2005. Pettit Lake received 51,239 BY05 eyed-eggs from NOAA Fisheries (36,197 eyed-eggs) and Eagle FH (15,042 eyed-eggs) during 2005.

A total of 58,379 BY05 eyed-eggs from production spawn crosses at Burley Creek FH were transferred to Oxbow FH in late 2005. Egg incubation and juvenile rearing for this production group will continue at Oxbow FH until smolt transfer to Idaho in 2006. Ending inventory for this production group at Oxbow FH was 58,379 eyed-eggs/developing fry (Table 2).

Results for BY05 spawn crosses conducted by NOAA will be reported under separate cover by that agency.

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.

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 BY05 broodstock will be determined by utilizing microsatellite DNA markers. Ending inventory for BY05 brood at Eagle FH was 808 eyed-eggs/developing fry (Table 1). Spawn crosses represented in the Eagle FH BY05 broodstock are presented in Table 5.

Anadromous and Residual Sockeye Salmon Trapping

Two adult traps 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 June 30 to September 21, 2005. The second trap is located on the upper Salmon River at the Sawtooth FH weir and was operated from June 3 to September 19, 2005.

In 2005, six anadromous sockeye salmon returned to the Sawtooth Valley. Traps on Redfish Lake Creek and the upper Salmon River at the Sawtooth FH intercepted two anadromous sockeye salmon adults each. Additionally, two were seined from below the Sawtooth FH weir. Fish were captured/collected between August 5 and September 14, 2005. The captured/collected adult sockeye salmon (three females and three males) originated from a variety of release strategies. A summary of adult returns is presented in Table 3.

Residual sockeye salmon trapping activities were conducted in 2005. Trapping efforts consisted of setting a series of three trap nets along the area commonly known as Sockeye Beach. Nets were set in the late afternoon prior to snorkeling activities. Nets were checked while conducting snorkel surveys and again at approximately 0300 hrs to ensure that no adult sockeye salmon (program releases) were trapped. Two residual sockeye salmon were captured during the month of October with tissue samples collected and preserved from each fish before being released back to Redfish Lake.

In 2005, four adult Chinook salmon (two unmarked females, one unmarked male, and one adipose fin-clipped male) were captured at the Redfish Lake Creek trap. The three unmarked adults were released upstream of the trap and the adipose fin-clipped male was transferred to the Sawtooth FH.

2005 Production Spawning

Historically, the broodstock program used pedigree information to guide broodstock selection for hatchery spawning. Spawn crosses in 2005 relied on DNA microsatellite information versus pedigree information for development of annual spawn matrices. Microsatellite data were generated from 339 DNA samples (maturing BY00, BY01, BY02, BY03, and 2005 anadromous sockeye salmon) at seven 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 NWFSC genetics staff. In 2005, this was accomplished by distributing and discussing a proposed spawning matrix at the SBSTOC held on September 1, 2005 in La Grande, 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 2005, zero age-5 fish from the BY00 broodstock, 16 age-4 (16 males) fish from the BY01 broodstock, 300 age-3 fish (120 females and 180 males) from the BY02 broodstock, and eight age-2 (eight males) fish from the BY03 broodstock matured at the Eagle FH. In addition, the six (three females, three males) anadromous sockeye salmon that returned to the Sawtooth Valley in 2005 (ANH05) were transferred to the Eagle FH and were incorporated into the spawning design.

One hundred twenty-one females and 195 males were spawned at Eagle FH between October 7 and November 1, 2005 to generate 208,014 green eggs. Three hundred fifty-five unique subfamilies were developed from BY05 spawn crosses at the 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 and three anadromous males that returned to the Sawtooth Valley (ANH05), female sockeye salmon from the BY02 captive broodstock and two anadromous females that returned to the Sawtooth Valley in 2005 (ANH05). 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).

Results for brood year 2005 spawn crosses conducted by NOAA will be reported under separate cover by that agency.

2005 Broodstock Spawning

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 808 eyed-eggs remaining at Eagle FH and 404 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 BY05 broodstock will be determined by utilizing microsatellite DNA markers. Spawn crosses represented in the Eagle FH BY05 broodstock are presented in Table 5.

Milt Cryopreservation

No milt from maturing sockeye salmon was cryopreserved in 2005.

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, sockeye salmon smolts obtained from out-migrant traps, and *O. nerka* obtained from trawl efforts. Seventy-two laboratory cases involving 1,897 individual fish were processed in 2005. 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 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 production and broodstock sockeye groups tested at Eagle FH in 2005. A total of 323 fish from calendar year 2005 broodstock crosses (BY01, BY02, BY03 spawners) were sampled without detection of viral pathogens. Additionally, two production sockeye groups reared at Sawtooth FH on Salmon River water were tested for viral pathogens in 2005. Sixty fish from the BY03 overwinter smolt release group and 60 fish from the BY04 presmolt release group were tested as part of a prerelease fish health sampling protocol. An additional 35 fish from the BY03 overwinter smolt group were tested postmortem 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 2005.

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. Discussions at the Stanley Basin Sockeye

Technical Oversight Committee (SBSTOC) meeting in Hagerman, Idaho (November 18, 2004) resulted in the unanimous decision to cull all resulting progeny from IHNV *positive* parents in an attempt to prevent vertical transmission of the virus. In addition, a decision was made to further investigate vertical transmission of the virus by retaining a small number of eggs from all possible anadromous crosses in a quarantine environment and sampling the resulting progeny for virus after yolk absorption and swim-up.

The Eagle Fish Health Wet Lab provided a full quarantine environment (separate water source, buildings spatially separated, treated effluent, restricted personnel) that posed minimal risk to captive sockeye that were cultured at the Eagle FH. Live eggs from 34 unique spawn pairings were transferred to the Eagle Fish Health Wet Lab and incubated (by individual subfamily) until yolk reserves from the resulting fry were fully depleted (Table 6). Fry were then examined for IHNV in the Eagle Fish Health Lab using sampling procedures as approved by the American Fisheries Society, Fish Health Section *Bluebook*. A total of 1,278 fry were negative for IHNV, indicating that in-hatchery spawning and disinfection protocols were successful in preventing the vertical transmission of virus under the conditions of this test.

Trials with IHNV Vaccines

Two safety tests were performed to examine the safety of injectable vaccines with Deadwood Reservoir stock kokanee *O. nerka* in the wet lab at the Eagle Fish Health Laboratory. These trials were undertaken to provide support for a vaccination of sockeye reared under a full-term smolt program at Sawtooth FH requiring Salmon River water for the last eight months of culture. The Salmon River is suspected as the source of IHNV infections of Chinook salmon at Sawtooth FH.

The first trial involved a b-Propriolactone killed IHNV culture obtained from a commercial source under the approval of the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) after the test vaccine lot was demonstrated nonviable by cell culture. Three groups of 50 kokanee (12.0 g mean) were vaccinated with 0.1 ml intraperitoneally and three similar groups were sham vaccinated with 0.85% saline. These groups were held at 13°C for post-vaccination (pv) observations. Two mortalities occurred on day 18 pv in the vaccinate group that later tested positive for IHNV by cell culture. This observation ended the safety test and demonstrated that injection of kokanee with the experimental vaccine was a more sensitive method of detecting virus that failed to be inactivated than the cell culture-based inactivation tests. The genetic type of the isolates obtained from this safety trial matched that of the vaccine strain, further confirming the origin.

A second trial was initiated with APEX-IHN, a DNA vaccine by AquaHealth Ltd (Charlottetown, PEI, Canada) and licensed for use with Atlantic salmon *Salmo salar* in Canada. A similar protocol was followed as above, except the kokanee were 15 g and a dose of 0.05 ml was delivered by the intramuscular route in the epaxial muscle anterior to the dorsal fin. No loss occurred during the 28-day safety trial. Kokanee were bled at 42 days pv and sera demonstrated significantly elevated titers of anti-IHNV antibodies using an ELISA test by Clear Springs Foods (Buhl, Idaho). This safety test was also authorized by the Idaho State Department of Agriculture and USDA-APHIS. This vaccine is under consideration for license in the United States.

Bacterial Pathogens

Clinical bacterial kidney disease (BKD), caused by *Renibacterium salmoninarum*, did not occur in any production or brood groups of sockeye salmon juveniles reared at Eagle FH or Sawtooth FH in 2005. Bacterial kidney disease antigen was not detected in smolts collected during emigration from Redfish, Pettit, or Alturas lakes in 2005. Additionally, all captive and anadromous adult sockeye salmon spawned in 2005 were free of clinical levels of BKD.

Furunculosis, caused by *Aeromonas salmonicida*, was not detected in anadromous adult sockeye salmon trapped in 2005. 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 examined annually for *M. cerebralis*. All juvenile *O. nerka* sampled in 2005 tested negative for *M. cerebralis* via pepsin/trypsin digest (PTD) and polymerase chain reaction (PCR) testing methods. Prior sampling for *M. cerebralis* in 2003 and 2004 yielded positive parasite detections in Alturas Lake trawl samples. Three of six returning anadromous adults tested positive for *M. cerebralis* via PTD and PCR testing; this is consistent with positive detections in four of the last six 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. 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 five of the six anadromous adult sockeye salmon that returned in 2005. Detection of *P. minibicornis* was made by PCR at the lab of Dr. Simon Jones, Department of Fisheries and Oceans, Canada. As of this writing, additional confirmation and parasite intensity levels from histological samples are pending. Twenty-nine of the thirty-five 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 2005, 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 17, 29, and December 8, 2005. Each shipment contained eyed-eggs for the NOAA Fisheries captive broodstock (404 eyed-eggs) and adult release (496 eyed-eggs) programs in Washington State.

Eagle FH transferred 128,457 BY05 production eggs to the Sawtooth FH on November 30 and December 7, 2005. Approximately 48,786 eyed-eggs were transferred from Burley Creek FH to the Sawtooth FH on November 23 and November 30, 2005. Fish that result from these transfers will be used for fall 2006 presmolt and 2007 smolt release strategies in Sawtooth Valley lakes and rivers.

On November 22, 2005, approximately 58,379 eyed-eggs were transferred from the NOAA Burley Creek FH to ODFW Oxbow FH for a 2007 smolt release (Table 2).

Eyed Egg and Fish Reintroductions

Sockeye salmon eyed-eggs and fish were transferred and/or released to various locations in 2005. 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 carryout all production releases of sockeye salmon made in 2005 (Table 7). All sockeye salmon juveniles and adults released to Sawtooth Valley waters in 2005 were adipose fin-clipped prior to release.

Adult Releases

Maturing adult sockeye salmon were released to Redfish Lake in September 2005 for volitional spawning. On September 7, 173 NOAA Manchester Research Station/Burley Creek FH-reared BY00 (n = 9), BY01 (n = 9), and BY02 (n = 155) adults (mean weight 2.0 kg/fish) were released. Efforts were made to release fish of equal sex ratios. No anadromous adults were released in 2005.

Smolt Releases

Smolts were released to the Salmon River on May 10, 2005. A total of 39,061 BY03 smolts were released above the Sawtooth FH weir and 39,269 BY03 smolts were released below the smolt trap on Redfish Lake Creek. Rearing of these smolts was split between ODFW Oxbow FH (38,608) and Sawtooth FH (39,722). The Oxbow FH group was transferred to Sawtooth FH in April because of drought related water issues at Oxbow FH. Smolts from each facility were split between release sites and differentially marked. All smolts were Ad-clipped and coded-wire tagged, with the Oxbow FH smolts also receiving a left ventral (LV) fin clip. Additionally 2,012 smolts (1,008 from Sawtooth FH and 1,004 from Oxbow FH) were PIT tagged before released to Redfish Lake Creek.

Presmolt Releases

Presmolt releases to Sawtooth Valley lakes were conducted in October 2005 at mid-lake (pelagic) locations with the aid of a release barge on loan to IDFG from NOAA. All presmolts were from BY04 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 5, 2005, Pettit Lake received 15,289 presmolts reared at the Sawtooth FH. Fish from this group were adipose fin-clipped (1,008 PIT tags) and had a mean weight of 5.4 grams per fish. On October 5, 2005, an additional 16,949 (1,007 PIT tagged) adipose fin-clipped presmolts (mean weight 5.7 grams/fish) were released to Alturas Lake. On October 6, 2005, 39,870 (1,005 PIT tagged) adipose fin-clipped presmolts (mean weight 6.1 grams/fish) were released to Redfish Lake.

Eyed-egg Planting

On November 30, 2005, approximately 51,239 eyed-eggs were transferred to eyed-egg boxes and planted in Pettit Lake (36,197 eyed-eggs from NOAA Burley Creek FH and 15,042 eyed-eggs from Eagle FH).

Table 1. Summary of losses and magnitude of mortality for six captive sockeye salmon broodstocks reared at IDFG facilities in 2005.

	Culture Groups					
	BY00	**BY01**	**BY02**	**BY03**	**BY04**	**BY05**
Starting Inventory (January 1, 2005)	4	20	320	401	506[a]	808[a]
Eyed-egg to Fry						
Undetermined[b]	na	na	na	na	11	0
Mechanical Loss						
Handling	0	0	0	0	0	na
Jump-out	0	0	0	0	0	na
Transportation	0	0	0	0	0	na
Noninfectious						
Lymphosarcoma	0	0	0	0	0	na
Nephroblastoma	0	0	0	0	0	na
Other[c]	1	3	13	6	17	na
Infectious						
Bacterial	0	0	0	0	0	na
Viral	0	0	0	0	0	na
Other	0	0	0	0	0	na
Maturation Spawners						
Mature Males	0	15	169	8	0	na
Mature Females	0	0	119	0	0	na
Maturation Non-Spawners						
Mature Males	0	0	11	1	0	na
Mature Females	0	0	1	0	0	na
Relocation						
Transferred In	0	0	0	0	0	na
Transferred Out	0	0	0	0	0	na
Planted/Released	0	0	0	0	0	na
Ending Inventory (December 31, 2005)	3	2	7	386	478	808

[a] December 2005 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 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 2005.

	Culture Groups					
	BY03 Sawtooth	**BY04 Sawtooth**	**BY05 Sawtooth**	**BY03 Oxbow**	**BY04 Oxbow**	**BY05 Oxbow**
Starting Inventory (January 1, 2005)	39,912	152,517	177,243[a]	39,681	49,723	58,379[b]
<u>Eyed-egg to Fry</u>						
Undetermined[c]	na	na	0	na	920	0
<u>Mechanical Loss</u>						
Handling	0	0	na	0	0	na
Jump-out	0	0	na	0	0	na
Transportation	0	0	na	0	0	na
<u>Noninfectious</u>						
Lymphosarcoma	0	0	na	0	0	na
Nephroblastoma	0	0	na	0	0	na
Other[d]	400	40,702	na	863	2,050	na
<u>Infectious</u>						
Bacterial	0	0	na	0	0	na
Viral	0	0	na	0	0	na
Other	0	0	na	0	0	na
<u>Maturation Spawners</u>						
Mature Males	0	0	na	0	0	na
Mature Females	0	0	na	0	0	na
<u>Maturation Non-Spawners</u>						
Mature Males	0	0	na	0	0	na
Mature Females	0	0	na	0	0	na
<u>Relocation</u>						
Transferred In	38,818	0	na	0	0	na
Transferred Out	0	0	na	38,818	0	na
Planted/Released	78,330	72,108	na	0	0	na
Ending Inventory (December 31, 2005)	0	39,707	177,243	0	46,753	58,379

[a] December 2005 developing fry and egg numbers (combined NOAA and Eagle numbers).
[b] December 2005 developing fry and egg numbers (supplied by NOAA).
[c] Typical egg to fry mortality includes nonhatching eggs, abnormal fry, and swim-up loss.
[d] Includes culling associated with cultural abnormalities and all undetermined, noninfectious mortality.

Table 3. Year 2005 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 weir
All Anadromous Adults	6	2	2	2
Anadromous Males	3	1	1	1
Anadromous Females	3	1	1	1
Unmarked Adults	2	2	0	0
AD-clipped Adults[b]	1	0	1	0
AD-clipped/CWT Adults[b]	1	0	0	1
AD/RV-clipped Adults[b]	2	0	1	1
AD/LV-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 2005 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				
ANH05	ANH05	698	552	79.08%	79.08%
ANH05	BY02	4,202	3,448	82.06%	89.55%
BY02	ANH05	2,617	2,366	90.41%	94.95%
BY02	BY01	19,417	16,212	83.49%	95.64%
BY02	BY02	168,865	112,223	66.46%	85.85%
BY02	BY03	12,215	10,406	85.52%	93.05%
	TOTALS	**208,014**	**145,207**	**69.81%**	**88.33%**

Note:* ANH05 refers to anadromous adults returning in 2005.
BY01 refers to captive adults produced in spawn year 2001.
BY02 refers to captive adults produced in spawn year 2002.
BY03 refers to captive adults produced in spawn year 2003.

Table 5. Parent family and number of eyed-eggs retained for brood year 2005 captive broodstock development at Eagle Fish Hatchery.

Family Cross*		No. of Eyed-eggs Retained for Eagle Broodstock
Female	Male	
ANH05	ANH05	2
ANH05	BY02	12
BY02	ANH05	14
BY02	BY02	65
BY02	BY02	677
BY02	BY02	38
	TOTAL	**808**

Note:* ANH05 refers to anadromous adults returning in spawn year 2005.
BY01 refers to captive adults produced in spawn year 2001.
BY02 refers to captive adults produced in spawn year 2002.
BY03 refers to captive adults produced in spawn year 2003.

Table 6. Summary of parental type and IHNV status for BY05 sockeye IHNV vertical transmission studies in Eagle Fish Health Laboratory, 2004-2005.

Female Origin (IHNV status)	Male Origin (IHNV status)	Number Crosses
Anadromous (+)	Anadromous (+)	4
Anadromous (+)	Captive (-)	8
Anadromous (-)	Anadromous (+)	6
Anadromous (-)	Captive (-)	5
Captive (-)	Anadromous (+)	8
Captive (-)	Captive (-)	3
	Total Crosses	34

Table 7. Sockeye salmon releases made to Sawtooth Valley waters in 2005.

Release Location	Strategy (Brood Year)	Release Date	Number Released	Number PIT Tagged	Marks[a]	Release Weight (g)	Rearing Location
Salmon River	smolt						
(above SFH weir)	(2003)	5/10/05	19,867	-	Ad/CWT	20.0	IDFG Sawtooth FH
	(2003)	5/10/05	19,194	-	Ad/CWT/LV		ODFW Oxbow FH
Redfish Lake Cr	smolt						
(below smolt trap)	(2003)	5/10/05	19,855	1,008	Ad/CWT	20.0	IDFG Sawtooth FH
	(2003)	5/10/05	19,414	1,004	Ad/CWT/LV		ODFW Oxbow FH
Alturas Lake	presmolt						
(direct lake)	(2003)	10/05/05	16,949	1,007	Ad	5.7	IDFG Sawtooth FH
Pettit Lake	presmolt						
(direct lake)	(2003)	10/05/05	15,289	1,008	Ad	5.4	IDFG Sawtooth FH
Redfish Lake	presmolt						
(direct lake)	(2003)	10/06/05	39,870	1,006	Ad	6.1	IDFG Sawtooth FH
Redfish Lake	adult						
	(2000)	9/07/05	9	-	Ad	3,700	NOAA Burley Creek FH
	(2000)	9/07/05	9	-	Ad	2,700	NOAA Burley Creek FH
	(2001)	9/07/05	155	-	Ad	1,500	NOAA Burley Creek FH
Pettit Lake	eyed-egg						
	(2005)	11/30/05	36,197	-	-	-	NOAA Burley Creek FH
	(2005)	11/30/05	15,042	-	-	-	IDFG Eagle FH

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

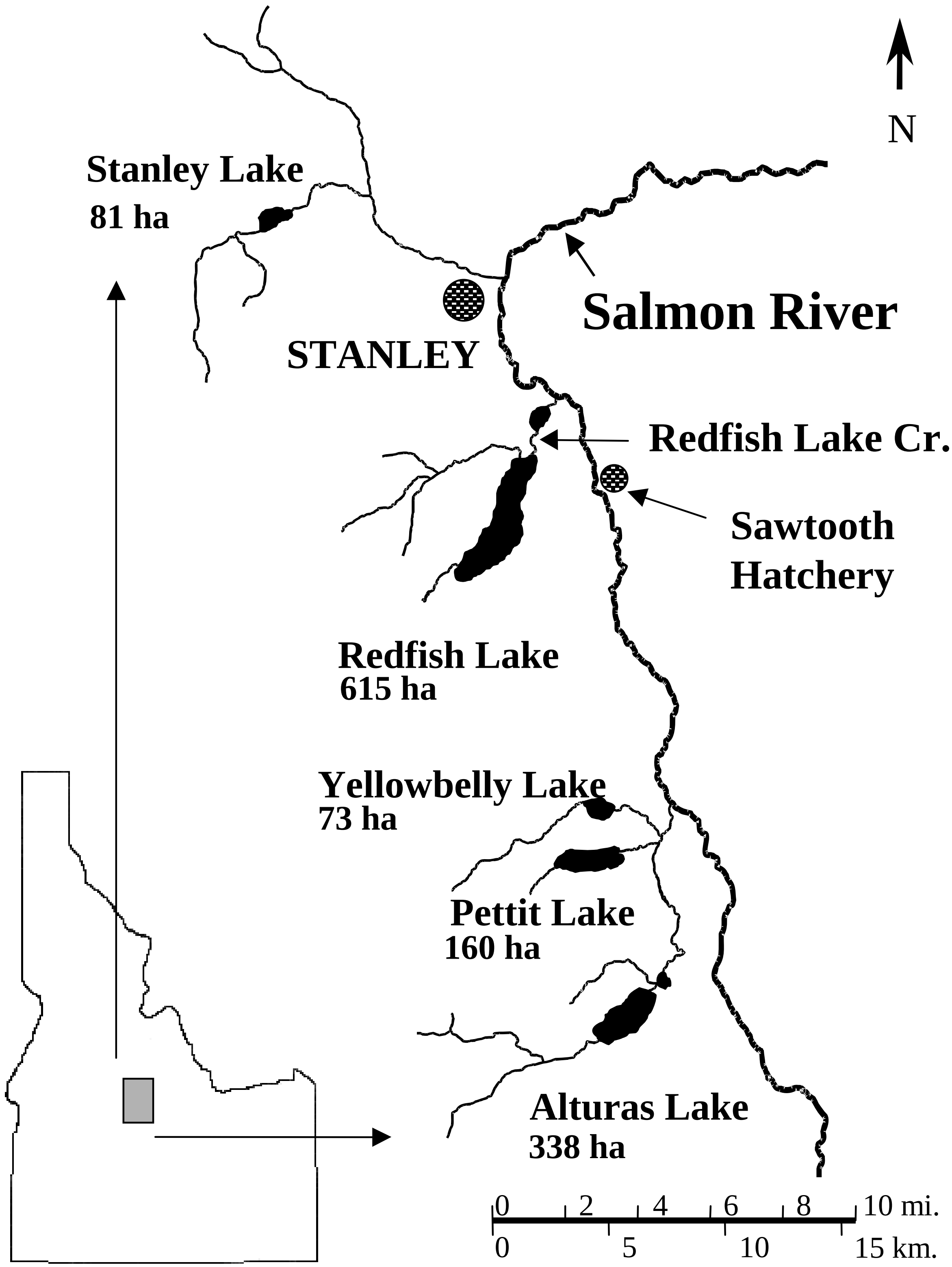

Figure 1. Sawtooth Valley study area.

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LITERATURE CITED

Baker, D. J., J. A. Heindel, J. J. Redding, and P. A. Kline. 2004. Snake River sockeye salmon captive broodstock program, hatchery element, 2003. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Baker, D. J., J. A. Heindel, J. J. Redding, and P. A. Kline. 2005. Snake River sockeye salmon captive broodstock program, hatchery element, 2004. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Bjornn, T. C., D. R. Craddock, and D. R. Corley. 1968. Migration and survival of Redfish Lake, Idaho, sockeye salmon, *Oncorhynchus nerka*. Transactions of the American Fisheries Society 97:360-373.

Bromage, N. R., and R. J. Roberts. 1995. Broodstock Management and Egg and Larval Quality. Blackwell Science Ltd. Cambridge, Massachusetts.

Chapman, D. W., W. S. Platts, D. Park, and M. Hill. 1990. Status of Snake River sockeye salmon. Don Chapman Consultants, Inc. Boise, Idaho.

Cloud, J. G., W. H. Miller, and M. J. Levenduski. 1990. Cryopreservation of sperm as a means to store salmonid germ plasm and to transfer genes from wild fish to hatchery populations. The Progressive Fish Culturist 52:51-53.

Erdahl, D. A. 1994. Inland Salmonid Broodstock Management Handbook. United States Department of the Interior, Fish and Wildlife Service. 712 FW 1.

Flagg, T. A. 1993. Redfish Lake sockeye salmon captive broodstock rearing and research, 1991-1992. Project no. 199204000. Bonneville Power Administration, Annual Report. Portland, Oregon.

Flagg, T. A., and W. C. McAuley. 1994. Redfish Lake sockeye salmon captive broodstock rearing and research, 1991-1993. Project no. 199204000. Bonneville Power Administration, Annual Report. Portland, Oregon.

Flagg, T. A., W. C. McAuley, M. R. Wastel, D. A. Frost, and C. V. W. Mahnken. 1996. Redfish Lake sockeye salmon captive broodstock rearing and research, 1994. Project no. 199204000. Bonneville Power Administration, Annual Report. Portland, Oregon.

Flagg, T. A., W. C. McAuley, D. A. Frost, M. R. Wastel, W. T. Fairgrieve, and C. V. W. Mahnken. 2001. Redfish Lake sockeye salmon captive broodstock rearing and research, 1995-2000. Project no. 199204000. Bonneville Power Administration, Annual Report. Portland, Oregon.

Frost, D. A., W. C. McAuley, D. J. Maynard, and T. A. Flagg. 2002. Redfish Lake sockeye salmon captive broodstock rearing and research, 2001. Project no. 199204000. Bonneville Power Administration, Annual Report. Portland, Oregon.

Hebdon, J. L., M. Elmer, and P. Kline. 2000. Snake River sockeye salmon captive broodstock program, research element, 1999. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Hebdon, J. L., J. Castillo, and P. Kline. 2002. Snake River sockeye salmon captive broodstock program, research element, 2000. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Hebdon, J. L., J. Castillo, C. Willard, and P. Kline. 2003. Snake River sockeye salmon captive broodstock program, research element, 2001. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Heindel, J. A., D. J. Baker, K. A. Johnson, P. A. Kline, and J. J. Redding. 2005. A simple isolation incubator for specialized rearing of salmonid eggs and first-feeding fry. North American Journal of Aquaculture 67:13-17.

Johnson, K. 1993. Research and recovery of Snake River sockeye salmon, 1992. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Johnson, K., and J. Pravecek. 1995. Research and recovery of Snake River sockeye salmon, 1993. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Johnson, K., and J. Pravecek. 1996. Research and recovery of Snake River sockeye salmon, 1994-1995. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P. 1994. Research and recovery of Snake River sockeye salmon, 1993. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P., and J. Younk. 1995. Research and recovery of Snake River sockeye salmon, 1994. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P., and J. A. Lamansky. 1997. Research and recovery of Snake River sockeye salmon, 1995. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P., and J. Heindel. 1999. Snake River sockeye salmon captive broodstock program, hatchery element, 1998. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P., and C. Willard. 2001. Snake River sockeye salmon captive broodstock program, hatchery element, 2000. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P., J. Heindel, and C. Willard. 2003a. Snake River sockeye salmon captive broodstock program, hatchery element, 1997. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Kline, P., C. Willard, and D. Baker. 2003b. Snake River sockeye salmon captive broodstock program, hatchery element, 2001. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Leitritz, E., and R. C. Lewis. 1976. Trout and salmon culture (hatchery methods). California Department of Fish and Game Fish Bulletin 164.

McDaniel, T. R., K. M. Prett, T. R. Meyers, T. D. Ellison, J. E. Follett, and J. A. Burke. 1994. Alaska Sockeye Salmon Culture Manual. Special Fisheries Report No. 6. Alaska Department of Fish and Game, Juneau, Alaska.

Pennell, W., and B. A. Barton. 1996. Principles of Salmonid Aquaculture. Elsevier Science B. V. Amsterdam, The Netherlands.

Piper, G. R., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Gowler, and J. R. Leonard. 1982. Fish Hatchery Management. U.S. Fish and Wildlife Service. Washington, D.C.

Pravecek, J., and K. Johnson. 1997. Research and recovery of Snake River sockeye salmon, 1995. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Pravecek, J., and P. Kline. 1998. Research and recovery of Snake River sockeye salmon, 1996. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Prentice, E. F., T. A. Flagg, and C. S. McCutcheon. 1990. Feasibility of using implanted passive integrated transponder (PIT) tags in salmonids. In N. C. Parker, A. E. Giorgi, R. C. Heidinger, D. B. Jester, Jr., E. D. Prince, and G. A. Winans (editors), Fish-marking techniques, International Symposium and Educational Workshop on Fish-marking Techniques. American Fisheries Society Symposium 7:317-322.

Thoesen, J. C., editor. 1994. Blue Book. Version 1. Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens. Fish Health Section, American Fisheries Society. Bethesda, Maryland.

Wedemeyer, G. A., editor. 2001. Fish Hatchery Management, second edition. American Fisheries Society. Bethesda, Maryland.

Wheeler, P. A., and G. A. Thorgaard. 1991. Cryopreservation of rainbow trout semen in large straws. Aquaculture 93:95-100.

Willard, C., D. Baker, J. Heindel, J. Redding, and P. Kline. 2003a. Snake River sockeye salmon captive broodstock program, hatchery element, 2002. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Willard, C., J. L. Hebdon, J. Castillo, J. Gable, and P. Kline. 2003b. Snake River sockeye salmon captive broodstock program, research element, 2002. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

Willard, C., K. Plaster, J. Castillo, and P. Kline. 2005. Snake River sockeye salmon captive broodstock program, research element, 2003. Project no. 199107200. Bonneville Power Administration, Annual Report. Portland, Oregon.

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