CLEARWATER FISH HATCHERY

ANNUAL REPORT

2001 CHINOOK AND 2002 STEELHEAD

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2001 CHINOOK BROOD YEAR REPORT

ABSTRACT

Clearwater

Spring Chinook salmon *Oncorhynchus tshawytscha*_are reared at Clearwater Fish Hatchery (CFH) and typically brought on station as either green or eyed eggs. Chinook were reared on station and released as parr pre-smolts or smolts.

Powell

Two adult traps were operated in the Lochsa basin. The Crooked Fork trap was installed on 6/18/2001, and the trap was taken out of operation on 10/14/2001.

The Walton Creek weir was installed on 5/15/2001 and taken out of operation on 9/21/2001. The run total for both traps was 2,344 fish, of which there were 78 jacks and 2,266 adults. A total of 219 fish were released to spawn naturally and 0 jacks were given to the food bank. All remaining fish were held for spawning. A total of 795 females (84 culls for high BKD) were spawned, producing 2,737,281 green eggs.

A total of 526,733 pre-smolts and 350,665 full-term smolts from Powell stock chinook were released from Powell Pond on 9/27/2002 and 4/1/2003.

South Fork (Red River / Crooked River)

Adults returning to Crooked River and Red River weirs were combined into one South Fork stock starting in 1997. Starting with BY-98, chinook stocks from Powell were used to backfill the South Fork populations. Stocks were combined due to high rate of straying. The integrity of all supplementation and natural fish were maintained in their native streams.

The Red River weir was installed on 3/27/2001 and taken out of operation 9/11/2001. The run total of 1,333 fish were combined with the returning adults from Crooked River. Of the total, 253 Chinook were released upstream to spawn naturally.

The Crooked River weir was installed 3/27/2001 and taken out of operation 9/12/2001. The run total of 2,013 fish were combined with returning adults from Red River. Of the total, 377 Chinook were released to spawn naturally.

The South Fork had a run total of 3,346 fish. A total of 794 fish were released to spawn naturally. All remaining fish were held for spawning. A total of 676 females were spawned of which 453 females were kept for production, and 223 females were culled due to high BKD levels, producing 1,840,509 green eggs.

A total of 351,066 full-term smolts were released from the Red River Pond on 4/2/2003.

A total of 629,687 full-term smolts were released from Crooked River April on 4/2/2003.

Idaho Supplementation Studies (ISS)

A total of 327,802 parr were released in the Lochsa basin for the ISS program. A total of 13,948 were released in Pete King Creek on 8/4/2002; 14,067 were released in Squaw Creek on 8/4/2002; and 299,787 were released in Colt Killed Creek on 7/31/2002 and 8/1/2002.

A total of 85,064 pre-smolts were released from the Red River Pond on 9/27/2002.

A total of 169,768 pre-smolts from the Powell stock were released from the Crooked River raceways 9/27/2002.

A total of 52,225 smolts were released in Papoose Creek on the Lochsa on 4/3/2003.

A total of 706,088 smolts were released in the Clearwater Basin for the Nez Perce Tribe production. This included 147,488 that were released at Lolo Creek on 3/19/2003; 43,621 were released at Mill Creek (S.F. Clearwater) on 3/14/2003; 74,066 were released at Newsome Creek (S.F. Clearwater) on 3/21/2003; 101,513 were released at Boulder Creek (Lochsa) on 3/20/2003; and 287,175 were released at Meadow Creek (Selway) on 3/17-3/18/2003.

INTRODUCTION

Funding Source

Construction responsibility for the Lower Snake River Compensation Plan (LSRCP) was assigned to the Walla Walla District, Army Corps of Engineers (USACE), while responsibility for fish hatchery Operation and Maintenance (O&M) funding was to be accomplished by "one of the Federal fishery agencies." The Corps, National Marines Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (USFWS) settled the question of O&M funding in 1977 with the signing of an interagency agreement. The agreements stated that the USFWS would budget for and administer O&M funding for LSRCP fish hatchery programs (responsibility for administration and O&M for fish passage and wildlife programs remains with the USACE).

The USACE estimated cost for construction of CFH and three satellite facilities was to be $43,153,000 (Joe McMichael's report December 1991).

Location

Clearwater Fish Hatchery is on the north bank of the North Fork of the Clearwater River, 1.5 miles downstream from Dworshak Dam, 72.5 river miles upstream from Lower Granite Dam, and 504 river miles upstream from the mouth of the Columbia River.

Crooked River satellite facility is 20 miles downstream of Red River. The trap is one-half mile upstream of the mouth of Crooked River, a tributary of the South Fork of the Clearwater River. The juvenile rearing ponds are ten miles upstream from the Crooked River adult trap. Crooked River is 172.5 river miles upstream from Lower Granite Dam and 604 river miles upstream from the mouth of the Columbia River.

Powell satellite facility is 122 river miles east of CFH at the headwaters of the Lochsa River. Missoula, Montana is the closest town, which is 45 miles east. Powell is 192.5 river miles upstream from Lower Granite Dam and 624 river miles upstream from the mouth of the Columbia River.

Red River satellite facility is 15 miles east of Elk City, Idaho, 186 river miles upstream from Lower Granite Dam, and 618 miles from the mouth of the Columbia River**.**

OBJECTIVES

Mitigation Goals

The LSRCP goal for CFH and its satellite facilities is to return 12,000 adult salmon and 14,000 ”B” steelhead above Lower Granite Dam.

Idaho Department of Fish and Game Objectives

The objectives of the Idaho Department of Fish and Game (Department) for CFH are to reestablish historic fish runs into the upper Clearwater River tributaries, to enhance the wild spawning population, and increase sport and tribal fishing opportunities.

FACILITY DESCRIPTION

General Hatchery Description

Clearwater Hatchery

Clearwater Fish Hatchery is the final facility built by the US Army Corps of Engineers (USACE) under the Lower Snake River Compensation Plan (LSRCP). This facility is also the largest of the LSRCP hatcheries built.

The hatchery office building consists of two parts. The dormitory section includes four bunkrooms with maximum capacity of 16 people, a living room, dining room, kitchen, shower rooms, and laundry room. The administration portion consists of office space with a visitor center and entry lobby.

The shop area includes a vehicle maintenance shop, a smaller mechanical repair shop, wood shop, and locker room.

The hatchery building also houses an incubation room and walk-in freezer. A screen and equipment storage building is on the west end of the hatchery.

There are seven residences on the hatchery grounds. Each residence also has a storage building.

Isolation incubation building is for receiving eggs with unknown disease status and a chemical storage building for storing barrels of formalin and chlorine.

Two 1.8-mile long pipelines run upstream to the Dworshak Dam. The pipelines go up the face of the dam to an elevation of 1,357 feet, then through the dam into the reservoir. The 18-inch pipe (secondary supply) is stationary at an elevation of 1,357 feet with a screened inlet to keep out debris. This pipe supplies cool water to the hatchery. The 48-inch flexible plastic pipe is suspended from a floating platform with a winch attached to the platform. A winch raises and lowers the intake of the pipe to the level of desired water temperature. This pipe supplies warm water (50 to 58° F) to the hatchery during the summer and fall.

Approximately 200 yards upstream from the hatchery is a distribution structure designed to reduce the 286-psi of the high-pressure supply lines to the gravity flow of seven psi to the hatchery. The structure consists of a primary and secondary chamber. The primary and secondary pipelines have each been outfitted with a hydroelectric generator and put into operation June 2000. The two generators will produce approximately 2400KW of electricity.

A 73,600 cubic foot cleaning sedimentation pond is used during cleaning to settle out the settleable solids produced by the hatchery. A 414,000 cubic foot final sedimentation pond settles waste from the total flow of hatchery operation and the out flow of the cleaning sediment.

In 2000, a new 2,040 square foot structure was constructed. The sides of the new building are four military transport containers, two on each side, welded end to end. They support a roof spanning a 51 x 40 foot area creating a new covered storage area. The two side areas are a nice addition of waterproof storage. The end of one side was partitioned off to house archived documents.

Crooked River

There are two separate sites to this facility. The first is the adult trap and a support cabin located one-half mile upstream of the mouth of Crooked River. The weir at this location consists of removable posts and panels supported by an iron bridge across Crooked River. There are no holding ponds at the site, and all fish are either released directly from the trap or transported to Red River holding ponds.

Ten miles upstream from the adult trap are two raceways for summer rearing and spring acclimation of smolts. There is a cleaning waste pond and final settling pond to meet EPA water quality standards. Additional facilities include a garage, shop, walk-in freezer to store fish food, and support cabin with kitchen, dining room, living room, bathroom, and bedroom.

Powell

The Powell facility is at the confluence of Crooked Fork Creek and Colt Killed Creek (White Sands), which form the Lochsa River. There is one rearing pond for summer rearing and spring acclimation of smolts. A water supply diversion and intake screen structure are on Walton Creek, and a pump house is on Colt Killed Creek. A weir diverts fish that come up into Walton Creek into the fish ladder and fish trap. The fish trap is connected to two adult holding ponds and covered spawning area. A floating weir that spans across the Lochsa River is stored at the facility for use when needed. Also on site is a support cabin with a kitchen, dining room, living room, bedroom, bathroom, and walk-in freezer to store fish feed. During the summer of 1994, the Corps of Engineers constructed a 16-ft x 14-ft formalin storage building.

Red River

The Red River facility consists of four structures: freezer/storage building that houses a walk-in-freezer, a work shop/garage area, a formalin storage building, and a support cabin.

The adult holding facility consists of two raceways with a holding capacity of 350 adult fish. A removable tripod and panel weir blocks fish passage across Red River and diverts them into the fish ladder.

There is one rearing pond for summer rearing and spring acclimation of smolts. This pond has a hypalon plastic liner with eight to ten inch diameter cobblestones on the inclined banks. The bottom of the pond is a bare liner, which aids in pond vacuuming.

Production Capacities by Unit

Clearwater Hatchery

The steelhead raceways consist of 300-ft x 10-ft x 6-ft raceways supplied by a center head raceway with an east and west bank of 12 raceways each. A total rearing space of 24 raceways is 216,000 cubic feet. This area will rear a maximum capacity of 2.4 million steelhead smolts with 0.3-density index (DI) (Piper 1986). A flow of approximately 1.67 cubic feet per second (cfs) is available for each raceway, but this flow will only allow 1.7 million steelhead to be reared in these raceways without exceeding the flow index (FI) of 1.2 (Piper). All water for these raceways flow through degassing towers and then into the head raceway. These raceways are supplied with water from both intakes.

Chinook raceways are 200-ft x 10-ft x 3-ft. Eleven raceways have a total rearing space of 66,000 cubic feet. The raceways are supplied with water from both primary and secondary intakes and a mixing chamber, which allows for the control of water temperature to rear chinook. The designed rearing capacity of these raceways is 1.5 million smolts at a 0.3 DI (Piper). The estimated flow per raceway is 2.4 cfs per raceway.

The adult holding facility consists of two ponds with a combined capacity of 8,000 cubic feet and a maximum holding capacity of 800 adult salmon. There is also a covered spawning area with two live wells for on-site egg taking. This facility is supplied with water from the tailrace of the juvenile chinook raceways. Estimated flow per pond is 3.5 cfs.

The incubation room contains 40 double stack Heath incubators with a total of 640 trays available for egg incubation. The maximum capacity of this facility is five million green eggs. The incubation room is supplied with both water sources to provide the desired temperature for incubation with a flow of 5 to 6 gpm per stack.

Isolation incubation consists of 15 double stack Heath Incubators with a total of 240 trays available for egg incubation. The maximum capacity of this facility is 1.5 million green eggs. The isolation incubation room is supplied with both water sources to provide the desired temperature for incubation with a flow of 5 to 6 gpm per stack.

Early rearing consists of sixty concrete vats. Each measures 40-ft x 4-ft x 3 ft and contains 480 cubic feet of rearing space. This part of the facility can rear 5.9 million fish to 287 fish/lb. at a 0.3 DI. The vats are supplied with water from each intake and have a flow of approximately 120 gpm per vat when all vats are in use. An incubation jar is plumbed directly into them. The 60 incubator jars have a total capacity of 2.6 million eggs with a flow of 15 gpm per jar.

Crooked River

The Crooked River acclimation facility has two raceways, measuring 145-ft x 20-ft x 4-ft, for a total of 23,200 cubic feet. These raceways have a capacity of 700,000 juvenile chinook with a DI of 0.29. Water flow per raceway is 6 cfs. Each raceway is outfitted with three automatic Nielson feeders. The adult trapping facility measures 10-ft x 12-ft x 4-ft with a total of 480 cubic feet. Water flow for the adult facility is 10 cfs. This facility has no provision for adult holding.

Powell

The rearing pond measures 165-ft x 65-ft x 5-ft and has 53,625 cubic feet of rearing space. The normal loading of 320,000 fish produces the best looking smolts and a DI significantly less than 0.3. The maximum design capacity is 500,000 fish with a DI of 0.092. Water flow through this pond is 6.24 cfs. A catwalk across the length of the pond supports eight automated Nielson feeders.

The two adult ponds, measuring 100-ft x 20-ft x 4-ft 8 inches, have a volume of 9,500 cuft and a holding capacity of 960 adult chinook. The adult trap measures 12-ft x 6-ft x 4-ft deep and is supplied with 6.24 cfs of water.

Red River

The adult holding facility consists of two ponds, measuring 10-ft x 45-ft x 4-ft, with a total of 3,400 cubic feet of holding space and a trap area 8-ft x 16-ft x 4-ft. These ponds have a holding capacity of 350 fish. A removable tripod and panel weir blocks fish passage and diverts them into the fish ladder. One half of the weir consists of floating panels and the other half is removable tripods and panels. Water flow through the ponds is 4.09 cfs.

The rearing pond measures 170-ft x 70-ft x 4-ft 6 inches and has 53,550 cubic feet of rearing space. The normal loading of 320,000 fish produces the best looking smolts and a DI significantly less than 0.3. The maximum design capacity is 500,000 fish with a DI of 0.092. This pond has a hypalon plastic liner with eight to ten inch diameter cobblestones on the inclined banks. The bottom of the pond is a bare liner, which aids in pond vacuuming. A catwalk runs the entire length of the rearing pond and holds eight automatic Nielson feeders.

WATER SUPPLY

Clearwater

Clearwater Fish Hatchery receives water through two supply pipelines from Dworshak Reservoir. The warm water intake is attached to a floating platform and can be adjusted from five feet to forty feet below the surface. The cool water intake is stationary at 245 feet below the

top of the dam. An estimated 10 cfs of water is provided by the cool water supply and 70 cfs of water from the warm water supply. The cool water supply has remained fairly constant between 38° and 45°F. The warm water can reach 80°F but is adjusted regularly to maintain 56°F for as long as possible throughout the year. When water temperatures drop in the fall, the intake will be moved to the warmest water available until water temperatures rise in the spring (Appendix A1 and A2). All water is gravity flow to the hatchery.

Crooked River

Crooked River rearing raceways are supplied by an intake 200 yards upstream of the raceways at Crooked River. The water rights stipulate 10 cfs from April 1 to June 30 and six cfs from July 1 to October 1 at the rearing facility. Temperatures ranged from 42° to 64°F (Appendix B1). All temperatures were taken at the adult trap. All water supplied to both facilities is gravity flow.

Powell

The intake is 100 yards upstream from the facility. Powell's water right for the gravity intake is 6.24 cfs from gravity flow system on Walton Creek and 2.5 cfs from a supply pumped out of Colt Killed Creek. Two 7.5 horsepower pumps can be used to supply Walton Creek with water from Colt Killed Creek during periods of low water. Water temperatures ranged from 43°F to 58°F from Walton Creek (Appendix B2).

Red River

Red River is supplied by gravity flow from an intake at the bottom of the South Fork of Red River, 225 yards upstream from the facility. The water right for the facility is 8.18 cfs. During low flow in the summer, about 5 cfs is available to the hatchery. Temperatures ranged from 42°F to 65°F (Appendix B3).

Water Quality Analysis

The water quality analysis at CFH was done by the State of Idaho, Department of Health and Welfare in Boise; Anatek Labs in Moscow, Idaho, did the satellite facilities.

The samples were taken from the hatchery incubation supply line June 1994 (Appendix C1).

Clearwater Hatchery water supply has a total alkalinity (as $CaCO_3$) of 16 mg/l, which is very low regarding fish culture.

Water quality analysis was taken at Crooked River, Powell, and Red River rearing facilities from the intake in 1998 (Appendix C2, C3 and C4).

STAFFING

Clearwater Fish Hatchery has eight permanent staff employees; this includes one Hatchery Manager, two Assistant Hatchery Managers, one Utility Craftsman, three Fish Culturists, and an Office Specialist II. The rest of the crew consists of temporary employees with positions of Fishery Technicians, Biological Aides, Laborers, Grounds Maintenance Worker, and Clearwater River Youth Program students. Under the supervision of CFH, each satellite facility (Red River, Crooked River, and Powell) is manned by one temporary worker.

Adult Chinook Collection

South Fork of the Clearwater River

The Crooked River and Red River production populations were combined in 1997. Trapping protocols for the South Fork traps are as follows:

Trapping protocols for the South Fork traps included ponding all Ad-clipped fish and opercle punching and releasing all ventral clipped and unmarked fish above the weirs. Any fish with no mark, having a CWT, were opercle punched and released below the weirs. All opercle-punched fish that returned to the traps were ponded for production.

The Crooked River weir and trap were in operation between March 27, 2001 and September 12, 2001. A total of 2,013 fish were trapped.

The Red River trap was installed on March 27, 2001 and taken out of operation on September 11, 2001. A total of 1,333 fish were trapped.

Age class breakdown of this run included: 34 I-ocean males; 11 I-ocean females; 12 I-ocean unknowns (<64 cm); 1,005 II-ocean males; 1,315 II-ocean females; 802 II-ocean unknowns (64-82 cm); 105 III-ocean males; 26 III-ocean females; and 36 III-ocean unknowns (83+ cm) (Appendices D1, D1a, D2, D2a, E1, E1a, E2, F1 and F2).

Powell

During 2001, two adult traps were installed in the Lochsa Basin. A picket weir was installed on Crooked Fork Creek approximately one mile upstream of twin bridges. This was an effort to reduce hatchery straying in that basin.

The trap on Walton Creek was installed on May 15, 2001 and taken out of operation September 21, 2001. The Crooked Fork trap was June 18, 2001 and taken out of operation October 14, 2001. A total of 2,344 fish (78 jacks and 2,266 adults) were trapped at Powell and Crooked Fork.

Trapping protocols for the Powell trap included ponding all Ad-clipped fish and opercle punching and releasing all ventral clipped and unmarked fish into the Lochsa. All opercle-

punched fish that returned to the trap were ponded for production. Due to the low return of jacks to Powell, all that were trapped were retained for spawning except unmarked, untagged fish. Trapping protocols for the Crooked Fork trap included transporting and ponding all Ad-clipped fish at Powell for production. All ventral clipped fish were released below the trap and all naturals / wild fish were released upstream.

Age class breakdown of this run included: 57 I-ocean males; 16 I-ocean females; 5 I-ocean unknowns (<64 cm); 653 II-ocean males; 1,096 II-ocean females; 461 II-ocean unknowns (64 – 82 cm); 32 III-ocean males; 12 III-ocean females; and 12 III-ocean unknowns (83+ cm) (Appendices G1, G1a, G2, G2a, G3, and H).

ADULT HOLDING

All South Fork production fish were temporarily held at Red River and then transported to Clearwater Hatchery for final holding and spawning. Some South Fork stock were held and spawned at Red River for NPT production by NPT staff and CFH staff.

All fish were injected with Erythromycin 200 at a rate of 20 mg/kg at trapping to inhibit BKD. Fish were treated with a formalin drip for one hour every other day to prevent fungal growth. Fish held at Clearwater were treated at 150 ppm, and fish at Powell were treated at 120 ppm. After sorting, fish were treated daily at the same concentration and duration until all females were spawned.

SPAWNING AND EGG TRANSPORT

A 1:1 male/female spawning ratio was used (CFH genetics protocol for more than 100 females) at both facilities during 2001. A second male was added after one minute, as a backup in case the first was not fertile.

At Powell, eggs were placed in egg tubes and coolers with100-ppm iodine solution for one hour. After water hardening, water was drained and green eggs were placed in fresh water and transported to CFH for incubation. The transport vehicle was met at the front gate and egg tubes were removed from transport coolers and placed in clean egg coolers containing tempered 100-ppm Argentyne solution for 10 minutes. Then eggs, at one female per tray, were placed in individual Heath egg trays in the incubation room. At Clearwater, eggs were placed in individual buckets and water hardened with 100-ppm iodine solution for one hour. After water hardening, the eggs were placed in incubators at one female per tray.

Tissue and ovarian samples were collected at the time of spawning. These samples were air mailed the next day to Eagle Fish Health Lab for BKD and virus testing (Appendix I).

South Fork of the Clearwater

Chinook were sorted twice per week for ripeness. The first fish was spawned August 6, 2001 and the last September 14, 2001. A total of 676 females were spawned. Pre-spawn mortality for the South Fork stock was 184 fish (5.5% pre-spawning mortality). All carcasses not showing clinical signs of BKD were returned to either Crooked River or Red River to add nutrients to the system (Appendix E2).

Powell

Fish were checked twice per week for ripeness. The first fish was spawned on August 7, 2001 and the last September 12, 2001. A total of 795 females were spawned. Fish carcasses not showing clinical signs of BKD were placed in the Lochsa and tributaries to add nutrients to the stream (Appendix G3). Pre-spawn mortality was 182 fish (7.8% pre-spawn mortality).

INCUBATION

Clearwater Hatchery

Green eggs were placed into Heath egg trays with one female's eggs per tray. All Heath stacks were operated at approximately 5.5 gallons per minute.

Females were screened for BKD using Elisa techniques. Females with optical density (O.D.) over .399 were culled. The BKD tests resulted in culling of 84 females at Powell and 223 females from the South Fork. Using an average fecundity of 4,000 eggs per fish, these culled females accounted for 1,228,000 green eggs, which was 21.21% of the entire egg take.

A total of 3,551,769 green eggs were incubated from BY01 spring chinook salmon. Overall development from green eggs to eyed-eggs was 3,330,700 for a total eye-up percentage of 93.78%. The South Fork stock achieved 96.7% eye-up, Powell 91.7% eye-up (Appendix I).

Beginning on the third or fourth day of incubation, all egg lots were treated with formalin to reduce fungal development. Treatments were administered three times per week at a 1:600 concentration (1667-ppm) for 15 minutes and continued until each egg lot reached 800 temperature units (TUs).

Eye-up occurred at approximately 500 TUs at which time all egg lots were shocked, then picked and enumerated by an electronic egg picker. Prior to hatching, all eyed-eggs were picked twice weekly. Hatching occurred at approximately 1,000 TUs. Swim-up fry were transferred to the early rearing vats at approximately 1,750 TUs (Appendix I).

Nez Perce Tribe

The NPT had a total of 1,026,021 green eggs from BY 01 spring chinook salmon. Overall development from green eggs to eyed-eggs was 850,716 for a total eye-up percentage of 82.91%. Red River achieved a 70.1% eye-up, and Powell an 89.7% eye-up (Appendix Ia).

EARLY REARING

Swim-up fry were ponded in hatchery vats at approximately 55,000 to 84,000 fish per vat. A total of 3,886,484 fry were segregated by stock in 39 vats over a four-month period.

Fish were started on feed within 24 to 48 hours of ponding in a full-length vat with baffles in place. Initial water flows were set at 46 gallons per minute (gpm) for approximately 10 days to initiate feeding then increased to 92 gpm on day eleven. A final increase to 120 gpm occurred after several months where it remained until the fish were moved outside. Flow indices were held at or below 1.923 while the density index never exceeded .481 during the entire early rearing period. Water temperatures during early rearing were between 39°F and 54°F (appendix A1 & A2).

Most of the chinook were moved outside during the marking process. Some of the smaller groups were marked but remained in vats until release. The inventory number was adjusted after the marking program to 1,077,918 for the Nez Perce Tribe and 1,291,395 for the Clearwater Hatchery for a total of 2,369,313 as a result of the hand count.

FINAL REARING

At marking, Powell stock was used to fill all Lochsa River programs. South Fork programs were filled with South Fork stock. The Nez Perce Tribe programs were filled with fish from Clearwater Hatchery. All chinook were marked between July 15, 2002 and August 2, 2002.

All BY01 chinook were fed one 28-day Erythromycin prophylactic treatment. Bio-Oregon BioDiet grower feed was used throughout the final rearing period. The parr and pre-smolts were fed full rations until release. The full-term smolts were fed full rations through marking and during medicated feed treatments and were otherwise fed four days on feed and three days off feed. The final two weeks of feeding was done with feed laced with a special vitamin pack to aid in smolting. Total feed used in early and final rearing was 185,158 pounds yielding 172,337 pounds of fish reared for a final conversion of 1.07 (appendix J). Total feed cost was $174,352.78, not including Nez Perce Tribe's cost for their portion of the feed.

Water temperatures were kept below 55°F to reduce growth rates and varied from 46°F to 53°F during the final rearing period with an estimated 2.2 cfs of water supplied to each raceway.

Parr chinook were released in August at three different locations. The Idaho Supplementation Study (ISS) program involved 229,787 fish and 28,015 for the Nez Perce Tribe programs for a total of 327,802 parr released. A total of 905,242 pre-smolts were released from September 27 to September 30, 2002. Clearwater Fish Hatchery (CFH) production took 650,410; ISS used 254,832. Chinook pre-smolts to be released at Powell and Crooked River were reared at the satellites throughout the summer. Those released at Red River were held at the satellite during two weeks in September only. A total of 2,037,506 smolts were released in March of 2003 at nine different locations. CFH production released 1,331,418; Nez Perce Tribe programs 653,863; and ISS programs 52,225.

FISH HEALTH

The BY-01 spring chinook reared at CFH were from low BKD parentage with O.D. below 0.399. All chinook eggs above this O.D. were culled.

All BY01 chinook received one 28-day Erythromycin prophylactic feed.

No fish health problems were detected during the rearing of Brood Year 2001 chinook.

PATHOLOGIST REPORT

Diseases Encountered and Treatments.

Acute Losses.

There was a 112,000 fish kill due to a freezing intake screen at Upper Crooked River Satellite Facility on March 28, 2003.

Organosomatic Index. (Appendix K1, K2, K3, K4, K5, and K6)

Due to the acute fish loss at Crooked River Satellite Facility on 3/28/2003, no organosomatic index exists for the spring released chinook salmon at that facility.

FISH MARKING

A total of 2,942,748 spring chinook were marked. Marks include: 2,269,003 Adipose (Ad) clipped; 418,913 coded wire tagged (CWT); 169,768 right ventral (RV) clipped and 85,064 left ventral (LV) clipped (Appendix L).

Chinook were marked from early rearing vats (inside) into final rearing raceways (outside). Spring marking started on 4/30/2002 and was completed on 5/14/2002. Summer marking started on 7/8/2002 and was completed on 8/2/2002. Fish ranged in size from 75.76 to 29.00 fpp. A total of 2,400 fish were Passive Integrated Transponder (PIT) tagged.

FISH DISTRIBUTION

Releases from CFH occurred in three different life stages:

	CFH	NPTH
Parr	327,802	0
Pre-smolt	905,242	0
Full term smolt	1,383,643	653,863
Total	2,616,687	653,86

Parr

Clearwater Production

A total of 13,948 fish (32.9 fpp) were released into Pete King Creek on the Lochsa on August 4, 2002. All parr were CWT-tagged with no fin clips and 1,000 were PIT-tagged (Appendix L).

On August 4, 2002 a total of 14,067 fish (29 fpp) were released into Squaw Creek on the Lochsa. All parr were CWT-tagged with no fin clips and 700 were PIT-tagged (Appendix L).

A total of 299,787 fish (64.5 fpp) were released into Colt Killed Creek (White Sands) on July 31, 2002 and August 1, 2002. All parr were RV-clipped and 700 were PIT-tagged (Appendix L).

Fall Pre-Smolt

Crooked River

On September 27, 2002 a total of 169,768 fish (14.3 fpp) were released into Crooked River. All pre-smolts were RV-clipped and 500 were PIT-tagged (Appendix L).

A total of 123,677 fish (48.1 fpp) were released into the South Fork Clearwater River on September 30, 2002. All pre-smolts were ad-clipped.

Powell

On September 27, 2002 a total of 526,733 fish (13.3 fpp) were released into Walton Creek. All pre-smolts were ad-clipped and 700 were PIT-tagged (Appendix L).

Red River

A total of 85,064 fish (17 fpp) were released into Red River on September 27, 2002. All pre-smolts were LV-clipped and 500 were PIT-tagged (Appendix L).

Full Term Smolt

Crooked River

A total of 629,687 smolts (18.1 fpp) were released into Crooked River. Smolts were transported to Crooked River 3/26/2003 through 4/1/2003 and forced released only. On 4/2/2003, the pond was drained and all remaining smolts were released. All smolts were Ad-clipped and 300 fish carried PIT tags (low BKD) (Appendix L).

Powell

A total of 350,665 smolts (17.3 fpp) were released into Walton Creek. Smolts were transported to Powell from March 24, 2003 through March 25, 2003. After approximately one week of acclimation, fish were released April 1, 2003. All smolts were Ad-clipped and 300 fish carried PIT-tags (Appendix L).

Red River

A total of 351,066 smolts (18.3 fpp) were released into Red River. Smolts were transported to Red River from March 25, 2003 through March 26, 2003. On April 2, 2003 the pond was drained and all remaining smolts were released. All smolts were Ad-clipped and 300 fish carried PIT-tags (Appendix L).

Papoose Creek

A total of 52,225 smolts (16.66 fpp) were direct released at Papoose Creek on the Lochsa on April 3, 2003. All smolts were CWT-tagged with no external clips. (Appendix L).

Nez Perce Tribe Production

On March 19, 2003 a total of 147,488 smolts (22.4 fpp) were direct released at Lolo Creek on. All smolts were CWT-tagged with no external clips.

A total of 43,621 smolts (23 fpp) were direct released at Mill Creek on the South Fork on March 14, 2003. All smolts were CWT-tagged with no external clips.

A total of 101,513 smolts (24.9 fpp) were direct released at Boulder Creek on the Lochsa on March 20, 2003. All smolts were CWT-tagged with no external clips.

A total of 74,066 smolts (27.16 fpp) were direct released at Newsome Creek on the South Fork on March 21, 2003. All smolts were CWT-tagged with no external clips.

A total of 287,175 smolts (26.15 fpp) were direct released at Meadow Creek on the Selway on March 17 and 18, 2003. All smolts were ad-clipped (Appendix L).

BROOD YEAR 2002 STEELHEAD REPORT

ABSTRACT

Clearwater Hatchery received 1,065,391 eyed Brood Year 2002 North Fork B-run steelhead eggs from Dworshak National Fish Hatchery (DNFH). A total of 935,960 smolts from the North Fork stock were released on September 30, 2003 and from April 9, 2003 through April 23, 2003; 149,664 at Red House hole; 108,052 at Kooskia Hatchery on Clear Creek; 249,987 at Red River; 264,558 at Crooked River; 33,362 at Mill Creek (SF Clearwater); 23,310 at Meadow Creek (SF Clearwater); 43,070 at Lolo Creek; and 63,957 surplus fish in the North Fork of the Clearwater River. The size of fish was 6.34 fpp for a total of 147,664 pounds and average length was 189 mm.

A total of 184,690 pounds of feed was fed with a cost of $94,461.64 to produce 147,664 pounds of fish at Clearwater Hatchery. The conversion rate was 1.25.

A feed study* was conducted at Clearwater Fish Hatchery on Brood Year 2002 North Fork Steelhead. The primary goal of the study was to determine which feed would maximize growth rates to obtain the desired smolt release size of 4.5 fpp. The secondary goals of the study were to determine which feed would improve feed conversions for cost efficiency and which would improve survival. The study consisted of two phases: an early rearing phase from swim-up to marking, and a final rearing phase from marking to release. The early rearing phase of the study evaluated the treatment groups of Moore-Clark Nutra Plus, a dry formulated diet, and BioOregon BioVita, a dry formulated diet, with the control group of BioOregon Grower, a moist diet. The final rearing phase evaluated the treatment groups of Moore-Clark NutraFry and BioOregon BioDry 1000 with the control group of Rangens 470 Slow Sink, all dry formulated diets.

*Feed Study in Abstract attached to Brood Year Report

Author:

Randy Hutzenbiler, Assistant Hatchery Manager

SYNOPTIC HISTORY

Clearwater Hatchery

Brood Source

Dworshak National Fish Hatchery was the source for North Fork stock B-run steelhead eggs.

Disease History

Dworshak Hatchery has a long history of Infectious Hematopoietic Necrosis Virus (IHNV). Therefore, Clearwater Hatchery only accepts steelhead eggs from IHNV-negative females and follows a strict disinfecting protocol when transporting them onto the station.

Spawning

When eggs were being collected for Clearwater Fish Hatchery at DNFH, one of our crew assisted with their spawning operation. We collected, packaged, and shipped all the disease samples by airmail to Eagle Fish Health Lab.

Incubation

Eyed steelhead eggs were received from Dworshak Hatchery in two shipments on March 22, 2002 and March 29, 2002, (Appendix M). The eggs from DNFH lots five and six were incubated approximately 17 days at Dworshak until the eggs eyed-up. All eggs from negative IHNV females were disinfected and transported to Clearwater Fish Hatchery. The transport vehicle was met at the front gate, and egg baskets were removed from egg coolers and placed in clean egg coolers containing tempered 100-ppm Argentyne solution for 10 minutes. The clean egg coolers were then taken to the incubation room, and eggs were placed into Heath egg trays with approximately 8,000 eggs per basket, and water flows through each stack were set at six gallons per minute. A total of 1,065,391 eyed-eggs were received (Appendix M). During incubation, steelhead eggs were on primary water only.

EARLY REARING

At swim-up, unfed fry from Dworshak stock B-run steelhead were moved to vats 1-4, 27-28, and 53-60. All fry were divided as evenly as possible (72,585 to 80,650 fish/vat). The initial DI was 0.07 and FI was 0.69. Fish were held in the hatchery vats until August when they were marked and moved to twelve steelhead raceways (7-12 east and 7-12 west). Average length of the fish at the end of early rearing was 3.36 inches (85 mm). The fish averaged 76 fpp.

The DI of the Dworshak steelhead ranged from 0.06 to 0.44, and the FI ranged from 0.66 to 2.01. These indexes were recalculated monthly and were never allowed to exceed DI of 0.44 or FI of 2.01.

Water temperatures for the early rearing period ranged from 52° to 58°F (Appendix A2).

FINAL REARING

The juvenile Dworshak stock B-run steelhead were moved to outside steelhead raceways 7-12 east and 7-12 west during August. The move was done in conjunction with fin clipping and CWT tagging in order to avoid double stressing the fish. Fin clipping was done in 24-hour shifts per day with new MATS trailer. Baffles were removed from vats; fish were then moved to the clipping trailers using the transfer tanks. The Red River and Crooked River supplementation fish were not clipped, but were inventoried during the move outside.

The DI of the Dworshak steelhead ranged from 0.08 to 0.28, and the FI ranged from 0.34 to 1.79. These indexes were recalculated monthly and were never allowed to exceed DI of 0.28 or FI of 1.79.

Water temperatures during final rearing period were maintained to keep temperatures as close to 57°F as possible (Appendix A2). Reservoir water temperatures began to drop in late October and bottomed out in January at 42.5^{o}F. Temperatures began to slowly increase in early April and had reached 49°F by late April. Estimated water flows per raceway were 2.1 cfs.

Fish were fed dry feed until released. A total of 163,079 pounds of feed was used during final rearing producing 133,326.46 pounds of gain at a cost of $70,238.12. A total of 184,690 pounds of feed was used throughout the entire rearing period to produce 145,907 pounds of fish at a cost of $94,461.64. The overall conversion rate from fry to smolt was 1.27. Percent body weight fed ranged from 1.35% to 9.85% (Appendix J).

FISH HEALTH

Brood Year 2002 steelhead were not challenged by epizootics from bacterial, viral, or mycotic infectious agents (Appendix N).

Steelhead spawned at Dworshak National Fish Hatchery were found to be positive for IHNV (1/100). The eggs from the one positive female were culled.

An egg quality team has been assembled to ascertain the cause of poor survival of NF CLW STB at primarily Magic Valley Hatchery, but also at Clearwater Hatchery. Some of the parameters being scrutinized are incubation water temperature, water chemistry, spawning methods, and culture practices. This cooperative effort should be able to identify problems and implement corrective measures to either raise a healthy NF CLW STB at these facilities or identify a replacement stock that will perform as needed.

FISH MARKING

Of the North Fork stock steelhead released into the South Fork of the Clearwater River, 84,326 were ad-clipped; 64,748 were CWT/AD/LV; and 884 were AD/PIT tagged. All 108,052 Clear Creek released fish were Ad clipped only (Appendix O).

A total of 63,957 ad-clipped surplus steelhead were released in the North Fork of the Clearwater.

The steelhead released at Red River were 100,000 ad-clipped and 149,452 unmarked with 535 no clip/PIT tagged. The Crooked River released fish were 97,632 ad-clipped; 78,810 no clips; 21,934 CWT with no clip; 64,694 CWT/AD/LV; 298 CWT/AD/LV/PIT; and 1,190 no clip/PIT tags.

The Mill Creek (S.F.) released fish were 32,837 non-clipped and 525 non-clipped/PIT. The Meadow Creek (S.F) released fish were 23,310 non-marked. The Lolo Creek released fish were 42,535 non-marked and 535 no clip/PIT.

FISH DISTRIBUTION

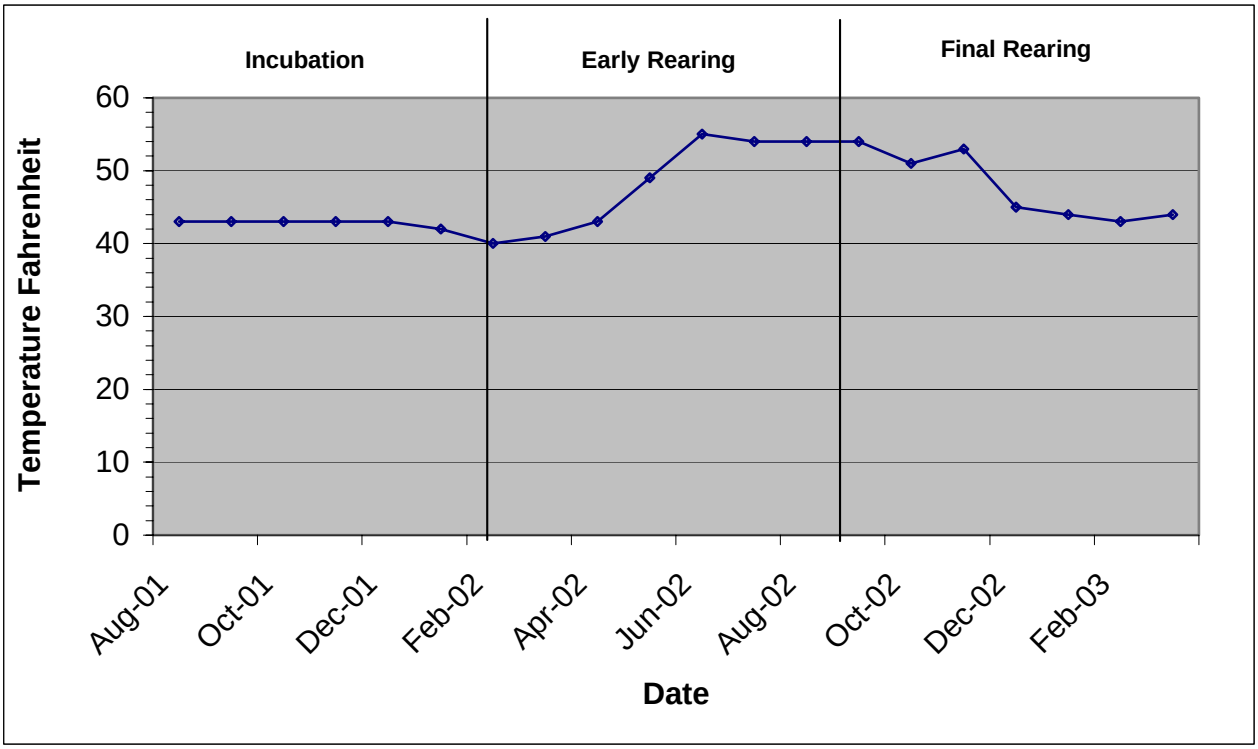
On September 30, 2002, a total of 63,957 (35.99 fpp) surplus Dworshak B-run steelhead were direct released in the North Fork of the Clearwater River. On April 18, 2003, a total of 149,664 (5.64 fpp) Dworshak B-run steelhead were direct released at the Red House hole plant site (approximately 3.5 miles upstream of Highway 13 and 14 junction) on the lower South Fork of Clearwater River. A total of 108,052 (6.68 fpp) Dworshak B-run steelhead were direct released into Clear Creek at Kooskia Hatchery on April 21, 2003. There were 249,987 fish, averaging 5.57 fpp, released at Red River on April 17, 2003 and an additional 264,558 fish, averaging 6.24 fpp, were released at Crooked River on April 19, 2003. There was very little crowding and hauling mortality from the fish transportation to the release sites (Appendix O).

ACKNOWLEDGEMENTS

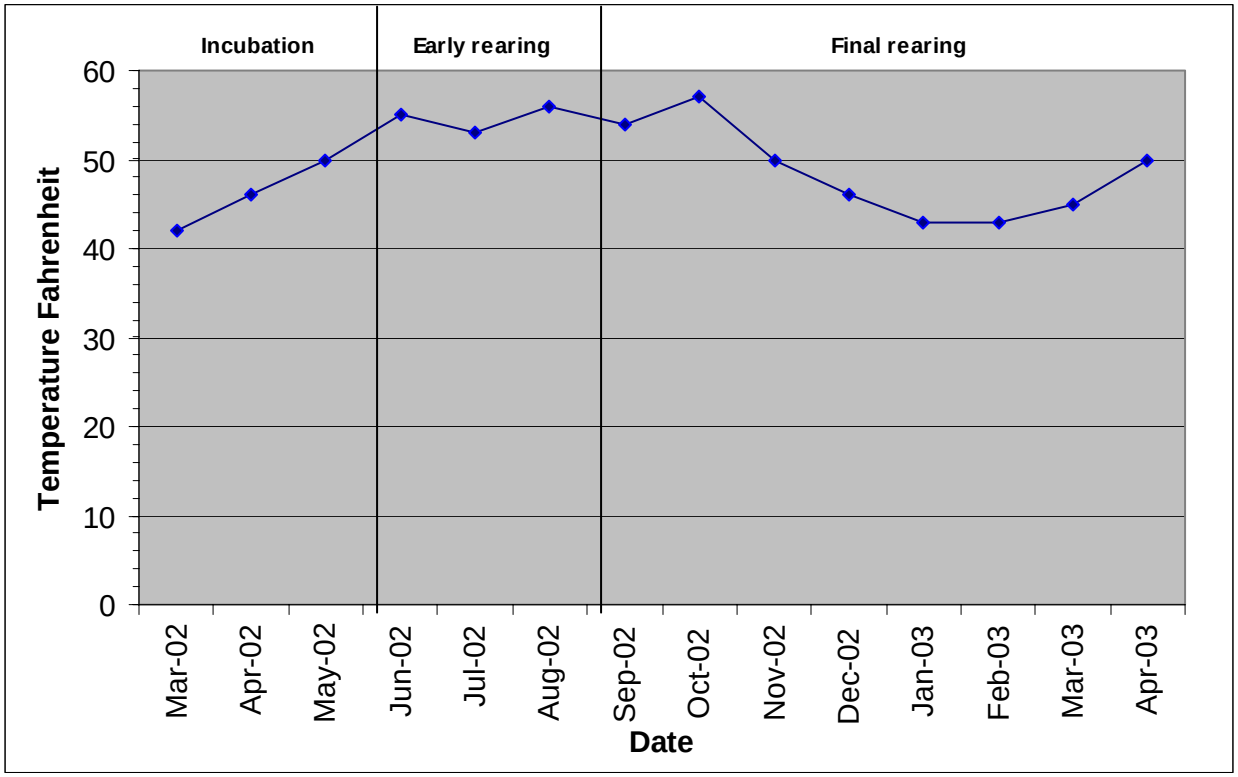
The Clearwater Hatchery has a crew of 22 people and all are assigned a wide variety of responsibilities. Everyone on station has contributed to the success of the program. The hatchery crew consists of: Jerry McGehee - Hatchery Manager; Brad George and Randy Hutzenbiler - Assistant Hatchery Managers; Jeff Houck, Chris Shockman, and Pat Moore - Fish Culturists; Ernie Yost - Utility Craftsman; Walter Boore - Office Specialist II; Ron Hopper, Chad Henson, and Don West - Fish Technicians; Theresa Elliott, Gary Duke, Barbara Zimiga, Bob Schloss, Connie Daly, Daryn Call - Bio-aides; Chris Lozar and Charles Ball - Laborers; Kim West - Grounds Maintenance Worker; Fred Hough, Maintenance Craftsman.

APPENDICES

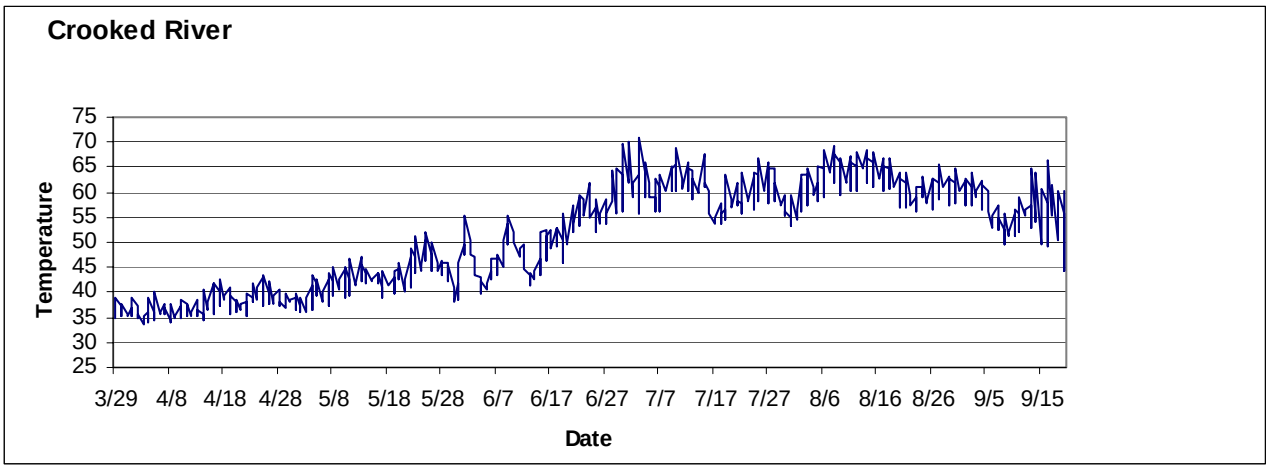
Appendix A1. Brood Year 2001 Chinook water temperatures, September 2001-March 2003

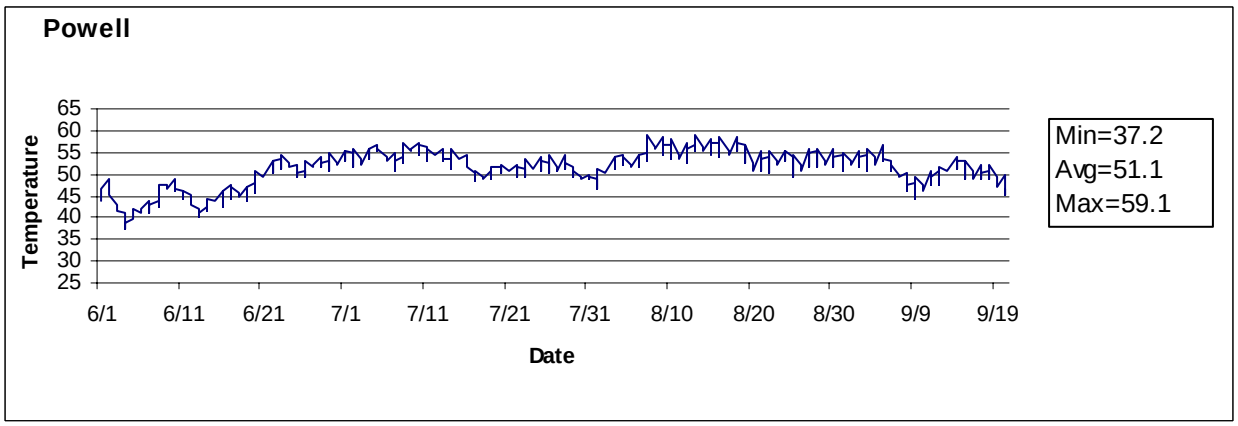


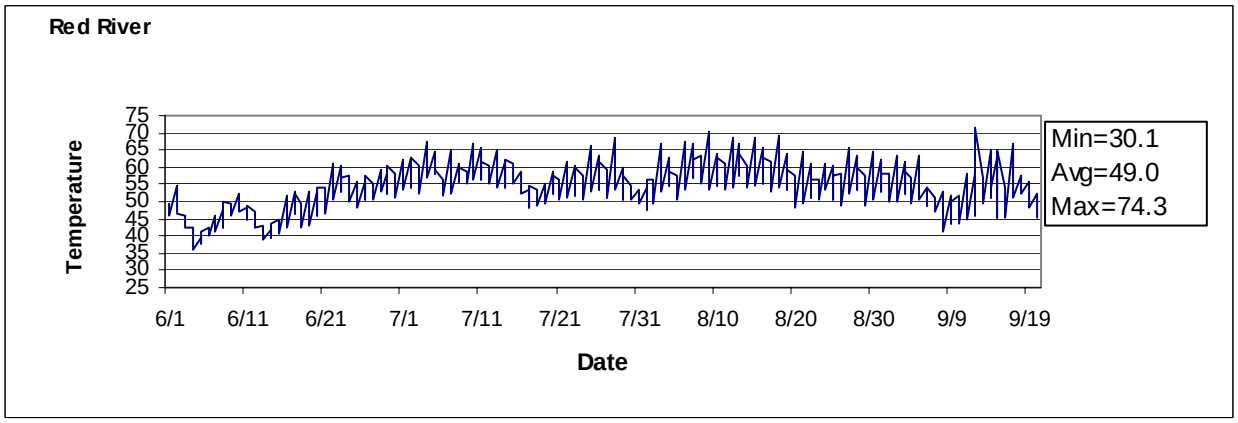
Appendix A2. Brood Year 2002 Steelhead water temperatures, March 2002-April 2003



Appendices B1, B2 and B3. Water temperatures at trap facilities.







Appendix C1. Clearwater Hatchery water quality analysis taken from the hatchery rearing facility on August 4, 1994

ANALYSIS	RESULTS (mg/l)	DATE ANALYZED	REARING LEVELS
Alkalinity	16.0	08/04/94	120 - 400 mg/l
Ammonia (as N)	<0.005	08/04/94	0.0125
Arsenic	<0.01	08/04/94	N/A
Barium	<0.1	08/04/94	N/A
Cadmium	<0.001	08/04/94	<.0004 mg/l
Calcium	3.8	08/12/94	N/A
Chloride	0.9	08/12/94	N/A
Chromium	<0.01	08/04/94	0.1
Color (C.U.)	15	08/12/94	N/A
Copper	<0.02	08/04/94	<.006 mg/l
Cyanide	<0.005	08/12/94	N/A
Detergents (surfactant)	<0.08	08/9/94	N/A
Fluoride	<0.1	08/30/94	N/A
Hardness	14.0	08/04/94	120 - 400 mg/l
Hydrogen Sulfide	<0.01	08/15/94	N/A
Iron	<0.02	08/11/94	N/A
Lead	<0.005	08/04/94	<0. 03 mg/l
Magnesium	<0.8	08/11/94	N/A
Manganese	<0.01	08/11/94	N/A
Mercury	<0.0005	08/11/94	<.002 mg/l
Nitrogen Nitrate	<0.013	08/18/94	0.2 mg/l
Potassium	0.5	08/12/94	N/A
Selenium	<0.005	08/10/94	N/A
Silica	11	08/30/94	N/A
Silver	<0.001	08/17/94	N/A
Sodium	1.5	08/17/94	N/A
Sulfate	<1	08/26/94	N/A
Total Dissolved Solids	28	08/11/94	80 mg /l
Zinc	<0.005	08/10/94	0.03 mg/l
pH (pH units)	7.20	08/09/94	6.5 - 8.0

Appendix C2. Upper Crooked River rearing pond water quality analysis report.

PRIMARY CONTAMINANTS ANALYSIS

Contaminant	Result	MDL	Method	Date
Antimony (0.006)	- - -	0.001	EPA 200.8	07/02/97
Nickel	- - -	0.001	EPA 200.8	07/02/97
Arsenic (0.05)	ND	0.005	EPA 200.8	07/02/97
Selenium (0.05)	ND	0.005	EPA 200.8	07/02/97
Barium (2)	0.029	0.01	EPA 200.8	07/02/97
Sodium	2.9	1	EPA 200.8	07/02/97
Beryllium (0.004)	- - -	0.001	EPA 200.8	07/02/97
Thallium (0.02)	- - -	0.001	EPA 200.8	07/02/97
Cadmium (0.005)	ND	0.001	EPA 200.8	07/02/97
Cyanide (0.2)	ND	0.01	EPA 200.8	07/02/97
Chromium (0.1)	0.002	0.005	EPA 200.8	07/02/97
Fluoride (4.0)	ND	0.1	EPA 300.0	06/27/97
Mercury (0.002)	ND	0.001	EPA 200.8	07/02/97
	SECONDARY CONTAMINANTS			
Chloride	ND	0.001	EPA 300.0	06/27/97
Ammonia/N	ND	0.1	EPA 350.2	07/01/97
Color 2		0.005	EPA110.2	06/27/97
Calcium	3.6	1	EPA 200.8	07/02/97
Sulfide (HS)	ND	0.01	EPA 376.1	06/27/97
Hardness (CaCO3)	12	5	2340 B0	7/02/97
Iron	0.26	0.05	EPA 236.1	07/02/97
Magnesium	0.6	1	EPA 200.8	07/02/97
Manganese	0.01	0.001	EPA 200.8	07/02/97
pH	6.9		EPA 150.1	07/02/97
Odor	- - -	1	EPA 140.1	
Potassium	0.15	1	EPA 200.8	06/27/97
Surfactants	ND	0.05	SM5540C	06/27/97
Silica (SIO3)	6.8	1	EPA 200.8	07/02/97
TDS	18	1	EPA 160.1	06/27/97
Lead	0.002	0.001	EPA 200.8	07/02/97
Zinc	0.012	0.001	EPA 200.8	07/02/97
Copper	0.016	0.001	EPA 200.8	07/02/97
Sulfate	ND	1	EPA 300.0	06/27/97
Conductivity (uS/cm)	25	10	EPA 120.1	06/27/97
Aluminum	- - -	0.001	EPA 200.8	07/02/97
Langlier Index	- - -			
Alkalinity	12	5	EPA 310.1	06/27/97
Silver	ND	0.01	EPA 200.8	07/02/97
Turbidity (NTU)	- - -	0.5	EPA 180.1	

Laboratory Reporting Codes:
Results are mg/L (ppm) unless otherwise noted
ND - Not detected within the sensitivity of the instrument
- - - = No analysis performed for this contaminant
Numerical Entry = Detection at level indicated
MCL (numbers in parenthesis)= EPA maximum contaminant level

Appendix C3. Powell adult holding pond water quality analysis report.

PRIMARY CONTAMINANTS ANALYSIS

Contaminant	Result	MDL	Method	Date
Antimony (0.006)	- - -	0.001	EPA 200.8	07/02/97
Nickel	- - -	0.001	EPA 200.8	07/02/97
Arsenic (0.05)	ND	0.005	EPA 200.8	07/02/97
Selenium (0.05)	ND	0.005	EPA 200.8	07/02/97
Barium (2)	0.009	0.01	EPA 200.8	07/02/97
Sodium	1.9	1	EPA 200.8	07/02/97
Beryllium (0.004)	- - -	0.001	EPA 200.8	07/02/97
Thallium (0.02)	- - -	0.001	EPA 200.8	07/02/97
Cadmium (0.005)	ND	0.001	EPA 200.8	07/02/97
Cyanide (0.2)	ND	0.01	EPA 200.8	07/02/97
Chromium (0.1)	0.002	0.005	EPA 200.8	07/02/97
Fluoride (4.0)	ND	0.1	EPA 300.0	06/27/97
Mercury (0.002)	ND	0.001	EPA 200.8	07/02/97
SECONDARY CONTAMINANTS				
Chloride	ND	0.001	EPA 300.0	06/26/97
Ammonia/N	ND	0.1	EPA 350.2	07/01/97
Color	4	0.005	EPA110.2	06/26/97
Calcium	4.2	1	EPA 200.8	07/02/97
Sulfide (HS)	ND	0.01	EPA 376.1	06/26/97
Hardness (CaCO3)	14	5	2340 B	07/02/97
Iron	0.15	0.05	EPA 236.1	07/02/97
Magnesium	0.7	1	EPA 200.8	07/02/97
Manganese	0.009	0.001	EPA 200.8	07/02/97
Ph	- - -		EPA 150.1	
Odor	- - -	1	EPA 140.1	
Potassium	0.07	1	EPA 200.8	07/02/97
Surfactants	ND	0.05	SM5540C	06/26/97
Silica (SIO3)	5	1	EPA 200.8	07/02/97
TDS	15	1	EPA 160.1	06/26/97
Lead	0.002	0.001	EPA 200.8	07/02/97
Zinc	0.006	0.001	EPA 200.8	07/02/97
Copper	0.016	0.001	EPA 200.8	07/02/97
Sulfate	ND	1	EPA 300.0	06/26/97
Conductivity (uS/cm)	27.2	10	EPA 120.1	06/25/97
Aluminum	- - -	0.001	EPA 200.8	07/02/97
Langlier Index	- - -			
Alkalinity	- - -	5	EPA 310.1	
Silver	ND	0.01	EPA 200.8	07/02/97
Turbidity (NTU)	- - -	0.5	EPA 180.1	

Laboratory Reporting Codes:
Results are mg/L (ppm) unless otherwise noted
ND - Not detected within the sensitivity of the instrument
- - - = No analysis performed for this contaminant
Numerical Entry = Detection at level indicated
MCL (numbers in parenthesis)= EPA maximum contaminant level

Appendix C4. Red River adult holding pond water quality analysis report.

PRIMARY CONTAMINANTS ANALYSIS

Contaminant	Result	MDL	Method	Date
Antimony (0.006)	- - -	0.001	EPA 200.8	07/16/97
Nickel	- - -	0.001	EPA 200.8	07/16/97
Arsenic (0.05)	ND	0.005	EPA 200.8	07/16/97
Selenium (0.05)	ND	0.005	EPA 200.8	07/16/97
Barium (2)	0.03	0.01	EPA 200.8	07/16/97
Sodium	3.2	1	EPA 200.8	07/16/97
Beryllium (0.004)	- - -	0.001	EPA 200.8	07/16/97
Thallium (0.02)	- - -	0.001	EPA 200.8	07/16/97
Cadmium (0.005)	ND	0.001	EPA 200.8	07/16/97
Cyanide (0.2)	ND	0.01	EPA 200.8	07/16/97
Chromium (0.1)	0.001	0.005	EPA 200.8	07/16/97
Fluoride (4.0)	ND	0.1	EPA 300.0	07/03/97
Mercury (0.002)	ND	0.001	EPA 200.8	07/16/97
Nitrate /N	ND	0.5	EPA 300.0	07/03/97
SECONDARY CONTAMINANTS				
Chloride	ND	0.001	EPA 300.0	07/03/97
Ammonia/N	ND	0.1	EPA 350.2	07/01/97
Color	15	0.005	EPA110.2	07/03/97
Calcium	3.92	1	EPA 200.8	07/16/97
Sulfide (HS)	ND	0.01	EPA 376.1	
Hardness (CaCO3)	13	5	2340 B	07/16/97
Iron	0.37	0.05	EPA 236.1	07/16/97
Magnesium	0.76	1	EPA 200.8	07/16/97
Manganese	0.014	0.001	EPA 200.8	07/16/97
pH	7.06		EPA 150.1	07/03/97
Odor	- - -	1	EPA 140.1	
Potassium	0.53	1	EPA 200.8	07/16/97
Surfactants	- - -	0.05	SM5540C	
Silica (SIO3)	7.9	1	EPA 200.8	07/16/97
TDS	21	1	EPA 160.1	07/03/97
Lead	0.002	0.001	EPA 200.8	07/16/97
Zinc	0.016	0.001	EPA 200.8	07/16/97
Copper	0.016	0.001	EPA 200.8	07/16/97
Sulfate	ND	1	EPA 300.0	07/03/97
Conductivity (uS/cm)	32	10	EPA 120.1	07/03/97
Aluminum	- - -	0.001	EPA 200.8	07/16/97
Langlier Index	- - -			
Alkalinity	- - -	5	EPA 310.1	
Silver	ND	0.01	EPA 200.8	07/16/97
Turbidity (NTU)	1.4	0.5	EPA 180.1	07/03/97

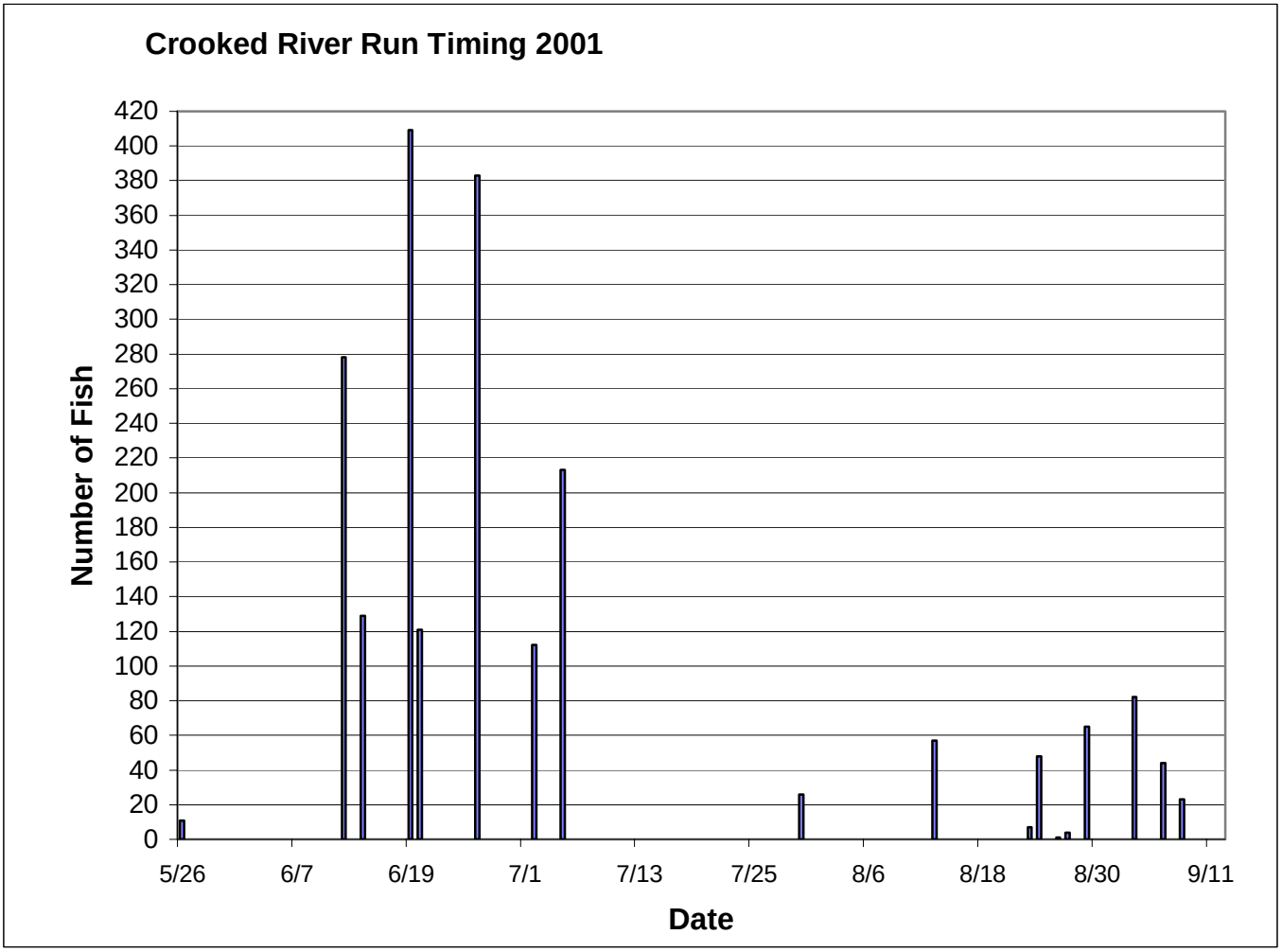
Laboratory Reporting Codes:
Results are mg/L (ppm) unless otherwise noted
ND - Not detected within the sensitivity of the instrument
- - - = No analysis performed for this contaminant
Numerical Entry = Detection at level indicated
MCL (numbers in parenthesis)= EPA maximum contaminant level

Appendix D1. Crooked River chinook run timing 2001.

Date	Adults	Jacks	Total
5/26	11	0	11
5/27	0	0	0
5/28	0	0	0
5/29	0	0	0
5/30	0	0	0
5/31	0	0	0
6/1	0	0	0
6/2	0	0	0
6/3	0	0	0
6/4	0	0	0
6/5	0	0	0
6/6	0	0	0
6/7	0	0	0
6/8	0	0	0
6/9	0	0	0
6/10	0	0	0
6/11	0	0	0
6/12	278	0	278
6/13	0	0	0
6/14	129	0	129
6/15	0	0	0
6/16	0	0	0
6/17	0	0	0
6/18	0	0	0
6/19	405	4	409
6/20	121	0	121
6/21	0	0	0
6/22	0	0	0
6/23	0	0	0
6/24	0	0	0
6/25	0	0	0
6/26	376	7	383
6/27	0	0	0
6/28	0	0	0
6/29	0	0	0
6/30	0	0	0
7/1	0	0	0
7/2	107	5	112
7/3	0	0	0
7/4	0	0	0
7/5	205	8	213
7/6	0	0	0
7/7	0	0	0
7/8	0	0	0
7/9	0	0	0
7/10	0	0	0
7/11	0	0	0
7/12	0	0	0
7/13	0	0	0
7/14	0	0	0
7/15	0	0	0
7/16	0	0	0
7/17	0	0	0
7/18	0	0	0
7/19	0	0	0

Date	Adults	Jacks	Total
7/21	0	0	0
7/22	0	0	0
7/23	0	0	0
7/24	0	0	0
7/25	0	0	0
7/26	0	0	0
7/27	0	0	0
7/28	0	0	0
7/29	0	0	0
7/30	21	5	26
7/31	0	0	0
8/1	0	0	0
8/2	0	0	0
8/3	0	0	0
8/4	0	0	0
8/5	0	0	0
8/6	0	0	0
8/7	0	0	0
8/8	0	0	0
8/9	0	0	0
8/10	0	0	0
8/11	0	0	0
8/12	0	0	0
8/13	54	3	57
8/14	0	0	0
8/15	0	0	0
8/16	0	0	0
8/17	0	0	0
8/18	0	0	0
8/19	0	0	0
8/20	0	0	0
8/21	0	0	0
8/22	0	0	0
8/23	7	0	7
8/24	48	0	48
8/25	0	0	0
8/26	1	0	1
8/27	4	0	4
8/28	0	0	0
8/29	65	0	65
8/30	0	0	0
8/31	0	0	0
9/1	0	0	0
9/2	0	0	0
9/3	82	0	82
9/4	0	0	0
9/5	0	0	0
9/6	44	0	44
9/7	0	0	0
9/8	21	2	23
9/9	0	0	0
9/10	0	0	0
9/11	0	0	0
9/12	0	0	0
TOTAL	**1,979**	**34**	**2,013**

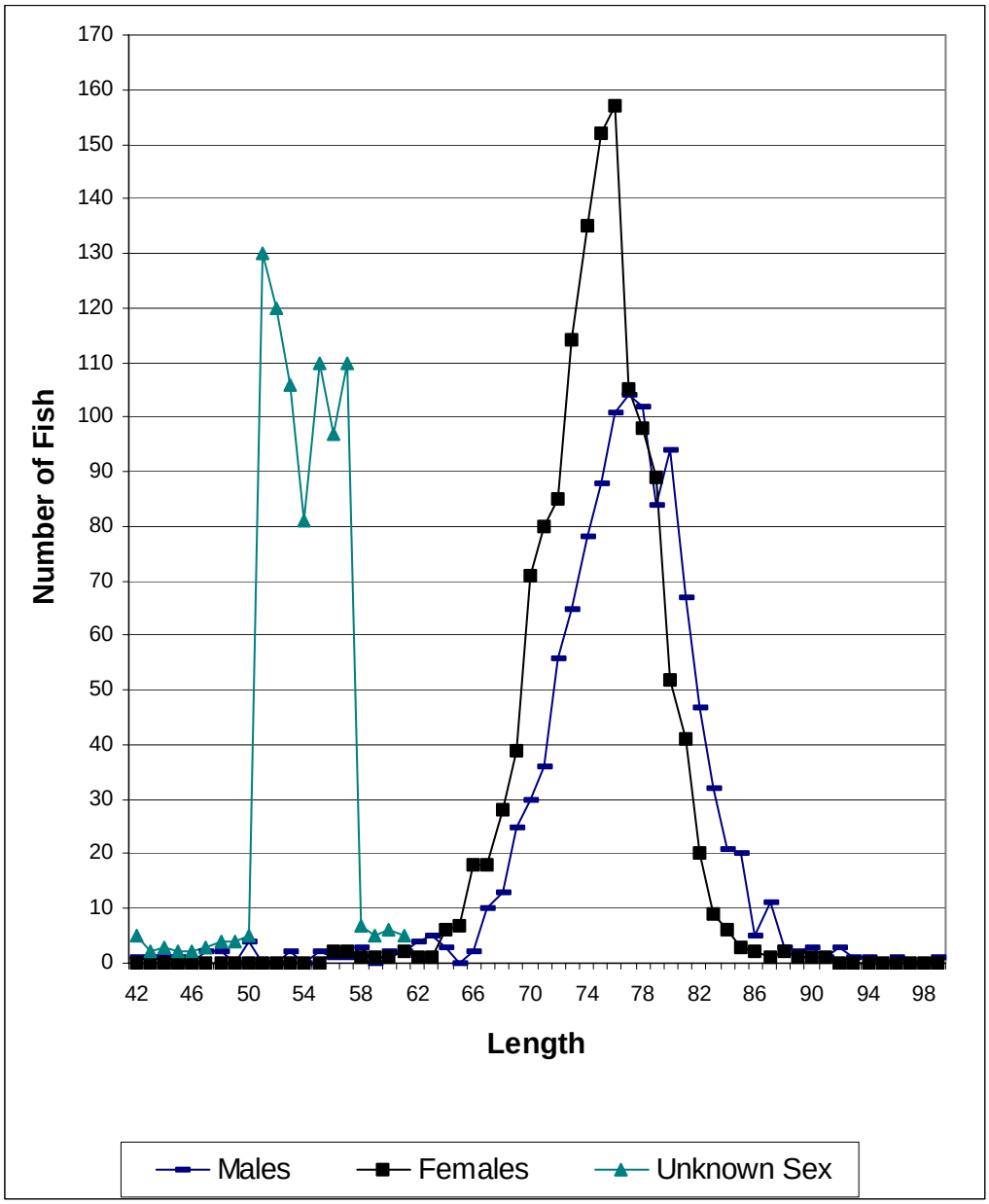
Appendix D1a. Crooked River Run Timing Graph, 2001.



Appendix D2. South Fork (Red River/Crooked River) chinook length frequency.

Length (cm)	Female	Males	Unk	Total
42	1	0		1
43	1	0		1
44	1	0		1
45	1	0		1
46	0	0		0
47	2	0		2
48	2	0		2
49	0	0		0
50	4	0		4
51	0	0		0
52	0	0		0
53	2	0		2
54	0	0		0
55	2	0		2
56	1	2		3
57	1	2		3
58	3	1	1	5
59	0	1	1	2
60	2	1	2	5
61	2	2	2	6
62	4	1	1	6
63	5	1	5	11
64	3	6	2	11
65	0	7	3	10
66	2	18	2	22
67	10	18	2	30
68	13	28	3	44
69	25	39	4	68
70	30	71	4	105
71	36	80	5	121
72	56	85	130	271
73	65	114	120	299
74	78	135	106	319
75	88	152	81	321
76	101	157	110	368
77	104	105	97	306
78	102	98	110	310
79	84	89	7	180
80	94	52	5	151
81	67	41	6	114
82	47	20	5	72
83	32	9	15	56
84	21	6	12	39
85	20	3	9	32
86	5	2		7
87	11	1		12
88	3	2		5
89	2	1		3
90	3	1		4
91	1	1		2
92	3	0		3
93	1	0		1
94	1	0		1
95	0	0		0
96	1	0		1
97	0	0		0
98	0	0		0
103	1	0		1
TOTAL	**1,144**	**1,352**	**850**	**3,346**

Appendix D2a. South Fork (Red River / Crooked River) Length Frequency Graph.

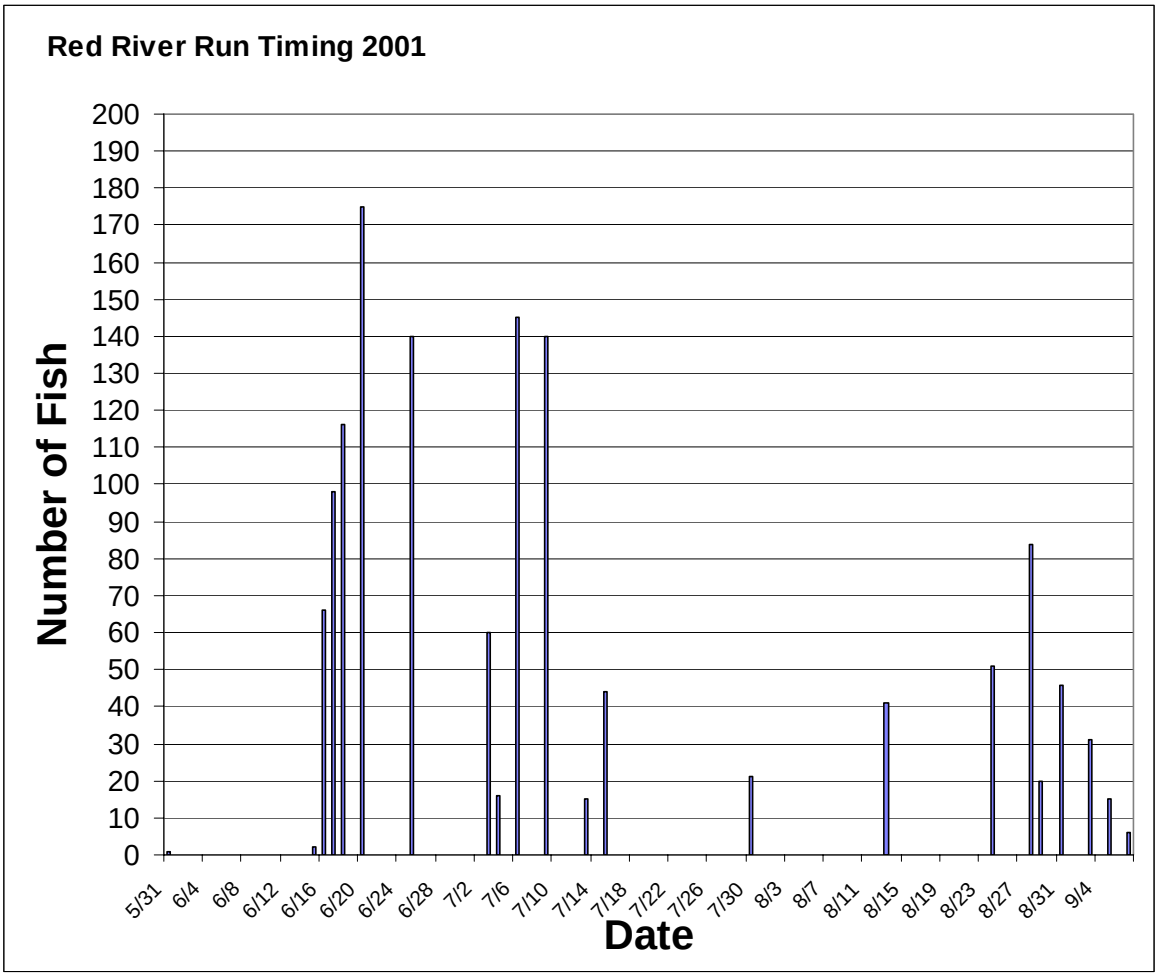


Appendix E1. Red River chinook run timing, 2001.

Date	Adults	Jacks	Total
5/31	1	0	1
6/15	2	0	2
6/16	66	0	66
6/17	98	0	98
6/18	116	0	116
6/19	0	0	0
6/20	175	0	175
6/21	0	0	0
6/22	0	0	0
6/23	0	0	0
6/24	0	0	0
6/25	140	0	140
6/26	0	0	0
6/27	0	0	0
6/28	0	0	0
6/29	0	0	0
6/30	0	0	0
7/1	0	0	0
7/2	0	0	0
7/3	57	3	60
7/4	14	2	16
7/5	0	0	0
7/6	142	3	145
7/7	0	0	0
7/8	0	0	0
7/9	137	3	140
7/10	0	0	0
7/11	0	0	0
7/12	0	0	0
7/13	12	3	15
7/14	0	0	0
7/15	42	2	44
7/16	0	0	0
7/17	0	0	0
7/18	0	0	0
7/19	0	0	0
7/20	0	0	0
7/21	0	0	0
7/22	0	0	0
7/23	0	0	0
7/24	0	0	0
7/25	0	0	0
7/26	0	0	0
7/27	0	0	0
7/28	0	0	0

Date	Adults	Jacks	Total
7/29	0	0	0
7/30	18	3	21
7/31	0	0	0
8/1	0	0	0
8/2	0	0	0
8/3	0	0	0
8/4	0	0	0
8/5	0	0	0
8/6	0	0	0
8/7	0	0	0
8/8	0	0	0
8/9	0	0	0
8/10	0	0	0
8/11	0	0	0
8/12	0	0	0
8/13	41	0	41
8/14	0	0	0
8/15	0	0	0
8/16	0	0	0
8/17	0	0	0
8/18	0	0	0
8/19	0	0	0
8/20	0	0	0
8/21	0	0	0
8/22	0	0	0
8/23	0	0	0
8/24	51	0	51
8/25	0	0	0
8/26	0	0	0
8/27	0	0	0
8/28	82	2	84
8/29	20	0	20
8/30	0	0	0
8/31	46	0	46
9/1	0	0	0
9/2	0	0	0
9/3	31	0	31
9/4	0	0	0
9/5	15	0	15
9/6	0	0	0
9/7	4	2	6
9/8	0	0	0
9/9	0	0	0
9/10	0	0	0
9/11	0	0	0
TOTAL	**1,310**	**23**	**1,333**

Appendix E1a. Red River Run Timing Graph, 2001.



Appendix E2. South Fork chinook summary of fish trapped, released, spawned and disposition of carcasses, Brood Year 2001

TOTAL FISH TRAPPED: 3346
(Red River 1333, Crooked River 2013)

AGE CLASSES	FEMALES	MALES	UNKNOWN	TOTAL
3 Years = (<64 cm)	11	34	12	57
4 Years = (64 - 82 cm)	1,315	1,005	802	3,122
5 Years = (> 83 cm)	26	105	36	167
	1,352	**1,144**	**850**	**3,346**

*These fish were released and not sexed or measured

FISH DISPOSITION FEMALES:

SPAWNED	676 *
MORTALITY	99
KILLED/CULLED @ SPAWN	30
RELEASED TO SPAWN	377
RELEASED /FISHERY	170
TOTAL	**1,352**

*This includes 186 females spawned by Nez Perce Tribal Fisheries

RECAPTURES RELEASED / FISHERY	
Males:	4
Females:	9
Unknown	3
	16

FISH DISPOSITION MALES

SPAWNED	483 *
MORTALITY	80
KILLED/CULLED @ SPAWN	2
RELEASED TO SPAWN	411
RELEASED /FISHERY	168
TOTAL	**1,144**

*This includes males spawned by Nez Perce Tribal Fisheries

FISH DISPOSITION SEX UNKNOWN

MORTALITY	5
RELEASED TO SPAWN	6
RELEASED /FISHERY	839
TOTAL	**850**

TOTAL DISPOSITION	**3,346**

Appendix F1. Summary of spring chinook salmon returns to Crooked River by Brood Year

Brood Year	Year Released	Number Released	3-yr-olds	Year Returned	4-yr-olds	Year Returned	5-yr-olds	Year Returned	Total by return	% return from
1985	-------	-------		1988	-------	1989	4	1990	4	
1986	-------	-------		1989	23	1990	5	1991	28	
1987	Spr 1989(a)	199,700	2	1990	13	1991	7	1992	22	0.011%
1988	Spr 1990(b)	300,407	2	1991	208	1992	276	1993	486	0.162%
1989	Fall 1990(c)	339,087	13	1992	119	1993	10	1994	142	0.042%
1990	Fall 1991(a)	320,400	7	1993	15	1994	0	1995	22	0.002%
1991	-------	-------	1*	1994	0	1995	1	1996	1	0.000%
1992	Spr 1994(d)	273,766	6	1995	241 (g)	1996	59	1997	306	0.112%
1993	Fall 1994	199,255								
	Fall 1994(e)	216,280	94 (g)	1996	935	1997	213	1998	1274	0.134%
	Spr 1995	258,293								
	Spr 1995(f)	279,615								
		953,443								
1994	Spr 1996	37,071	2	1997	22	1998	3	1999	27	0.073%
1995	Spr 1997	0	0	1998	0	1999	0	2000	0	0.00%
1996	Spr 1998	205,906	122	1999	637	2000	101	2001	860**	0.417%
1997	Fall 1998	162,119	454	2000	1878**	2001	276**	2002		
	Spr 1999	600,981								
		763,100								
1998	Fall 1999	89,299	34**	2001	1023**	2002		2003		
	Spr 2000	399,060								
		488,359								
1999	Fall 2000	105,507	37**	2002		2003		2004		
	Spr 2001	84,649								
		190,156								
2000	Fall 2001	155,887		2003		2004		2005		
	Spr 2002	726,489								
2001	Fall 2002	169,768		2004		2005		2006		
	Spr 2003	629,687								

[a]Transferred from Dworshak Hatchery
[b]Direct released from Kooskia Fish Hatchery
[c]Transferred from Dworshak and Rapid River hatcheries
[d]Eggs from Lookingglass Hatchery (Rapid River stock) reared at Clearwater Hatchery
[e]Eggs from Rapid River hatchery reared at Clearwater Hatchery
Non-acclimated release
[f]These numbers do not match run report numbers. Each one has been corrected to reflect straying from other stocks.
* Natural Fish
**Does not include fish caught in fishery or left in river

Appendix F2. Summary of spring chinook returns to Red River by brood year

Brood Year	Year Released	Number Released	3-yr-old	Year Returned	4-yr-olds	Year Returned	5-yr-olds	Year Returned	Total by return	% return from plant
1982	Fall 1983	260,000	2	1985	a	1986	107	1987	109	0.036%
	Spr 1984	40,000								
1983	Spr 1985(b)	80,000	A	1986	377	1987	259	1988	636	0.795%
1984	Spr 1986(b)	136,800	35	1987	132	1988	74	1989	241	0.176%
1985	Fall 1986(c)	96,400	3	1988	25	1989	13	1990	41	0.021%
	Spr 1987(c)	96,800								
1986	Fall 1987	233,100	5	1989	38	1990	8	1991	51	0.022%
1987	Fall 1988	291,200	2	1990	9	1991	3	1992	14	0.005%
1988	Fall 1989	240,500	1	1991	31	1992	39	1993	71	0.029%
1989	Fall 1990	273,800	5	1992	99	1993	13	1994	117	0.025%
	Spr 1991(d)	63,000								
	Spr 1991(e)	124,000								
		460,800								
1990	Fall 1991	354,700	1	1993	18	1994	1	1995	20	0.004%
	Spr 1992(f)	207,500								
		562,200								
1991	Fall 1992	6,000		1994	0	1995	0	1996	0	0.000%
1992	Fall 1993	22,246	3	1995	4 (g)	1996	45	1997	52	0.234%
1993	Fall 1994	320,755	5	1996	191	1997	42	1998	238	0.074%
1994	Spr 1996	24,002	2	1997	25	1998	2	1999	29	0.121%
1995	Spr 1997	2,983	1	1998	6	1999	22	2000	29	0.972%
1996	Spr 1998	51,208	15	1999	81	2000	66**	2001	162	0.316%
1997	Fall 1998	66,114	1	2000	1244**	2001	122**	2002		
	Spr 1999	360,983	178	2000		2001		2002		
1998	Fall 1999	74,981	23**	2001		2002		2003		
	Spr 2000	159,051			494**					
		234,032								
1999	Fall 2000	68,684	7**	2002		2003		2004		
2000	Fall 2001	84,238		2003		2004		2005		
	Spr 2002	350,318								
2001	Fall 2002	85,064		2004		2005		2006		
	Spr 2003	351,066								

[A]Trap was not installed in 1986 due to construction
[b]These fish wintered in the rearing pond
[c]These fish were Rapid River stock reared at Sawtooth and released directly into Red River with no acclimation
[d]Planted off bridge at ranger station, reared at Dworshak Hatchery, Clearwater Stock
[e]Planted off bridge at ranger station, reared at Kooskia, Clearwater Stock
Acclimated in rearing pond for 21 days, transferred from Dworshak
[f]These numbers do not match run report numbers. Each one has been corrected to reflect straying from other stocks.

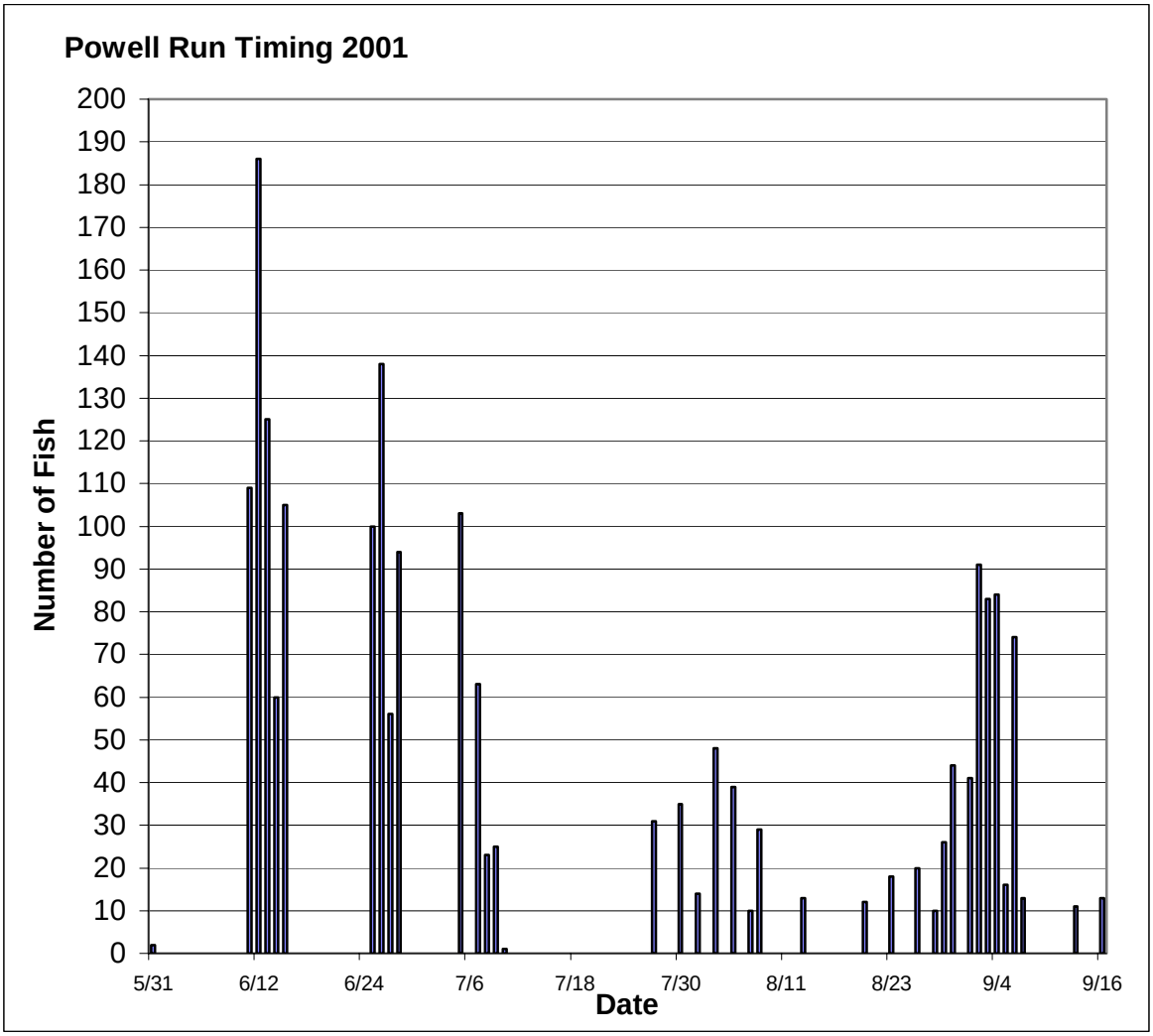
**Does not include fish caught in fishery or left in river.

Appendix G1. Powell and Crooked Fork Creek Chinook Run Timing, 2001.

Date	Adults	Jacks	Total
5/31	2	0	2
6/1	0	0	0
6/2	0	0	0
6/3	0	0	0
6/4	0	0	0
6/5	0	0	0
6/6	0	0	0
6/7	0	0	0
6/8	0	0	0
6/9	0	0	0
6/10	0	0	0
6/11	109	0	109
6/12	186	0	186
6/13	125	0	125
6/14	60	0	60
6/15	103	2	105
6/16	0	0	0
6/17	0	0	0
6/18	0	0	0
6/19	0	0	0
6/20	0	0	0
6/21	0	0	0
6/22	0	0	0
6/23	0	0	0
6/24	0	0	0
6/25	100	0	100
6/26	135	3	138
6/27	52	4	56
6/28	90	4	94
6/29	0	0	0
6/30	0	0	0
7/1	0	0	0
7/2	0	0	0
7/3	0	0	0
7/4	0	0	0
7/5	94	9	103
7/6	0	0	0
7/7	52	11	63
7/8	20	3	23
7/9	20	5	25
7/10	0	1	1
7/11	0	0	0
7/12	0	0	0
7/13	0	0	0
7/14	0	0	0
7/15	0	0	0
7/16	0	0	0
7/17	0	0	0
7/18	0	0	0
7/19	0	0	0
7/20	0	0	0
7/21	0	0	0
7/22	0	0	0
7/23	0	0	0
7/24	0	0	0
7/25	0	0	0

Date	Adults	Jacks	Total
7/26	0	0	0
7/27	31	0	31
7/28	0	0	0
7/29	0	0	0
7/30	33	2	35
7/31	0	0	0
8/1	14	0	14
8/2	0	0	0
8/3	47	1	48
8/4	0	0	0
8/5	38	1	39
8/6	0	0	0
8/7	9	1	10
8/8	27	2	29
8/9	0	0	0
8/10	0	0	0
8/11	0	0	0
8/12	0	0	0
8/13	13	0	13
8/14	0	0	0
8/15	0	0	0
8/16	0	0	0
8/17	0	0	0
8/18	0	0	0
8/19	0	0	0
8/20	11	1	12
8/21	0	0	0
8/22	0	0	0
8/23	17	1	18
8/24	0	0	0
8/25	0	0	0
8/26	19	1	20
8/27	0	0	0
8/28	9	1	10
8/29	25	1	26
8/30	37	7	44
8/31	0	0	0
9/1	39	2	41
9/2	88	3	91
9/3	80	3	83
9/4	81	3	84
9/5	14	2	16
9/6	74	0	74
9/7	12	1	13
9/8	0	0	0
9/9	0	0	0
9/10	0	0	0
9/11	0	0	0
9/12	0	0	0
9/13	11	0	11
9/14	0	0	0
9/15	0	0	0
9/16	13	0	13
9/17	0	0	0
9/18	0	0	0
9/19	0	0	0
9/20	0	0	0
9/21	0	0	0
TOTAL	**1,890**	**75**	**1,965**

Appendix G1a. Powell and Crooked Fork Creek Chinook Run Timing Graph, 2001.

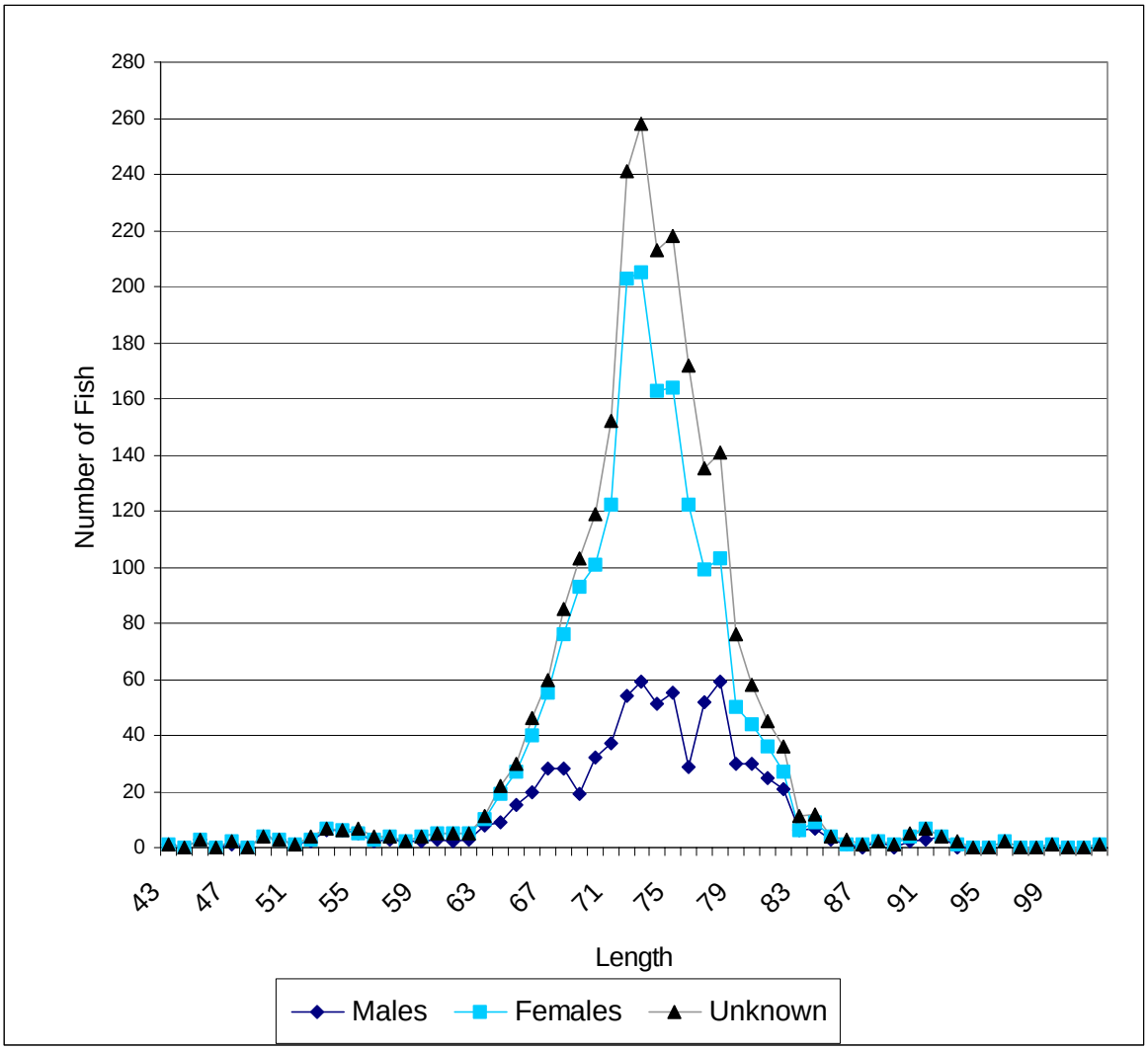


Appendix G2. Powell and Crooked Fork Creek chinook length frequency.

Length (cm)	Female	Males	Unk	Total
43	1	0	0	1
44	0	0	0	0
45	3	0	0	3
46	0	0	0	0
47	1	1	0	2
48	0	0	0	0
49	4	0	0	4
50	3	0	0	3
51	1	0	0	1
52	2	1	1	4
53	6	1	0	7
54	6	0	0	6
55	5	0	2	7
56	2	1	1	4
57	3	1	0	4
58	2	0	0	2
59	2	2	0	4
60	3	2	0	5
61	2	3	0	5
62	3	2	0	5
63	8	2	1	11
64	9	10	3	22
65	15	12	3	30
66	20	20	6	46
67	28	27	5	60
68	28	48	9	85
69	19	74	10	103
70	32	69	18	119
71	37	85	30	152
72	54	149	38	241
73	59	146	53	258
74	51	112	50	213
75	55	109	54	218
76	29	93	50	172
77	52	47	36	135
78	59	44	38	141
79	30	20	26	76
80	30	14	14	58
81	25	11	9	45
82	21	6	9	36
83	6	0	5	11
84	7	2	3	12
85	3	1	0	4
86	1	0	2	3

Length (cm)	Female	Males	Unk	Total
87	0	1	0	1
88	2	0	0	2
89	0	1	0	1
90	2	2	1	5
91	3	4	0	7
92	4	0	0	4
93	0	1	1	2
94	0	0	0	0
95	0	0	0	0
96	2	0	0	2
97	0	0	0	0
98	0	0	0	0
99	1	0	0	1
100	0	0	0	0
101	0	0	0	0
102	1	0	0	1
TOTAL	**742**	**1,124**	**478**	**2,344**

Appendix G2a. Powell and Crooked Fork Creek Length Frequency, 2001.



Appendix G3. Powell chinook summary of fish trapped, released, spawned and distribution Of carcasses for Powell and Crooked Fork adult traps, Brood Year 2001

TOTAL FISH TRAPPED:	1,965
Crooked Fork Creek:	379
TOTAL	**2,344**

AGE CLASSES	**FEMALES**	**MALES**	**UNKNOWN**	**TOTAL**
3 Years = (<64 cm)	16	57	5	78
4 Years = (64 - 82 cm)	1,096	653	461	2,210
5 Years = (> 83 cm)	12	32	12	56
	1,124	**742**	**478**	**2,344**

FISH DISPOSITION FEMALES:	
SPAWNED	795 *
MORTALITY	106
KILLED/CULLED @ SPAWN	55
RELEASED TO SPAWN	78
RELEASED IN FISHERY	90
TOTAL	**1,124**

*This includes 190 females spawned by CFH personnel for NPT production

FISH DISPOSITION MALES:	
SPAWNED	482 *
MORTALITY	76
RELEASED TO SPAWN	81
RELEASED IN FISHERY	103
TOTAL	**742**

*This includes males spawned by CFH personnel for NPT production

RECAPTURES RELEASED / FISHERY	
Males:	18
Females	6
Unknowns:	2
Total	**26**

FISH DISPOSITION UNKNOWN SEX:

RELEASED IN FISHERY	418
RELEASED TO SPAWN	60
TOTAL	**478**
TOTAL DISPOSITION	**2,344**

Appendix H. Summary of spring chinook returns to Powell by brood year.

Brood Year	Year Released	Number Released	3-yr-olds	Year Returned	4-yr-olds	Year Returned	5-yr-olds	Year Returned	Total by return	% return from plant
1984	Spr 1986	-------		1987		1988	16	1989	16	
1985	Spr 1987	-------		1988	111	1989	20	1990	131	
1986	Spr 1988(a)	200,100	27	1989	157	1990	10	1991	194	0.097%
1987	Spr 1989(b)	200,639	2	1990	16	1991	15	1992	33	0.016%
1988	Fall 1989	314,500	7	1991	249	1992	288	1993	544	0.173%
1989	Fall 1990	307,100	6	1992	204	1993	57	1994	267	0.054%
	Spr 1991(c)	180,764								
1990	Fall 1991	358,400	8	1993	28	1994	1	1995	37	0.007%
	Spr 1992(d)	150,800								
	Spr 1992(e)	53,500								
		562,700								
1991	Fall 1992(f)	500	1	1994	1	1995	0	1996	2	0.400%
	Fall 1992(g)									
1992	Spr 1994(h)	144,823	12	1995	141	1996	129	1997	268	0.102%
	Spr 1994(i)	61,060								
	Spr 1994(j)	55,745								
		261,628								
1993	Fall 1994	311,690	45	1996	587	1997	310	1998	942	0.156%
	Spr 1995	290,417								
		602,107								
1994	Spr 1996	232,731	2	1997	177	1998	53	1999	232	0.099%
1995	Spr 1997	3,549	1	1998	8	1999	88	2000	97	2.73%
1996	Spr 1998	244,847	119	1999	877	2000	56**	2001	1052	0.430%
1997	Fall 1998	330,555	300	2000	2210**	2001	202**	2002		
	Spr 1999	334,482								
		665,037								
1998	Spr 2000	293,522	78**	2001	1156**	2002		2003		
1999	Spr 2001	212,648	36**	2002		2003		2004		
2000	Fall 2001	559,630		2003		2004		2005		
	Spr 2002	349,890								
2001	Fall 2002	526,733		2004		2005		2006		
	Spr 2003	350,665								

(a) Rapid River stock reared at Dworshak
(b) Clearwater stock reared at Kooskia and Dworshak
(c) Clearwater reared at Kooskia; acclimated in rearing pond
(d) Acclimated 21 days in rearing pond before release into Walton Cr, transferred from Dworshak
(e) Not acclimated, transferred to rearing pond and immediately released
(f) These smolts were released from the rearing pond to Walk Creek
(g) Released at headwaters of Crooked Fork Creek
(h) Acclimated 17 days, volitional release 5 days, released in Walton Cr.
(i) Non-acclimated, transferred to rearing pond and immediately released
(j) Released directly into Walton Cr.
(k) Most of these five-year-olds were large four-year-olds

** Does not include fish caught in fishery or left in river.

Appendix I. 2001 Chinook egg take and eye-up at CFH

POWELL

Spawn Date	Number Females Spawned	Number Adult Males	Number Jacks	Number Females Culled	Number Production Females	Number Green Eggs	Number Eyed Eggs	
8/7/01	6	6	0	2	4	14,560	13,988	
8/14/01	12	12	0	1	11	47,937	41,852	
8/17/01	19	14	5	4	15	62,788	56,372	
8/21/01	39	33	6	4	35	123,536	117,066	
8/24/01	64	50	14	2	62	245,058	231,168	
8/28/01	155	130	25	25	130	510,815	469,933	
8/29/01	119	119	0	9	110	408,999	394,387	
8/31/01	36	36	0	5	31	113,222	102,041	
9/5/01	60	60	0	4	56	221,624	183,930	
9/12/01	95	95	0	9	86	319,057	284,524	
TOTAL	605	555	50	65	540	2,067,596	1,895,201	91.7%

10.7% cull rate on females
* Part of lot 8, 9 and all of lot 10 went to NPT
** Adult males used more than once, jacks only once Fecundity = 3,829 per/female

SOUTH FORK

8/06/01	2	2	0	1	1	4,456	4,447	
8/13/01	14	14	0	14	0	0	0	
8/16/01	16	16	0	3	13	57,337	56,269	
8/20/01	61	61	0	12	49	205,575	201,548	
8/23/01	71	88	3	23	48	205,034	197,894	
8/27/01	111	100	11	22	89	371,643	363,337	
8/30/01	87	71	16	22	65	259,139	251,928	
9/04/01	95	95	0	25	70	279,221	263,542	
9/06/01	19	19	0	4	15	59,410	58,284	
9/10/01	10	10	0	1	9	33,222	30,558	
9/14/01	4	4	0	1	3	9,136	7,692	
TOTAL	490	460**	30**	128	362	1,484,173	1,435,499	96.7%

Fecundity= 4,100 per/female

26.3% cull rate on females
** Adult males used more than once for spawning, jacks only once

Appendix Ia. 2001 Chinook egg take and eye-up of NPT at CFH.

RED RIVER-NPT

Spawn Date	Number Females Spawned	Number Adult Males	Number Jacks	Number Females Culled	Number Production Females	Number Green Eggs	Number Eyed Eggs	
8/9/01	3	3	0	2	1	4,620	2,685	
8/14/01	1	1	0	0	1	3,881	2,834	
8/17/01	4	4	0	4	0	0	0	
8/21/01	6	6	0	2	4	12,654	10,324	
8/24/01	13	13	0	8	5	20,013	17,776	
8/28/01	39	39	0	39	0	0	0	
8/31/01	47	47	0	8	39	155,541	116,314	
9/05/01	49	49	0	24	25	95,300	58,400	
9/07/01	24	24	0	8	16	64,327	41,430	
TOTAL	186	186	0	95	91	356,336	249,763	70.1%

51.1% cull rate on females
** Adult males used more than once.

Fecundity = 3,916 per/female

POWELL- NPT

8/31/01	30	30	0	8	22	83,628	74,244	
9/05//01	60	60	0	4	56	219,365	185,279	
9/07/01	100	100	0	7	93	366,692	341,430	
TOTAL	190	190**	0	19	171	669,685	600,953	89.7%

Fecundity= 3,916 per/female

Appendix J. Production cost for BY-01 Chinook and BY-02 North Fork Steelhead.

Rearing to Release:

	CHINOOK BY-01	**North Fork Steelhead BY-02**
Number Produced	2,616,687	935,960
Weight	168,252	147,664
% Mortality (From eyed eggs)	21.4%	12.1%
Conversion Rate	1.07	1.25

FOOD FED AND WEIGHT GAINED

	Chinook (BY-01)	**North Fork Steelhead (BY-02)**
Period Fed	December 2001-March 2003	May 2002-April 2003
Feed Used lbs.	180,180	184,690
Weight Gain	168,252	147,664
Feed Cost	**$174,352.78**	**$94,461.64**

Total Feed Cost $268,814.42
Average Cost per pound only
Chinook: $1.04
Steelhead: $0.64

* Includes Nez Perce Tribes food fed.
** Does not include Nez Perce Tribes expenditures for feed.

Cost Per 1,000 fish using entire budget
Chinook $ 322.00
Steelhead $ 505.00
Combined $ 412.00

Summary of Fish Autopsy

ACCESSION NO:	02-466	LOCATION:	CrR
SPECIES:	sc	AUTOPSY DATE:	9/18/2003
STRAIN:	POW	AGE:	juv
UNIT:		SAMPLE SIZE:	20
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:			

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	0.00	0.00	0.00
WEIGHT	0.00	0.00	0.00
KTL*	0.00	0.00	0.00
CTL*	0.00	0.00	0.00
HEMATOCRIT	48.00	0.41	0.12
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.99	0.26	0.13

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOUTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	20	N	20	N	20	0	20	0	0	B	0	0	20	N	20	A	20	0	0
B1	0	F	0	S	0	1	0	1	0	R	20	1	0	S	0	B	0	1	0
B2	0	C	0	L	0	2	0	2	5	G	0	2	0	M	0	C	0	2	0
E1	0	M	0	S&L	0			3	9	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	5	E	0	Mean=0.00		U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.00	
H2	0			O	0			Mean=3.25								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

	20	20	20	20	20	20	20	20	20	0
SEX		M: 0		F: 0		U: 0				

GENERAL REMARKS:

FINS:

GONADS:

SKIN:

OTHER:

Appendix K2. Crooked River Brood Year 2001 spring chinook summary of fish autopsy, Spring 2003 releases

No autopsies were done on the Crooked River spring released fish due to the acute fish loss that resulted in an earlier than anticipated release.

Appendix K3. Powell Brood Year 2001 chinook, summary of fish autopsy, fall 2002 release

Summary of Fish Autopsy

ACCESSION NO:	02-483	LOCATION:	pow
SPECIES:	sc	AUTOPSY DATE:	9/23/2002
STRAIN:	POW	AGE:	juv
UNIT:		SAMPLE SIZE:	20
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:			

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	0.00	0.00	0.00
WEIGHT	0.00	0.00	0.00
KTL*	0.00	0.00	0.00
CTL*	0.00	0.00	0.00
HEMATOCRIT	47.16	0.33	0.20
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	7.22	0.65	0.13

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOUTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	20	N	20	N	20	0	20	0	0	B	0	0	20	N	20	A	20	0	0
B1	0	F	0	S	0	1	0	1	0	R	20	1	0	S	0	B	0	1	0
B2	0	C	0	L	0	2	0	2	5	G	0	2	0	M	0	C	0	2	0
E1	0	M	0	S&L	0			3	8	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	7	E	0	Mean=0.00		U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.00	
H2	0			O	0			Mean=3.1								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

	20	20	20	20	20	20	20	20	20	0
SEX		M: 0		F: 0		U: 0				

GENERAL REMARKS:

FINS: GONADS:

SKIN: OTHER:

Appendix K4. Powell Brood Year 2001 chinook, summary of fish autopsy, spring 2003 release

Summary of Fish Autopsy

ACCESSION NO:	03-105	LOCATION:	POW
SPECIES:	SC	AUTOPSY DATE:	3/30/2003
STRAIN:	POW	AGE:	juv
UNIT:		SAMPLE SIZE:	20
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:			

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	0.00	0.00	0.00
WEIGHT	0.00	0.00	0.00
KTL*	0.00	0.00	0.00
CTL*	0.00	0.00	0.00
HEMATOCRIT	40.90	0.24	0.15
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.99	0.34	0.11

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOUTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	20	N	20	N	20	0	20	0	0	B	0	0	20	N	20	A	20	0	0
B1	0	F	0	S	0	1	0	1	0	R	20	1	0	S	0	B	0	1	0
B2	0	C	0	L	0	2	0	2	6	G	0	2	0	M	0	C	0	2	0
E1	0	M	0	S&L	0			3	9	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	5	E	0	Mean=0.00		U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.00	
H2	0			O	0			Mean=2.95								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

	20	20	20	20	20	20	20	20	20	0
SEX	M: 0		F: 0		U: 0					

GENERAL REMARKS:

FINS: GONADS:

SKIN: OTHER:

Appendix K5. Red River Brood Year 2001 summary of fish autopsy, fall 2002 release

Summary of Fish Autopsy

ACCESSION NO:	02-467	LOCATION:	RdR
SPECIES:	sc	AUTOPSY DATE:	9/18/2003
STRAIN:	SF CLW	AGE:	juv
UNIT:		SAMPLE SIZE:	20
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:			

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	0.00	0.00	0.00
WEIGHT	0.00	0.00	0.00
KTL*	0.00	0.00	0.00
CTL*	0.00	0.00	0.00
HEMATOCRIT	49.20	0.44	0.23
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.50	1.00	0.11

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOUTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	20	N	20	N	20	0	20	0	0	B	0	0	20	N	20	A	20	0	0
B1	0	F	0	S	0	1	0	1	0	R	20	1	0	S	0	B	0	1	0
B2	0	C	0	L	0	2	0	2	3	G	0	2	0	M	0	C	0	2	0
E1	0	M	0	S&L	0			3	10	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	7	E	0	Mean=0.00		U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.00	
H2	0			O	0			Mean=3.2								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

	20	20	20	20	20	20	20	20	20	0
SEX	M: 0	F: 0	U: 0							

GENERAL REMARKS:

FINS: GONADS:

SKIN: OTHER:

Appendix K6. Red River Brood Year 2001 spring chinook summary of fish autopsy, spring 2003 release

Summary of Fish Autopsy

ACCESSION NO:	03-104	LOCATION:	RdR
SPECIES:	SC	AUTOPSY DATE:	3/29/2003
STRAIN:	SF CLW	AGE:	juv
UNIT:		SAMPLE SIZE:	13
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:			

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	0.00	0.00	0.00
WEIGHT	0.00	0.00	0.00
KTL*	0.00	0.00	0.00
CTL*	0.00	0.00	0.00
HEMATOCRIT	41.00	0.21	0.14
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.77	0.33	0.11

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOUTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	20	N	20	N	20	0	20	0	0	B	0	0	20	N	20	A	20	0	0
B1	0	F	0	S	0	1	0	1	0	R	20	1	0	S	0	B	0	1	0
B2	0	C	0	L	0	2	0	2	2	G	0	2	0	M	0	C	0	2	0
E1	0	M	0	S&L	0			3	10	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	1	E	0	Mean=0.00		U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.00	
H2	0			O	0			Mean=2.24								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

	20	20	20	20	20	20	20	20	20	0
SEX		M: 0		F: 0		U: 0				

GENERAL REMARKS:

FINS: GONADS:

SKIN: OTHER:

Appendix L. Clearwater Fish Hatchery BY-01 spring chinook fish marking and distribution summary

DATE PLANTED	RELEASE SITE	LENGTH	POUNDS	NUMBER PER/LB	TOTAL PLANTED	MARKS
8/4/2002	Pete King Cr	4.43	424	32.9	13,948	No clip/CWT; 1000 Pit tag
8/4/2002	Squaw Cr	4.62	485	29	14,067	No clip/CWT; 700 Pit tag
7/31-8/02	Colt Killed Cr	3.54	4,648	64.5	299,787	RV clipped; 700 Pit tag
9/27/2002	Crooked R	5.85	11,872	14.3	169,768	RV clipped; 500 Pit tag
9/30/2002	SFC, Red House Hole	3.9	2,571	48.1	123,677	Ad clipped
9/27/2002	Walton Cr	5.99	39,604	13.3	526,733	Ad clipped; 700 Pit tag
9/27/2002	Red R	5.52	5,004	17	85,064	LV clipped; 500 Pit tag
	TOTAL	5.17	64,608	19.09	1,233,044	
4/2/2003	Crooked R	5.26	34,789	18.1	629,687	Ad clipped; 300 Pit
4/1/2003	Walton Cr	5.51	20,270	17.3	350,665	Ad clipped; 300 Pit
4/2/2003	Red R	5.24	19,184	18.3	351,066	Ad clipped; 300 Pit
4/3/2003	Papoose Cr	5.56	3,135	16.66	52,225	No clip/ CWT
	TOTAL	5.28	77,378	17.88	1,383,643	

Released by NPT

3/19/2003	LoLo Cr	4.9	6,584	22.4	147,488	No clip/ CWT
3/14/2003	Mill Cr	4.85	1,897	23	43,621	No clip/ CWT
3/20/2003	Boulder Cr	4.73	4,077	24.9	101,513	No clip/CWT
3/21/2003	Newsome Cr	4.59	2,727	27.16	74,066	No clip/CWT
3/17-3/18/03	Meadow Cr (Selway R)	4.65	10,982	26.15	287,175	Ad clip
	TOTAL	4.73	26,267	24.89	653,863	

Appendix M. Brood Year 2002 steelhead (B) eggs received from Dworshak National Fish Hatchery

EGG TAKE NUMBER	SPAWN DATE	EYED EGG DELIVER DATE	NUMBER OF EYED EGGS	TEMPERATURE UNITS
5	3/05/02	3/22/02	896,827	376
6	3/12/02	3/29/02	168,564	374
TOTAL			**1,065,391**	

STOCK	NUMBER OF EYED EGGS	RELEASED SMOLTS	PERCENT SURVIVAL
Dworshak	1,065,391	935,960	87.9%

Appendix N. Steelhead brood year 2002 summary of autopsy report, spring 2003 Releases

Summary of Fish Autopsy

ACCESSION NO:	03-094	LOCATION:	CLW
SPECIES:	STB	AUTOPSY DATE:	3/20/03
STRAIN:	NF CLW	AGE:	juv
UNIT:	####	SAMPLE SIZE:	20
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:			

	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION
LENGTH	0.00	0.00	0.00
WEIGHT	0.00	0.00	0.00
KTL*	0.00	0.00	0.00
CTL*	0.00	0.00	0.00
HEMATOCRIT	44.32	6.99	1.50
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN	6.20	0.78	0.11

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER
**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOUTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	20	N	18	N	20	0	20	0	0	B	0	0	20	N	20	A	0	0	0
B1	0	F	2	S	0	1	0	1	1	R	20	1	0	S	0	B	20	1	0
B2	0	C	0	L	0	2	0	2	2	G	0	2	0	M	0	C	0	2	0
E1	0	M	1	S&L	0			3	9	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	8	E	0	Mean=0.00		U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.00	
H2	0			O	0			mean=3.2								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

	20	18	20	20	20	20	20	20	20	0
SEX		M: 0		F: 0		U: 0				

GENERAL REMARKS:

FINS:

GONADS:

SKIN:

OTHER:

Appendix O. Brood Year 2002 North Fork steelhead marking and distribution.

SITE	DATE	LENGTH	POUNDS	NUMBER PER/LB	NUMBER PLANTED	MARKS
South Fork Clearwater-Red House Hole	4/18/03	7.76	26,536	5.64	149,664	84,326 ad clipped; 64,748 ad/lv/cwt; 884 ad/pit
Clear Creek	4/21/03	7.33	16,175	6.68	108,052	Ad only
Red River	4/17/03	7.79	44,881	5.57	249,987	100K ad clipped; 149,452 no clip; 535 no clip/pit
Crooked River	4/19/03	7.5	42,397	6.24	264,558	97,632 ad clipped; 78,810 no clip; 21,934 no clip/cwt; 64,694 ad/lv/cwt; 298 ad/lv/cwt/pit; 1,190 no clip/pit
North Fork Clearwater River	9/30/02	4.3	1777	35.99	63,957	Ad only
TOTAL		**7.45**	**131,766**	**6.35**	**836,218**	

Releases by NPT

SITE	DATE	LENGTH	POUNDS	NUMBER PER/LB	NUMBER PLANTED	MARKS
LoLo Creek	4/22/03	7.5	6902	6.24	43,070	42,535 no clip; 535 no clip/ pit
Meadow Creek	4/22/03	7.47	3700	6.3	23,310	No clip
Mill Creek	4/23/03	7.47	5296	6.3	33,362	32,837 no clip; 525 no clip/pit
TOTAL		**7.49**	**15,898**	**6.27**	**99,742**	
		7.45	**147,664**	**6.34**	**935,960**	

Appendix P. Brood Year 2002 North Fork Steelhead Feed Study at Clearwater Fish Hatchery

Introduction

A feed study was conducted at Clearwater Fish Hatchery on Brood Year 2002 North Fork steelhead. The primary goal of the study was to determine which feed would maximize growth rates to obtain the desired smolt release size of 4.5 fish per pound. The secondary goals of the study were to determine which feed would improve feed conversions for cost efficiency and which would improve survival. The study consisted of two phases: an early rearing phase from swim-up to marking, and a final rearing phase from marking to release. Historically after marking, the fish were transitioned from a BioOregon moist diet to a Rangens dry diet affecting growth rates, feed conversions, and survival. The treatment groups of the feed study evaluated a dry diet to dry diet transition after marking to try to maximize growth rates, feed conversions, and survival. The early rearing phase of the study evaluated the treatment groups of Moore Clark Nutra Plus, a dry formulated diet, and BioOregon BioVita, a dry formulated diet, with the control group of BioOregon Grower, a moist diet. The final rearing phase evaluated the treatment groups of Moore Clark Nutra Fry and BioOregon BioDry 1000 with the control group of Rangens 470 Slow Sink, all dry formulated diets.

Methods

Early Rearing Phase

The early rearing phase of the study, from swim-up to marking, involved six indoor vats of fish from the same spawn take. Each feed group consisted of approximately 165,000 fish split into two forty-foot vats. Two vats were fed the Moore-Clark Nutra Plus, two vats were fed the BioOregon BioVita, and two vats were fed the BioOregon Grower. The treatment groups and control group were all fed near satiation daily. Feed was administered by hand every half-hour during the day for the first six weeks and then administered with Loudon automatic feeders three times per hour during the day for the remainder of the early rearing phase. Fish mortality was monitored daily whereas fish growth and feed conversions were monitored monthly. Water temperature was monitored daily to adjust feed rates if necessary.

Final Rearing Phase

The final rearing phase of the feed study, from marking to release, involved six outdoor raceways of fish. Each feed group consisted of approximately 150,000 fish split into two extendable raceways. Two raceways were fed the Moore-Clark Nutra Fry, two raceways were fed the BioOregon BioDry1000, and two raceways were fed the Rangens 470 Slow Sink. After marking, the treatment group fed the Moore Clark dry diet in early rearing remained on the Moore-Clark dry diet for final rearing. The treatment group fed

the BioOregon BioVita dry diet in early rearing was then fed the BioOregon BioDry 1000 dry diet for final rearing. The control group fed the BioOregon Grower moist diet in early rearing was then fed the Rangens 470 Slow Sink dry diet for final rearing. The treatment groups and the control group were all fed near satiation daily. Feed was administered by hand every hour during the day for the first four weeks and then administered with Nielsen automatic feeders attached to a moveable bridge eight times per day until release. Fish mortality was monitored daily whereas fish growth and feed conversions were monitored monthly. Condition Factors were administered twice during the final rearing phase on both treatment groups and the control group consisting of two hundred fish per group. Water temperatures were monitored daily to adjust feed rates if necessary. The water temperature began declining in late October and feed rates were adjusted to accommodate.

Conclusion

The primary goal of this feed study was to evaluate which diet would maximize growth rates to obtain the desired smolt release size of 4.5 fish per pound. The Moore-Clark treatment group had the best growth during the early rearing phase of this study (Table 4). However, by release, the BioVita/BioDry 1000 treatment group produced the largest fish (Table 5). The secondary goals of this study were to determine which feed would improve feed conversions and which would improve survival. The Moore-Clark treatment group had the best feed conversion throughout the study (Table 6). The BioOregon Grower/Rangens control group had the best survival during the early rearing phase of the study (Table 1). By release however, the BioOregon Grower/Rangens control group had the best survival but the lowest survival while fed the Rangens diet during the final rearing phase of the study (Table 2). The Moore-Clark diet proved to be the most expensive of the three diets while the BioOregon Grower/Rangens diet was the cheapest (Table 7). Condition Factors were carried out twice during the final rearing phase of the study and were not significantly different between the three diets and were about equal by release (Table 9).

Recommendations

Based on the results of this study, it is recommended that future steelhead at Clearwater Fish Hatchery be fed BioOregon Grower for a short time after swim-up to improve survival then fed BioVita for the remainder of early rearing to maximize growth rates and continued for 2 weeks after marking and moving to outside raceways. Thereafter, until release, the steelhead should be fed BioDry 1000. This strategy will maximize growth rates and survival but yet be cost efficient for the hatchery.

Table 1. Summary of early rearing survival from swim-up to marking.

***BioOregon Grower**

Starting Number	164,077
Mortality	13,331
% Loss	8.12%

***BioVita**

Starting Number	161,550
Mortality	16,493
% Loss	10.21%

***Moore-Clark**

Starting Number	173,101
Mortality	23,090
% Loss	13.34%

Table 2. Summary of final rearing survival from marking to release.

***Rangens**

Starting Number	150,746
Mortality	1,699
% Loss	1.13%

*** BioDry 1000**

Starting Number	145,057
Mortality	648
% Loss	0.48%

***Moore-Clark**

Starting Number	150,011
Mortality	669
% Loss	0.45%

Table 3. Overall survival from swim-up to release.

Feed Group	**BioGrower/Rangens**	**BioVita/BioDry 1000**	**Moore-Clark**
Starting Number	164,077	161,550	173,101
Mortality	15,030	17,141	23,759
% Loss	9.16%	10.61%	13.73%

Table 4. Summary of early rearing feed conversions and pound counts from swim-up to marking. Monthly Growth Rate (MGR) was calculated as number of fish per pound

*Moore-Clark	Vat 60	Vat 59
End Pound Count	64.2	68.3
End Conversion	0.77	0.89
Average Pound Count	66.25	
Average Conversion	0.83	
Total Days on Feed	86	

*BioVita	Vat 58	Vat 57
End Pound Count	65.7	75
End Conversion	0.89	0.91
Average Pound Count	70.35	
Average Conversion	0.90	
Total Days on Feed	87	

*BioGrower	Vat 56	Vat 55
End Pound Count	66.7	81.2
End Conversion	0.86	0.97
Average Pound Count	73.95	
Average Conversion	0.92	
Total Days on Feed	87	

Table 5. Summary of final rearing feed conversions and pound counts from marking to release. Monthly Growth Rate (MGR) was calculated as number of fish per pound.

*Moore-Clark	11E	11W
End Pound Count	5.83	5.43
End Conversion	1.04	0.97
Average Pound Count	5.63	
Average Conversion	1.0	
Total Days on Feed	227	

*BioDry 1000	10E	10W
End Pound Count	5.85	4.90
End Conversion	1.36	1.21
Average Pound Count	5.38	
Average Conversion	1.29	
Total Days on Feed	221	

*Rangens 470	12E	12W
End Pound Count	7.20	6.5
End Conversion	1.19	1.07
Average Pound Count	6.85	
Average Conversion	1.13	
Total Days on Feed	227	

Table 6. Summary of overall feed conversion from swim-up to release.

Feed Group	**BioGrower/Rangens**	**BioVita/BioDry1000**	**Moore-Clark**
Total Pounds Fed	24,101.7	33,840.5	26,296.7
Total Pounds of Fish	21,781.12	26,998.27	26,560.6
Conversion for the Year	1.11	1.25	0.99

Table 7. Total Cost per Pound of Fish

Feed Group	**BioGrower/Rangens**	**BioVita/BioDry1000**	**Moore-Clark**
Cost/Pound	$0.3718	$0.5708	$0.6779

Table 8. Total Cost per Thousand Fish

Feed Group	**BioGrower/Rangens**	**BioVita/BioDry1000**	**Moore-Clark**
Cost/Thousand	$54.42	$106.72	$120.57

Table 9. Summary of condition factors. C = (weight/(length)^3)

Feed Group	**BioGrower/Rangens**	**BioVita/BioDry 1000**	**Moore-Clark**
January C-Factor	3.73	3.86	3.90
Release C-Factor	3.80	3.85	3.78

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