BONNEVILLE POWER ADMINISTRATION

Snake River Sockeye Salmon Captive Broodstock Program

Hatchery Element

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FISHERY RESEARCH

SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

2004 ANNUAL PROGRESS REPORT
January 1, 2004—December 31, 2004

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January 2006

Snake River Sockeye Salmon Captive Broodstock Program Hatchery Element

Project Progress Report

2004 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 under separate cover. 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, 2004 and December 31, 2004 for the hatchery element of the program are presented in this report.

In 2004, twenty-seven 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 four adults, respectively. Additionally, one adult sockeye salmon was collected at the East Fork Salmon River weir, 18 were seined from below the Sawtooth Fish Hatchery weir, one adult sockeye salmon was observed below the Sawtooth Fish Hatchery weir but not captured, and two adult sockeye salmon were observed in Little Redfish Lake but not captured. Fish were captured/collected between July 24 and September 14, 2004. The captured/collected adult sockeye salmon (12 females and 12 males) originated from a variety of release strategies and were transferred to Eagle Fish Hatchery on September 14, 2004 and later incorporated into hatchery spawn matrices.

Nine anadromous females, 102 captive females from brood year 2001, and one captive female from brood year 2000 broodstock groups were spawned at the Eagle Hatchery in 2004. Spawn pairings produced approximately 140,823 eyed-eggs with egg survival to eyed stage of development averaging 72.8%.

Eyed-eggs (49,134), presmolts (130,716), smolts (96), and adults (241) were planted or released into Sawtooth Valley waters in 2004. Reintroduction strategies involved releases to Redfish Lake, Alturas Lake, and Pettit Lake.

During this reporting period, five broodstocks and five 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. Two of the five broodstocks were incorporated into the 2004 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 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; 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 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, 2004.

FACILITIES

Eagle Fish Hatchery

Eagle Fish Hatchery 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 shut down and capped. 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 Fish Hatchery 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 Fish Hatchery remains flexible to accommodate culture activities ranging from spawning and incubation through adult rearing. Egg incubation capacity at Eagle Fish Hatchery 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 1.0 g weight. Two- and three-meter tanks

are used to rear juveniles to approximately 10.0 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 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 Fish Hatchery 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 Fish Hatchery from Eagle Fish Hatchery or NOAA, are incubated in vertical trays. Fry are ponded to 0.7 m fiberglass tanks. Juvenile sockeye (>1 g) are held in vats or in a series of 2.0 m fiberglass tanks installed in 1997. Typically, juvenile sockeye salmon reared at Sawtooth Fish Hatchery are released as presmolts or smolts. Prespawn anadromous adults captured at Redfish Lake Creek or Sawtooth Fish Hatchery weirs are held in vats until release for natural spawning or transfer to the Eagle Fish Hatchery for 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 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 Hatchery 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 Hatchery are 3.30 cubic meters per second (116.51 cfs). Calendar year 2004 represents the first year that Oxbow Fish Hatchery personnel and facilities have been utilized for sockeye smolt rearing with the captive broodstock program.

Eyed-eggs, received at Oxbow Fish Hatchery from Eagle Fish Hatchery or NOAA, are incubated in vertical-stack trays. 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 Fish Hatchery 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) 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 Fish Hatchery weir.

Spawning Activities

Spawning has occurred at Eagle Fish Hatchery 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). Before 1994, adult sockeye returns were spawned at the Sawtooth Fish Hatchery (Johnson 1993). Spawning activities in 2004 followed accepted, standard practices as described by Erdahl (1994) and McDaniel et al. (1994). Prior to spawning adults at Eagle, 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 2004, breeding plans relied on DNA microsatellite information versus pedigree information. Microsatellite data were generated from 1,277 DNA samples (BY00, BY01, BY02, and ANH04 sockeye salmon spawners) at eight 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.). Genetic samples were also collected from spawned carcasses to facilitate mitochondrial DNA and/or nuclear DNA evaluations for sockeye salmon broodstocks held in the program. 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.

Juvenile Fish Quality Assessment

In 1999, the SBSTOC recommended applying assessments of fish quality to juvenile sockeye salmon produced in this program to provide additional perspective on factors that may affect fish survival from outplanting through out-migration. General parameters considered for investigation included: 1) proximate body composition analysis, 2) organosomatic index, and 3) fish health.

To determine proximate body composition, sampled fish were dried, ground, and analyzed using standardized methods for proximate composition from the Association of Official Analytical Chemists (AOAC). Sample protein content was analyzed using a LECO FP 28 nitrogen analyzer. Crude lipid content in samples was analyzed using a LECO TFE 2000 supercritical CO^2 extractor (both are from LECO Corporation, St. Joseph, Missouri).

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 250 gal (946 L), 1000 gal (3,785 L), and 2,500 gal (9,463 L) capacities. Transport density guidelines were in place to not exceed 0.75 lb/gal (89 g/L).

Eyed-Egg and Fish Supplementation

In 2004, 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 250 gal (946 L) 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 2004, sockeye salmon smolts were released in the outlet of Redfish Lake Creek downstream of the juvenile out-migrant weir and in the Salmon River downstream of the Sawtooth Fish Hatchery 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 five production groups were in culture at IDFG and ODFW facilities representing brood years 2000, 2001, 2002, 2003, and 2004. 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 Fish Hatchery was five fish. One female matured in 2004 and four fish remained immature. The one mature female was crossed with three different BY01 males. At the end of this reporting period, four BY00 broodstock remained in culture at the Eagle Fish Hatchery (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 Fish Hatchery was 236 fish. One hundred five females and 100 males matured as age-3 fish in 2004 (102 females and 88 males were used in spawn crosses). At the end of this reporting period, 20 BY01 broodstock remained in culture (Table 1).

BY02 Production

Two hundred forty-seven spawn crosses representing 89 females and 115 males were developed from brood year 2002 production spawn crosses at the Eagle Fish Hatchery. The BY02 production group was developed using male sockeye salmon from the BY98, BY99, and

BY00 broodstocks and female sockeye salmon from the BY99 and BY00 broodstocks. Specific crosses performed to develop production groups included: 1) BY99 females x BY98 males, 2) BY99 females x BY99 males, 3) BY99 females x BY00 males, and 4) BY00 females x BY99 males. Initial inventory for BY02 production fish at Sawtooth Fish Hatchery was 199 presmolts. On May 11, 2004, ninety-six smolts were release to the Salmon River below the Sawtooth Fish Hatchery weir (Table 6). At the end of this reporting period, zero BY02 production fish remained in culture at the Sawtooth Fish Hatchery (Table 2).

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 Fish Hatchery was 339 fish. Zero BY02 fish matured at age-2. At the end of this reporting period, 320 fish were in culture at Eagle Fish Hatchery (Table 1).

BY03 Production

Five hundred ninety-five spawn crosses representing 209 females and 148 males were developed from brood year 2003 production spawn crosses at the Eagle Fish Hatchery. The BY03 production group was developed using male sockeye salmon from the BY99, BY00, and BY01 broodstocks and female sockeye salmon from the ANHBY03, BY00, and BY01 broodstocks. Specific crosses performed to develop production groups included: 1) ANHBY03 females x BY99 males, 2) ANHBY03 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 Fish Hatchery was 197,965 fry. Presmolts reared at the Sawtooth Fish Hatchery were released to Sawtooth Valley lakes in October. Pettit Lake received 29,700 presmolts (10.5 grams per fish mean) on October 6, Alturas Lake received 21,129 presmolts (10.3 g/f mean) on October 6, and Redfish Lake received 79,887 presmolts (10.6 g/f mean) on October 5, 2004 (Table 5). Sawtooth Fish Hatchery transferred 40,078 presmolts to outside raceways on October 15, 2004 for a smolt release in May 2005. Ending inventory at Sawtooth Fish Hatchery was 39,912 fish (Table 2).

Initial inventory at Eagle Fish Hatchery was 42,235 fry. Eagle Fish Hatchery transferred 39,871 presmolts (7.49 g/f mean) to ODFW's Oxbow Fish Hatchery on October 17, 2004 for a smolt release in May 2005. Ending inventory at Eagle Fish Hatchery was zero BY02 production fish. Starting inventory at Oxbow Fish Hatchery was zero BY03 production sockeye salmon, and the ending inventory was 39,681 BY03 production sockeye salmon (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 will be utilized to determine genotypes for the BY03 broodstock to establish a spawning matrix based on kinship coefficients. Starting inventory at Eagle Fish Hatchery was 418 BY03 fry, and the ending inventory was 400 fish (Table 1).

BY04 Production

Three hundred and thirty-seven spawn crosses representing 112 females and 102 males were developed from brood year 2004 spawn crosses at the Eagle Fish Hatchery. 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 140,823 eyed-eggs were produced from BY04 spawn crosses at Eagle Fish Hatchery. A total of 14,814 eyed eggs were culled as a result of infectious hematopoietic necrosis virus (IHNV) detection, and an additional 3,369 IHNV-positive eyed eggs were used for IHNV vertical transmission studies at the Eagle Fish Health Lab (see Fish Health Investigations section). Eagle Fish Hatchery transferred 113,248 BY04 production eggs to the Sawtooth Fish Hatchery on November 30 and December 7, 2004. Approximately 41,721 eyed-eggs were transferred from the NOAA Burley Creek Fish Hatchery to the Sawtooth Fish Hatchery on November 23 and November 30, 2004. Initial inventory at Sawtooth Fish Hatchery was 154,969 eyed-eggs. Ending inventory at Sawtooth Fish Hatchery was 152,517 developing fry (Table 2).

Eyed-eggs were released to Pettit Lake in November and December 2004. NOAA Fisheries transferred 18,146 eyed-eggs for release to Pettit Lake on November 10, 2004. An additional 16,065 eyed-eggs from NOAA Fisheries and 1,146 eyed-eggs from Eagle Fish Hatchery were released on November 24, 2004. A final transfer of 6,038 eyed-eggs from NOAA Fisheries and 7,739 eyed-eggs from Eagle Fish Hatchery were released to Pettit Lake on December 1, 2004. Pettit Lake received a total of 49,134 BY04 eyed-eggs from NOAA Fisheries (40,249 eyed-eggs) and Eagle Fish Hatchery (8,885 eyed-eggs) during 2004.

A total of 50,002 BY04 eyed-eggs from production spawn crosses at the NOAA Burley Creek facility were transferred to the ODFW Oxbow Fish Hatchery in late 2004. Egg incubation and juvenile rearing for this production group will continue at Oxbow Fish Hatchery until smolt transfer to Idaho in 2006. Ending inventory for this production group at Oxbow Fish Hatchery was 49,723 eyed-eggs/developing fry (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 Fish Hatchery was 507 eyed-eggs. Ending inventory of BY04 broodstock at Eagle Fish Hatchery was 506 fry (Table 1).

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 July 13 to September 13 in 2004. The second trap is located on the upper Salmon River at the Sawtooth Fish Hatchery weir and was operated from May 25 to September 14 in 2004.

In 2004, twenty-seven 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 four adults, respectively. Additionally, one adult sockeye salmon was collected at the East Fork Salmon River weir, 18 were seined from below the Sawtooth Fish Hatchery weir, one adult sockeye salmon was observed below the Sawtooth Fish Hatchery weir but not captured, and two adult sockeye salmon were observed in Little Redfish Lake but not captured. Fish were captured/collected between July 24 and September 14, 2004. The captured/collected adult sockeye salmon (12 females and 12 males) originated from a variety of release strategies. A summary of adult returns is presented in Table 3.

In 2004, three adult Chinook salmon (one unmarked jack, one unmarked four-year-old male, and one four-year-old, adipose fin-clipped, coded wire tagged male) were captured at the Redfish Lake Creek trap and released above the weir.

2004 Production Spawning

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 2004, this was accomplished by distributing and discussing a proposed spawning matrix at the SBSTOC held on September 8, 2004 in Stanley, Idaho. 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 2004, one age-4 fish (female) from the BY00 broodstock, 205 age-3 fish (105 females and 100 males) from the BY01 broodstock, and zero age-2 fish from the BY02 broodstock matured at the Eagle Fish Hatchery. In addition, the 24 (12 females, 12 males) anadromous sockeye salmon that returned to the Sawtooth Valley in 2004 (ANH04) were transferred to the Eagle Fish Hatchery and were incorporated into the spawning design.

One hundred-twelve females and 102 males were spawned at Eagle Fish Hatchery between October 4 and November 12, 2004 to generate 193,349 green eggs. Three hundred

thirty-seven unique subfamilies were developed from brood year 2004 spawn crosses at the Eagle Fish Hatchery. To simplify tracking, families were grouped under one production group title: BY04. The BY04 production group was developed using male sockeye salmon from the BY01 broodstock and cryopreserved milt from males spawned in 1996 (n = 3: RES92, ANBY93-B6, ANBY93-A4) and 1997 (n = 1: A+NBY94), female sockeye salmon from the BY00 and BY01 broodstocks, and five anadromous females that returned to the Sawtooth Valley in 2004 (ANH04) and were retained for spawning. Specific crosses performed to develop this production group included: 1) BY01 females x cryopreserved milt, 2) ANH04 females x BY01 males, 3) BY00 female x BY01 males, 4) BY01 females x ANH04 males, and 5) BY01 females x BY01 males. Spawn crosses produced approximately 193,349 green and 140,823 eyed-eggs. Brood year 2000 female fecundity was 677 green eggs per female and BY01 female fecundity averaged 1,670 green eggs per female. Egg survival to the eyed stage of development for the BY04 production group averaged 72.83% (median 79.70%) (Table 4). In 2004, seventeen of the 24 anadromous adults transferred to Eagle Hatchery and incorporated into the spawning matrix were found to be positive for IHNV. All subfamilies created using IHNV positive females and/or males were culled and removed from the BY04 production group.

Results for brood year 2004 spawn crosses conducted by NOAA will be reported under separate cover by that agency.

2004 Broodstock Spawning

Approximately 507 eyed-eggs representing 295 subfamilies (98 unique females and 89 unique males) were selected from specific spawn crosses described above and incubated for future broodstock needs. A duplicate component was not sent to NOAA Fisheries because IHNV was found present in the ANH04 sockeye salmon.

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 BY04 broodstock will be determined by utilizing microsatellite DNA markers. Spawn crosses represented in the Eagle Fish Hatchery BY04 broodstock are presented in Table 5.

Milt Cryopreservation

No milt from maturing sockeye salmon was cryopreserved in 2004.

Fish Health Investigations

The IDFG Eagle Fish Health Laboratory processed samples for diagnostic and inspection purposes from broodstock and production groups of sockeye salmon including: 1) anadromous adult sockeye salmon that were retained for hatchery spawning; 2) sockeye salmon smolts obtained from out-migrant traps; and 3) *O. nerka* obtained from Sawtooth Valley trawl efforts. Sixty-five laboratory cases involving 513 individual fish were processed in 2004. 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 were not detected in any of the production and broodstock sockeye groups tested at Eagle in 2004, which was consistent with results from all previous sampling years. Sixty fish from the BY03 presmolt group and 197 fish from calendar year 2004 broodstock crosses (BY00, BY01 spawners) were sampled without detection of viral pathogens. Additionally, two production sockeye groups reared at Sawtooth Fish Hatchery on Salmon River water were tested for viral pathogens in 2004. Sixty fish from the BY02 overwinter smolt group were tested as part of a pre-release fish health sampling protocol and six mortalities from the BY03 overwinter smolt group were tested as part of a routine fish health necropsy procedure. All virology samples from Sawtooth Fish Hatchery production sockeye groups resulted in negative detection of viral pathogens for 2004.

While the detection of viral pathogens in production and broodstock groups sampled in 2004 followed the historical trend of negative viral detections in Program fish, calendar year 2004 marked the first detection of viral pathogens in the Redfish Lake stock of sockeye salmon when IHNV was detected in 17 of the 24 anadromous adults that were captured in 2004. The 24 anadromous adults (12 females, 12 males) captured in 2004 were transferred from the Sawtooth Fish Hatchery to Eagle Fish Hatchery on September 14 to await final spawn. Viral samples obtained from all adults post-spawn resulted in primary detection (serum neutralization) of IHNV in 13 adults (2 females, 11 males) and blind-pass detection in four additional adults (3 females, 1 male). Additional viral samples from 197 captive adults used in the 2004 spawn design were negative for the detection of IHNV, indicating that this pathogen was successfully quarantined to the anadromous adults held at the Eagle Fish Hatchery.

The detection of IHNV presents a new set of management implications for the future of Redfish Lake sockeye salmon culture and recovery, yet it is important to note that measures to protect against the spread of IHNV from anadromous adults to cultured populations are in place and have been established since the inception of the captive broodstock program in 1991. In 2004, all anadromous adults that were transferred to the Eagle Fish Hatchery were cultured in rearing vessels that were physically segregated (spatially, as well as water supply/effluent) from program broodstock and production groups. At spawning, gametes (eggs, milt) from all anadromous adults were taken in an isolated area of the spawning compound. Specific spawning gear was restricted to anadromous adults only (buckets, totes, waders, nets, etc.). Gametes were collected in individual plastic sample bags and then recombined in an area isolated from the egg-take area. After fertilization, eggs from all resulting anadromous crosses (anadromous female and/or anadromous male subfamilies) were transferred to individual isolation incubators and allowed to water-harden in an Iodophor solution (100 mg/L) for 20 minutes prior to final incubation. All isolation incubators from anadromous crosses were then placed in culture vessels segregated from regular production/broodstock crosses and allowed to incubate while awaiting final fish health sampling results.

Discussions at the 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 that posed no risk to captive sockeye that were in culture at the Eagle Fish Hatchery (separate water source, buildings spatially separated, treated effluent, restricted personnel). A total of 14,814 eggs from IHNV positive crosses were culled as a result of the SBSTOC management decision and 3,369 IHNV positive eggs were retained in the Eagle Fish Health Lab for IHNV trials in 2005 (results pending).

In an attempt to further protect the existing captive broodstock and production programs at both IDFG and NOAA facilities, the SBSTOC recommended that progeny produced from IHNV *negative* anadromous females (all males were IHNV positive) be excluded from the broodstock collection process and production rearing components of both programs. In 2004, this was accomplished by including the remaining eyed-eggs from IHNV negative anadromous females into the Pettit Lake egg-box program. In addition, the decision was made to source brood year 2004 broodstock at NOAA facilities from NOAA-produced pairings made in 2004. Historically, broodstocks for both facilities had been sourced from spawn crosses made at the Eagle Fish Hatchery.

Clinical bacterial kidney disease (BKD), caused by *Renibacterium salmoninarum*, did not occur in any production groups of sockeye salmon juveniles reared at Eagle or Sawtooth fish hatcheries in 2004. Bacterial kidney disease antigen was not detected in smolts collected during emigration from Redfish, Pettit, or Alturas lakes in 2004. Additionally, captive adult sockeye salmon spawned in 2004 were free of clinical levels of BKD. Enzyme-linked immunosorbent assay (ELISA) optical density (OD) values from one anadromous adult (female) indicated clinical levels of BKD and two additional anadromous females had ELISA OD values that minimally exceeded background levels of BKD. Two of the three anadromous females with elevated ELISA OD values died prior to spawning and eggs from the third female were culled because of IHNV detection.

Furunculosis, caused by *Aeromonas salmonicida*, was not detected in anadromous adult sockeye salmon trapped in 2004. 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.

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*. Alturas Lake trawl samples were found to be positive for *M. cerebralis* (1 of 3, 5-fish pools) in 2004 using both pepsin/trypsin digest (PTD) and polymerase chain reaction (PCR) testing methods. Sampling for *M. cerebralis* in 2003 yielded similar results, with parasite detection limited exclusively to Alturas Lake trawl samples. The Eagle Fish Health Laboratory continues to investigate infectivity of *M. cerebralis* in the river water supply of the Sawtooth Fish Hatchery 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 20 of the 24 anadromous adult sockeye salmon that returned in 2004. 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. The detection of *P. minibicornis* in the Redfish Lake stock of anadromous sockeye salmon is 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 2004, 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.

On November 30 and December 7, 2004, approximately 113,248 eyed-eggs from production crosses were transferred from the Eagle Fish Hatchery to the Sawtooth Fish Hatchery. On November 23 and 30, 2004, approximately 41,721 eyed-eggs were transferred from the NOAA Burley Creek Fish Hatchery to the Sawtooth Fish Hatchery. Fish that result from these transfers will be used for fall 2005 presmolt and 2006 smolt release strategies in Sawtooth Valley lakes. On November 16, 2004, approximately 50,002 eyed-eggs were transferred from the NOAA Burley Creek Fish Hatchery to ODFW Oxbow Fish Hatchery for a 2006 smolt release (Table 2).

Eyed Egg and Fish Reintroductions

Pursuant to Special Condition B9 Requirement D3 of Permit No. 1120, IDFG received authorization from NOAA to carry out the following production releases of sockeye salmon in 2004 (Table 6). All sockeye salmon released were adipose fin clipped.

Adult Releases

Maturing adult sockeye salmon were released to Redfish Lake in September 2004 for volitional spawning. On September 7 and 10, 214 and 27 (respectively) NOAA Manchester Research Station/Burley Creek Fish Hatchery-reared BY00 and BY01 adults (mean weight 2,000.0 grams) were released. Efforts were made to release fish of equal sex ratios. No anadromous adults were released in 2004.

Smolt Releases

Smolts were released to the Salmon River on May 13, 2004. Ninety-six BY02 smolts were released below the Sawtooth Fish Hatchery weir. This was a sentinel group of 200 presmolts that were transferred to river water in October of 2003 and reared overwinter to smolt stage before release. All 96 fish released were ad-clipped and PIT tagged before release.

Presmolt Releases

Presmolt releases to Sawtooth Valley lakes were conducted in October 2004 at mid-lake (pelagic) locations with the aid of a release barge on loan to IDFG from NOAA. All presmolts were from brood year 2003 and were reared at IDFG's Sawtooth Fish Hatchery. Presmolts from Sawtooth Fish Hatchery were adipose fin-clipped prior to release, with a representative number of fish PIT tagged for evaluation purposes. On October 6, 2004, Pettit Lake received 29,700 presmolts reared at the Sawtooth Fish Hatchery. Fish from this group were adipose fin-clipped (1,013 PIT tags) and had a mean weight of 10.5 grams per fish. On October 6, 2004, an additional 21,129 (1,008 PIT tagged) adipose fin-clipped presmolts (mean weight 10.3 grams/fish) were released to Alturas Lake. On October 5, 2004, 79,887 presmolts (mean weight 10.6 grams/fish) were released to Redfish Lake (1,003 PIT tagged).

Eyed-egg Planting

On November 10, November 23, and November 30, 2004, approximately 49,134 eyed-eggs were transferred to eyed-egg boxes and planted in Pettit Lake (40,249 eyed-eggs from NOAA Burley Creek Fish Hatchery and 8,885 eyed-eggs from Eagle Fish Hatchery).

Table 1. Summary of losses and magnitude of mortality for five captive sockeye salmon broodstocks reared at IDFG facilities in 2004.

	Culture Groups				
	BY00	**BY01**	**BY02**	**BY03**	**BY04**
Starting Inventory (January 1, 2004)	5	236[a]	339	418	507[b]
Eyed-egg to Fry					
Undetermined[c]	na	na	na	11	1
Mechanical Loss					
Handling	0	0	0	0	na
Jump-out	0	0	0	0	na
Transportation	0	0	0	0	na
Noninfectious					
Lymphosarcoma	0	0	0	0	na
Nephroblastoma	0	0	0	0	na
Other[d]	0	11	19	7	na
Infectious					
Bacterial	0	0	0	0	na
Viral	0	0	0	0	na
Other	0	0	0	0	na
Maturation Spawners					
Mature Males	0	88	0	0	na
Mature Females	1	102	0	0	na
Maturation Non-Spawners					
Mature Males	0	12	0	0	na
Mature Females	0	3	0	0	na
Relocation					
Transferred In	0	0	0	0	na
Transferred Out	0	0	0	0	na
Planted/Released	0	0	0	0	na
Ending Inventory (December 31, 2004)	4	20	320	400	506

[a] Starting inventory reflects an inventory adjustment made post-completion of the 2003 BPA Annual Report.
[b] December 2004 developing fry and egg numbers.
[c] Typical egg to fry mortality includes non-hatching eggs, abnormal fry, and swim-up loss.
[d] Includes culling associated with cultural abnormalities and all undetermined, noninfectious mortality.

Table 2. Summary of losses and magnitude of mortality for five captive sockeye salmon production groups reared at IDFG facilities in 2004.

	Culture Groups				
	BY02 Sawtooth	**BY03 Sawtooth**	**BY03 Eagle/Oxbow**	**BY04 Sawtooth**	**BY04 Oxbow**
Starting Inventory (January 1, 2004)	199	197,965	42,235	154,969[a]	50,002[b]
Eyed-egg to Fry					
Undetermined[c]	0	10,885	2,235	2,452	279
Mechanical Loss					
Handling	0	0	0	0	0
Jump-out	0	0	0	0	0
Transportation	0	0	50	0	0
Noninfectious					
Lymphosarcoma	0	0	0	0	0
Nephroblastoma	0	0	0	0	0
Other[d]	103	16,452	269	0	0
Infectious					
Bacterial	0	0	0	0	0
Viral	0	0	0	0	0
Other	0	0	0	0	0
Maturation Spawners					
Mature Males	0	0	0	0	0
Mature Females	0	0	0	0	0
Maturation Non-Spawners					
Mature Males	0	0	0	0	0
Mature Females	0	0	0	0	0
Relocation					
Transferred In	0	0	0	0	0
Transferred Out	0	0	0	0	0
Planted/Released	96	130,716	0	0	0
Ending Inventory (December 31, 2004)	0	39,912	39,681[e]	152,517	49,723

[a] December 2004 developing fry and egg numbers (combined NOAA and Eagle numbers).
[b] December 2004 developing fry and egg numbers (supplied by NOAA).
[c] Typical egg to fry mortality includes non-hatching eggs, abnormal fry, and swim-up loss.
[d] Includes culling associated with cultural abnormalities and all undetermined, noninfectious mortality.
[e] Transferred from Eagle Fish Hatchery to Oxbow Fish Hatchery (ODFW) for smolt production rearing (initial transfer inventory of 39,871).

Table 3. Year 2004 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	24	1	5[b]	18
Anadromous Males	12	1	2[b]	9
Anadromous Females	12	0	3	9
Unmarked Adults	4	0	2	2
AD-clipped Adults[c]	8	0	1	7
AD-clipped/CWT Adults[c]	9	1	1[b]	7
AD/RV-clipped Adults[c]	2	0	1	1
AD/LV-clipped Adults[c]	1	0	0	1

[a] SFH = Sawtooth Fish Hatchery.
[b] One adult sockeye salmon returned to the East Fork Salmon River Trap operated by the Sawtooth Fish Hatchery.
[c] AD = adipose fin clip; LV = left ventral fin-clip; RV = right-ventral fin-clip; and CWT = coded-wire tag.

Table 4. Summary information for 2004 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				
ANH04	ANH04	8,280	7,722	93.26%	97.18%
ANH04	BY01	12,614	11,054	87.63%	97.02%
BY00	BY01	677	474	70.01%	70.80%
BY01	ANH04	4,622	4,124	89.23%	90.57%
BY01	BY01	166,760	117,283	70.33%	77.81%
BY01	CRYO	396	166	41.92%	49.03%
	TOTALS	**193,349**	**140,823**	**72.83%**	**79.70%**

Note: ANH04 refers to anadromous adults returning in 2004.
BY00 refers to captive adults produced in spawn year 2000.
BY01 refers to captive adults produced in spawn year 2001.
CRYO refers to cryopreserved representing BY96 milt from ANBY93-A6, ANBY93-A4 and BY97 milt from A+NBY94.

Table 5. Parent family and number of eyed-eggs retained for brood year 2004 captive broodstock development at Eagle Fish Hatchery.

Family Cross*		No. of Eyed-eggs Retained for Eagle Broodstock
Female	**Male**	
ANH04	ANH04	0
ANH04	BY01	0
BY00	BY01	6
BY01	ANH04	0
BY01	BY01	495
BY01	CRYO	6
	TOTAL	507

Note:* ANH04 refers to anadromous adults returning in spawn year 2004.
BY00 refers to captive adults produced in spawn year 2000.
BY01 refers to captive adults produced in spawn year 2001.
CRYO refers to cryopreserved milt used in 2004 representing BY96 (2) and BY97 (1) males.

Table 6. Sockeye salmon releases made to Sawtooth Valley waters in 2004.

Release Location	Strategy (Brood Year)	Release Date	Number Released	Number PIT Tagged	Marks	Release Weight (g)	Rearing Location
Salmon River (below SFH weir)	smolt (2002)	5/13/04	96	96	Ad [a]	20.0	IDFG Sawtooth Fish Hatchery
Alturas Lake (direct lake)	presmolt (2003)	10/06/04	21,129	1,008	Ad	10.3	IDFG Sawtooth Fish Hatchery
Pettit Lake (direct lake)	presmolt (2003)	10/06/04	29,700	1,013	Ad	10.5	IDFG Sawtooth Fish Hatchery
Redfish Lake (direct lake)	presmolt (2003)	10/05/04	79,887	1,003	Ad	10.6	IDFG Sawtooth Fish Hatchery
Redfish Lake	adult						
	(2000)	9/07/04	44	-	None	2,000	NOAA Manchester Marine Lab
	(2000)	9/07/04	12	12	None	2,000	NOAA Burley Creek Hatchery
	(2001)	9/07/04	139	-	None	2,000	NOAA Manchester Marine Lab
	(2001)	9/07/04	19	19	None	2,000	NOAA Burley Creek Hatchery
	(2001)	9/10/04	27	-	None	2,000	NOAA Manchester Marine Lab
Pettit Lake	eyed-egg						
	(2004)	11/10/04	18,146	-	-	-	NOAA Burley Creek Hatchery
	(2004)	11/23/04	16,065	-	-	-	NOAA Burley Creek Hatchery
	(2004)	11/23/04	1,146	-	-	-	IDFG Eagle Fish Hatchery
	(2004)	11/30/04	6,038	-	-	-	NOAA Burley Creek Hatchery
	(2004)	11/30/04	7,739	-	-	-	IDFG Eagle Fish Hatchery

[a] Ad = adipose fin clip.

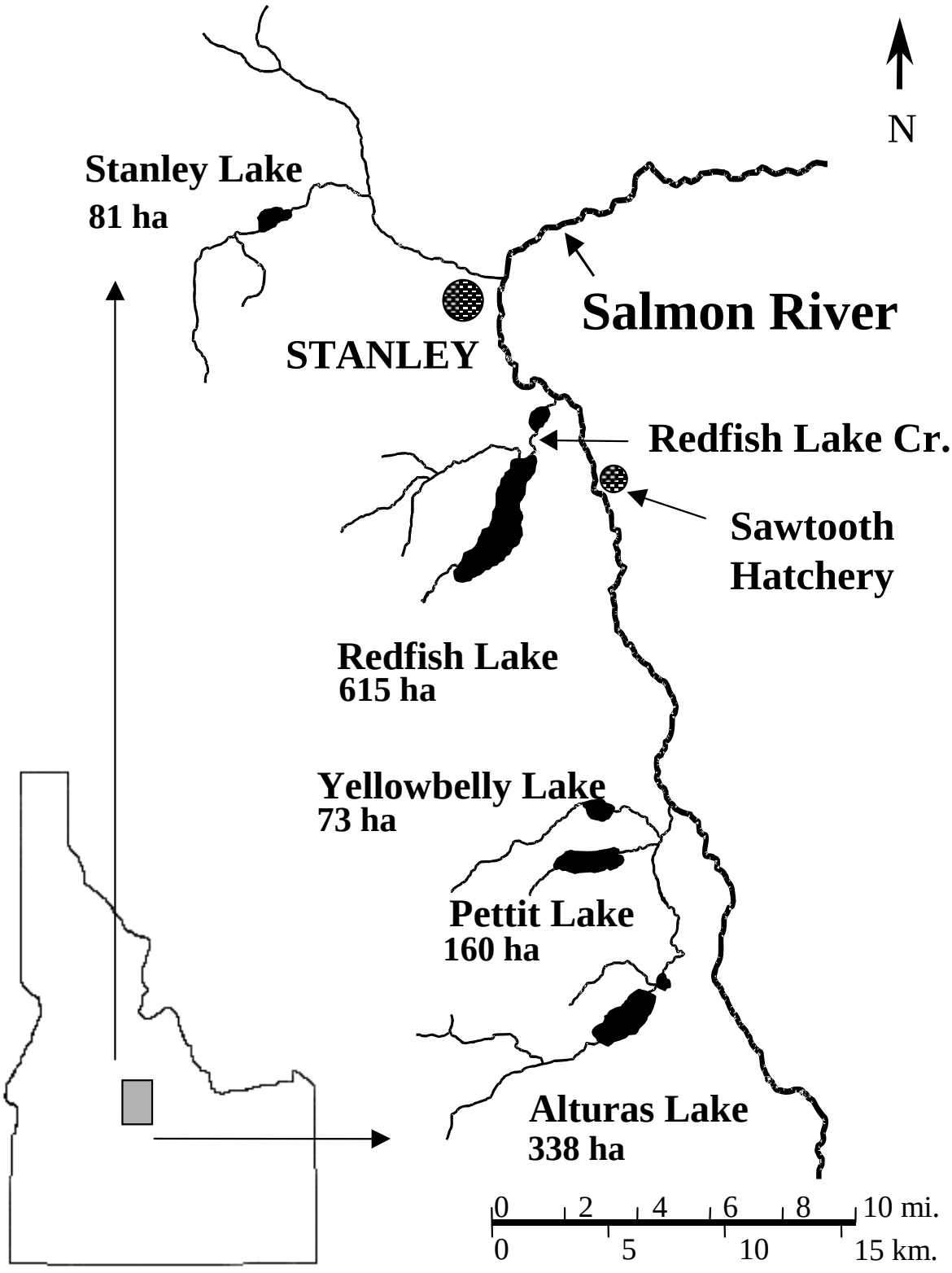

Figure 1. Sawtooth Valley study area.

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