Tucannon River Spring Chinook Salmon Captive Broodstock Program

2002 Annual Report

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Acknowledgments

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Abstract

This report summarizes the objectives, tasks, and accomplishments of the Tucannon River Spring Chinook Captive Broodstock Program during 2002.

The WDFW initiated a captive broodstock program in 1997. The overall goal of the Tucannon River captive broodstock program is for the short-term, and eventually long-term, rebuilding of the Tucannon River spring chinook salmon run, with the hope that natural production will sustain itself. The project goal is to rear captive salmon selected from the supplementation program to adults, spawn them, rear their progeny, and release approximately 150,000 smolts annually into the Tucannon River between 2003-2007. These smolt releases, in combination with the current hatchery supplementation program (132,000 smolts) and wild production, are expected to produce 600-700 returning adult spring chinook to the Tucannon River each year from 2005-2010.

The captive broodstock program collected fish from five (1997-2001) brood years (BY). As of January 1, 2003, WDFW has approximately 11 BY 1998, 194 BY 1999, 314 BY 2000, 447 BY 2001, and 300 BY 2002 (for extra males) fish on hand at LFH.

The 2002 eggtake from the 1997 brood year (Age 5) was 13,176 eggs from 10 ripe females. Egg survival was 22%. Mean fecundity based on the 5 fully spawned females was 1,803 eggs/female.

The 2002 eggtake from the 1998 brood year (Age 4) was 143,709 eggs from 93 ripe females. Egg survival was 29%. Mean fecundity based on the 81 fully spawned females was 1,650 eggs/female.

The 2002 eggtake from the 1999 brood year (Age 3) was 19,659 eggs from 18 ripe females. Egg survival was 55%. Mean fecundity based on the 18 fully spawned fish was 1,092 eggs/female.

The total 2002 eggtake from the captive brood program was 176,544 eggs. A total of 120,833 dead eggs (68%) were removed with 55,711 live eggs remaining for the program. As of May 1, 2003 we had 46,417 BY 2002 captive brood progeny on hand

A total of 20,592 excess BY 01 fish were marked as parr (AD/CWT) and released during May 2002 into the Tucannon River (rkm 40-45). This allowed us to stay within our maximum allowed number (150,000) of smolts released.

On August 20, 97 (21 1998 BY and 76 1999 BY) adult captive broodstock were determined to be in excess of eggtake goals and were outplanted into the Tucannon River at Panjab Bridge (rkm 74.5). Released fish were tagged with Monel jaw tags and radio transmitters were inserted into ten females for tracking and monitoring.

Due to the low frequency of natural spawning by released fish, high mortality due to predation and illegal harvest, and high egg mortality in the hatchery during 2002, priority will be to release

excess progeny as parr to stay within smolt release goals rather than release excess captive broodstock as adults.

During April 2003, WDFW volitionally released 140,396 BY 2001 captive broodstock progeny smolts from Curl Lake Acclimation Pond into the Tucannon River. These fish were marked with agency-only wire tags and no fin clips in order to differentiate them from the supplementation fish (CWT/Right Red VIE/No Finclip). A total of 1,007 captive brood progeny smolts were PIT tagged to compare their outmigration with smolts from the supplementation program (1,010 tagged). Monitoring their survival and future releases to adult returns, along with future natural production levels, will determine the success or failure of this captive broodstock program.

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Introduction

Reporting Period

This report summarizes the accomplishments of the Tucannon River spring chinook salmon (*Oncorhynchus tshawytscha*) captive brood program for 2002. This report, while originally intended to cover activities accomplished exclusively under the Fiscal Year (FY) 2002 contract, includes some events during FY2003 activities as well. This was done to provide readers with complete results from the tagging, rearing, and spawning activities that have occurred.

Tucannon River Spring Chinook Program Overview

Prior to 1985, artificial production of spring chinook in the Tucannon River was nearly nonexistent, with only two fry releases in the 1960s (WDFW et al. 1999). In August 1962 and June 1964, 16,000 Klickitat (2.3 g fish or 197 fish/lb) and 10,500 Willamette (2.6 g fish or 175 fish/lb) spring chinook stock, respectively, were released by the Washington Department of Fisheries into the Tucannon River. The out-planting program was discontinued after a major flood destroyed the rearing ponds in 1965. Neither of these releases is believed to have returned any significant number of adults. After completion of the four lower Snake River dams, the Lower Snake River Compensation Plan (LSRCP) program was formed to provide hatchery compensation for loss of spring chinook, fall chinook, and summer steelhead in the Snake River (USACE 1975). In 1985, WDFW began the hatchery spring chinook production program in the Tucannon River by trapping wild (unmarked) adults for the hatchery broodstock. Hatchery-origin fish have been returning to the Tucannon River since 1988. The hatchery broodstock since 1989 has consisted of natural and hatchery-origin fish.

In 1992, the National Marine Fisheries Service (NMFS) listed Snake River spring/summer chinook as “endangered” (April 22, 1992 Federal Register, Vol. 57, No. 78, p 14653), which included the Tucannon River stock. The listing status was changed to “threatened” in 1995 (April 17, 1995 Federal Register, Vol 60, No 73, p 19342). Between 1993-1998, WDFW operated the supplementation program under Section 10 direct take permit #848 for artificial propagation and research. Since 1998, WDFW has operated both the supplementation and captive broodstock program under Section 10 direct take permits #1126 (artificial propagation), and #1129 (research). The Endangered Species Act (ESA) allows for “the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures pursuant to the Act are no longer necessary” (ESA 1973).

Consistent with that provision, WDFW and the co-managers [The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Nez Perce Tribe (NPT)] decided in 1997 to implement the Tucannon River captive broodstock program to sustain and potentially recover this listed population. Both of the hatchery programs (supplementation and captive brood) are being conducted with the recognition that artificial propagation may have potentially deleterious direct and indirect effects on the listed fish (Hard et al. 1992; Cuenco et al. 1993; Busack and Currens 1995; Campton 1995). These effects may include genetic and ecological hazards that cause maladaptive genetic, physiological, or behavioral changes in donor or target populations, with attendant losses in natural productivity (Hard et al. 1992). However, WDFW and the co-managers believed the risk of extinction in the Tucannon River was high enough to warrant intervention beyond the current supplementation program. Further, this program has been defined to last for only one-generation cycle (five brood years), and any potential negative effects should be reduced due to the short-term nature of the program.

Adult returns between 1985-1993 were between 400-750 wild and hatchery fish combined (Figure 1). In 1994, the adult escapement declined severely to less than 150 fish, and the run in 1995 was estimated at 54 fish. In 1995, WDFW started the Captive Broodstock Program on their own but discontinued it based upon the 1996-97 predicted returns. Unfortunately, the 1996 and 1997 returns were not as strong as predicted. In addition, major floods in 1996 and 1997 on the Tucannon River eliminated most natural production. Moreover, an 80% loss of the hatchery egg take occurred in 1997 due to an operation malfunction of a water chiller that cold shocked the eggs. Because of the lower returns, and losses to both natural and hatchery production, the Tucannon River spring chinook captive broodstock program was re-initiated with the 1997 brood year.

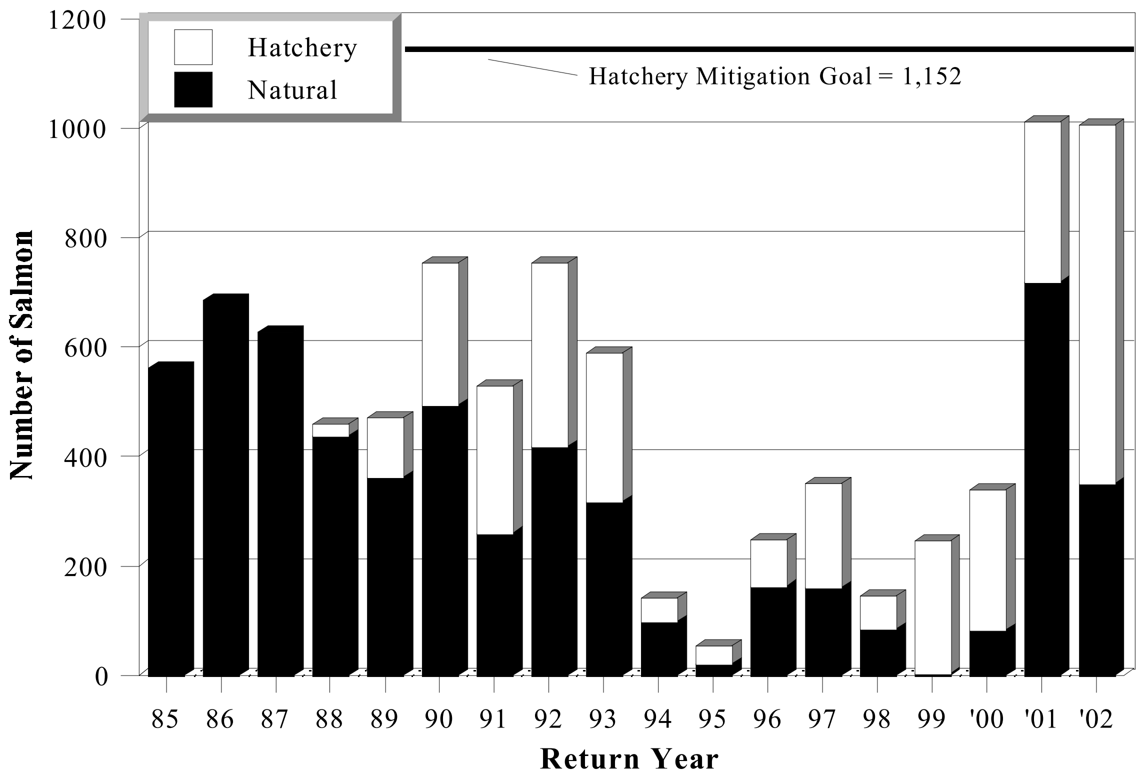

Figure 1. Total estimated escapement of Tucannon River spring chinook salmon from 1985-2002.

Key to the Tucannon River spring chinook restoration effort will be whether or not the natural population can consistently return above the replacement level. Since 1985, WDFW has monitored and estimated the success of the natural population for comparison to the hatchery program as part of the LSRCP program (USFWS 1998). Monitoring efforts to date have shown the natural population below replacement almost every year (Figure 2). In short, unless the

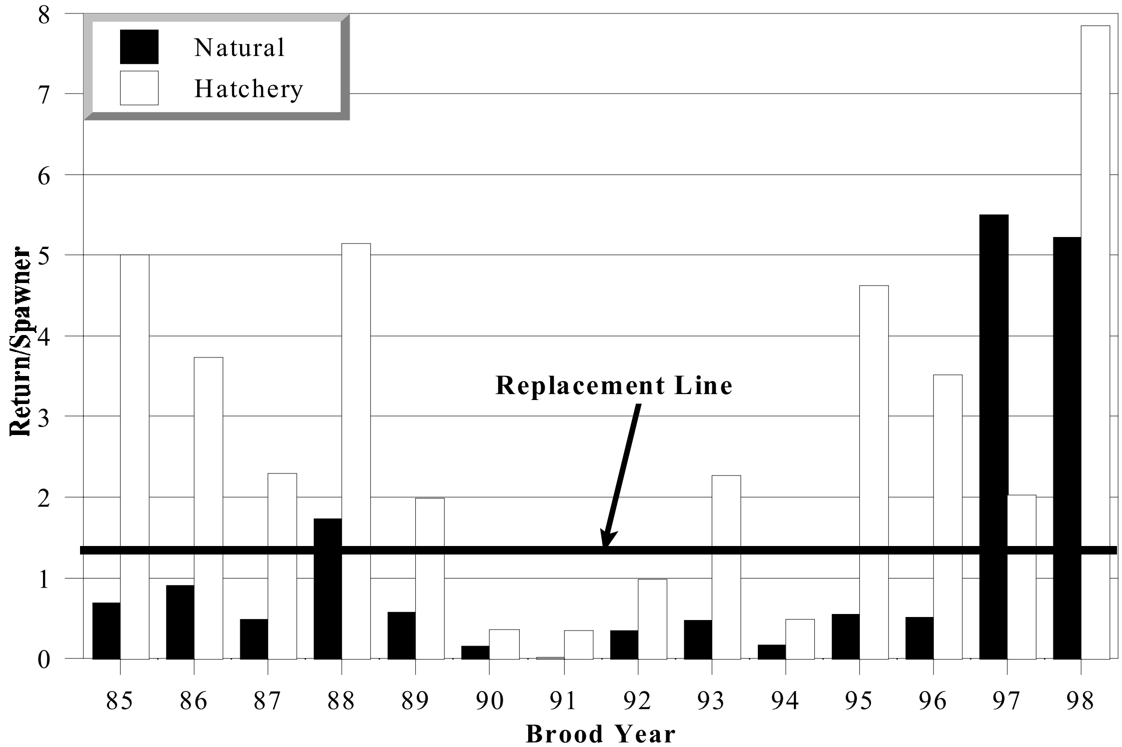

Figure 2. Return per spawner ratio (with replacement line) for Tucannon River spring chinook salmon for the 1985-1998 brood years.

natural population returns to a point above replacement both the captive broodstock and supplementation programs will fail to achieve their respective goals.

Tucannon River Watershed Characteristics

The Tucannon River empties into the Snake River between Little Goose and Lower Monumental dams approximately 622 river kilometers (rkm) from the mouth of the Columbia River (Figure 3). Stream elevation rises from 150 m at the mouth to 1,640 m at the headwater (Bugert et al. 1990). Total watershed area is about 1,295 km^2. Mean discharge is 4.9-m^3/sec with a mean low of 1.7-m^3/sec (August) and a mean high flow of 8.8-m^3/sec (April/May). Local habitat problems related to logging, road building, recreation, and agriculture/livestock grazing has limited the production potential of spring chinook in the Tucannon River. Spring chinook typically spawn and rear above rkm 40. WDFW and the co-managers believe smolt releases in the upper watershed have the best chance for high survival, and recovery effects from the captive brood and supplementation programs will be maximized by producing smolts.

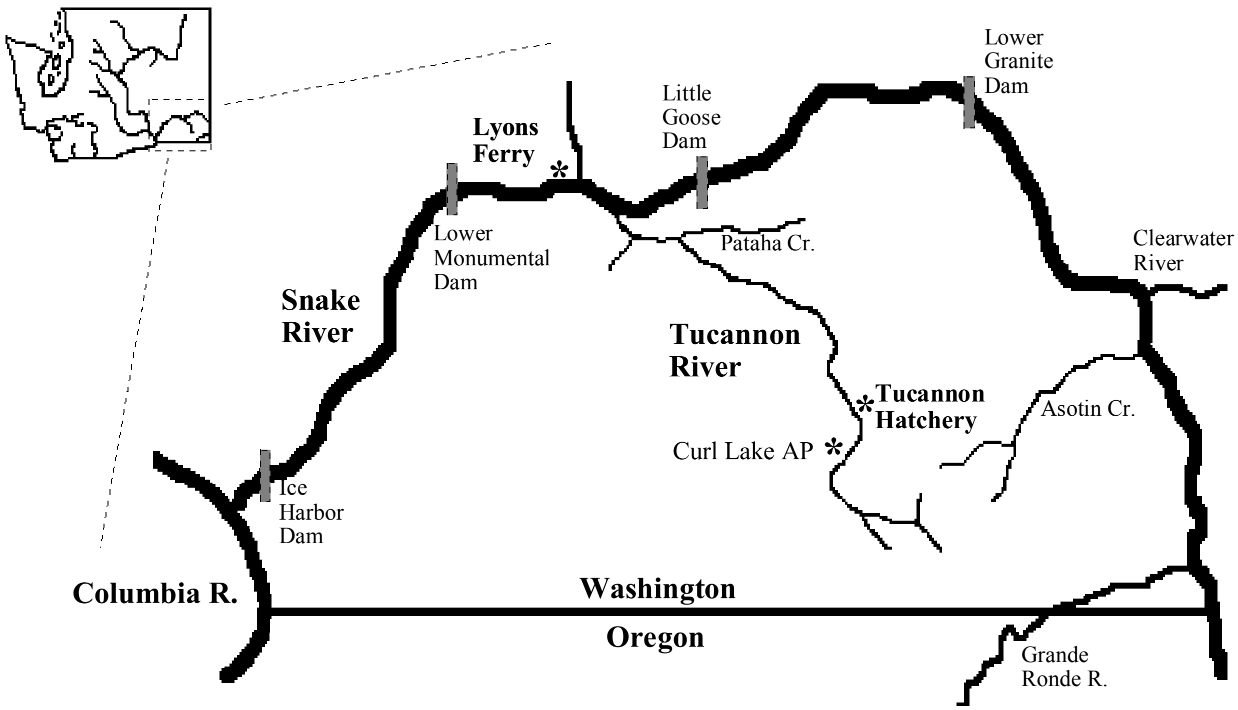

Figure 3. Location of the Tucannon River within the Snake River Basin, and locations of Lyons Ferry Hatchery, Tucannon Hatchery, and Curl Lake Acclimation Pond within the Tucannon River Basin.

It is hoped that recent initiatives for habitat improvement within the Tucannon Basin (BPA funded Tucannon River Model Watershed Program, and the State of Washington Governor's Salmon Recovery Plan) that are aimed at increasing in-river survival, along with changing and improved ocean conditions, and continued adult and juvenile passage improvements at Federal Columbia River Power System (FCRPS) dams, will be enough to return the natural population above the replacement level. For example, broad based goals of the Tucannon Model Watershed Program are to: 1) restore and maintain natural stream stability, 2) reduce water temperatures, 3) reduce upland erosion and sediment delivery rates, and 4) improve and re-establish riparian vegetation. Managers hope that these habitat recovery efforts will ultimately increase survival of naturally reared spring chinook in the river. While this will only provide an increase to population numbers (parr or smolts), greater numbers of juveniles will return more adult fish to the Tucannon River even if passage problems and ocean conditions remain unchanged. The captive brood program should provide a quick increase in the number of adults that will produce progeny to take advantage of these habitat improvements.

Facility Descriptions

The spring chinook supplementation program currently utilizes three different WDFW facilities: Lyons Ferry Hatchery (LFH), Tucannon Fish Hatchery (TFH), and Curl Lake Acclimation Pond

(AP). Each of these facilities will also be used in some manner for the captive broodstock program for rearing, release and subsequent adult capture upon return. Lyons Ferry Hatchery is located on the Snake River (rkm 90) at its confluence with the Palouse River (Figure 3). Lyons Ferry was constructed with funds provided by the Army Corps of Engineers, and has subsequently been funded through the LSRCP program of the U.S. Fish and Wildlife Service. Ultimately, the FCRPS through BPA bears the cost of the LSRCP program. Lyons Ferry is used for adult broodstock holding and spawning, and incubation and early life rearing until production marking. Fifteen 1.2-m diameter circular starter tanks were purchased when the captive broodstock program was started in 1995. In 1999, LSRCP purchased and supplied the funding for installation of eight 6.1-m diameter circular rearing tanks for the adults, and for relocation of the small circular tanks. The tanks were installed during August and September of 1999 in the captive broodstock rearing area at LFH. During 2000, BPA supplied funding for security fencing around the broodstock rearing area. A diagram of the captive broodstock facility is shown in Appendix A.

Tucannon Hatchery, located at rkm 59 on the Tucannon River, has an adult collection trap on-site (Figure 3). Following marking at LFH, juveniles are transferred to TFH to rear through winter. In mid-February, the fish are transferred to Curl Lake AP for a minimum of three weeks acclimation. Curl Lake AP is a 0.85 ha natural bottom lake with a mean depth of 2.8 meters (pond volume estimated at 22,203 m^3). During the middle of March, the pond exit is opened and the fish are allowed to volitionally emigrate from the lake until the third week of April when they are forced out.

Monitoring and Evaluation

As previously mentioned, the LSRCP Tucannon River spring chinook supplementation program has ongoing evaluations. Some of the monitoring and evaluation activities include: smolt release sampling, smolt trapping, spawning ground surveys, genetic monitoring, snorkel surveys for juvenile population estimates, spawning, fecundity monitoring, and experimental release strategies for smolts. Through these and other activities, survival rates of the natural and hatchery fish have been documented for the span of the supplementation program. These same and other activities will continue to play a major role in evaluating the success of the captive broodstock program in the future (for both parents and progeny).

As part of the monitoring plan, survival and rate of maturation are being documented by family groups within each brood year. Fecundity and egg size in relation to spawning success will be documented for all spawned captive broodstock females. Maturation timing will be monitored as well as overall growth rates for each brood year. Smolt migration will be monitored through the use of Passive Integrated Transponder (PIT) tags, and adult return rates will be monitored through adult trapping and carcass recoveries during spawning ground surveys.

Captive Broodstock Program

The overall goal of the Tucannon River spring chinook salmon captive broodstock program is for the short-term, and eventually long-term, rebuilding of the natural run, with the intent that the natural population will sustain itself. The current hatchery mitigation goal under the LSRCP is to return 1,152 adult spring chinook of Tucannon River stock to the river annually. Attempts to reach the LSRCP mitigation goal through an annual release of 132,000 smolts have failed largely because of poor smolt-to-adult survival rates. Currently, there is not an escapement goal for naturally produced spring chinook in the Tucannon River. It is hoped that through re-negotiation of the Columbia River Fish Management Plan (CRFMP), an agreed upon goal will be established to better manage the population.

The captive broodstock program is not intended to replace the hatchery supplementation program. Rather, it is to provide a quick "boost" to the population in the short term because of poor runs initially predicted through 2000. A quick "boost" would not be possible under the existing supplementation program, as it would require about 200 adults for hatchery broodstock each year. This was not believed possible by co-managers, as returns from 1998-2000 were expected to be less than 200 total fish annually. Further, such an increase would require taking more fish from the river, nearly eliminating any natural production potential. WDFW and the co-managers believed that the low runs between 1997-2000 would limit both natural and hatchery production, possibly to a point where the run would not be able to fully recover. Based on this conclusion, the captive broodstock program was initiated.

The specific objectives of the program are to rear spring chinook salmon from eggs to adults, spawn them, rear their progeny, and release the progeny as smolts into the Tucannon River. The program is scheduled to terminate with the final release of smolts in 2008. Successes and failures during and after the program ends will be evaluated by WDFW concurrently with the LSRCP hatchery evaluation program.

Eggs/fry to be incorporated into the captive broodstock program were collected from the 1997-2001 BYs that are part of the supplementation program. The captive broodstock goal is to collect 290,000 eggs/year from captive brood females when three complete age classes (Age 3-Age 5) are spawned concurrently. Under original program design, these eggs are expected to produce about 150,000 smolts for release from the Curl Lake AP. Depending on smolts produced each year this should provide a return of about 300 adult fish of captive broodstock origin per year between 2005-2010. These fish combined with fish from the hatchery supplementation program and natural production from the river should return 600-700 fish annually between 2005-2010. While this return is still well below the LSRCP mitigation goal, it increases the in-river population level to a pre-1994 run size.

Captive brood program production (adults, eggs, or juveniles) in excess of the smolt goal may be released by other methods as discussed in the Master Plan (WDFW et al. 1999). Options include adult outplants, remote site incubation, fry outplants, or smolt releases into other systems deemed suitable for Tucannon River spring chinook introductions.

The spring chinook captive broodstock program in the short term will help ensure that the Tucannon River spring chinook population is preserved until habitat-related factors and Columbia/Snake River passage problems affecting the productivity and survival of wild fish can be remedied. The captive brood program, in conjunction with the supplementation program, is intended to facilitate recovery of the natural population, while minimizing the risk of further decline. Monitoring and evaluation programs are in place to assess the effects of the captive broodstock program and adjust it as needed (Bumgarner and Schuck 1999, Bumgarner et al. 2000). Measures have been taken to minimize and mitigate potential genetic and/or ecological hazards of this program to the listed population (WDFW et al. 1999).

Source of Captive Population

As described in the Tucannon Master Plan (WDFW et al. 1999), the captive population will come from the hatchery supplementation program during the 1997-2001 BYs. Supplementation broodstock consist of both natural and hatchery returns (generally 1:1 ratio). Returning hatchery fish used in the supplementation broodstock are verified to have come from the Tucannon River stock through Coded-Wire Tag (CWT) verification. Collection of eggs/fry from the supplementation program was done to lessen the effects of removing more fish from the natural population. Also, disease history and origin of parents would be known, and the overall effect to the supplementation program would be minimal.

During the spawning process in the supplementation program, the eggs of two females are split in half with each lot fertilized by a different primary male (each male also acts as a secondary male). Due to the relatively small population size, this 2 x 2 mating (Figure 4) strategy has been incorporated into the supplementation program to increase genetic variation. Milt from a secondary male is added as a backup after 30 seconds. Actual fertilization takes place in a few seconds, so the backup male may not contribute equally to each individual egg lot unless semen from the primary male is non-viable.

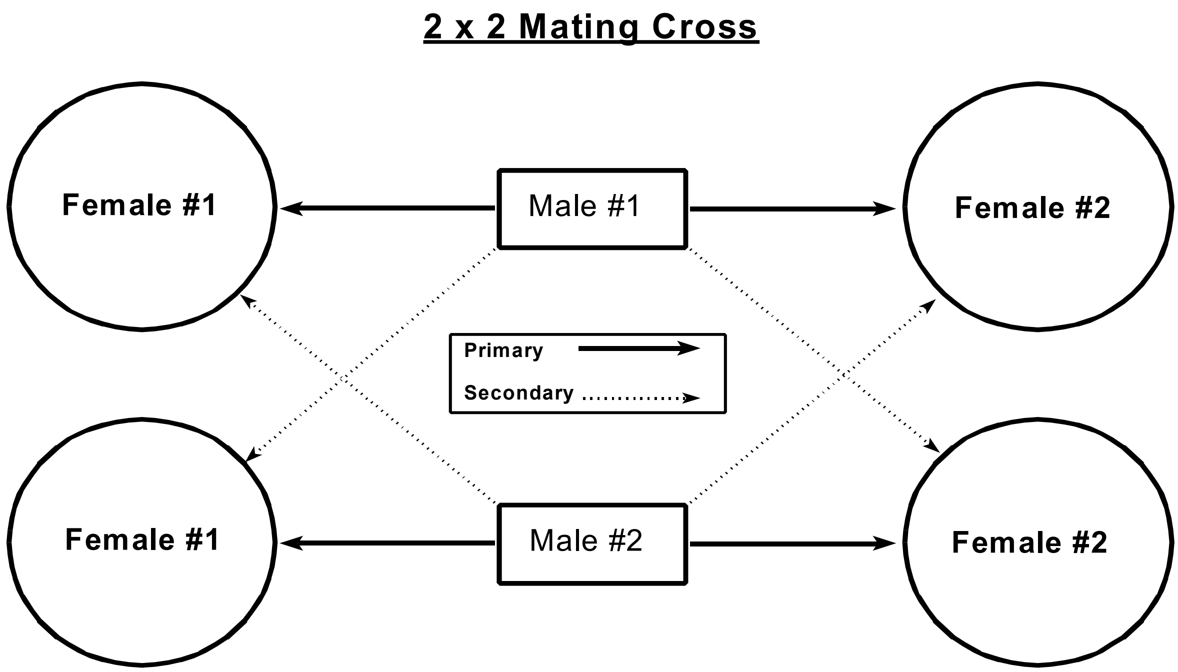

Figure 4. Diagram of the 2 x 2 mating scheme used by WDFW in the supplementation and captive broodstock program.

Because of the mating strategy, some progeny from the two females are likely related as a family unit. Therefore, we consider all crosses with identical males (whether as primary or secondary to the mating) as one family unit to avoid within-family matings in the future. So while only 15 "family" units are chosen for the program, actual contribution of male and female parents (population size) to the captive broodstock program on a yearly basis will be higher. The actual number of parents that comprise the 1997-2001 BYs are given in Appendix B. Effective population size for each brood year was calculated by the formula:

$$N_e = 4 (N_M)(N_F)/(N_M + N_F)$$

Where: N_M = number of males
N_F = number of females

The effective population sizes of the 1997-2001 BYs were 53, 58, 42, 56, and 58, respectively. Allendorf and Ryman (1987) and Verspoor (1988) have suggested that little (<1%) genetic variability will be lost in most salmonid species if the N_e of the founding population is greater than 50.

Selection of eggs/fry for the captive brood program is based on Bacterial Kidney Disease (BKD) and virology screening of females, parent origin, and matings (Appendix B). Spawned females were examined for BKD using the Enzyme Linked Immunosorbent Assay (ELISA) technique. Only females which are given a "Low" (0.11 - 0.19 Optical Density (OD)) or "Below Low" (< 0.11 OD) ELISA result are used for selection, with priority given to "Below Low" females. Priority for selection (in the following order) of eggs/fry is given to Wild x Wild, Wild x Hatchery (Mixed), and Hatchery x Hatchery crosses. All BYs identified for the program will follow the same criteria.

Screening for BKD was a major factor in WDFW's decision to collect eggs/fry from the supplementation program. By having the test results prior to selection, and by having rearing criteria that called for minimal sampling/handling, we felt that BKD outbreaks would be minimized. To date, we know of no mortalities that can be attributed to BKD in the captive brood population.

After the eggs have hatched and absorbed their yolk sac, they are ready to be placed in the rearing vessels and the selection process begins. Eighty fish (or generally 40 fry/female) from each of the 15 "family units" are selected (1,200 total fish) from each BY and moved to the 1.2-m circular fiberglass tanks. After rearing for one year, each of the "family" groups is reduced to 30 fish/family (450 fish/BY) by random selection just prior to marking. Excess fish are returned to the supplementation production group. Fish destined for the captive broodstock program are marked by "family" group with a CWT in the snout and adipose fin (backup). This is to verify "family" groups during future spawning activities so that full or half-siblings are not mated together. In addition to the CWT, an alpha-numeric visual implant (VI) tag is placed behind the left or right eye to identify each fish. The VI tag, should it be retained, will provide a quicker "family" identification method than the CWT. In addition, fish that retain the VI will provide individual growth rates. After the fish have been tagged, they are transferred to one of the 6.1-m circular fiberglass tanks for rearing to maturity. Once the fish have been transferred to the larger rearing tanks, they are not moved again unless survival rates are greater than anticipated, or density limits are exceeded within the rearing tanks. At maturity, fish are transferred to the lower section of an adult raceway, directly below fish that have been trapped for the supplementation program. Family size and marking procedures will be the same for all brood years collected.

Density limits for each rearing tanks were established prior to any stocking of fish. Most of the density limits prescribed were taken from the WDFW Dungeness River Captive Broodstock Program, where similar size starter and adult rearing tanks are used. Based on those density limits and expected survival and maturation rates, we were able to design the facilities needed. The current fish number maximums are as follows: 1.2-m circular tanks = no more than 200 fish/tank at Age 1; 6.1-m circular tanks = no more than 150 fish/tank at Age 3, or 100 fish/tank at Age 4.

Fry from each brood year were collected as described above, with appropriate families chosen for the program (Appendix B). Data on average length (mm), weight (g), and condition factor (K) for each "family" group were compiled during tagging (Appendix C).

Rearing, Spawning, and Release

Captive brood fish are being reared at LFH using standard fish culture practices and approved theraputants in pathogen free well water that is a constant 11ºC. Each 6.1-m circular captive tank is supplied with 581.3 L/min, while the 1.2-m tanks receive 23.3 L/min. To reduce the risk of catastrophic fish loss due to hatchery facility or operational failure, a number of safeguards are in place. LFH is staffed full time by personnel living on-station, providing for the protection of fish from vandalism and predation. The hatchery is also equipped with back up generators in the event of power outages. All staff are trained in proper fish handling, transport, rearing, biological sampling, and WDFW fish health maintenance procedures to minimize the risk of fish loss due to human error. All fish are handled, transported, and propagated in accordance with the WDFW Fish Health Manual (WDFW 1996) and Pacific Northwest Fish Health Protection Committee (PNFHPC 1989) disease prevention and control standards to minimize loss due to disease. Sanitation procedures are employed to reduce the transfer and incidence of fish diseases, and to promote quality fish in accordance with PNFHPC (1989) and Integrated Hatcheries Operations Team (1995) guidelines.

A variety of high quality commercial feed is provided through a state contract, and feed size varies with the estimated fish size of the different BYs. To date, we've used Moore-Clark Nutra™, Moore-Clark Fry™, Bio-Products Salmon Brood Feed™, and Moore-Clark Pedigree Trout Brood Feed™ on the captive brood. Estimated size only is generally used to prescribe feed, as WDFW decided initially that too much handling of the fish to determine growth and size would not maintain a healthy population. This decision resulted from problems that Oregon Department of Fish and Wildlife (ODFW) and Idaho Department of Fish and Game (IDFG) captive programs experienced during their first years of operation with monthly fish sampling (Bumgarner and Gallinat 2001). Due to the degree of early maturation of females in the 1997 and 1998 brood years, size at age recommendations were revised to produce more mature Age 4 and 5 fish. Size at age goals are as follows for each of the brood years: Age 1, 20-25 g; Age 2, 150-200 g; Age 3, 900 g; and Age 4, 4,000 g. All captive brood fish are reared outside under natural photoperiod conditions. However, each of the 6.1-m circular tanks are covered with camouflage netting which provides a shading effect over the pond. The netting also prevents fish from jumping out of the tank, and seems to maintain a "fright" response in the fish.

During the summer (late June to early July), captive brood fish that are Age 2 or greater are examined for signs of sexual maturation. Maturation is determined by change in body coloration, as other morphological sexual characteristics are not as obvious. Mature fish are removed and held below maturing spring chinook at LFH that have been trapped from the Tucannon River for the supplementation program. Some biologists believe that holding the captive brood below fish trapped from the river assists in maturation and spawn timing. Mature female captive broodstock were injected with Erythromycin (0.5 cc/4.5 kg of body weight) at sorting to prevent Bacterial Kidney Disease. The broodstock are also treated with a formalin flush (167 ppm) every other day to control fungus. Mature fish (primarily Age 2 jacks) not used for spawning are sacrificed at the end of the spawning season.

All captive brood progeny smolts will be marked differently from supplementation progeny for identification upon adult return. Smolts will be unclipped and marked with an agency-only wire tag in the snout (production fish have an elastomer tag and CWT). When supplementation or captive brood fish return as adults at the TFH adult trap, each unmarked (no adipose clip) adult spring chinook will be scanned for wire in the snout and examined for a VI tag. If the fish is not adipose fin clipped, and wire is present in the snout and no VI is present, the fish is likely from the captive broodstock program and will be passed upstream to spawn in the river. Only if the run completely collapses would any of the captive broodstock fish be collected for hatchery broodstock.

All five brood years (1997-2001) have been selected for the captive brood program. We started the year (Jan. 1, 2002) with 18 97BY; 161 98BY; 324 98BY; 448 00BY, and 1,200 01BY fish on hand. As of January 1, 2003, WDFW had approximately 11 BY98; 194 BY99; 314 BY00, and 447 BY01. In addition, we have selected 300 BY02 fish for rearing to have extra males on hand for spawning as the program comes to a close. The paragraphs below detail the selection, tagging, rearing, sorting, spawning activities, and mortalities for each BY during 2002.

1997 Brood Rearing

We began 2002 with 18 BY 1997 fish on hand. Fish from this brood have remained healthy throughout their rearing at LFH, with three mortalities during the year not related to maturation (Appendix D, Table 1). Since Age 1, there have been 76 (17.6%) mortalities not related to maturation. The captive broodstock were sorted for maturity on July 8, 2002. Since we are only keeping each broodstock to the age of 5, all 15 fish from the 97 BY were transported to the spawning raceway for holding. All mature captive brood fish at the spawning building are held directly below the supplementation broodstock captured at the adult trap on the Tucannon River. Length and weight samples were not collected from the 97 BY before transport.

Mortalities by age for each stage of maturity have been followed since program inception (Figure 5). Fish from the captive brood program have matured earlier than fish from the supplementation program (Figure 5, Appendix D). Captive brood males begin maturing at Age 2 and captive brood females begin to mature at Age 3 (Figure 5). Mature fish not used for spawning are fish that were in excess of the number required for spawning or mature fish that did not become ripe in time for spawning (Figure 5). The results from spawning the mature fish from the 1997 BY during 2002 are provided in the spawning section of this report.

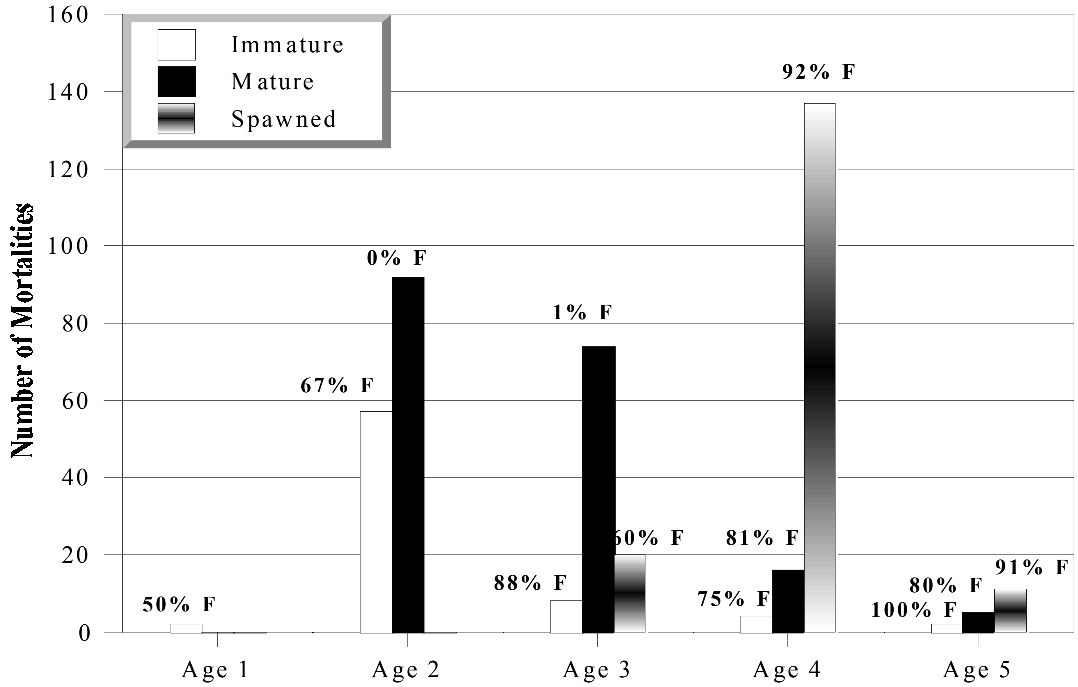

Figure 5. Number of mortalities by age and percent composition of females for each stage of maturity for the 1997 brood year.

1998 Brood Rearing

We started 2002 with 161 BY 1998 fish on hand. Fish from this brood have remained healthy throughout their rearing at LFH, with five mortalities during the year not related to maturation (Appendix D, Table 2). Since Age 1, there have been only 38 (9.3%) mortalities not related to maturation. One hundred twenty-four fish were determined to be mature based on coloration and were transported to the spawning building for holding on July 8. Our projections indicated that if all mature captive brood were spawned we would exceed our eggtake goal again as happened in 2001. To prevent having excess fish on hand we decided to outplant excess adult captive broodstock in 2002. A total of 21 excess mature fish were placed into Tank #5 (Appendix A) for adult outplanting. Eleven immature fish were sampled for lengths only (scale was not working) and placed into Tank #2 (Table 1).

Table 1. Length statistics of the 1998 brood year immature fish sampled on July 8, 2002.

Sample Size	Mean Length (cm)	Standard Deviation of Length	Coefficient of Variation
11	44.5	8.5	15.4

A greater number of 3-year old females matured and were spawned in the 1998 BY than the 1997 BY (Figures 5 and 6; Appendix D). This is most likely due to their accelerated growth and resulted in fewer Age 4 females spawned during 2002.

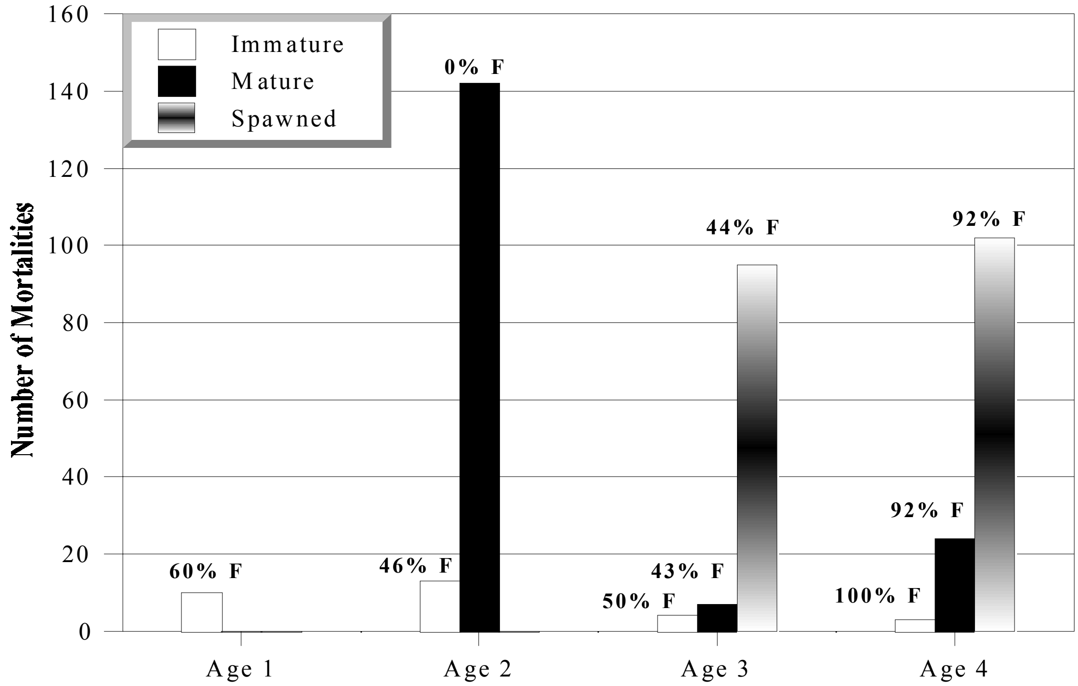

Figure 6. Number of mortalities by age and percent composition of females for each stage of maturity for the 1998 brood year. (Age 4 does not include 21 fish of unknown sex released as adult outplants).

1999 Brood Rearing

We began 2002 with approximately 324 BY 1999 fish on hand. Fish from this brood have remained healthy throughout their rearing at LFH, with three mortalities during the year not related to maturation (Appendix D, Table 3). Since Age 1, there have been only 6 (4.2%) mortalities not related to maturation. Fifty-one mature fish were transported to the adult spawning building. As with the 1998 BY, 76 mature fish were projected to be in excess of eggtake needs and were placed into Tank #5 with the 1998 BY excess fish for adult outplanting. The remaining 194 fish were immature and split into two tanks with 100 fish (49 sampled for length) placed into Tank #3 and 94 fish (50 sampled for length) placed into Tank #6 to reduce rearing density (Table 2).

Table 2. Length statistics of the 1999 brood year immature fish sampled on July 8, 2002.				
Tank #	Sample Size	Mean Length (cm)	Standard Deviation of Length	Coefficient Of Variation
3	49	39.2	3.1	7.9
6	50	39.4	4.2	10.7
Total	99	39.3	3.7	9.4

There have been proportionally fewer spawned females for the 99 BY at Age 3 than for the 1997 and 1998 brood years (Figure 7). Results from spawning the mature fish from the 1999 BY during 2002 are provided in the spawning section of this report.

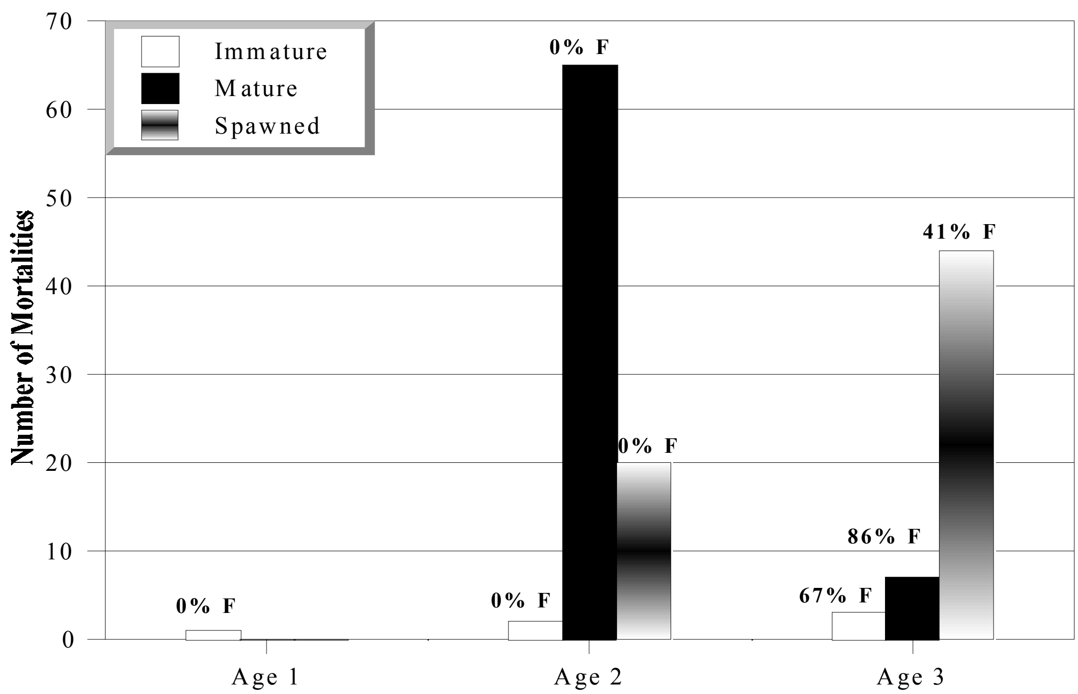

Figure 7. Number of mortalities by age and percent composition of females for each stage of maturity for the 1999 brood year. (Age 3 does not include 76 fish of unknown sex released as adult outplants).

2000 Brood Rearing

We began 2002 with approximately 448 BY 2000 fish on hand. Fish from this brood have remained healthy throughout their rearing at LFH, with two mortalities during the year not related to maturation (Appendix D, Table 4). During sorting on July 8, 103 mature fish (presumably males) were placed into Tank #7 to be used as needed during spawning. A hole was discovered in the crowder while sorting this brood year so number of immature fish are approximations. Approximately 163 immature fish (50 sampled for length) were placed into

Tank #4 and approximately 151 immature fish (50 sampled for length) were placed into Tank #8 (Table 3).

Table 3. Length statistics of the 2000 brood year immature fish sampled on July 8, 2002.				
Tank #	Sample Size	Mean Length (cm)	Standard Deviation of Length	Coefficient Of Variation
4	50	25.7	2.0	7.9
8	50	25.5	1.9	7.2
Total	100	25.6	2.0	7.6

2001 Brood Rearing

WDFW started 2002 with approximately 1,200 BY 2001 fish on hand in the 1.2-m circular tanks. During October, family sizes were reduced to 30 fish/family (450 total). These fish were tagged with CWT (snout and adipose fin) and an alphanumeric tag was placed behind the left eye (Appendix C). After tagging all fish were placed in a single 6.1-m circular rearing tank. Three fish died immediately following tagging with no other mortalities reported in 2002. Fish not selected for the captive brood program were mixed with juveniles (2001 BY) from the supplementation program at Curl Lake for volitional release.

2002 Extra Males

We determined that there would be insufficient captive brood males to spawn with females towards the end of the captive broodstock program. To prevent this from occurring, 20 fish from 15 families (300 fish total) were selected from the 2002 supplementation fish in order to have extra males on hand in the future. Assuming that 50 percent of these selected fish are males, we will have approximately 150 extra males to spawn with the captive broodstock. Eggs from ripe females will not be collected from this group. Instead, as BY02 females become mature they will be outplanted into the Tucannon River during the spawning season. The first anticipated ripe females are expected to be outplanted during the 2005 spawning season (Age 3). Selection of the 15 families used the same criteria as the captive broodstock and was based on origin, crosses (WxW, WxH, HxH), and BKD test results (Table 4). Effective population size (N_e) for the 2002 extra males was 59. Fish were moved to the 1.2-m circular rearing tanks located in the captive broodstock enclosure during December 2002.

Table 4. Selection of extra males for the Tucannon River spring chinook captive broodstock program based on origin, crosses, and BKD ELISA results, 2002 BY.					
Family Unit	**Eggtake Date**	**Female Number**	**Male Number**	**Cross**	**ELISA[1]**
1	8/27	W103+W104	HM1+HM2	Mixed	BL
2	8/27	H110	DOAA+ABO1	Mixed	BL
3	9/03	W203+W204	HM5+HM6	Mixed	BL/LOW
4	9/03	W211+W215	HM7+HM8	Mixed	BL
5	9/03	W217+W219	HM9+HM10	Mixed	BL
6	9/03	H209+H210	B5BD+8DO7	Mixed	BL
7	9/03	H212+H213	A6CE+BC25	Mixed	BL
8	9/03	H214+H216	AOCD+29BC	Mixed	BL
9	9/10	W301+W303	HM11+HM12	Mixed	BL
10	9/10	W307+W309	HM15+HM16	Mixed	BL/LOW
11	9/17	H401+H402	1515+98BA	Mixed	BL
12	9/17	H403+H404	CO45+BF27	Mixed	BL
13	9/17	H405+H408	A58C+BEBO	Mixed	BL
14	9/17	W406+W407	HM24+HM25	Mixed	BL
15	9/17	W409+W410	HM19+HM20	Mixed	LOW/BL

[1] Low = 0.11-0.19 Optical Density; Below Low = < 0.11 Optical Density.

2002 Spawning with Comparisons to the Supplementation Broodstock

Two of the 15 mature fish from the 1997 brood year (Age 5) were males; of which one was used in spawning and one was killed outright (green). Mean length and weight for Age 5 mature males was 52.8 cm and 1,703 g (Appendix E, Table 1). The remaining 13 mature fish were females. Of those, 10 were spawned (5 were partially ripe) and three died before spawning. Mean length and weight of Age 5 mature females was 53.8 cm and 2,357 g, respectively (Appendix E, Table 1). Length-weight relationships for males, females, and both sexes combined are found in Appendix E, Table 2.

Eggs were initially disinfected and water hardened for one hour in iodophor (100 ppm). During incubation, formalin (1,000 ppm) was added every other day for a 30 min treatment period to control fungus on the eggs. Eggtake from the 1997 brood year was 13,176 eggs and egg survival was 22%. It is unknown why egg survival was so low for Age 5 fish. Egg survival will be followed throughout the length of the program to see if it is age related. Mean fecundity based on the 5 fully spawned females was 1,803 eggs/female. Fecundity by size relationship for Age 5 females was expressed by the formula:

Fecundity = 108.30 + 30.99 x Fork Length (cm) ($r^2 = 0.16; P > 0.10$)

Peak spawning was two weeks later than observed for the supplementation fish (Figure 8). Due to the close proximity in spawn timing we were able to use wild males with a portion of the captive brood females. We did not attempt to cryo-preserve any semen from wild males but instead placed semen from wild origin fish into plastic bags with oxygen and stored them in a refrigerator for up to one week. Eight of the ten females were crossed with wild (unmarked) males from the supplementation program. One was crossed with a hatchery male and the other with a captive male.

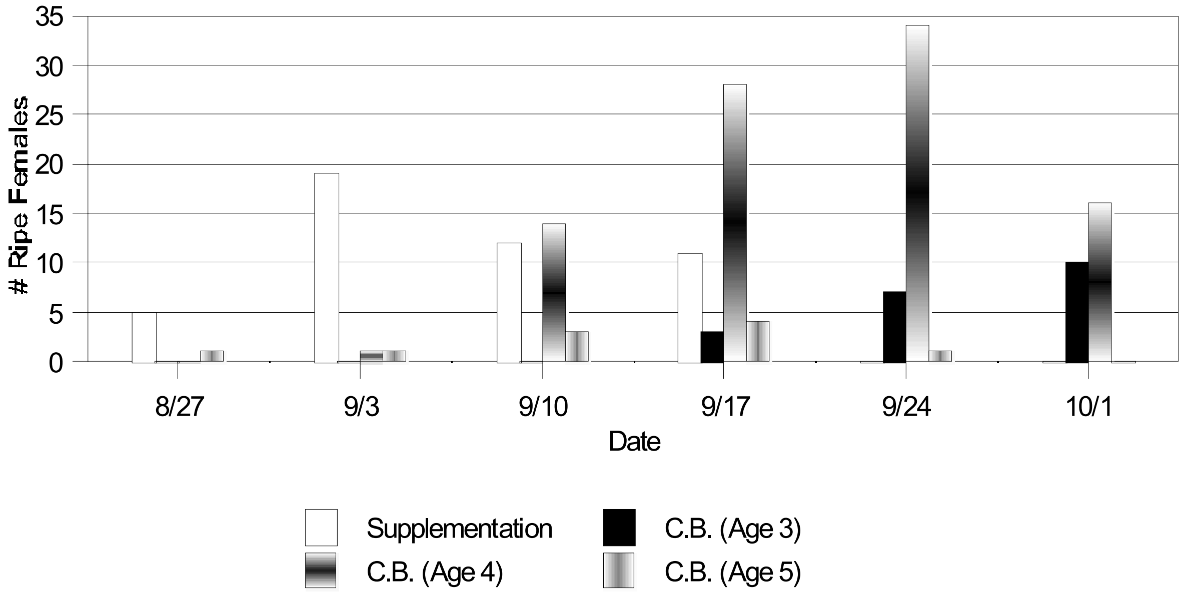

Figure 8. Spawn timing comparison by origin for the 2002 spawning season.

Eleven of the 124 mature fish from the 1998 brood year (Age 4) were males, of which 9 were used for spawning, one was killed outright, and one died before spawning. Average length and weight for mature Age 4 males was 51.3 cm and 1,705 g (Appendix E, Table 1). One hundred-thirteen of the mature fish were females. Of those, 93 were spawned (12 were partial spawns), five were killed outright (green), and 15 died before spawning. Average length and weight for mature Age 4 females was 54.1 cm and 2,305 g (Appendix E, Table 1). Length-weight relationships for males, females, and both sexes combined are found in Appendix E, Table 2. Eggtake was 143,709 eggs and egg survival was 29%. This is in comparison to 69% survival to the eyed-egg stage for Age 4 fish (1997 BY) spawned in 2001. Mean fecundity based on the 81 fully spawned females was 1,650 eggs/female. This is lower than the fecundity of Age 4 fish spawned in 2001 (1,990 eggs/female based on 105 fully spawned fish) but differences may be due to sample size. Fecundity by size relationship for Age 4 females was expressed by the formula:

Fecundity = -2,673.52 + 79.92 x Fork Length (cm) ($r^2 = 0.57$; $P < 0.01$)

Seventeen of the 81 spawned females were crossed with wild (unmarked) males from the supplementation program, seven were crossed with hatchery males, and the remaining 69 crossed with mature captive brood males. Peak spawning was three weeks later than observed for the supplementation fish (Figure 8).

Twenty-seven of the 51 mature fish from the 1999 brood year (Age 3) were males, of which 26 were used in spawning and one was a pre-spawn mortality. Mean length and weight for Age 3 mature males was 41.2 cm and 917 g (Appendix E, Table 1). Twenty-four of the mature fish were females. Of those, 18 were spawned and six were green and killed outright. Mean length and weight of Age 3 mature females was 46.8 cm and 1,392 g (Appendix E, Table 1).

Eggtake was 19,659 eggs and egg survival was 55%. This is in comparison to 81% egg survival for Age 3 females in 2001 (1998 BY) and 47% survival in 2000 (1997 BY). Mean fecundity based on the 18 fully spawned fish was 1,092 eggs/female. This is similar to fecundity of Age 3 females (1998 BY) during 2001 spawning (1,160 eggs/female). Fecundity by size relationship for Age 3 females was expressed by the formula:

$$\text{Fecundity} = -2{,}012.00 + 66.60 \times \text{Fork Length (cm)} \qquad (r^2 = 0.79;\ P < 0.01)$$

Peak spawning was four weeks later than observed for the supplementation fish (Figure 8). Seven females were crossed with wild males, one with a hatchery male and the remaining 10 fish with captive males.

One hundred of the 103 mature fish from the 2000 BY (Age 2) were males, of which forty-seven were used for spawning. The remaining 53 males were killed outright and sampled for length and weight. Mean length and weight for males was 28.3 cm and 301 g (Appendix E, Table 1). One immature male was incorrectly identified as mature during sorting. Three immature females were also incorrectly identified as mature. Mean length and weight for these females was 30.1 cm and 363 g (Appendix E, Table 1).

The total eggtake for the captive brood program was 176,544 eggs. A total of 120,833 dead eggs (68%) were removed leaving 55,711 live eggs in the incubators. An additional 5,249 dead eggs/fry (9.4%) were picked at ponding leaving 50,462 fish for rearing.

Multiple comparison analysis was performed to determine if there were significant differences (at the 95% confidence interval) in mean fecundities between captive brood (Age 4) and wild and hatchery origin females (Age 4) trapped from the Tucannon River for the supplementation program. Age 4 fish trapped for the supplementation program (both hatchery and wild origin) had significantly higher fecundities than Age 4 captive brood females ($P<0.05$) (Figure 9). Fecundities of hatchery and wild origin fish trapped in the river for the supplementation program were not significantly different ($P>0.05$).

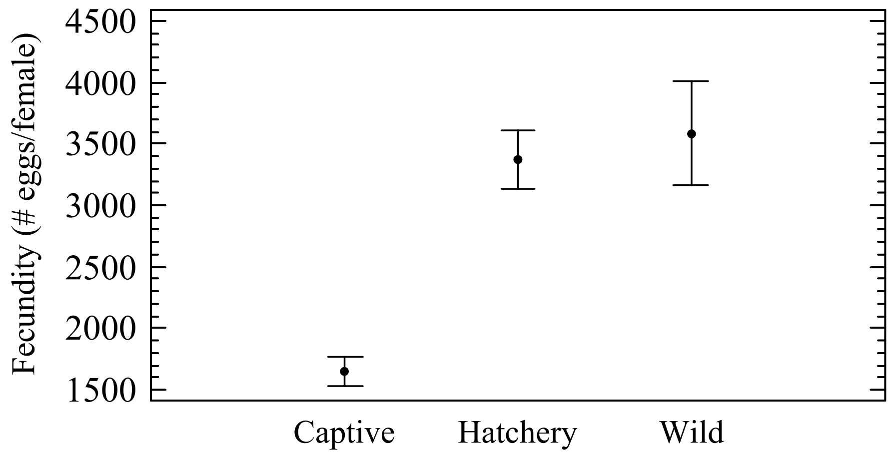

Figure 9. Mean fecundity (with 95% confidence intervals) of Age 4 captive, wild, and hatchery origin spawned females, 2002.

Egg size (g/egg) has been tracked in the supplementation program since 1988. Mean egg size was significantly different at the 95% confidence level between Age 4 hatchery origin fish and Age 4 wild origin fish from the supplementation program ($P < 0.05$), but Age 4 hatchery origin eggs were not significantly different in size from Age 4 captive brood eggs ($P > 0.05$) (Figure 10). Mean egg size of Age 5 captive brood females was not significantly different ($P>0.05$) from Age 5 females (hatchery and wild) from the supplementation program. Heath et al. (2003) found that chinook salmon raised in a commercial hatchery in Canada developed significantly smaller eggs within four generations in captivity. Our findings to date have found the opposite, with hatchery and captive brood eggs significantly larger than eggs from wild origin fish (Figure 10).

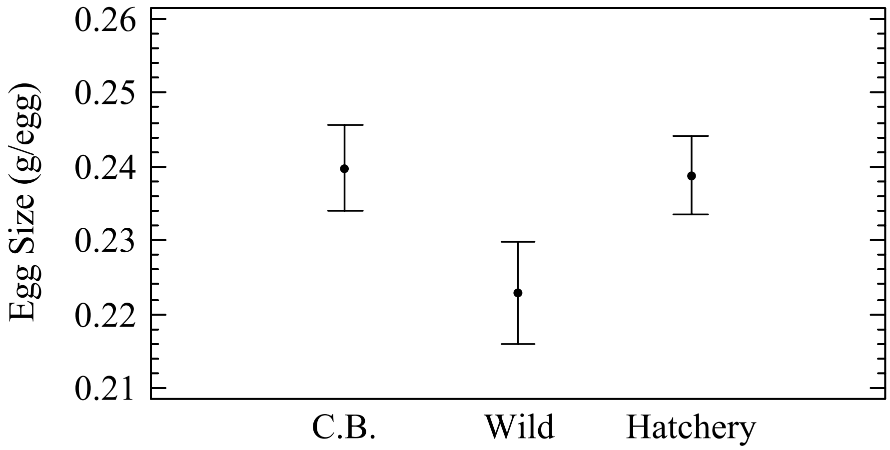

Figure 10. Mean egg size (g/egg) with 95% confidence intervals for Age 4 captive brood females (2001-2002) compared to Age 4 wild and hatchery origin females from the supplementation program, 1988-2002.

Surprisingly, mean egg size was not significantly different between Age 4 captive broodstock and Age 4 hatchery origin supplementation fish even though captive broodstock females were significantly smaller ($P < 0.05$) (Table 5). Captive brood females may be able to allocate more energy into producing larger eggs with their protection in the hatchery environment. These large eggs in small fish results in captive broodstock with lower fecundities than fish trapped from the wild.

Table 5. Comparison of mean fork length (cm) and mean egg size (g/egg) from female captive broodstock (2000-2002) and female supplementation broodstock (1988-2002).

Female Origin (Age)	N	Mean Fork Length (cm)	S.D.	Mean Egg Size (g/egg)	S.D.	Range
Captive Brood (Age 3)	67	46.2	3.3	0.20	0.03	0.15-0.27
Captive Brood (Age 4)	218	53.9	5.7	0.24	0.04	0.15-0.39
Captive Brood (Age 5)	9	54.4	6.1	0.24	0.05	0.19-0.36
Wild Origin (Age 4)	95	71.7	4.3	0.22	0.03	0.15-0.33
Hatchery Origin (Age 4)	156	71.7	3.7	0.24	0.03	0.10-0.32
Wild Origin (Age 5)	65	84.0	4.1	0.27	0.04	0.13-0.35
Hatchery Origin (Age 5)	20	78.1	4.3	0.27	0.04	0.20-0.34

Using analysis of variance, mortality to the eyed egg stage was significantly higher for captive brood origin eggs than eggs from the supplementation program ($P < 0.05$) (Figure 11). It is unknown why egg mortality was so high for the captive brood fish. It may be nutritionally or hatchery environment related. The effect of male origin (captive, wild, hatchery) was examined using multiple comparison analysis to determine the influence of male origin on egg survival, but no statistically significant differences were found (P=0.45).

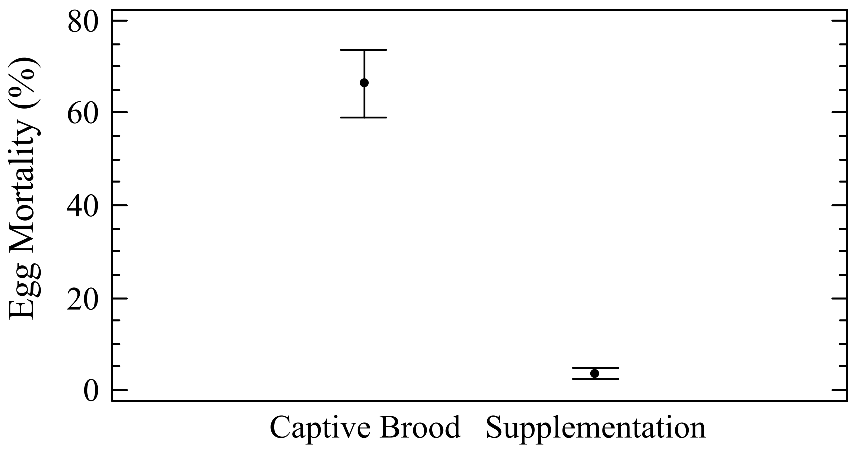

Figure 11. Mean percent egg mortality (with 95% confidence intervals) of captive brood and supplementation origin eggs from the 2002 spawning season.

Adult Outplants

On August 20, 97 (21 1998 BY and 76 1999 BY) excess Tucannon River adult spring chinook were released (Table 6) into the Tucannon River at Panjab Bridge (rkm 74.5). All released fish were tagged with metal (Monel) jaw tags and radio transmitters were inserted into ten of the larger (presumably female) fish for tracking and monitoring in the wild. Radio tagged fish were monitored weekly through the end of September (Appendix F). Table 6 summarizes the tagging and recovery information from the radio tagged fish. Two of the radio tagged females spawned successfully within 2 km of the release site (9/165 and 9/192). Another female (9/167) that was attempting to spawn (actively digging a redd) died after releasing less than 10% of her eggs. Of the remaining seven fish: three tags were recovered on the stream bank without a carcass and may have been illegally harvested; two fish were eaten by predators; one fish was a prespawn mortality unrecoverable in a debris jam; and one fish (9/203) was never located after release – the radio stopped transmitting or the fish and transmitter left the area.

Outplanted adults differed from wild and hatchery-origin fish in the river in morphology and coloration. Captive brood males lacked a prominent kype and captive fish were more golden-yellow in color. During redd surveys, released captive brood adults were observed being chased by more dominant male and female wild and hatchery-origin fish in the river.

In studies by Berejikian et al. (1997), wild coho females produced more nests than captive brood females. They also found that captive brood coho males were dominated by wild males and were also attacked more often by females than wild males. Fleming and Gross (1993) found coho hatchery females were delayed in spawning, retained more eggs, spawned in less desirable areas, and were less successful in guarding nest sites.

Losses to predation may be higher for fish released from a hatchery environment due to inability to accurately assess predation risks, secondary stress effects, and a general unfamiliarity with their new surroundings (Steward and Bjornn 1990).

Due to the low frequency of natural spawning by released fish, high mortality due to predation and illegal harvest, and high egg mortality in the hatchery during 2002, priority will be to release excess progeny as parr to stay within smolt release goals rather than release excess captive broodstock as adults.

Table 6. Radio tagging and recovery data for ten adult captive spring chinook salmon tagged on July 16 and released on August 20 at Panjab Bridge in the Tucannon River during 2002.

	Release Data			Recovery Data				
Channel/ Code	Panjab Br. Rkm	Sex	FL (cm)	Recovery Information	Date	Rkm	Poached	Spawned
9/165	74.5	F	58.0	Recovered fish & tag	9/25	72.9	No	Yes
9/167	74.5	F	55.5	Recovered fish & tag	9/13	73.0	No	No
9/171	74.5	F	56.5	Recovered fish & tag	9/23	73.4	No	No
9/179	74.5	F	55.5	Tag found on bank	9/20	77.7	Yes	No
9/183	74.5	F	52.0	Tag found on bank	9/20	74.5	Yes	No
9/184	74.5	F	51.0	Carcass in log jam	--	68.7	No	No
9/192	74.5	F	50.0	Recovered fish & tag	9/27	73.6	No	Yes
9/193	74.5	F	51.0	Tag in animal den	--	73.5	No	No
9/203	74.5	F	49.0	Lost contact	--	--	??	??
9/205	74.5	F	47.0	Tag found on bank	9/13	76.6	Yes	No

2002 Progeny

As of May 1, 2003 we had 46,417 BY 2002 captive brood progeny on hand at Lyons Ferry Hatchery. These fish will be coded-wire tagged and volitionally released during March-April 2004.

2001 Progeny

A total of 20,592 marked (AD clip/CWT) excess captive brood progeny (BY01) were released on May 6, 2002 between rkm 40-45 on the Tucannon River (Table 7). This parr release allowed us to stay within our maximum allowed number of smolts released under Section 10 Permit #1129 (150,000 supplementation, 150,000 captive brood progeny). The remaining 2001 BY captive brood juveniles (144,492 fish) were marked on September 9-13 with an agency-only wire tag in the snout and transported to TFH on October 11. During February 19-20, 2003 approximately 140,414 BY01 captive brood progeny were transferred to Curl Lake for acclimation and volitional release. Fish were sampled for length, weight, hatchery mark quality, and PIT tagged for outmigration comparisons (1,010 supplementation fish and 1,007 captive brood progeny) before transfer to Curl Lake (Table 8). Length and weight samples were collected three times from the 2001 BY fish during the rearing cycle (Table 9). Volitional release began April 1 and continued until April 21 when they were forced out. Mortalities were low in Curl Lake and WDFW released 140,396 BY 2001 captive broodstock progeny into the Tucannon River (Table 7). These fish were marked with agency-only wire tag and no fin clips in order to differentiate them from the supplementation fish (CWT/Right Red VIE/No Finclip). Monitoring their survival and future releases to adult returns, along with future natural production levels, will determine the success or failure of the captive broodstock program. Fish releases from the program to date can be found in Appendix G.

Table 7. Summary of parr and yearling spring chinook releases in the Tucannon River, 2001 brood year.

Release		Release		Total	CWT	Number	Ad-only	
Year	(BY)	Location	Date	Released	Code	Tagged	Marked	kg
2002	2001	Bridge 11	5/06	20,592	63/14/30	20,435	157	56.6
2003	2001	Curl Lake	4/01-4/21	140,396	63	134,401	N.A.	4,581.3

N.A. = Not Applicable.

Table 8. Length and weight statistics of the 2001 brood year supplementation and captive brood progeny PIT tagged in February 2003.

Origin	N	Mean Length (mm)	Mean Weight (g)	Coefficient of Variation	Condition Factor (K)	Number PIT Tagged
Supp.	250	126	24.9	15.5	1.19	1,010
C.B.	250	116	19.5	12.7	1.19	1,007

Table 9. Summary of sample sizes (N), mean lengths (mm), coefficients of variation (CV), condition factors (K), and fish/lb (FPP) of 2001 BY juveniles sampled at LFH, TFH, and Curl Lake.

Date	Progeny Type	Sample Location	N	Mean Length	CV	K	FPP
5/03/02	Captive Brood	LFH	200	62.5	9.7	1.09	165.0
2/18/03	Captive Brood	TFH	250	116.5	12.7	1.19	23.3
4/08/03	Captive Brood	Curl Lake	250	135.3	17.2	1.21	13.9

DNA Genetic Samples

Since the beginning of the program in 1997, evaluation staff has collected DNA samples from all spring chinook parents that eventually contributed gametes to the captive broodstock population. Additional samples are also collected on an annual basis from other Tucannon River origin spring chinook carcasses to provide a large genetic data set that will describe the population. Opercle punches for DNA analysis were collected from 2002 spawners, including captive brood spawners. All 2002 DNA samples were sent to the WDFW genetics lab in Olympia for baseline microsatellite DNA analysis.

Coordination and Reporting

Since BPA funding was acquired, WDFW has joined other researchers in a group known as the Captive Broodstock Technical Oversight Committee (CBTOC). The CBTOC is a forum for all BPA funded projects working with captive broodstock or captive rearing programs. The CBTOC goal is to ensure that all groups are coordinated, and communication is occurring between projects. The CBTOC also gives each of the researchers a chance to ask questions about other program's successes and failures, so each respective program can be adapted for better results.

In addition, WDFW formed its own Technical Working Group (TWG), which consists of WDFW project personnel, and representatives from the NPT and CTUIR. The group was formed so that WDFW and co-managers could make unified decisions about the Tucannon Spring Chinook captive broodstock program.

To satisfy ESA Section 10 permit requirements, WDFW also provides NMFS with a monthly update on the captive broodstock and supplementation program activities. This monthly program update is also sent to the co-managers to inform them of fish on hand, mortalities incurred, and any up-coming actions (i.e., sorting of mature fish) that may warrant their attention.

This annual progress report is produced by WDFW to disseminate the information gathered from this project to other researchers in the Columbia and Snake River basins. Additional reports and papers will also be published following complete returns of all captive brood origin fish back to the Tucannon River.

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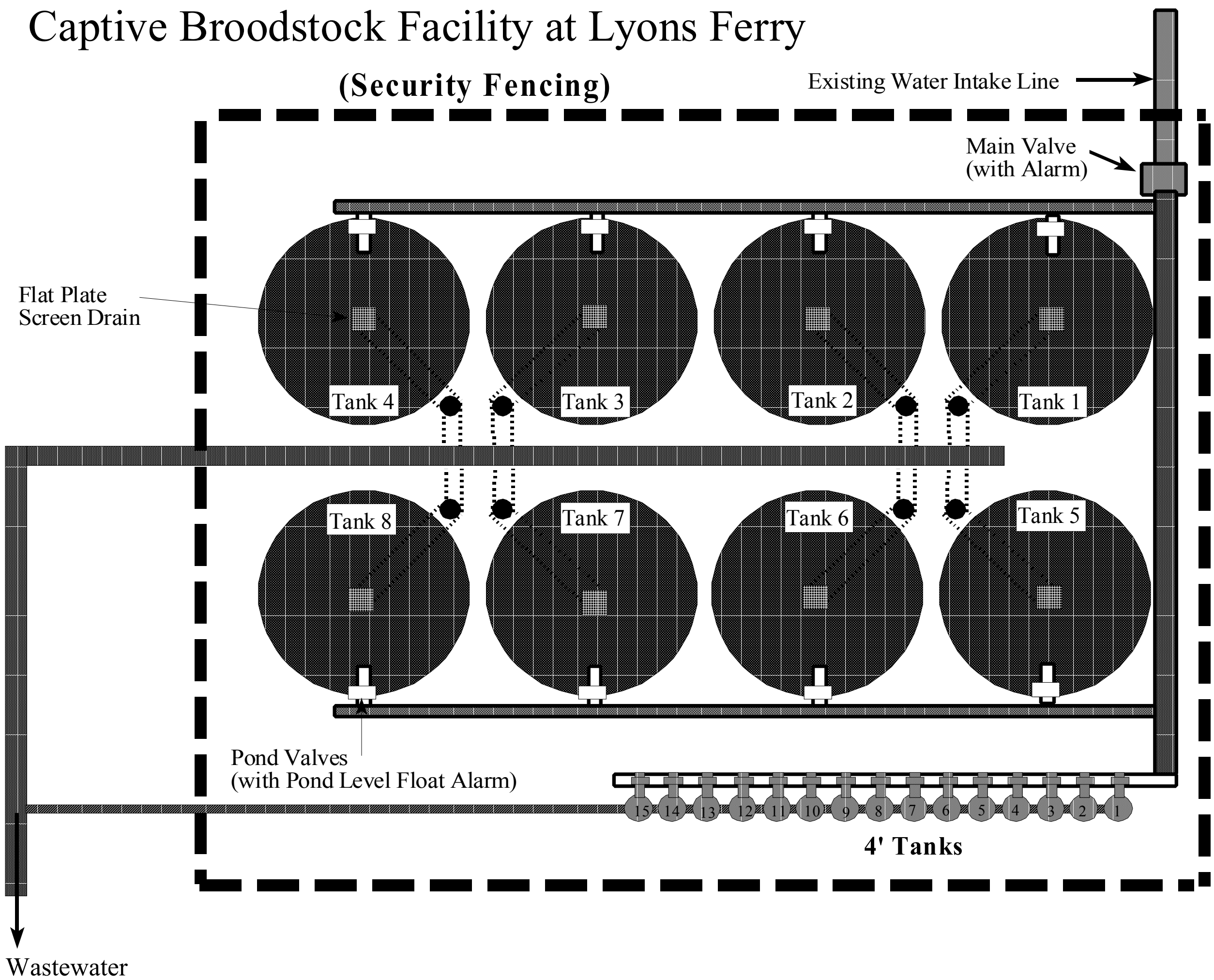
APPENDIX A


Captive Broodstock Facility at Lyons Ferry
(Security Fencing)
Existing Water Intake Line
Main Valve
(with Alarm)
Flat Plate
Screen Drain
Tank 4
Tank 3
Tank 2
Tank 1
Tank 8
Tank 7
Tank 6
Tank 5
Pond Valves
(with Pond Level Float Alarm)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
4' Tanks
Wastewater

APPENDIX B

Table 1. Selection of progeny for the Tucannon River spring chinook captive broodstock program based on origin, crosses, and BKD ELISA results, 1997 and 1998 BYs.						
Brood Year	Eggtake Date	Female Numbers	Male Numbers	Crosses	BKD ELISA*	Tank/Family Number
97	09/16	H885 + H886	W108 + W110	Mixed	LOW, BL	TANK 1
97	09/16	H889	W116 + W120	Mixed	BL	TANK 2
97	09/23	W958 + W957	H122 + H123	Mixed	BL	TANK 3
97	09/16	W897 + W898	H156 + H199	Mixed	BL	TANK 4
97	09/09	H872 + H871	W159 + W161	Mixed	BL	TANK 5
97	09/09	H873	W163 + W165	Mixed	LOW	TANK 6
97	09/09	W881 + W882	H167 + H175	Mixed	BL	TANK 7
97	09/16	W951 + W952	H149 + H157	Mixed	BL	TANK 8
97	09/09	W874 + W875	H171 + H173	Mixed	BL	TANK 9
97	09/09	W878 + W876	H179 + H181	Mixed	LOW, BL	TANK 10
97	09/02	W869 + W867	H191 + H193	Mixed	BL	TANK 11
97	09/09	H879	W169 + W177	Mixed	BL	TANK 12
97	09/16	W899	H153 + H154	Mixed	BL	TANK 13
97	09/02	W870	H183 + H185	Mixed	BL	TANK 14
97	09/02	H868	W187 + W189	Mixed	BL	TANK 15
98	08/25	W1003 + W1004	H754 + H753	Mixed	BL	TANK 1
98	08/25	W1005 + W1006	H751 + W131	Mixed	LOW, BL	TANK 2
98	09/08	W3001 + W3002	H758 + H759	Mixed	LOW, BL	TANK 3
98	09/08	W3003 + W3004	H755 + H756	Mixed	BL	TANK 4
98	09/08	W3005 + W3006	H757 + H760	Mixed	BL	TANK 5
98	09/08	W3007 + W3008	W128 + W129	Mixed	BL	TANK 6
98	09/08	H3009 + H3010	W130 + W133	Mixed	LOW, BL	TANK 7
98	09/11	H4001 + H4002	W135 + W134	Mixed	LOW, BL	TANK 8
98	09/11	W4003 + W4004	H762 + H761	Mixed	LOW, BL	TANK 9
98	09/11	W4007 + W4008	H767 + H765	Mixed	LOW, BL	TANK 10
98	09/11	W4009 + W4010	H769 + H768	Mixed	BL	TANK 11
98	09/15	W5002	H777 + H773	Mixed	LOW	TANK 12
98	09/15	W5003	H772 + H771	Mixed	LOW	TANK 13
98	09/22	W6005 + W6006	H781 + H780	Mixed	BL	TANK 14
98	09/22	W6007 + W6008	H783 + H782	Mixed	BL	TANK 15

* Low = 0.11-0.19 Optical Density; Below Low = < 0.11 Optical Density.

Table 2. Selection of progeny for the Tucannon River spring chinook captive broodstock program based on origin, crosses, and BKD ELISA results, 1999 and 2000 BYs.

Brood Year	Eggtake Date	Female Numbers	Male Numbers	Crosses	BKD ELISA*	Tank/Family Number
99	08/31	H101	H1+H2+H526	Hatchery	LOW	TANK 1
99	09/07	H203	H12+H13+H536	Hatchery	BL	TANK 2
99	09/07	H204	H15+H530+H531	Hatchery	LOW	TANK 3
99	09/07	W205	H18+H532+H533	Mixed	LOW	TANK 4
99	09/07	H206	H528+H529+H534	Hatchery	BL	TANK 5
99	09/07	H212	H19+H20	Hatchery	BL	TANK 6
99	09/14	H305	W31+H571	Mixed	LOW	TANK 7
99	09/14	H306	W21+H576	Mixed	LOW	TANK 8
99	09/14	H307	H40+H550	Hatchery	LOW	TANK 9
99	09/14	H309	H23+H549	Hatchery	BL	TANK 10
99	09/14	H310	H39+H572	Hatchery	LOW	TANK 11
99	09/14	H311	H36+H568	Hatchery	LOW	TANK 12
99	09/14	H312	H24+H544	Hatchery	LOW	TANK 13
99	09/21	H403	H45+H580	Hatchery	LOW	TANK 14
99	09/21	H404	H581+H582+H583	Hatchery	LOW	TANK 15
00	8/29	H102	H1 + H2	Hatchery	BL	TANK 1
00	8/29	H103 + H104	H3 + H4	Hatchery	BL	TANK 2
00	8/29	H105 + W106	H5 + H6	Mixed	BL	TANK 3
00	9/05	H202	W1 + H19	Mixed	BL	TANK 4
00	9/05	H203 + H204	W2 + H7	Mixed	BL	TANK 5
00	9/05	H205 + H206	H8 + H9	Hatchery	BL	TANK 6
00	9/05	H209 + H210	H12 + H13	Hatchery	BL	TANK 7
00	9/05	H211	H14 + H15	Hatchery	BL	TANK 8
00	9/05	H213 + H214	H16 + H17	Hatchery	BL	TANK 9
00	9/05	W215	H10 + H11	Mixed	BL	TANK 10
00	9/12	H301 + H302	H20 + H24	Hatchery	BL	TANK 11
00	9/12	H303 + H304	W3 + H23	Mixed	BL	TANK 12
00	9/12	H308 + H311	W5 + H22	Mixed	BL	TANK 13
00	9/19	W401 + H402	H30 + H31	Mixed	BL	TANK 14
00	9/19	H403 + H404	W6 + H32	Mixed	BL	TANK 15

* Low = 0.11-0.19 Optical Density; Below Low = < 0.11 Optical Density.

Table 3. Selection of progeny for the Tucannon River spring chinook captive broodstock program based on origin, crosses, and BKD ELISA results, 2001 BY.						
Brood Year	Eggtake Date	Female Numbers	Male Numbers	Crosses	BKD ELISA*	Tank/Family Number
01	8/28	H101 + H103	28A2 + BCCC	Mixed	BL	TANK 1
01	9/04	W201 + W203	HM8 + HM9	Mixed	BL	TANK 2
01	9/04	W205 + W207	HM4 + HM5	Mixed	BL	TANK 3
01	9/04	H206 + H208	B2F4 + AAE7	Mixed	BL	TANK 4
01	9/04	W211 + W212	HM3 + HM6	Mixed	BL	TANK 5
01	9/04	H210 + H213	AOFB + DB6E	Mixed	BL	TANK 6
01	9/04	W214 + W220	HM2 + HM7	Mixed	BL	TANK 7
01	9/11	W301 + W303	HM10 + HM11	Mixed	BL	TANK 8
01	9/11	W314	HM16 + HM23	Mixed	BL	TANK 9
01	9/11	W304 + W305	HM12 + HM14	Mixed	BL	TANK 10
01	9/11	W307 + W308	HM13 + HM17	Mixed	BL	TANK 11
01	9/11	H309 + H311	9890 + 2912	Mixed	BL	TANK 12
01	9/11	H312	FEAC + 5F6F	Mixed	BL	TANK 13
01	9/18	W401 + W409	HM25 + HM26	Mixed	BL	TANK 14
01	9/18	W410 + W411	2626 + AF96	Wild	BL	TANK 15

* Low = 0.11-0.19 Optical Density; Below Low = < 0.11 Optical Density.

APPENDIX C

Average length (mm), weight (g), and condition factor (K) with standard deviations for each family unit from the 1997, 1998, 1999, 2000 and 2001 BYs of captive broodstock at the time of tagging.

Brood Year	Family Unit	Number of Fish	Mean Length	S.D.	Mean Weight	S.D.	K
1997	1	29	113	7.8	19.4	4.4	1.31
1997	2	14	110	5.2	17.3	2.7	1.29
1997	3	31	125	9.1	28.4	6.0	1.44
1997	4	29	118	9.3	22.7	6.0	1.37
1997	5	31	119	9.3	22.7	5.8	1.30
1997	6	30	119	8.6	22.6	5.2	1.33
1997	7	30	117	7.2	21.3	4.3	1.32
1997	8	29	121	10.2	24.8	6.8	1.36
1997	9	30	117	8.1	21.8	5.0	1.32
1997	10	30	115	11.0	19.7	6.1	1.27
1997	11	30	101	6.4	13.1	2.6	1.25
1997	12	30	120	12.5	24.5	8.0	1.38
1997	13	30	121	9.3	24.4	6.6	1.34
1997	14	30	112	6.2	18.8	3.2	1.33
1997	15	30	109	9.6	18.7	4.8	1.41
Totals / Means		**433**	**116**	**10.5**	**21.5**	**6.4**	**1.34**
1998	1	30	120	15.6	22.3	8.6	1.23
1998	2	29	108	10.0	15.9	5.0	1.25
1998	3	30	112	13.1	18.6	7.8	1.26
1998	4	30	112	11.5	17.7	6.4	1.24
1998	5	30	117	16.0	20.5	9.9	1.20
1998	6	28	117	15.0	21.6	11.0	1.26
1998	7	32	120	18.0	23.2	11.6	1.26
1998	8	30	129	12.0	26.5	7.8	1.21
1998	9	30	121	16.9	23.0	9.9	1.24
1998	10	28	130	9.0	26.0	4.9	1.18
1998	11	25	120	13.6	22.3	7.7	1.26
1998	12	31	127	10.1	24.0	4.9	1.16
1998	13	29	122	11.4	22.0	6.7	1.19
1998	14	27	120	13.2	21.6	7.7	1.20
1998	15	29	138	11.0	30.3	6.7	1.14
Totals / Means		**438**	**121**	**15.2**	**22.4**	**8.7**	**1.22**
1999	1	27	147	14.6	41.1	11.3	1.25
1999	2	28	138	13.1	35.7	8.9	1.34
1999	3	28	133	11.6	33.9	11.3	1.42
1999	4	30	145	8.9	39.2	6.7	1.27
1999	5	25	136	15.8	35.4	11.8	1.34
1999	6	30	136	10.7	33.8	8.9	1.32
1999	7	27	129	20.9	30.0	14.8	1.29
1999	8	29	129	12.0	29.9	9.0	1.35
1999	9	25	128	16.3	29.3	11.6	1.33
1999	10	23	130	18.9	31.0	14.4	1.32
1999	11	23	137	13.1	36.0	10.7	1.37
1999	12	28	141	13.5	38.4	10.2	1.33
1999	13	30	133	13.9	31.9	9.1	1.34
1999	14	30	133	10.7	31.6	7.6	1.32
1999	15	26	132	16.6	34.1	14.1	1.39
Totals / Means		**409**	**135**	**15.1**	**34.1**	**11.2**	**1.33**

Appendix C (cont.). Average length (mm), weight (g), and condition factor (K) with standard deviations for each family unit from the 1997, 1998, 1999, 2000 and 2001 BYs of captive broodstock at the time of tagging.

Brood Year	Family Unit	Number of Fish	Mean Length	S.D.	Mean Weight	S.D.	K
2000	1	30	164	11.8	52.3	8.4	1.19
2000	2	30	157	11.1	45.5	8.1	1.16
2000	3	30	152	10.1	37.9	5.9	1.08
2000	4	30	152	11.0	43.0	8.0	1.20
2000	5	30	152	8.4	38.6	5.9	1.09
2000	6	30	138	11.3	31.2	6.1	1.18
2000	7	30	140	10.1	31.4	5.4	1.14
2000	8	30	147	8.4	35.0	5.4	1.10
2000	9	30	151	9.5	37.3	6.3	1.07
2000	10	30	151	7.7	37.4	5.7	1.08
2000	11	30	143	13.9	34.9	8.3	1.18
2000	12	30	147	9.1	35.4	5.2	1.12
2000	13	30	144	13.5	34.1	8.7	1.13
2000	14	30	136	9.4	27.1	4.5	1.08
2000	15	30	132	10.8	25.1	5.1	1.10
Totals / Means		**450**	**147**	**13.4**	**36.4**	**9.4**	**1.13**

2001	1	30	95	6.7	10.4	2.1	1.22
2001	2	30	101	8.7	12.6	3.0	1.22
2001	3	30	100	5.0	12.8	1.9	1.27
2001	4	30	107	6.9	14.8	3.9	1.21
2001	5	30	110	8.3	17.5	3.2	1.30
2001	6	30	104	7.7	14.7	3.6	1.29
2001	7	30	101	6.9	13.1	2.4	1.27
2001	8	30	105	8.2	14.6	2.6	1.25
2001	9	30	106	9.2	13.8	3.1	1.17
2001	10	30	97	6.5	11.4	2.4	1.24
2001	11	30	101	7.5	12.7	2.7	1.21
2001	12	30	101	5.0	12.5	1.8	1.21
2001	13	30	100	7.5	12.2	2.9	1.20
2001	14	30	100	8.8	12.2	2.9	1.22
2001	15	30	99	7.6	12.2	2.7	1.25
Totals / Means		**450**	**102**	**8.3**	**13.2**	**3.2**	**1.24**

APPENDIX D

Table 1. Tucannon River spring chinook captive broodstock mortalities by family unit, sex, age, and maturity for the 1997 Brood Year.

Family Unit	N	Males											Females											Total Mort.[1]	% Mort.[2]
		Age 1	Age 2		Age 3			Age 4			Age 5		Age 1	Age 2	Age 3			Age 4			Age 5				
		IM	IM	MA	IM	MA	SP	IM	MA	SP	MA	SP	IM	IM	IM	MA	SP	IM	MA	SP	IM	MA	SP		
1	29		1	4		6				1				3					3	9		1	1	29	100
2	14			4		1	2													6				13	93
3	31		3	4		3					1		1		1			1	3	6		2	2	27	87
4	29		2	4		10				1				3			1			9				30	103
5	31			8		7	1			2				4	1					7	1			31	100
6	30		2	13		1		1						3	1	1		1	2	7			1	33	110
7	30		1	5		5	1			2				3				1		9			3	30	100
8	29			14		1								1	1		2			9				28	97
9	30		2	6		5	2							4						12				31	103
10	30		1	7		5				2				3	1		3		2	7				31	103
11	30	1	2	3		6	1		2					3					1	12				31	103
12	30		2	5		4				1		1		3			4			10				30	100
13	30		1	7		4								1	1					11			2	27	90
14	30		1	1	1	13	1			1					1		1			7	1	1	1	30	100
15	30		1	7		2			1	1				7			1		2	5				27	90
Totals	433	1	19	92	1	73	8	1	3	11	1	1	1	38	7	1	12	3	13	126	2	4	10	431	99

IM = Immature, MA = Mature, SP = Spawned

[1]Total includes 3 fish of unknown sex.

[2]Some percentages higher than 100% due to misreading of visible implant tags.

Appendix D, Table 2. Tucannon River spring chinook captive broodstock mortalities by family unit, sex, age, and maturity for the 1998 Brood Year.

Family Unit	N	Males											Females												Total Mort.[1]	% Mort.[2]
		Age 1	Age 2		Age 3			Age 4			Age 5		Age 1	Age 2		Age 3			Age 4			Age 5				
		IM	IM	MA	IM	MA	SP	IM	MA	SP	MA	SP	IM	IM	MA	IM	MA	SP	IM	MA	SP	IM	MA	SP		
1	30			12		1			1	1								1	2	2	8				28	93
2	29			9			6			1										1	8				25	86
3	30			11			1						1	2				2		1	8				26	87
4	30		1	10		1	6		1					2				1			9				31	103
5	30			8			5			1				1				4		2	6				27	90
6	28		2	5			6			2								2			9				26	93
7	32		1	8			7											2			8				26	81
8	30		1	9			7										1	1		2	6				27	90
9	30			5		1	3			1				1		1		2		7	6				27	90
10	28			15						1							1	9			3				29	104
11	25			10	2		1											6		1	3				23	92
12	31	1		11			3			1			1					7	1		6				31	100
13	29		1	8		1	6										1			1	6				24	83
14	27		1	10			1									1		1		4	6				24	89
15	29	3		11			1						4					4		1	2				26	90
Totals	438	4	7	142	2	4	53		2	8			6	6	0	2	3	42	3	22	94				429	98

IM = Immature, MA = Mature, SP = Spawned
[1]Total includes 8 fish of unknown sex and 21 adult outplants.
[2]Some percentages higher than 100% due to misreading of visible implant tags.

Appendix D, Table 3. Tucannon River spring chinook captive broodstock mortalities by family unit, sex, age, and maturity for the 1999 Brood Year.

Family Unit	N	Males													Females										Total Mort.[1]	% Mort.
		Age 1	Age 2			Age 3			Age 4			Age 5		Age 1	Age 2	Age 3			Age 4			Age 5				
		IM	IM	MA	SP	IM	MA	SP	IM	MA	SP	MA	SP	IM	IM	IM	MA	SP	IM	MA	SP	IM	MA	SP		
1	27			6	3		1											1							11	41
2	28		1	6	1			2										4							14	50
3	28			4	2			5									1								12	43
4	30		1	3				4									2	1							11	37
5	25			3	4			2										2							11	44
6	30			5	2	1		2										1							11	37
7	27			5				2																	7	26
8	29			3	2			1									1	1							8	28
9	25			5	2			1										1							9	36
10	23			4	1			1									1	1							8	35
11	23			4	1			1																	6	26
12	28			4				1										1							6	21
13	30	1		7	1												1	4							14	47
14	30			5				3																	8	27
15	26			1	1			1								2		1							6	23
Totals	409	1	2	65	20	1	1	26								2	6	18							218	53

IM = Immature, MA = Mature, SP = Spawned

[1]Total includes 76 adult outplants.

Appendix D, Table 4. Tucannon River spring chinook captive broodstock mortalities by family unit, sex, age, and maturity for the 2000 Brood Year.

		Males														Females												
		Age 1	Age 2			Age 3			Age 4			Age 5		Age 1	Age 2		Age 3			Age 4			Age 5				
Family Unit	N	IM	IM	MA	SP	IM	MA	SP	IM	MA	SP	MA	SP	IM	IM	MA	IM	MA	SP	IM	MA	SP	IM	MA	SP	Total Mort.	% Mort.
1	30	1		2	3																					6	20
2	30			4	3																					7	23
3	30			1	3																					4	13
4	30			6	5									1	1											13	43
5	30			3	8																					11	37
6	30			3	2																					5	17
7	30			3	1										1											5	17
8	30			4	2										1											7	23
9	30			2	6																					8	27
10	30			3	3																					6	20
11	30			7																						7	23
12	30			2	5																					7	23
13	30		1	5	2																					8	27
14	30			7	4										1											12	40
15	30		1																							1	3
Totals	450	1	2	52	47									1	4											107	24

IM = Immature, MA = Mature, SP = Spawned

APPENDIX E

Table 1. Fork length (cm) and weight (g) statistics for male, female, and both sexes combined by brood year for mature captive brood fish sampled during spawning, 2002.								
Brood Year	**Sex**	**N**	**Mean Length (cm)**	**Range**	**S.D.**	**Mean Wt. (g)**	**Range**	**S.D.**
1997	M	2	52.8	52.0-53.5	1.1	1702.5	1543.6-1861.4	224.7
1997	F	13	53.8	40.0-65.0	6.6	2356.7	817.2-3450.4	787.8
1997	*Both*	*15*	*53.7*	*40.0-65.0*	*6.2*	*2256.0*	*817.2-3450.4*	*762.7*
1998	M	11	51.3	47.5-56.5	3.1	1704.6	1089.6-2360.8	445.5
1998	F	113	54.1	41.5-63.0	4.6	2304.7	1135.0-4040.6	624.9
1998	*Both*	*124*	*53.9*	*41.5-63.0*	*4.6*	*2246.3*	*1089.6-4040.6*	*633.8*
1999	M	27	41.2	35.0-50.0	3.7	916.7	499.4-1589.0	267.2
1999	F	24	46.8	38.0-58.0	4.6	1392.3	862.6-3223.4	504.6
1999	*Both*	*51*	*43.8*	*35.0-58.0*	*5.0*	*1145.0*	*499.4-3223.4*	*462.1*
2000	M	100	28.3	23.0-32.7	1.4	300.5	181.6-454.0	50.3
2000	F	3	30.1	28.4-32.1	1.9	363.2	272.4-454.0	90.8
2000	*Both*	*103*	*28.3*	*23.0-32.7*	*1.5*	*302.4*	*181.6-454.0*	*52.3*

S.D. = Standard Deviation

Table 2. Length-weight relationship for male, female, and both sexes combined by brood year for the captive brood during spawning, 2002.				
Brood Year	**Sex**	**Length-Weight Relationship**	**r^2**	**Probability**
1997	Female	Fork Length (cm) = 34.429 + 0.0081 x Wt (g)	0.79	< 0.01
1997	Male[a]	Fork Length (cm) = 44.714 + 0.0047 x Wt (g)	---	---
1997	*Combined*	*Fork Length (cm) = 36.842 + 0.0073 x Wt (g)*	*0.73*	*< 0.01*
1998	Female	Fork Length (cm) = 39.178 + 0.0065 x Wt (g)	0.77	< 0.01
1998	Male	Fork Length (cm) = 40.144 + 0.0065 x Wt (g)	0.86	< 0.01
1998	*Combined*	*Fork Length (cm) = 39.571 + 0.0064 x Wt (g)*	*0.78*	*< 0.01*
1999	Female	Fork Length (cm) = 36.229 + 0.0076 x Wt (g)	0.71	< 0.01
1999	Male	Fork Length (cm) = 29.437 + 0.0129 x Wt (g)	0.84	< 0.01
1999	*Combined*	*Fork Length (cm) = 32.901 + 0.0096 x Wt (g)*	*0.79*	*< 0.01*
2000	Female[a]	Fork Length (cm) = 22.700 + 0.0204 x Wt (g)	---	---
2000	Male	Fork Length (cm) = 21.332 + 0.0231 x Wt (g)	0.64	< 0.01
2000	*Combined*	*Fork Length (cm) = 21.315 + 0.0232 x Wt (g)*	*0.67*	*< 0.01*

[a] Small sample size.

APPENDIX F

Movements of ten radio tagged female captive brood adults released into the Tucannon River during 2002.			
Channel/Code Date	**Tucannon Rkm**	**Location**	**Comments**
9/165			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 58.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	72.0	3rd Cattle guard	
8/30/02	73.0	100 m above C.C. Br.	
9/05/02	73.0	100 m above C.C. Br.	Drive by.
9/09/02	72.8	Below C.C. Bridge	Between campground and cattle guard.
9/13/02	72.9	Below C.C. Bridge	R.B. lower end of habitat site, by new redd.
9/16/02	72.9	Below C.C. Bridge	L.B. below rocks, with wild male.
9/20/02	72.9	Below C.C. Bridge	Area where she was digging now small TD.
9/23/02	72.9	Below C.C. Bridge	Fungused eyes, fins, tail frayed.
9/25/02	72.9	Below C.C. Bridge	Recovered tag and fish, 100% spent.
9/167			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 55.5 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	73.2	HMA5-S Side Channel	
8/30/02	73.3	Log jam below log weir	
9/05/02	72.9	Cow Camp Bridge	Drive by.
9/09/02	73.0	100 m above C.C. Br.	By redd 2-6, with other fish, wild male close by.
9/13/02	73.0	100 m above C.C. Br.	Recovered tag and fish - did not spawn.
9/171			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 56.5 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	73.2	HMA5-S Side Channel	
8/30/02	73.2	HMA5-S Side Channel	
9/05/02	73.2	Between C.C. & C.G. 9	Drive by.
9/09/02	73.4	Above C.C. Br. .35 km	Log jam near 9/04/02JD test dig.
9/13/02	74.5	Below Panjab Ck. mouth	Went down to pool w/ 9/183 then upstream.
9/16/02	73.6	C.G. 9 lower entrance	Drive by.
9/20/02	73.6	S.C. at C.G. 9	Near new redds in S.C., not actively digging.
9/23/02	73.4	Log jam above rock sill	Recovered tag and fish. Fish partially eaten.
9/179			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 55.5 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02		Ladybug Flat?	Couldn't locate – heard chirps near Ladybug.
8/30/02		Not Found	Couldn't locate.
9/05-09/02	77.7	Ladybug Flat	Run and pool under poplar, fish moving around.
9/13-16/02	77.7	Ladybug Flat	Under alder, about 25 m upstream of path sign.
9/20/02	77.7	Ladybug Flat	Recovered tag only. Tag found between rocks. Probably poached.

Appendix F (continued). Movements of ten radio tagged adult female captive brood adults released into the Tucannon River during 2002.

Channel/Code Date	Tucannon Rkm	Location	Comments
9/183			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 52.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	74.4	Below Panjab Bridge	
8/30/02	74.5	Panjab Bridge	
9/05/02	74.5	Above Panjab Bridge	In 2nd pool above bridge.
9/09/02	74.5	Above Panjab Bridge	In 2nd pool above bridge.
9/13/02	74.5	Above Panjab Bridge	In 2nd pool above bridge.
9/16/02	74.5	Above Panjab Bridge	Drive by.
9/20/02	74.5	Above Panjab Bridge	Recovered tag only on bank – probably poached.
9/184			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 51.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	74.5	Panjab Bridge	
8/30/02	74.6	Wilderness C.G. 1	
9/05/02	74.6	Info. Sign below C.G. 1	Below redd 3-7MH, saw fish.
9/09/02	72.9	Below Cow Camp Bridge	Upper end of camping area.
9/13/02	69.0	Below Cattle Chute Area	Drive by.
9/16/02	69.0	Below Cattle Chute Area	Fish fungused – will not live long.
9/20/02	68.7	Above Camp Wooten Cabins	In log jam at lower end of side channel.
9/23/02	68.7	HMA 15 – Above Cabins	Drive by.
9/192			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 50.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02		Ladybug?	Couldn't locate – heard chirps near Ladybug.
8/30/02	74.4	Below Panjab Bridge	
9/05/02	74.7	Wild C.G. 1	Saw fish in pool across from 2 week old redd.
9/09/02	74.5	100 m below main info. sign	Wood cutting area sign.
9/13/02	74.6	Below C.G. 1	Beside redd 4-4, not on redd though.
9/16/02	73.7	C.G. 9	Drive by.
9/20/02	73.6	S.C. at C.G. 9	Near new redds in S.C., not actively digging.
9/23/02	73.6	S.C. at C.G. 9	Near redd 5-3 (9-18-02JD).
9/27/02	73.6	Below C.G. 9	Recovered tag and fish – 100% spawned.
9/193			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 51.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	72.0	3rd Cattle Guard	
8/30/02	73.0	100 m above C.C. Bridge	
9/05/02	73.5	Lower end C.G. 9	Couldn't pinpoint – tag may be out of fish.
9/09/02	73.5	Across from house, above C.C.	In run 10 m above National Forest Boundary.
9/13/02	73.5	Across from house, above C.C.	Tag in otter den.
9/23/02	73.5	Across from house, above C.C.	Tag in den.

Appendix F (continued). Movements of ten radio tagged adult female captive brood adults released into the Tucannon River during 2002.			
Channel/Code Date	**Tucannon Rkm**	**Location**	**Comments**
9/203			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 49.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	74.5	Panjab Bridge	
8/30/02		Not Found	Lost contact.
9/05/02		Not Found	Lost contact.
9/205			
7/16/02		Lyons Ferry Hatchery	Length at tagging – 47.0 cm.
8/20/02	74.5	Panjab Bridge	Released into river.
8/27/02	74.4	Below Panjab Bridge	
8/30/02		Not Found	
9/05/02	76.6	1 km below Ladybug Flat	Fish holding under spruce over river.
9/09/02	76.6	1 km below Ladybug Flat	50 m downstream of road 025.
9/13/02	76.6	1 km below Ladybug Flat	Recovered tag only under brush on bank. Probably poached.

APPENDIX G

Summary of captive brood progeny releases from the Tucannon River Spring Chinook Captive Broodstock Program.								
Release Year	**BY[1]**	**Release Date**	**CWT**	**No Wire**	**Wire**	**Total Released**	**Lbs**	**Fish/Lb**
2002	2000 (S)	3/15-4/23	63	24	3,031	3,055	343	8.9
2002	2001 (P)	5/06	63/14/30	157	20,435	20,592	124.8	165.0
2003	2001 (S)	4/01-4/21	63	5,995	134,401	140,396	10,100	13.9

[1] S = Smolt release; P = Parr release.