FISHERY RESEARCH

SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

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SNAKE RIVER SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM HATCHERY ELEMENT

Project Progress Report

1997 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 Marine Fisheries Service at two locations adjacent to Puget Sound in Washington State. Activities conducted by the Shoshone-Bannock Tribes and the National Marine Fisheries Service 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 under separate cover. Captive broodstock program activities conducted between January 1, 1997 and December 31, 1997 are presented in this report.

One hundred twenty-six female sockeye salmon from one captive broodstock group were spawned at the Eagle Fish Hatchery in 1997. Successful spawn pairings produced approximately 148,781 eyed-eggs with a cumulative mean survival to eyed-egg rate of 57.3%.

Approximately 361,600 sockeye salmon were released to Sawtooth basin waters in 1997. Reintroduction strategies included eyed-eggs (brood year 1997), presmolts (brood year 1996), and prespawn adults for volitional spawning (brood year 1994). Release locations included Redfish Lake, Alturas Lake, and Pettit Lake.

During this reporting period, four broodstocks and two unique production groups were in culture at the Eagle Fish Hatchery. Two of the four broodstocks were incorporated into the 1997 spawning design, and one broodstock was terminated following the completion of spawning.

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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 basin) remain as potential sources of production (Figure 1). Historically, five Sawtooth basin 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 Marine Fisheries Service (NMFS) 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, NMFS declared Snake River sockeye salmon endangered.

The Idaho Department of Fish and Game (IDFG), as part of their five-year management plan, is charged with the responsibility of re-establishing sockeye salmon runs to historic areas, with emphasis placed on efforts to utilize Sawtooth basin sockeye salmon and kokanee resources (IDFG 1996). In 1991, SBT, along with 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 and 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. NMFS ESA Permit Nos. 795, 823, and 844 authorize IDFG to conduct scientific research on listed Snake River salmon.

Initial steps by IDFG to recover the species include the establishment of captive broodstocks at the IDFG Eagle Fish Hatchery in Eagle, Idaho and at NMFS facilities in Washington State. To date, 15 broodstocks have been established from Redfish Lake out-migrants, anadromous adults, and residual adults. Eight of these broodstocks have completed their lifecycle and spawned (Flagg and McAuley 1994; Johnson 1993; Flagg et al.; Johnson and Pravecek 1995; Johnson and Pravecek 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998).

The IDFG participation in the Sawtooth Valley Project falls under two general areas of effort: the sockeye salmon captive broodstock program (hatchery element) and Sawtooth basin sockeye/kokanee monitoring and evaluation (research element). Activities associated with the captive broodstock program hatchery element are presented in this report.

PROGRAM GOALS

The ultimate goal of IDFG captive broodstock development efforts is to recover sockeye salmon runs in Idaho waters to self-sustaining levels that provide a degree of state and tribal harvest opportunity. The immediate project goal is to maintain this unique sockeye salmon population through captive broodstock technology and to avoid species extinction.

Objectives and Tasks

Objective 1. Develop and culture captive broodstocks from Redfish Lake anadromous sockeye salmon.

Task a. Maintain facilities to produce sockeye salmon captive broodstocks.

Task b. Modify facilities (e.g., wells, water delivery, buildings) to meet basic fish culture needs and safety concerns to satisfy Objective 1.

Task c. Use existing and emerging conservation hatchery technologies to develop, culture, and maintain sockeye salmon captive broodstocks.

Task d. Trap returning anadromous adults, juvenile out-migrants, and residual sockeye salmon to initiate broodstocks.

Task e. Collect samples for genetic analysis from wild and hatchery-produced sockeye salmon. Transfer samples to NMFS and University of Idaho cooperators for analysis.

Task f. Incorporate wild and hatchery-produced fish in captive breeding design based on lineage and genetic identity.

Task g. Establish spawning matrices in consultation with NMFS and the program technical oversight committee.

Task h. Spawn captive adults using a factorial design that follows the approved spawning design. Maximize genetic diversity when possible.

Task i. Produce genetically defined progeny (eyed-eggs, presmolts, smolts, and adults) for use in multiple release strategies to Sawtooth basin lakes.

Task j. Produce genetically defined progeny to meet future broodstock spawning needs. Divide broodstock eggs between NMFS and IDFG facilities for rearing. Ship eggs and/or travel as needed to deliver eggs to NMFS facilities.

Task k. Produce "designer broodstocks" from cryopreserved milt to broaden the genetic base in future spawn years. Divide eggs between NMFS and IDFG facilities for rearing. Ship eggs and/or travel as needed to deliver eggs to NMFS facilities.

Task l. Cryopreserve milt from specific wild and hatchery-produced sockeye salmon.

Task m. Conduct fertilization trials using cryopreserved milt from captive broodstock adults.

Task n. Maintain cryopreserved archives at three locations to spread the risk of loss from catastrophic events.

Task o. Monitor and adaptively manage hatchery outcomes related to fish survival, maturation rates, age-at-maturity, sex ratio, diet, and gamete quality of captive sockeye salmon.

Task p. Evaluate and adaptively manage time held on chilled water (maturing adults) in relation to gamete quality, fertilization rates, and anomalies in broodstock progeny.

Objective 2. Determine the contribution hatchery-produced sockeye salmon make toward recovery.

Task a. Maintain and operate juvenile and adult trapping facilities at the Sawtooth Hatchery and at lake outlet locations.

Task b. PIT tag wild and hatchery-produced juveniles to facilitate evaluations of out-migration and adult return success by release location and strategy.

Task c. Differentially fin clip hatchery-produced juveniles to facilitate evaluations of out-migration and adult return success.

Task d. Estimate *O. nerka* out-migration from Sawtooth basin lakes by release location and release strategy.

Task e. Evaluate out-migration success by release location and release strategy and adaptively manage the development of future release designs.

Task f. Develop estimates of travel time to lower Snake River hydropower projects and evaluate survival by release location and release strategy.

Task g. Identify spawning location and timing for prespawn adult sockeye released to lakes. Estimate spawning success.

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

Task a. Estimate *O. nerka* population variables by mid-water trawl in four Sawtooth basin lakes.

Task b. Conduct trawl samples to estimate abundance and density by age-class.

Task c. Collect scale and otolith samples from trawl captures for age and microchemistry analysis. Collect tissue samples for genetic analysis. Collect stomachs for diet analysis.

Task d. Develop lake carrying capacity estimates cooperatively with Shoshone-Bannock Tribes.

Task e. Monitor sport fisheries in sockeye salmon nursery lakes to determine their impact on recovery efforts (emphasis on kokanee harvest).

Objective 4. Determine the origin of wild and broodstock *O. nerka* to provide maximum effectiveness in their utilization within the broodstock program.

Task a. Use otolith microchemistry to identify the origin of *O. nerka* with unknown life histories.

Task b. Integrate microchemistry results with genetic information.

Objective 5. Technology Transfer.

Task a. Participate in the technical oversight committee process. Provide an adequate level of staffing at meetings to adequately present program information and to discuss program issues and challenges.

Task b. Network with technical experts on issues related to culture and broodstock techniques, genetics, pathology, and monitoring and evaluations.

Task c. Participate in essential program management and planning activities such as (but not limited to): budget meetings convened by CBFWA, BPA, IOSC, NWPPC or NOAA fisheries; subbasin planning meetings; Artificial Production Review and Evaluation (APRE) meetings; Safety Net and Artificial Production Program (SNAPP) meetings; Hatchery and Genetic Management Plan (HGMP) meetings; and specific meetings considered essential to address comments and concerns of funding and review agencies such as the NWPPC and BPA.

Task d. Coordinate public information transfer with project cooperators.

Task e. Provide written activity reports to satisfy the needs and requirements of IDFG, the technical oversight committee, NMFS, and BPA.

METHODS

Fish Culture Facilities

Eagle Fish Hatchery

Eagle Fish Hatchery is the primary Idaho site for the sockeye captive broodstock program. Artesian water from five wells is currently in use. Artesian flow is augmented with four separate pump/motor systems. Water temperature remains a constant 13.3°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. Nine water level alarms are in use and linked through an emergency service operator. Additional security is provided by limiting public access and by the presence of three on-site residences occupied by IDFG hatchery personnel.

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 180,000 eggs. Incubation is accomplished in small containers specifically designed for the program. Incubators are designed to distribute both upwelling and downwelling flow to accommodate pre- and post-hatch 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 m diameter semisquare tanks (0.30 m^3), 3) 2 m diameter semisquare tanks (1.42 m^3), 4) 3 m diameter circular tanks (6.50 m^3), and 5) 4 m diameter semisquare tanks (8.89 m^3). Typically, 0.7 m and 1 m tanks are used for rearing fry from ponding to approximately 1 g weight. Two and three meter tanks are used to rear juveniles to approximately 10 g and to depot and group fish by lineage or release strategy prior to distribution to Sawtooth basin 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 NMFS, 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 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 their transfer to the Eagle Fish Hatchery for spawning. All incubation, rearing, and holding occur on well water. Water temperature varies by time of year from approximately 2.5°C in January/February to 11.1°C in August/September. Back-up and redundancy systems are in place. Rearing protocols are established cooperatively between IDFG personnel and reviewed at the SBSTOC level.

Fish Culture

Fish culture methods used in the captive broodstock program follow accepted standard practices (for an overview of standard methods, see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; Bromage and Roberts 1995; McDaniel et al. 1994; Pennell and Barton 1996). Considerable coordination takes place between NMFS and IDFG culture experts and at the SBSTOC level.

Fish are fed a commercial diet produced by Bio-Oregon, Inc. (Warrenton, Oregon). Through approximately 100.0 g weight, fish receive a standard Bio-Oregon semimoist formulation. Rations are weighed daily and follow 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 are enhanced by the addition of natural flavors from fish and krill. Beyond 100.0 g weight, fish receive the Bio-Oregon custom broodstock diet.

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

Incubation and rearing water temperature is maintained between 10.0°C and 13.3°C. Chilled water (9.0°C to 11.0°C) may be used during incubation and early rearing to equalize development and growth differences that may result from a protracted spawning period. Sockeye salmon greater than age-1 are generally maintained on chilled water. Rearing water temperature varies as a function of demand, but is generally maintained between 10.0°C and 12.0°C.

Passive integrated transponder (PIT) tags are used to evaluate the overwinter survival and out-migration success of production groups released to Sawtooth basin waters. PIT tags are also used to track sockeye salmon retained in the program as broodstock fish. Production and broodstock sockeye salmon are PIT tagged at approximately six months of age. The PIT tag procedures follow accepted, regional protocols (Prentice et al. 1990).

Chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to initiating treatments, the use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all program mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed. Carcasses are either incinerated, land filled, or rendered.

Anadromous and Residual Adult Sockeye Salmon Trapping

Two adult traps are used to capture returning anadromous sockeye salmon in the Sawtooth basin. The first trap is located on Redfish Lake Creek approximately 1.4 km downstream from the lake outlet. The second trap is located on the upper Salmon River at the Sawtooth Fish Hatchery weir.

A floating Merwin trap is used to capture residual sockeye salmon adults in Redfish Lake when they are incorporated into the captive broodstock program. When used, the trap is installed in October on the west side of the lake at the north end of Sockeye Beach.

Spawning Activities

Spawning has occurred at Eagle Fish Hatchery each year since 1994 (Johnson and Pravecek 1995; Johnson and Pravecek 1996). Prior to 1994, adult sockeye returns were spawned at the Sawtooth Fish Hatchery (Johnson 1993). Spawning follows accepted, standard practices as described by McDaniel et al. (1994) and Erdahl (1994). The IDFG is required by

NMFS Permit No. 795 to discuss proposed broodstock spawning matrices prior to conducting activities. In general, eggs produced at spawning are divided into two lots (by female) and fertilized with milt from two males. Eggs are incubated by lot on different water temperatures to yield lineage-specific size groups for supplementation under different strategies and to produce fish to meet future broodstock needs.

Milt Cryopreservation

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

Fish Health Investigations

The Eagle Fish Health Laboratory operated by IDFG processes samples for diagnostic and inspection purposes from captive broodstock sockeye salmon, production sockeye salmon, and anadromous sockeye salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease *Renibacterium salmoninarum*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.). In addition to the above, anadromous adult sockeye salmon are screened for the causative agent of whirling disease *Myxobolus cerebralis*, *Furunculosis Aeromonas salmonicida* and the North American strain of viral hemorrhagic septicemia virus. All laboratory diagnostic and inspection procedures follow protocols described by Thoesen (1994).

Detection of Anomalies in Brood Year 1996 Anadromous Progeny

Progeny of the single, anadromous female sockeye salmon that returned to Redfish Lake Creek in 1996 (ANBY96) were noticed to lack development of one or both eyes. In 1997, hatchery personnel enumerated the incidence of single and bilateral optic aplasia in all ANBY96 progeny. In addition, Eagle Fish Health Laboratory personnel conducted histological examinations of 15 ANBY96 progeny to document and investigate the presence of optic anomalies.

Eyed-Egg and Fish Transfers

Eggs are shipped at the eyed stage between NMFS and IDFG facilities using a commercial air service. Iodophor- (100 ppm) disinfected eggs are packed at a conservative density in perforated tubes, then capped and labeled. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small coolers. Ice chips are added to ensure proper temperature maintenance, and coolers are sealed with packing tape. Personnel from IDFG and NMFS are responsible for shuttling coolers to air terminals.

Containers used to transport fish vary by task. In all cases, containers of the proper size and configuration are used for the task. Fish are maintained in water of the proper quality (temperature, oxygen, chemical composition) as much as is possible during the handling and transfer phases of transportation. Containers vary 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 in long distance (or duration) transfers, are available to the program with 300 gal (1,136 L), 1,000 gal (3,785 L), and 2,500 gal (9,463 L) capacities. Transport density guidelines are in place to not exceed 89 g/L (0.75 lb/gal).

Eyed-Egg and Fish Supplementation

To date, sockeye salmon have been reintroduced to Sawtooth basin waters as eyed-eggs, presmolts, smolts and prespawn adults.

Eyed-eggs are distributed to egg boxes manufactured by IDFG personnel specifically for this program. Plastic light baffle grids and plastic mesh netting partition and prevent eggs from falling into the biofilter ring medium until after hatch. Plastic mesh netting surrounding egg boxes allows fish to volitionally emigrate following yolk absorption. Egg boxes accommodate approximately 5,000 eggs each. Following loading, egg boxes are lowered to the lake substrate in approximately 3 m of water over known or suspected areas of lakeshore spawning. Prior to 1997, sockeye salmon egg box supplementation had only occurred in Redfish Lake. In 1997, egg box supplementation activities were expanded to include Alturas Lake.

Sockeye salmon presmolts are distributed to Sawtooth basin lakes in truck-mounted transportation tanks. Fish are transferred from truck-mounted tanks to 250 gal (946 L) barge-mounted tanks for pelagic releases and net pen introductions. Adequate water temperature tempering occurs prior to the release of fish. Prior to 1997, sockeye salmon presmolt releases had only occurred in Redfish and Pettit lakes. In 1997, presmolt releases were expanded to include Alturas Lake.

Sockeye salmon smolts are distributed to Sawtooth basin waters using truck-mounted transportation tanks. Adequate water temperature tempering occurs before the release of fish. To date, smolts have only been introduced to the outlet of Redfish Lake Creek downstream of the juvenile out-migrant weir.

Prespawn adult sockeye salmon are distributed to Sawtooth basin waters using truck-mounted transportation tanks. Fish are released at public access points at dusk. Adequate water temperature tempering occurs prior to the release of fish. Before 1997, prespawn adult releases had only occurred in Redfish Lake. In 1997, adult releases were expanded to include Alturas and Pettit lakes.

RESULTS AND DISCUSSION

Fish Culture

During this reporting period, two production groups and four broodstocks were in culture at IDFG facilities representing brood years 1993, 1994, 1996, and 1997. A summary of losses, while in culture during this reporting period, is presented in Tables 1 and 2. Culture groups

developed primarily for reintroduction to Sawtooth basin waters are designated as “production” groups. Culture groups developed to meet future spawning needs are designated as “broodstock” groups. The year of development for specific culture groups may appear abbreviated (e.g., BY96 refers to brood year 1996).

BY93 Broodstock

Two unique broodstocks were pooled in 1997 to create a group collectively known as “BY93 broodstock.” The first group (ANBY93) consisted of first generation progeny of the two female and six male sockeye salmon that returned to Redfish Lake Creek in 1993 (AN93). Parents were crossed to create 12 distinct subfamilies. The second group (OMBY93) consisted of first generation progeny of female 1991 Redfish Lake out-migrants (OM91) and the six male sockeye salmon that returned to Redfish Lake Creek in 1993 (AN93). Parents were crossed to produce 45 unique subfamilies. Initial inventory for the BY93 broodstock was 118 fish (98 ANBY93 and 20 OMBY93). Within this broodstock group, 63 males matured and were used for spawning (no age-4 females produced viable eggs in 1997). Of the remaining 55 fish, 10 fish died during culture, and 45 were culled due to lack of gonadal development. Brood year 1997 represented the second spawn opportunity for this broodstock. At the end of the reporting period, zero fish from this broodstock remained in culture at the Eagle Fish Hatchery (Table 1).

ANBY94 Broodstock

This broodstock is composed of first generation progeny of the single female sockeye salmon that returned to Redfish Lake Creek in 1994 (AN94). Males used for spawning crosses in brood year 1994 included first generation progeny of the one female and three male sockeye salmon that returned to Redfish Lake Creek in 1991 (ANBY91) and 1991 Redfish Lake out-migrants (OM91). Initial inventory for the reporting period was 1,026 fish. Two hundred forty-six fish matured in 1997 and were used for spawning. In August 1997, an additional 80 maturing adults were released to Sawtooth basin lakes for natural spawning. In November 1997, 300 immature fish were transferred to the NMFS Big Beef Creek Hatchery in Washington State. Progeny produced at Eagle Fish Hatchery in brood year 1997 will be released to Sawtooth basin waters in 1998 and 1999. Two hundred eighty-four fish remained in this broodstock at the end of the reporting period (Table 1).

BY96 Broodstock

Two primary culture groups were developed in 1996 to meet future broodstock needs. The first group (ANBY96) consisted of first generation progeny of the single female sockeye salmon that returned to Redfish Lake Creek in 1996 (AN96). Males crossed with this female included first generation progeny of the two female and six male sockeye salmon that returned to Redfish Lake Creek in 1993 (ANBY93) and one 1993 Redfish Lake out-migrant (OM93). Initial inventory for the ANBY96 broodstock was 2,067 eyed-eggs. Four hundred forty eyed-eggs were transferred to the NMFS Big Beef Creek Hatchery to spread culture responsibilities and guard against catastrophic loss at one location. In July 1997, 400 presmolts from this broodstock were released to Redfish Lake as part of the direct lake release strategy. At the end of this reporting period, 332 ANBY96 broodstock fish remained in culture at the Eagle Fish Hatchery (Table 1). The second group (BY96) consisted of first generation progeny produced from two ANBY93 and one OMBY93 females crossed with cryopreserved milt from the single

male sockeye salmon that returned to Redfish Lake Creek in 1992 (AN92). Initial inventory for the BY96 broodstock was 40 eyed-eggs. Three eggs did not hatch, and two fish died during culture. At the end of this reporting period, 35 BY96 broodstock fish remained in culture at the Eagle Fish Hatchery (Table 1).

BY96 Production

Two primary lineage groups were produced for supplementation in brood year 1996. The majority of supplementation progeny were second generation fish produced from ANBY93 male and female parents. The second lineage group consisted of second generation fish produced from OMBY93 female and ANBY93 male parents. In addition, progeny of one brood year 1993 residual sockeye salmon female and two brood year 1992 residual males were produced in brood year 1996 for 1997 supplementation. Production groups were reared at IDFG Eagle and Sawtooth Fish Hatcheries. Initial inventories for this reporting period were 137,018 eyed-eggs at the Eagle facility and 157,983 eyed-eggs at Sawtooth Fish Hatchery. In 1997, 255,711 presmolts were released to Sawtooth basin waters via several release strategies. At the end of this reporting period, 14,351 progeny were rearing at the Sawtooth Fish Hatchery for a May 1998 smolt release (Table 2). Zero brood year 1996 production fish remained in culture at Eagle Fish Hatchery.

BY97 Broodstock

This group consists of progeny from ANBY94 females and cryopreserved milt from 1991 Redfish Lake out-migrant males (OM91), 1992 Redfish Lake out-migrant males (OM92), and the single male sockeye salmon that returned to Redfish Lake in 1992 (AN92). Approximately 2,271 green eggs were fertilized with milt from these males producing 672 eyed-eggs (average survival to eyed stage = 29.6%, range = 0-90.3%). Approximately 296 eyed-eggs were transferred to the NMFS Big Beef Creek Hatchery for cooperative culture and to guard against catastrophic loss at one location. At the end of this reporting period, 376 fry were in culture at the IDFG Eagle Fish Hatchery (Table 1).

BY97 Production

The BY97 production group is composed of second generation progeny of ANBY94 female and ANBY93 male broodstock sockeye salmon reared at both Eagle Fish Hatchery and the NMFS Big Beef Creek Hatchery in Washington State. Spawning activities at Big Beef Creek and Eagle facilities produced approximately 37,752 and 148,781 eyed-eggs, respectively. Of the 186,533 total eyed-eggs produced in 1997 production crosses, 110,983 were transferred to the Sawtooth Fish Hatchery for final incubation and rearing for 1998 presmolt and 1999 smolt releases. Progeny that result from the 75,550 eyed-eggs remaining at Eagle Fish Hatchery are destined for presmolt release strategies in 1998. Ending inventory for the reporting period is approximately 186,533 eyed-eggs and reflects initial eyed-egg numbers at Eagle and Sawtooth fish hatcheries (Table 2).

Anadromous and Residual Sockeye Salmon Trapping

In 1997, the adult trap on Redfish Lake Creek was operated from July 22 to October 21. No anadromous sockeye salmon were captured during this period. The trap was checked daily by personnel from the Sawtooth Fish Hatchery. In 1997, no adult chinook salmon *O. tshawytscha* were captured at the Redfish Lake Creek adult sockeye trap.

No attempts were made to capture residual sockeye salmon during the 1997 season.

Spawning Activities

The IDFG is required by NMFS Permit No. 795 to discuss proposed broodstock spawning matrices with NMFS Coastal Zone and Estuarine Studies Division genetics staff. In 1997, this was accomplished by providing a proposed spawning design to NMFS genetics staff participants of the SBSTOC (Appendix A).

In 1997, 126 ANBY94 female broodstock sockeye salmon matured and spawned at the Eagle Fish Hatchery between October 7 and November 25. Eighty-five percent of all 1997 spawning occurred in the month of October. Results from 1997 Eagle Fish Hatchery spawning activities are reviewed below. Progeny developed for supplementation to Sawtooth basin waters are designated “BY97 Production,” and progeny developed to meet future spawning needs are designated “BY97 Broodstock.” Results from spawning activities conducted by NMFS at Washington State facilities will appear separately by that agency.

BY97 Production

During the fall of 1997, 246 fish from the ANBY94 broodstock (age-3) and 63 fish from the BY93 broodstock (age-4) matured at the Eagle Fish Hatchery. To avoid half-sibling spawn crosses, F_1 male progeny from the BY93 broodstock were crossed with F_1 ANBY94 females. One hundred twenty-six females (ANBY94) were spawned to generate approximately 260,000 green eggs. Eleven of the 126 females failed to produce viable eggs. In addition, eggs produced from two females were removed and destroyed following the detection (in female parent) of elevated bacterial kidney disease *Renibacterium salmoninarum* (BKD) Enzyme-Linked Immunosorbent Assay (ELISA) optical density values. In most cases, each ANBY94 female was spawned with two BY93 males (representing different subfamily lineage) resulting in the production of two unique subfamilies per female. Mean fecundity averaged 2,299 eggs per female. Egg survival to the eyed-stage ranged from 0.0% to 98.4% and averaged 57.3%. Approximately 148,781 eyed-eggs were produced from the above crosses, of which 73,231 were transferred to Sawtooth Fish Hatchery and 75,550 retained at Eagle Fish Hatchery. At the end of this reporting period, approximately 140,000 fry from these crosses were in culture at Eagle and Sawtooth facilities. The majority of BY97 production progeny will be released throughout the summer and fall of 1998, with a small portion retained for a 1999 smolt release.

BY97 Broodstock

Eagle Fish Hatchery broodstock spawn crosses were generated from first generation females (ANBY94) from the single female that returned to Redfish Lake Creek in 1994 (AN94). Males used in spawn crosses were of cryopreserved origin and consisted of cryopreserved milt

from 1991 Redfish Lake out-migrant males (OM91), 1992 Redfish Lake out-migrant males (OM92), and the single male sockeye salmon that returned to Redfish Lake in 1992 (AN92). The progeny resulting from these crosses were the first broodstock at Eagle Fish Hatchery to be created exclusively with cryopreserved milt.

Sublots of eggs from seven ANBY94 females were spawned with cryopreserved milt from OM91, OM92, and AN92 males to generate approximately 2,271 green eggs. Egg survival to the eyed stage ranged from 0.0% to 90.3% and averaged 29.6%. Approximately 672 eyed-eggs were produced from these crosses. Two hundred ninety-six eyed-eggs from this broodstock were transferred to the NMFS Big Beef Creek Hatchery for cooperative culture and to guard against catastrophic loss at one location. At the end of this reporting period, 376 fry were in culture at the Eagle Fish Hatchery.

Milt Cryopreservation

Cryopreserving sperm from donor males has been used in fish culture to preserve gametes for future use. In the captive broodstock program at Eagle Fish Hatchery, cryopreservation has been successfully used since the inception of the project in 1991. In 1997, milt from 21 unique ANBY94 broodstock males was cryopreserved on October 28 and 29 at the Eagle Fish Hatchery and on November 19 at Washington State University and the University of Idaho. The procedure is replicated at three facilities to guard against catastrophic loss associated with human error and/or storage equipment failure. Cryopreserved milt from this particular broodstock may be utilized in future spawning years to expand available genetic diversity.

On October 16, 1997, cryopreserved milt from 1991 Redfish Lake out-migrant males (OM91), 1992 Redfish Lake out-migrant males (OM92), and the single male sockeye salmon that returned to Redfish Lake in 1992 (AN92) was used to fertilize eight sublots of eggs produced from four ANBY94 broodstock females. Egg survival to the eyed stage ranged from 0.0% to 90.3% and averaged 29.6%. Six hundred seventy-two eyed-eggs were produced from these crosses. Progeny produced in this fashion will contribute to the enhancement of genetic variability in future brood years.

Fish Health Investigations

The IDFG Eagle Fish Health Laboratory processed samples for diagnostic and inspection purposes from broodstock and production groups of sockeye salmon. Seventy-four laboratory cases involving 234 individuals were processed in 1997. The laboratory also summarized pathology findings to satisfy the needs of adjacent state agencies for issuance of sockeye salmon import and transport permits.

There was no evidence of viral pathogens in any of the production and broodstock groups in 1997. These results have been consistent since the inception of the program in 1991 and indicate that fish culture efforts have not introduced infectious pancreatic necrosis virus (IPNV) or infectious hematopoietic necrosis virus (IHNV) into this population. Monitoring for bacterial kidney disease *Renibacterium salmoninarum* (BKD) in adults and juveniles has been routinely conducted using the ELISA technique. Of the 232 fish examined in 1997, only two females (ANBY94) exhibited elevated ELISA optical density values (0.284, 0.628). In 1997, Eagle Fish Hatchery continued its participation in the University of Idaho's Investigational New

Animal Drug (INAD) program to continue to have access to erythromycin. Periodic prophylactic treatments with erythromycin -medicated feed occurred in 1997.

During this reporting period, nine ANBY94 adult sockeye salmon developed lymphosarcomas of the thymus, kidney, liver, or pseudobranchs, and one developed a hepatic tumor. The frequency of these diseases is consistent with findings from past years.

Detection of Anomalies in Brood Year 1996 Anadromous Progeny

Progeny of the single, anadromous female sockeye salmon that returned to Redfish Lake Creek in 1996 (ANBY96) were noticed to lack development of one or both eyes. This condition occurred regardless of which male genetic group was used to fertilize sublots of eggs. We enumerated the incidence of single and bilateral optic aplasia (by male parent family) in June 1997 when fish were approximately 10 g. The prevalence of the bilateral condition varied from 5% to 13% (mean 9%), while absence of a single eye ranged from 17% to 26% (mean 20%) (Table 3). Histological examinations, conducted by Eagle Fish Health Laboratory personnel, revealed that fish missing single eyes failed to develop complete optic structure internal to the cornea. Similarly, fish that appeared to be missing both eyes had the full complement of optic structures, but failed to inflate the ocular chamber with vitreous humor. The female contributing to these crosses had two fully developed eyes, was five years old, and was presumably fostered by Redfish Lake residual sockeye salmon parents (no anadromous sockeye salmon have had access to Redfish Lake since 1990). The 1996 female represented the second most frequently occurring mitochondrial DNA haplotype found to date in Redfish Lake Creek anadromous and residual sockeye salmon.

Eyed-Egg and Fish Transfers

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

On November 18, 1997, the Eagle Fish Hatchery transferred 300 ANBY94 adult sockeye salmon (age-3) to the NMFS Big Beef Creek Hatchery. This move was made to spread the risk associated with single facility culture of the remaining representatives of this broodstock.

On December 5, 1997, Eagle Fish Hatchery transferred 296 eyed-eggs from BY97 broodstock crosses to the NMFS Big Beef Creek facility.

On December 8, 1997, 37,752 eyed-eggs were transferred from the NMFS Big Beef Creek Hatchery to the Sawtooth Fish Hatchery for final incubation and rearing until release.

On December 9, 1997, IDFG transferred 29,996 eyed-eggs from the Eagle Fish Hatchery to the Sawtooth Fish Hatchery. On December 12, 1997, Eagle Fish Hatchery personnel transferred an additional 43,235 eyed-eggs to the Sawtooth facility. Progeny that result from these eggs will contribute to 1998 presmolt (age-0) and 1999 smolt (age-1) release efforts.

Eyed-Egg and Fish Supplementation

Pursuant to Special Condition B.1.e. of Permit No. 795, IDFG received authorization from NMFS to carry out the following supplementation releases in 1997. Details by date are listed below. A summary of 1997 releases is presented in Tables 4 and 5.

Presmolt Releases

A total of 21,036 brood year 1996 presmolt sockeye salmon were released in Redfish Lake at midlake locations on June 30 (8,610) and July 14 (12,426) 1997. All fish were adipose fin-clipped, and 2,041 were PIT tagged for evaluation purposes. Mean weight at release for the June 30 group was 8.7 grams per fish (g/f). No weight data was obtained from the July 14 release group.

On July 1, 1997, 8,643 brood year 1996 (age-0) presmolt sockeye salmon were released at a midlake location in Pettit Lake. All fish were adipose fin-clipped, and 1,336 were PIT tagged for evaluation purposes. Mean weight at release for Pettit Lake juveniles was 8.7 g/f.

A total of 22,250 brood year 1996 presmolt sockeye salmon were released in Alturas Lake at midlake locations on July 2 (9,134) and July 15 (13,116) 1997. All fish were adipose fin-clipped, and 2,032 were PIT tagged for evaluation purposes. Mean weight at release for the July 2 group was 8.7 g/f. No weight data was obtained from the July 15 release group.

On July 7, 8, 9, and 10, 66,257 brood year 1996 (age-0) juvenile sockeye salmon were transferred to Redfish Lake net pens. All fish were adipose fin-clipped, and 2,682 were PIT tagged for evaluation purposes. Mean weight at transfer was 9.0 g/f. On October 21, 62,907 (2,596 PIT tagged) fish were released to Redfish Lake from net pens. Mean weight at release was 21.1 g/f.

On October 15, 1997, 68,379 brood year 1996 presmolt sockeye salmon were released at a midlake location in Redfish Lake. All fish were adipose fin-clipped, and 2,010 were PIT tagged for evaluation purposes. The majority (67,372) of the Redfish Lake release group originated from Sawtooth Fish Hatchery with a mean weight at release of 6.3 g/f. The remaining 1,007 fish from this group originated from Eagle Fish Hatchery with a mean weight at release of 21.1 g/f.

On October 16, 1997, 72,496 brood year 1996 presmolt sockeye salmon were released at a midlake location in Alturas Lake. All fish were adipose fin-clipped, and 1,861 were PIT tagged for evaluation purposes. All PIT-tagged fish (1,861) originated from Eagle Fish Hatchery with a mean weight at release of 21.0 g/f. The remaining fish (70,635) originated from Sawtooth Fish Hatchery with a mean weight at release of 6.3 g/f.

Adult Releases

On September 8 and 11, 1997, 80 maturing (brood year 1994) hatchery reared adult sockeye salmon were released to Redfish Lake for volitional spawning. The September 8 release consisted of 20 females and 20 males originating from the Eagle Fish Hatchery captive broodstock program. All fish were adipose fin-clipped and PIT tagged, and six adults (all female) were implanted with ultrasonic transmitters to allow tracking of fish movement through telemetry

investigations. The September 11 release consisted of 20 females and 20 males originating from the NMFS Manchester Marine Experimental Station captive broodstock program. All fish were adipose fin-clipped and PIT tagged.

On September 9, 1997, the following adult releases occurred: 1) 20 maturing brood year 1994 sockeye salmon (10 female, 10 male) were released to Alturas Lake, and 2) 20 maturing brood year 1994 sockeye salmon (10 female, 10 male) were released to Pettit Lake. All fish released to Alturas and Pettit lakes originated from the Eagle Fish Hatchery captive broodstock program. All fish were adipose fin-clipped and PIT tagged, and six adults (all female) from each release location were implanted with ultrasonic transmitters to allow tracking of fish movement through telemetry investigations.

Eyed-Egg Releases

On November 18, 1997, 20,389 eyed-eggs originating from spawning activities at NMFS facilities were distributed to egg boxes and planted in Alturas Lake. All egg boxes were positioned in the northwest end of the lake.

In November of 1997, eyed-egg releases to Redfish Lake included the following: 1) 27,854 eyed-eggs planted on November 18 at Sockeye Beach, 2) 28,892 eyed-eggs planted on November 20 at the south end of the lake, and 3) 28,632 eyed-eggs planted November 25 at both Sockeye Beach (14,316) and the south end of the lake (14,316). All eyed-eggs were distributed to egg boxes, and all eggs originated from spawning activities at NMFS facilities in 1997.

Table 1. Summary of losses and magnitude of mortality for four captive sockeye salmon broodstocks reared at IDFG facilities in 1997.

	Broodstocks			
	BY93	**ANBY94**	**BY96 / ANBY96**	**BY97**
Starting Inventory (January 1, 1997)	118	1,026	2,107[a]	672[b]
Eyed-Egg to Fry				
Undetermined	n/a	n/a	115[c]	0
Mechanical Loss				
Handling	3	2	1	n/a
Jump-out	1	1	0	n/a
Human Error	0	0	0	n/a
Noninfectious				
Lymphosarcoma	0	9	0	n/a
Other	4[d]	88[d]	783[d]	n/a
Infectious				
Bacterial	0	0	1	n/a
Viral	0	0	0	n/a
Other	2	16	0	n/a
Maturation				
Mature Males	63	120	0	n/a
Mature Females	0	126	0	n/a
Other	45	0	0	n/a
Relocation				
Transferred In	0	0	0	0
Transferred Out	0	300[e]	440[e]	296[e]
Planted/Released	0	80	400	0
Ending Inventory (December 31, 1997)	0	284	367	376

[a] December 1996 eyed-egg numbers.
[b] December 1997 eyed-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, non-infectious mortality.
[e] Transferred from IDFG Eagle Fish Hatchery to NMFS for broodstock rearing.

Table 2. Summary of losses and magnitude of mortality for two captive sockeye salmon production groups reared at IDFG facilities in 1997.

	Broodstocks	
	BY96	**BY97**
Starting Inventory (January 1, 1997)	295,001[a]	148,781[b]
Eyed-Egg to Fry		
Undetermined	21,358[c]	0
Mechanical Loss		
Handling	3,200[d]	n/a
Jump-out	0	n/a
Human Error	0	n/a
Noninfectious		
Lymphosarcoma	0	n/a
Other	381[e]	n/a
Infectious		
Bacterial	0	n/a
Viral	0	n/a
Other	0	n/a
Maturation		
Mature Males	0	n/a
Mature Females	0	n/a
Other	0	n/a
Relocation		
Transferred In	0	37,752[f]
Transferred Out	0	0
Planted/Released	255,711	0
Ending Inventory (December 31, 1997)	14,351	186,533

[a] December 1996 eyed-egg numbers.
[b] December 1997 eyed-egg numbers.
[c] Typical egg to fry mortality includes non-hatching eggs, abnormal fry, and swim-up loss.
[d] Approximately 3,200 mortalities were suspected to have died from a carbon monoxide poisoning event during transport to net pens.
[e] Includes culling associated with cultural abnormalities, and all undetermined, non-infectious mortality.
[f] Eyed-egg transfers from NMFS to IDFG Sawtooth Fish Hatchery for production rearing.

Table 3. Occurrence of bilateral and single optic aplasia in progeny of the single female sockeye salmon that returned to Redfish Lake Creek in 1996.

Male Family	Presort Inventory	Bilateral Aplasia		Single Aplasia	
		Number	Percent	Number	Percent
ANBY93 — A3	97	7	7.2	22	22.7
ANBY93 — B4	133	10	7.5	35	26.3
ANBY93 — B5	143	11	7.7	31	21.7
ANBY93 — pool	334	45	13.5	60	18.0
OM93	150	8	5.3	26	17.3
TOTAL	**857**	**81**	**9.5**	**174**	**20.3**

Table 4. Hatchery-produced sockeye salmon pre-smolt releases to Sawtooth basin lakes in 1997 (all fish were adipose fin-clipped prior to release).

Lineage	# Released	# PIT tagged	Date	Weight (g)	% PIT tagged
Spring Direct Release to Redfish Lake[a]					
ANBY96	6,668	1,032	6-30	9.6	15.5
OMBY96	1,942	1,009	6-30	5.7	51.2
Subtotal	8,610	2,041			23.7
ANBY96	11,246	0	7-14		0
OMBY96	1,180	0	7-14		0
Subtotal	12,426+	0			0
Total	**21,036**	**2,041**			**9.4**
Spring Direct Release to Alturas Lake[a]					
ANBY96	7,084	1,033	7-02	8.4	14.6
OMBY96	2,050	999	7-02	6.4	48.7
Subtotal	9,134	2,032			22.2
ANBY96	11,236	0	7-15		0
OMBY96	1,880	0	7-15		0
Subtotal	13,116	0			0
Total	**22,250**	**2,032**			**9.1**
Spring Direct Release to Pettit Lake[a]					
ANBY 96	7,245	1,000	7-01	8.7	13.8
OMBY96	1,398	336	7-01	8.7	24.0
Total	**8,643**	**1,336**			**15.5**
Redfish Lake Net Pens					
BY96 Broodstock	400	0	7-07	10	0
RESBY96	588	588	7-07	8.5	100.0
ANBY96	44,038	1,014	7-07	9.0	2.3
OMBY96	17,881	994	7-07	9.0	5.4
Total	**62,907**	**2,596**	**10-21**	**21.1**	**4.1**
Fall Direct Release to Redfish Lake					
ANBY96	63,594	1,007	10-15	6.5[b]	1.6
OMBY96	4,785	1,00	10-15	6.3	21.0
Total	**68,379**	**2,010**			**2.9**
Fall Direct Release to Alturas Lake					
ANBY96	67,536	926	10-16	6.3[2]	1.4
OMBY96	4,960	935	10-16	6.3	18.9
Total	**72,496**	**1,861**			**2.6**

[a] Prerelease mortalities have been subtracted from the total.
[b] PIT-tagged fish for fall releases originated from the Eagle Fish Hatchery and averaged 21.0 g.

Table 5. Prespawn adult releases and eyed-egg (egg box) releases to Sawtooth basin lakes in 1997.

Location#	Released	Date	Comments
Adults released in 1997			
Redfish Lake	40	9-8	Eagle broodstock; 12 sonic-tagged females
Alturas Lake	20	9-9	Eagle broodstock; 6 sonic-tagged females
Pettit Lake	20	9-9	Eagle broodstock; 6 sonic-tagged females
Redfish Lake	40	9-11	Manchester broodstock; 0 sonic tags
Total Adults	**120**		
Egg plants in 1997			
Redfish Lake	27,854	11-18	Manchester eggs; planted at Sockeye Beach
Alturas Lake	20,389	11-18	Manchester eggs; planted at the N.W. area
Redfish Lake	28,892	11-20	Manchester eggs; planted at the south end
Redfish Lake	28,632	11-25	Manchester eggs; planted at both areas
Total Eggs	**105,767**		

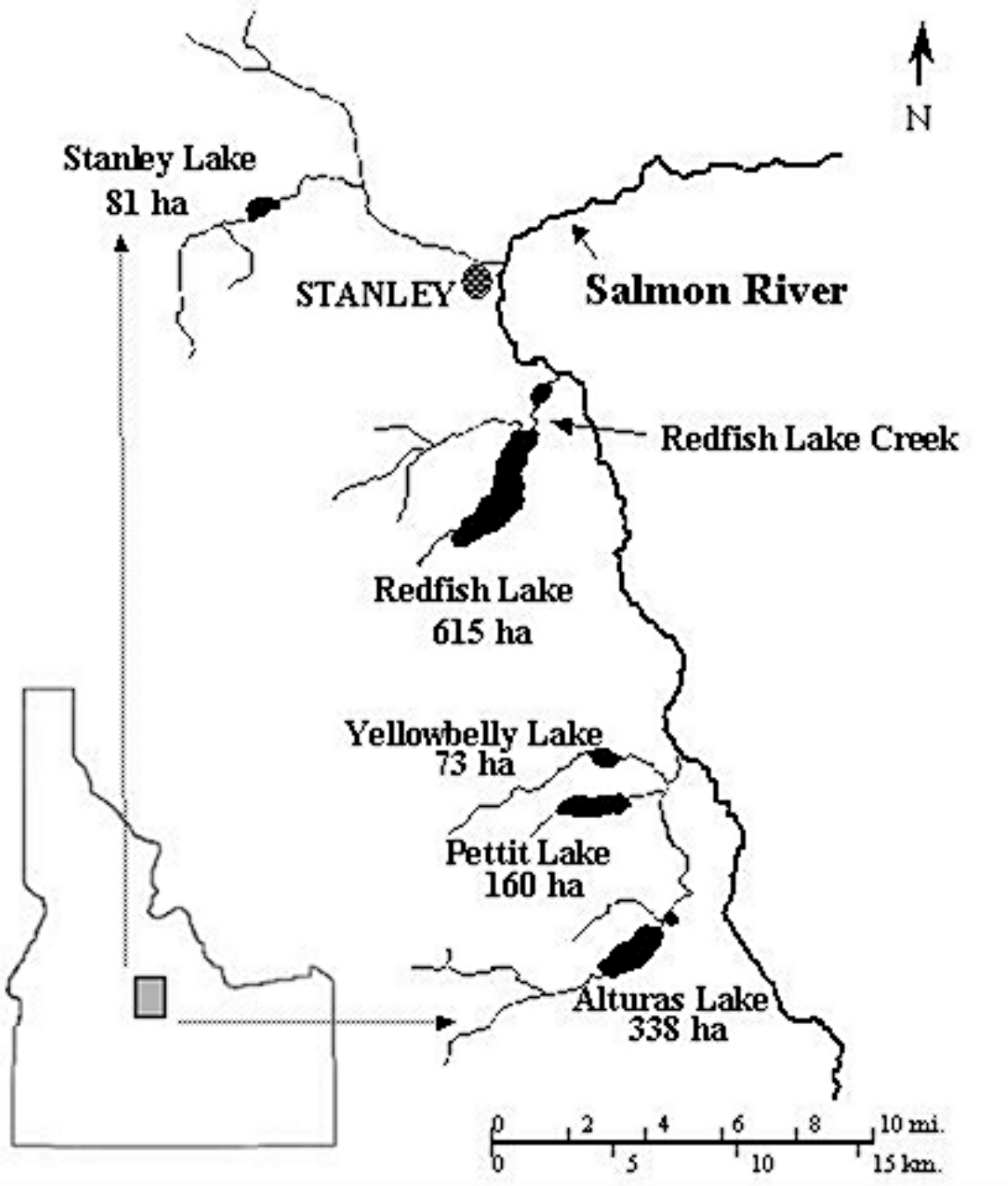

Figure 1. Sawtooth basin study area.

ACKNOWLEDGMENTS

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APPENDICES

Appendix A. Memo to Dr. Robin Waples concerning proposed spawning matrix for 1997.

IDAHO DEPARTMENT OF FISH AND GAME
Eagle Fish Health Laboratory
1800 Trout Road
Eagle, ID 83616
Phone (208)939-2413 Fax (208)939-2415

May 13, 1997

M E M O R A N D U M:

TO: ROBIN WAPLES, CZESD, NMFS

FROM: KEITH A JOHNSON AND PAUL KLINE

SUBJECT: BY97 SPAWNING MATRIX

cc: SBSTOC

This memo will initiate the requirement of Permit No. 795, which stipulates that the Idaho Department of Fish and Game (IDFG) establishes spawning matrices in advance of expected maturity for each brood year of maturing sockeye in the captive broodstock program. Since Permit No. 1005 covering Manchester's broodstock activities contains a similar provision, we have included those, as well, in this matrix. As expected, this is becoming increasingly more complex. We have tried to simplify potential crosses by stating whether a particular cross is "preferred" (P) or is not (NSG), based on anticipated inbreeding rates. The matrix will deal with groups which we anticipate to mature at Eagle Fish Hatchery, anadromous adults which return in 1997 of both wild and hatchery origin, adults which are expected to mature at Big Beef Creek (BBC) and any which may return from releases made at Bonneville Hatchery (BFH, ODFW).

GROUPS EXPECTED TO MATURE IN 1997

EAGLE FISH HATCHERY

BY94: These are the progeny of the single anadromous female that returned in 1994, crossed with BY91 An (Fm, A, C, B) + OM 91 & 92.

BY93: These are progeny of the two females and six males that returned in 1993.

HAn: Hatchery origin anadromous returns which out-migrated in 1996 and should be composed of 71% OM91 X An93, 21% An93 X An93 and 8% BY91 X BY91, based on percent out-migration at the RFLC weir. All of these were AD clipped and can be differentiated from those below.

Wan: Adults that originated from natural spawning of RFL residuals.

BBC HATCHERY:

BY94: Origins as above.

BY93: Origins as above.

BY94 Safety Net: These are the Group 1 progeny that were reared at BBC and BFH and returned to Manchester Marine Lab for final rearing in saltwater. This group composed of BY91 X BY91 crosses and are all half sibs (which had clinical BKD during rearing, although at a low rate). Designated BY94SN in table below.

BONNEVILLE HATCHERY

BY94: These are members of Group 3, which were released from BFH in 1996 at a size of 70 g. Some of these may return as three-year-old adults and will likely be males. This group did not meet the ELISA criteria IDFG established for importation for release to RFLC due to clinical BKD and ELISA history. All are BY91 X BY91 half sibs.

SPAWN CROSSES FOR EAGLE FISH HATCHERY

MALE					
	BY94	BY93	HAn	Wan	CRYO
BY94	NSG	P	P	P	92,93
BY93	P	NSG	NSG	P	91,92,92,95
FEMALE					
HAn	P	NSG	NSG	P	91,92
WAn	P	P	P	NSG	91-96

SPAWN CROSSES FOR BIG BEEF CREEK HATCHERY

MALE					
	BY94	BY93	BY94SN	HAn or WAn	CRYO
BY94	NSG	P	NSG	P	92, 93
BY93	P	NSG	NSG	P	91,92,94,95
FEMALE					
BY94SN	NSG	P	NSG	P	

SPAWN CROSSES FOR BONNEVILLE HATCHERY RETURNS

Returns would not be expected under normal age-at-maturity for sockeye, since these would be three-year-old “jacks.” However, the large size at release in May 1996 may result in some returns. Most would probably be males. The suggested plan is to transport female adults to BBC for maturation. These would be crossed with BY93 males on station. Crosses with BY94 males would be highly inbred.

Appendix A, continued.

SLIDING SCALE FOR 1997 ADULT RETURNS

Permit No. 795 includes wording that "up to twenty anadromous adults can be retained for broodstock purposes." This year is the first in which we expect adults back originating from enhancement efforts of the captive broodstock program. While it is unlikely that returns will exceed twenty adults, we feel that this should be re-evaluated by the SBSTOC. The original intent was to deal with naturally produced adults in the interim before hatchery fish began returning. The figure of 20 was a compromise to provide for natural spawning in the event of a "large" run and to have enough genetic diversity in the broodstocks in captivity. We propose a sliding scale to allow for both broodstock diversity and natural spawning. Remember that only 250 progeny of the natural returns are being proposed to be retained for continuing the broodstock program at MAN and the rest will be returned to RFL under one or more of the release strategies. The disposition of adults for these two program are proposed as follows:

NUMBER OF ADULTS	TO EAG	TO RFL
10 OR LESS	All	0
11 to 15	9	2 to 6
16 to 20	14	2 to 6
21 to 30	15	6 to 15
31 or more	20	11 or more

The number of adults retained should include all those designated WAn in the spawning matrix, since they have more flexibility in use to prevent in-breeding in creating BY97. Similar sliding scales have been used in supplementation studies and in mining natural returns for broodstock development.

PATHOLOGY SAMPLING RATES FOR 1997 SPAWNERS

EAGLE: 100% BY93 and BY94 captive females for VIRO and ELISA. Cull eggs if IHNV or VHSV positive. Retain eggs of females with ELISA O.D.'s of <0.1; those from females with ELISA O.D.'s > than 0.1, but <0.2 would be transported to SFH; cull eggs from females with ELISA O.D.'s of >0.2.

Appendix A, continued.

100% sampling of HAn and WAn adults for VIRO and ELISA. Retain eggs at EAG if VIRO negative and ELISA O.D.'s are <0.2; split 250 eggs from crosses to BBC. If adults are IHNV positive, eggs would be shared with BBC (NMFS' choice), but no progeny would be reared at EAG. if ELISA O.D.'s are >0.2, split 250 eggs to BBC, remaining eggs reared in isolation at SFH for release.

BBC: 100% sampling of BY93, BY94 and BY94SN females for VIRO and ELISA. If VIRO positive, eggs do not return to Idaho. ELISA O.D. values will direct destiny as in prior years:

If <0.1, eggs to EAG.
If >0.1, but <0.2, eggs to SFH.
If >0.2, eggs do not come to Idaho facilities, but may be used in
In-lake incubation.

The matrix for BBC includes a provision for shipping fresh, chilled sperm from HAn and WAn males from EAG to BBC. This has not been done in this program to date, but has been discussed as a possibility. The Washington Department of Fish and Wildlife (WDFW) will have to confer through the Import Permit process on shipping milt from wild, unsampled gametes. My (KAJ) inquiry with Kevin Amos (WDFW) indicated that this move would be permitted, provided gametes are water-hardened in 100 mg/L iodine and kept in quarantine with effluent depuration until sample results prove negative.

Obviously, this process is becoming more cumbersome each spawning year. We are afraid that the three of us (Waples, Johnson, Kline) are the only ones who can follow this any longer. We are to the practical limit of the utility of this process. Once returns exceed 50 adults, or BY96 adults have matured, we see no further need for this process. That's a measure of success. We will present this matrix at the SBSTOC meeting in Stanley for a first review and will modify as needed.

KAJ/PK:db

Appendix B. Pathology results from 1997 female spawners and male cryopreservation donors.

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December 31, 1997

M E M O R A N D U M:

To: Paul Kline, IDFG Eagle Fish Hatchery

From: Keith Johnson

Subject: Pathology Results of BY94 and BY93 Sockeye Spawners

cc: SBSTOC

The results of the BKD and Virology sampling from the spawners used to make BY97 production and "safety net" groups are listed below by spawn date and LAS #. This will be up-dated as results are completed.

BY94 MALES CRYO'D			
DATE	**LAS #**	**ELISA RESULTS**	**VIRO RESULTS**
11/15/97	97-439	0/1	0/1
11/25/97	97-453	1/23 O. D.=.145	0/23
Totals:		1/24	0/24

Appendix B, continued.

BY94 SPAWNERS (FEMALES)			
DATE	**LAS #**	**ELISA RESULTS**	**VIRO RESULTS**
10/07/1997	97-349	0/4	0/4
10/09/97	97-353	0/11	0/11
10/14/97	97-376	0/18	0/18
10/16/97	97-382	0/4 CRYO FM	0/4
10/17/97	97-384	0/20	0/20
10/20/97	97-391	0/12	0/12
10/23/97	97-393	0/12	0/12
10/27/97	97-400	0/8	0/08
10/30/97	97-406	0/15	0/15
11/03/97	97-413	0/2	0/2
11/06/97	97-423	1/ 2 OD=.628	0/2
11/10/97	97-429	0/2	0/2
11/14/97	97-437	0/4	0/4
11/17/97	97-440	1/6 OD=.284	0/6
11/21/97	97-450	0/1	0/1
11/25/97	97-452	0/4	0/4
Totals:		2/125	0/125

Appendix B, continued.

BY93 SPAWNERS (MALES)			
DATE	**LAS #**	**ELISA RESULTS**	**VIRO RESULTS**
10/09/97	97-354	0/1	0/1
10/23/97	97-394	0/3	0/3
10/24/97	97-396	0/3	0/3
10/26/97	97-398	0/1	0/1
10/26/97	97-399	0/1	0/1
10/27/97	97-401	0/3	0/3
10/28/97	97-402	0/5	0/5
10/29/97	97-405	1/4 (O.D. .252)	0/4
10/30/97	97-407	0/4	0/4
10/31/97	97-408	0/1	0/1
11/01/97	97-409	0/1	0/1
11/02/97	97-410	0/5	0/5
11/03/97	97-414	0/7	0/7
11/04/97	97-416	0/5	0/5
11/04/97	97-418	0/2	0/2
11/05/97	97-419	0/1	0/1
11/06/97	97-417	0/3	0/3
11/07/97	97-425	0/3	0/3
11/08/97	97-426	0/6	0/6
11/09/97	97-427	0/2	0/3
11/10/97	97-430	0/3	0/3
11/13/97	97-435	0/1	0/1
11/14/97	97-438	0/1	0/1
11/14/97	97-442	1/1 O.D.=.137	0/1
11/21/97	97-451	0/1	0/1
11/25/97	97-454	N=1	0/1
11/25/97	97-454	0/1	0/1
Totals:		2/69	0/69

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