



OXBOW FISH HATCHERY

**2002 Steelhead Brood Year Report
2001 Spring Chinook Brood Year Report
2001 Fall Chinook Brood Year Report**



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ABSTRACT

The Oxbow Fish Hatchery (OFH) trap was operated for 10 days between October 29 and November 19, 2001 and for 10 days between March 12 and April 4, 2002. A total of 4,988 steelhead *Oncorhynchus mykiss* were trapped during these operating periods. This total consisted of 4,934 (99%) hatchery steelhead and 54 (1%) wild steelhead. During the fall of 2001 and the spring of 2002, 4,093 steelhead were outplanted for sport fisheries or supplementation programs.

Spawning consisted of 12 egg-takes from March 19 to April 29, 2002. A total of 300 females were spawned. After culling 16 females for poor egg quality or as surplus to production needs, 1,646,085 green eggs from 284 females were incubated to eye-up. Survival to eye-up was 81% and produced 1,325,497 eyed eggs. From these, 470,896 eyed eggs and 444,570 fry were shipped to Niagara Springs Fish Hatchery (NSFH) and 143,935 eyed eggs and 26,611 fry were shipped to Hagerman State Fish Hatchery (HSFH).

Eggs from 836 females were shipped from Pahsimeroi Fish Hatchery (PFH) to OFH. The eggs from 453 of the females were culled. The remaining 383 females produced 1,682,927 eyed eggs from 1,954,382 green eggs. From these, 405,677 eyed eggs were shipped to Magic Valley Fish Hatchery (MVFH) and 568,693 were shipped to NSFH. The remaining eggs were raised to fry stage. Of the resulting button-up fry, 567,979 were shipped to NSFH and 54,679 to HSFH. The remaining 59,173 fry were discarded.

In anticipation of a large return of spring Chinook *O. tshawytscha* to the Rapid River Fish Hatchery (RRFH), Idaho Department of Fish and Game (Department) managers elected not to trap spring Chinook at OFH trap in 2001. The OFH staff assisted with spawning at RRFH and subsequent incubation of Rapid River eggs. Eggs from 469 females were incubated at OFH. At eye-up, eggs from 164 females were culled based on bacterial kidney disease protocol. The remaining 305 females produced 1,002,319 eyed eggs from 1,063,031 green eggs. Overall eye-up was 94%. The eggs were transported back to RRFH for final incubation and rearing.

A total of 178,409 eyed fall Chinook *O. tshawytscha* eggs were acquired from Lyons Ferry Hatchery and transported to the OFH on December 10, 2001. They were placed in Heath trays and incubated with 53.7°F water until button up. Fry were placed in the outside raceways on Feb 4 and 5, 2002 and raised on wellwater at a temperature of 56°F. They were fed Moore Clark feed starting with mash and ending with 1.5 mm pellets. Two weeks before fin clipping they were fed Moore Clark enhanced beta glucan feed. There was no elevated mortality after clipping. On May 21, 2002, 171,463 smolts were released below Hells Canyon Dam. They averaged 42 fish per pound (fpp), 4.24 inches in length, and had a total weight of 4,082 lb. The survival rate from eyed-egg stage to release was 96.2 %.

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HATCHERY OVERVIEW

Introduction

Oxbow Fish Hatchery (OFH) is part of the Idaho Power Company (IPC) hatchery system and has been in operation since 1962. The OFH facility is owned and funded by IPC and operated by the Idaho Department of Fish and Game (Department). OFH was constructed to mitigate for losses of anadromous fish resulting from the construction of Brownlee, Oxbow and Hells Canyon dams on the Snake River. The OFH is a steelhead *Oncorhynchus mykiss* adult holding, spawning, and egg rearing station. In addition, spring Chinook salmon *O. tshawytscha* are collected and held for transport to Rapid River Fish Hatchery (RRFH). In the fall of 2000, IPC constructed two raceways for the production of fall Chinook salmon *O. tshawytscha*. The OFH receives eyed fall Chinook eggs from the Lyons Ferry Hatchery. The eggs are incubated at the hatchery until hatch, reared for four months, and then released as sub-yearling smolts below Hells Canyon Dam.

Location

The OFH is located in eastern Oregon and is adjacent to the confluence of Pine Creek and the Snake River on the Oregon shore of the Snake River at the IPC village known as Oxbow, OR. It is located at the easternmost end of Oregon State Highway 86 approximately 67 highway miles east of Baker City, and approximately 150 highway miles northwest of Boise. The Hells Canyon trap which is used for interrogating adult fish for the OFH is located twenty-three miles downstream at the base of Hells Canyon Dam on the Oregon shore line of the Snake River.

Objectives

The OFH has three main objectives:

1. Trap and spawn sufficient adult steelhead to provide Niagara Springs Fish Hatchery (NSFH) with approximately 1 million eggs and fry.
2. Trap adult spring Chinook and transfer them to RRFH for spawning. The number of adults should be sufficient to produce approximately 1.2 million eggs.
3. Rear 1 million sub-yearling fall Chinook smolts for release into the Snake River below Hells Canyon Dam.

Facility Description

The OFH consists of the following: a hatchery building which houses the office, shop, and an incubation room; four adult holding ponds including fish loading and off-loading facilities; an incubation water chilling unit; a spawning building; dormitory; Assistant Hatchery Manager's residence; two cement raceways; and an off-site fish trap. A more detailed description of the main facilities follows.

The hatchery building is a 28-ft x 60-ft single-story metal structure partitioned into two main rooms. Half of the building consists of a shop and office space, and the other half is for egg incubation. The incubation room has 384 Heath trays in 24 stacks, with the capacity to incubate 4 million eggs. Two 8-ft square sheds provide storage.

Adult holding and production facilities include four holding ponds, a fish trap, and a fish transport truck. The four holding ponds are actually two large ponds separated into four sections. The two larger divisions each measure 105-ft x 35-ft x 5-ft providing 36,750 cubic feet (cuft) of holding area. The two smaller divisions measure 55-ft x 35-ft x 5-ft, providing 19,250 cuft of holding space. Two electric crowding racks provide the ability to move the fish into a center raceway, which is 4.5-ft wide x 70-ft long. It has a small electric crowd rack used to move the fish into the spawning building.

The adult fish trap is located 23 road miles downstream from OFH on the Oregon shore of the Snake River immediately below Hells Canyon Dam. It consists of an attraction channel with approximately 150 feet of ladder, the holding area (trap), and a loading hopper. During processing, the fish move from the trap into the loading hopper and are hoisted up 80 feet to a transport truck.

The wellwater chiller utilizes a two-stage chiller. The primary compressor has a 60 horsepower (hp) motor and the secondary unit has a 10 hp motor. The chiller is operated to regulate temperature for incubating eggs and fry. The water chiller is enclosed in a 12-ft x 17-ft metal building to the west of the hatchery building. The chiller has the capacity to chill 120 gallons per minute (gpm) of 54°F water to 40°F.

The spawning building is located adjacent to the holding ponds and consists of a small fiberglass sided building. Part of it is recessed into the ground to provide holding areas for the fish that are to be spawned. The remaining portion is at ground level where the females are spawned and the eggs fertilized and processed.

In 2000, two cement raceways were constructed to provide rearing space for fall Chinook. They are each 130-ft long x 6-ft wide x 4-ft deep. A cement wall divides the first 30 feet of each raceway into two sections. The head-box and outlet end of the raceways reduce the useable length of rearing space to approximately 118 feet. The capacity of the raceways was designed for 250,000 sub-yearling smolts at 70 fish per pound (fpp). Wellwater and river water are plumbed to the raceways in order to achieve required flows and to aid in controlling water temperature.

Water Supply

Outside Operation Water Source

Water for adult hatchery operations is pumped from the Snake River. A platform adjacent to the hatchery supports two 100-hp production pumps. They each produce 20 ft³/s. One pump is powered from the Pine Creek substation, and the second is powered from the Oxbow power plant substation. Only one pump operates at a time. The other pump serves as an emergency backup. Water from the production pumps passes over two aeration pump platforms before entering the four adult holding ponds. In the spring of 2001, a filtration system was installed at the north water inflow pipes to prevent debris from entering the adult holding ponds and salmon raceways. Water temperatures range from a winter low of 34°F to a late summer high of 72°F.

Water from well #2 is used for the fall Chinook fry when they are placed in the outside raceways. Once they reach 100 fpp Snake River water is introduced. As the fry grow, more river water is added and raceway volume is increased to maintain targeted flow and density indices

Incubation Water Source

Two wells provide water for egg incubation. Well #1 serves as a primary water source, while well #2 is an emergency backup with a separate power source. The primary wellwater is a constant 52°F and the backup is a constant 56°F. Well #1 has a 3-hp pump and produces 120 gpm. Well #2 has a 10-hp pump and provides 125 gpm for incubation and 330 gpm for the salmon raceways. Water used for incubation is chilled to approximately 42°F before entering an elevated surge tank in the hatchery building, where it is distributed through two 4-inch PVC water lines to the 24 incubator stacks. Un-chilled wellwater is piped directly to 11 of the incubator stacks to provide warmer water, if desired.

Staffing

One permanent Fish Hatchery Assistant Manager staffs OFH. Two four-month and two eight-month Biological Aides share 4,159 hours of temporary labor time budgeted for hatchery maintenance and operation.

Hatchery Improvements

Accomplished

Over the last few years, IPC Oxbow maintenance personnel have been responsible for work related to several hatchery improvements. Although the following projects may have been completed before this report and the list may not be all-inclusive, some items are included for informational purposes.

- 1) We installed an adult holding tank for fish that are held overnight before returning them to the river. It is 3-ft x 3-ft x16-ft.
- 2) The storage area for fish food and equipment attached to the incubation building was enclosed.
- 3) Personnel from the IPCs Oxbow Maintenance Shop rebuilt the north aeration pump.
- 4) New controllers for the center crowd-rack were installed.
- 5) Four new Heath tray incubator stacks were ordered and will be installed this year to increase incubation capacity.
- 6) The river water pumps, aeration pumps, and wellwater pumps were rewired for automatic start-up. If there is a temporary utility power failure, the pumps will automatically restart when power is restored.

Recommended

- 1) The spawning building should be enlarged and lowered four feet into the ground. This would increase worker safety by reducing the potential for falls or injuries while climbing ladders. It would enable release of unripe fish into ponds without dropping them over the fence, decreasing the potential for injury and stress to the fish. Enlarging the space would also make fish health sample collection more efficient.
- 2) Both aeration towers need to be sandblasted and repainted.
- 3) A cement slab (approximately 15-ft x 40-ft) is needed in front of the hatchery building for doing truck maintenance and other hatchery projects.
- 4) A walk-in cooler should be placed in the outside storage area to provide storage for salmon food.
- 5) Six cinder block raceways located behind the office should be removed and the resulting hole filled or reconfigured into a settling basin. We should eliminate the existing safety hazard and incorporate an effluent control plan.

- 4) We recommend three modifications to increase operating efficiency and reduce the chance of chiller failure during the summer months. Build a shade structure over the chiller building. The building should be painted white. An air conditioner should be installed to reduce heat in the building
- 5) A 220-volt convenience outlet for a welder should be installed. This would allow hatchery personnel to perform maintenance operations.
- 6) A 16-ft x 20-ft storage building should be constructed to provide additional storage space.
- 7) Fencing should be placed around the fall Chinook raceways to eliminate the existing fall hazard.

STEELHEAD PRODUCTION

Adult Collection

Steelhead Returns

The OFH trap operated for 20 days during the trapping season. It operated for 10 days between October 29 and November 19, 2001, and for 10 days between March 12 and April 4, 2002. Staff from IPC removed hatchery fish from the trap each trap day and transported them to OFH. We processed the fish on arrival at the hatchery. Early in the season, we held all hatchery fish. After we trapped enough adults to meet production goals, the remaining adults were outplanted. After meeting release requests, the Department elected to discontinue trapping operations.

During the fall, we trapped 3,799 adult steelhead and another 1,189 entered the trap in the spring (Appendices 1 and 2). These 4,988 steelhead consisted of 4,934 (99%) hatchery steelhead and 54 (1%) wild steelhead. The wild fish were released below Hells Canyon Dam.

Analysis of trapping, hauling, ponding, and outplanting the hatchery fish, and returning the wild fish to the river, revealed that we could process about 10.5 fish/hour/employee or about 0.1 man-hours/fish. This does not include the time required for transporting and releasing fish in other locations.

Length Frequencies and Age and Sex Ratios

We measured fork lengths and determined sex on all steelhead except 10 hatchery-origin trap mortalities. Age-classes were defined by length. One-ocean females were 65 cm or less and one-ocean males were 67 cm or less. Two-ocean females were 66 cm and greater, and two-ocean males were 68 cm and greater. Age-class and sex ratio by origin are as follows: for hatchery-origin steelhead; One-ocean fish consisted of 2,332 males (53%) and 2,049 females (47%) for a total of 4,381 or 89% of the hatchery fish. Two-ocean fish consisted of 265 (49%) males and 278 (51%) females for a total of 543 or 11% of the hatchery fish. For wild steelhead: one-ocean fish consisted of 28 males (78%) and 8 females (22%) for a total of 36 or 67% of the wild fish. Two-ocean fish consisted of 12 (67%) males and 6 (33%) females for a total of 18 or 33% of the wild fish. All data on steelhead length frequency, age and gender by origin are summarized in appendices 3, 4 and 5.

Outplanting

During the fall of 2001 and the spring of 2002, 4,093 surplus adult steelhead were outplanted for sport fisheries or supplementation programs. The surplus fish are divided by agreement between Idaho, Oregon, and the Nez Perce Tribe. The shares were divided as follows: 1,400 into the Boise River for Idaho, and 1,387 into Hells Canyon Reservoir for Oregon. The Nez Perce Tribe transported and released 430 into the Little Salmon River and 876 into the Salmon River at Slate Creek.

Incidental Capture

Seven rainbow trout *O. mykiss* were trapped and transported to OFH. They were released into Hells Canyon Reservoir. No other species were incidentally captured.

Marks, Fin Clips, Injuries

When they arrived at the hatchery, the steelhead were checked for fin clips, tags and injuries. Fin clips consisted of 4,934 adipose (AD) fin-clipped with 120 of those having only been partially clipped. Other marks included 173 with coded-wire-tags (CWTs), 11 with floy-tags, and 1 with a radio tag. The tagging agencies included the National Marine Fisheries Service (NMFS), the University of Idaho UofI), Oregon Department of Fish and Wildlife (ODFW), and the Department. During spawning, snouts were removed from all CWT fish and sent to the Department's marking lab in Lewiston. Injuries included four fish with gill net scars, 16 with fresh body injuries, 62 with body scars, 61 with operculum or gill injuries, 73 with fin damage, 14 with eye damage, 13 with head injuries, and five with marks that appeared to be lamprey scars.

Holding And Spawning

Prespawning Mortality

Prespawning mortality numbers include all females that died prior to spawning and all males that died through the second week of spawning (March 30). Prespawn mortality was 14 males and 18 females for a total of 32 adults.

Spawning Operations

Ponded steelhead were sorted by sex and separated into two ponds on March 5, 2002. Steelhead transported to the hatchery after March 5 were sorted on arrival. On each spawn day, we checked all females for ripeness. Ripe females were spawned and unripe females were returned to the holding pond. Spawning consisted of 12 egg takes from March 19 to April 29 (Appendix 8). We spawned 300 females. Eggs from one female were culled due to excessive blood and the eggs from three more females were rejected because they were green. This left eggs from 296 females to be incubated. Sperm from two or more males fertilized the eggs from each female, and then the eggs from two females were pooled. Eggs were water hardened in 100 ppm iodophor for at least 15 minutes. Each pooled bucket was decanted and the eggs placed in an incubator tray.

Disease Testing

During spawning, staff from the Department's Eagle Fish Health Laboratory (EFHL) tested 92 (31%) of the females for viruses, 57 (19%) for Bacterial Kidney Disease (BKD), and 20 (7%) for Whirling Disease. All test results were negative for pathogens. These percentages are of total females spawned and include samples from females that were spawned but their eggs discarded.

Incubation

Egg Development

Incubation water was chilled to approximately 42°F and adjusted to about 5 gpm through each stack of 16 trays. The water was chilled to delay development of eggs and fry to achieve smolt target size. Eggs were treated with formalin twice each week during March and April, and three times each week during May and the first half of June to inhibit mycosis caused by *Saprolegnia*. Treatment was stopped on each lot as it neared hatching. All eyed eggs were shocked at 360 to 380 daily temperature units (DTU) or about 30 days after spawn. This was accomplished by pouring the eggs from the Heat tray from a height of 2 to 3 feet into a bucket containing approximately 1 to 1.5 inches of water. The eggs were then poured back into the Heath tray and allowed to sit overnight to allow the dead eggs to turn white. Dead eggs were

removed the day after shocking. This year some eggs were enumerated based on the average fecundity of their total egg lot. This included 70,228 eggs from 12 females that were culled as surplus from lots 7 and 10, and 33,870 eggs from 6 females that were retained for Hagerman State Fish Hatchery (HSFH). The remaining 1,612,215 green eggs from 278 females were enumerated using a Jensorter™ electronic counter. The total egg-take, including 70,228 that were culled, 33,870 that were retained for HSFH, and 1,612,215 that were counted electronically, was 1,716,313 green eggs. Of the 1,646,085 eggs retained for rearing 1,325,497 reached the eyed stage, constituting 81% eye-up success.

Pahsimeroi Fish Hatchery (PFH) transferred eggs from 12 spawn dates from March 20 to May 1. Eggs from 836 females were shipped from PFH to OFH. When they arrived, we processed them in the same manner as OFH eggs. The eggs from 453 of the females were culled in order to make room for eggs from later spawns or because targets were reached. About 2,462,615 eggs were discarded (based on the average fecundity of each lot). The remaining 383 females produced 1,954,382 green eggs. Eye-up was 86.1% resulting in 1,682,927 eyed eggs. The overall average fecundity was 5,103 eggs per female.

Fry Development

Some eggs were not shipped at the eyed-egg stage and were reared to the button-up fry stage. These eggs hatched about 63 days after being spawned. Button-up was about 950 DTUs. This year, fry were shipped at about 1,003 DTUs, which was 85 days after being spawned.

Egg and Fry Disposition

Egg Shipments

During May and June 2002, 470,896 eyed eggs were shipped to NSFH and 143,935 were shipped to HSFH. They were placed in 48-quart coolers for transport. Each cooler was loaded with eggs from pre-defined trays in order to achieve the number/spawn and number/cooler requested by the receiving-hatchery managers. The coolers were transported by OFH staff. The remaining eggs were raised to fry stage (Appendix 9).

The eyed eggs from PFH were shipped in the same manner as OFH eggs. A total of 405,677 eyed eggs were shipped to Magic Valley Fish Hatchery and 568,693 were shipped to NSFH

Fry Shipments

After reaching approximately 1,000 DTUs, 444,570 OFH fry were shipped to NSFH in June and July, and 26,611 were shipped to HSFH in July. They were shipped in stainless steel tubes, each containing fry from 2-3 incubation trays. The tubes were loaded into a 1,000-gallon fish transport tanker filled with chilled wellwater. The remaining 218,189 fry were discarded (Appendix 9).

The PFH eggs that were raised to fry stage were shipped as described above. Of the resulting button-up fry, 567,979 were shipped to NSFH and 54,679 to HSFH. The remaining 59,173 fry were discarded

Carcass Disposition

All carcasses were checked for tags then picked up once a week by the local sanitation company and hauled to a Department of Environmental Quality (DEQ) approved landfill.

SPRING CHINOOK SALMON PRODUCTION

Adult Collection

Salmon Returns

The number of adult spring Chinook returning to Idaho in 2001 was projected to be one of the largest in recent history. Therefore, Department fishery managers decided it would not be necessary to trap spring Chinook at the OFH trap below Hells Canyon Dam for broodstock.

Incubation

Egg Development

During August and September 2001 OFH staff assisted with spawning of Rapid River returns at RRFH. Due to limited incubation space at RRFH, the eggs from 469 females covering four spawn dates were transported to OFH for incubation. The same day the eggs were spawned they were put into egg tubes and placed in coolers where they were water-hardened for one hour in a solution of wellwater and 100 ppm of iodophor. Then they were rinsed and covered with fresh wellwater. Ice was added to the coolers to maintain the correct water temperature during the trip from RRFH to OFH. When they arrived at OFH, iodophor was added to the water in the coolers at a rate of 100 ppm for additional disinfecting. The water temperature was taken and the

water warmed or cooled as necessary prior to the eggs being placed into the incubation trays. Incubation wellwater bypassed the chiller and entered the stacks at approximately 55°F. Flow was regulated to approximately 5 gpm. After the first two days of incubation, the eggs were treated three times each week with a 15-minute drip treatment of 1,667-ppm formalin to prevent mycosis.

The eggs were shocked at 500 TU to 530 TU. Shocking was accomplished by pouring the eggs from the Heath tray into a bucket that contained one inch of water from a height of approximately two to three feet. The eggs were then poured back into the Heath tray and allowed to sit overnight allowing the dead eggs to turn white. One or two days after shocking, the eggs were floated in a salt bath and the majority of the dead eggs were removed with a screen. The remaining dead eggs were removed by hand. The live and dead eggs were counted separately using a Jensorter™ Model BC egg counter. All females were sampled for bacterial kidney disease (BKD) at spawning. Based on the results of these tests, eggs from 164 females were culled due to high levels of BKD. The remaining 305 females produced 1,002,319 eyed eggs from 1,063,031 green eggs resulting in 94% eye-up (Appendix 11).

Egg Disposition

Within a few days after sorting and counting, 1,002,319 eyed eggs were placed into egg tubes and coolers and prepared for shipment. Ice was added to the coolers to lower the water temperature to approximately 46°F. Eggs were transported from OFH to RRFH in the hatchery pickup.

FALL CHINOOK SALMON PRODUCTION

Egg Development

The Department obtained 178,409 eyed-eggs from the Washington Department of Fish and Wildlife's Lyons Ferry Hatchery located in Starbuck, Washington. They were picked up by OFH personnel and transported to the OFH on December 10, 2001. Approximately 22,301 eyed-eggs were placed in each of eight coolers for transport. Incubation water temperature at Lyons Ferry Hatchery is 54°F. Upon arrival at OFH, the temperature of the water in the coolers was measured and then warmed with wellwater back to 54°F before disinfection. They were disinfected for approximately 30 minutes in a solution of wellwater and 100 ppm of iodophor. After disinfection, the eggs were placed in 63 Heath trays. Each tray received approximately 2,720 eggs. These eggs were incubated with 53.7°F water at approximately 5 gpm. After two days of incubation, the eggs were treated three times each week with a 15-minute drip treatment of 1,667-ppm formalin to retard mycosis. Dead eggs were picked at 794 TU, 1,034 TU and 1,402 TU. A total of 3,001 eggs were picked off before hatch. Survival from eyed egg to hatch was 98.3%.

Fry to Smolt Development

The OFH fall Chinook raceways were designed to hold 125,000 sub-yearling smolts in each raceway to a size of 70 fpp. At the start of the project, it was not clear what the water temperature would be with a constant demand on the well or how soon river water would be required. The Integrated Hatchery Operations Team (IHOT) recommendations for a flow index of 1.0 and a density index of .30 were followed as closely as possible (Appendix 12). Growth was tracked each week and pound counts and lengths were recorded (Appendix 13). Fall Chinook were fed Moore-Clark feed from button up to release (Appendix 14). We used a combination of hand feeding and belt feeders to supply food to each raceway. The fish were raised in the outside raceways on wellwater until reaching 100 fpp on March 21 when 77 gpm of river water was introduced. The addition of 40°F river water decreased the temperature in the raceways from 52.5°F to 51°F over the next couple days. During the rearing period, river water, wellwater, and mixed water temperatures were monitored (Appendix 15).

Moore-Clark feed was used during this season to allow comparison with the data collected the previous year. There was not a drastic drop in feed consumption this year when the river water was introduced to the raceways during week nine (Appendix 16). Moore-Clark feed containing beta glucan was fed for two weeks prior to marking. Moore-Clark's research suggests that beta glucan may help promote the immune system and combat the effects of stress such as fin marking. The fall Chinook showed no increase in mortality after clipping. A total of 171,463 sub-yearlings, which averaged 42 fpp and 4.24 inches in length, were released into the Snake River at the US Forest Service (USFS) boat ramp one mile below Hells Canyon Dam. Sub-yearling production numbers for each month are shown in Appendix 17. Although the original target for release was June 1, the release target size of 42 fpp was attained in late May. This and water conditions related to a lower than normal snowpack suggested that an earlier release could improve survival. Indications that Snake River water temperatures would increase and flows decline led to the decision to move the release forward. The fish were released on May 21, which was approximately the same time as the previous year. The two brood cycles have helped us evaluate constraints in reaching target size. Depending on conditions, we will adjust release timing in 2003 for Brood Year 2002 smolts.

Predators

Known predators included two kingfishers and two mink. The mink were trapped and released down river. They did not return to the hatchery. Since it was impossible to trap the kingfishers, camouflaged netting was placed over the raceways as a deterrent. In addition, the netting provided shade for the fish and reduced the risk of sunburn.

Fish Marking

Fish marking commenced on April 23 and was completed on April 26, 2002. All fall Chinook were adipose fin clipped. In addition to fin clipping, 1,000 were implanted with Passive Integrated Transponder (PIT) tags. On May 6, 2002, a clip evaluation was performed on 500 fish. Five were found with deep clips, two with partial adipose fins and one with a full adipose fin.

Fish Health

Disease Testing

Staff from EFHL performed routine health inspections. The last inspection was just before release. No diseases were encountered in fall Chinook during this brood year. Antibiotic medicated feeds were not used during this brood year.

Organosomatic Index

The Organosomatic Index in this context is a measure of fish health developed as part of the Autopsy-Based Fish Health/Condition Assessment System (Goede, R. W., and S. Houghton. 1987) Results of organosomatic scoring for Brood Year 2001 fall Chinook are presented in Appendix 18.

Acute Losses

Neither acute nor chronic losses were experienced during the 2001-2002 rearing cycle.

Other Assessments

Although production was almost doubled, fish health remained good. Since the addition of the degassing towers, gas bubble disease seems to be under control. *Ceratomyxa shasta* has still not been isolated from these fish.

Season Mortality

Mortalities were tracked daily and reported weekly (Appendix 19). This information was compared with mortality data for 2000 (Appendix 20). In 2000, the degassing towers were installed after early high mortality had started. When 2000 is compared with 2001, mortality in week one is higher, but there is a much lower mortality in weeks three through eleven. The early mortality suggests that we should degas wellwater before it is used on eggs in the incubation room. This is something we are going to consider for Brood Year 2002.

Smolt Transport

The Niel Ring Trucking Company from Buhl, Idaho transported smolts to the release site in the Snake River below Hells Canyon Dam using a tank trailer owned by IPC. The fish were transported in a single load and no visible mortality occurred. For background information, historic releases into Hells Canyon are listed in Appendix 21.

ACKNOWLEDGEMENTS

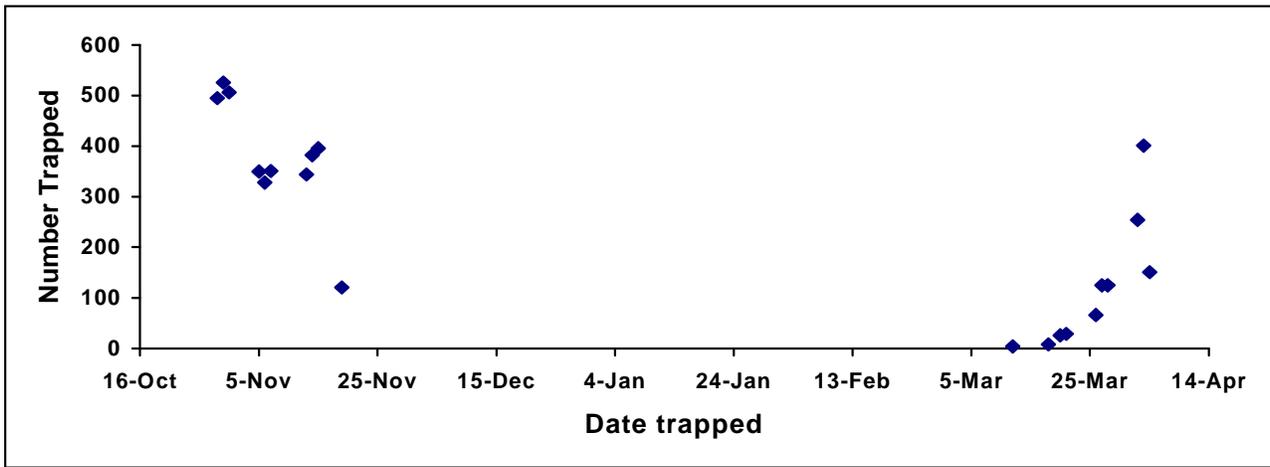
We would like to thank the staffs of Lyons Fish Hatchery, Idaho Power Company and the Idaho Department of Fish and Game that have contributed to the successful operation of OFH this year.

LITERATURE CITED

Goede, R. W., and S. Houghton. 1987. ASUM: A Computer Program For The Autopsy-Based Fish Health/Condition Assessment System. Utah Division of Wildlife Resources Fisheries Experiment Station, 1465 West 200 North, Logan, Utah 84321.

APPENDICES

Appendix 1. Steelhead trap counts.

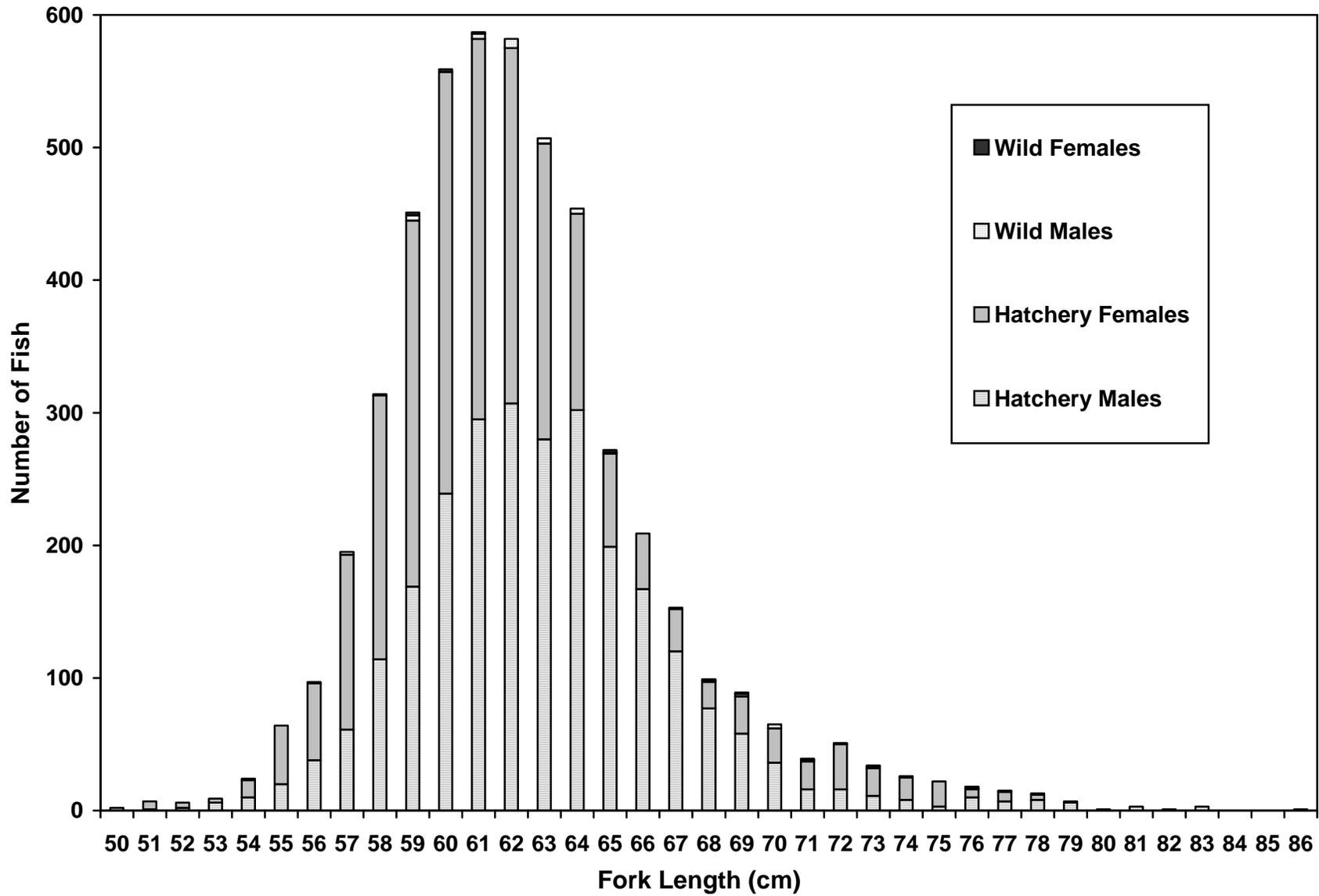


Appendix 2. Adult steelhead trapped at Hells Canyon Dam during fall 2001 and spring 2002

Fall 2001 Trapping		Spring 2002 Trapping	
Date	Number Of Fish	Date	Number Of Fish
October 29	495	March 12	4
October 30	526	March 18	8
October 31	506	March 20	26
November 5	350	March 21	29
November 6	328	March 26	66
November 7	351	March 27	125
November 13	344	March 28	125
November 14	382	April 2	254
November 15	396	April 3	401
November 19	121	April 4	151
TOTAL	3799	TOTAL	1189

This table includes 10 trap morts that were not measured or sexed.

Appendix 3, Length-frequency of steelhead trapped at Hells Canyon Dam during fall 2001 and spring 2002.



Appendix 4. Lengths of steelhead trapped at Hells Canyon Dam during fall 2001 and spring 2002.

Fork Length (cm)	Total Fish	Hatchery Males	Hatchery Females	Wild Males	Wild Females
50	2	2			
51	7	1	6		
52	6	2	4		
53	9	6	3		
54	24	10	13	1	
55	64	20	44		
56	97	38	58		1
57	195	61	132	2	
58	314	114	199	1	
59	451	169	276	4	2
60	559	239	318		2
61	587	295	287	4	1
62	582	307	268	7	
63	507	280	223	4	
64	454	302	148	4	
65	272	199	70	1	2
66	209	167	42		
67	153	120	32	1	
68	99	77	20	1	1
69	89	58	28	2	1
70	65	36	26	3	
71	39	16	21	1	1
72	51	16	34		1
73	34	11	21	1	1
74	26	8	17	1	
75	22	3	19		
76	18	10	6	1	1
77	15	7	7	1	
78	13	8	4	1	
79	7	6	1		
80	1	1	0		
81	3	3	0		
82	1	1	0		
83	3	3	0		
84	0	0	0		
85	0	0	0		
86	1	1	0		
Total	49798	2597	2327	410	14
Age-class	Male	Female	Total	Average Length	
One-ocean	2,360	2,057	4,417	61 cm	
Two-ocean	277	284	561	68.9 cm	
Total	2,637	2,341	4,978	62.3 cm	

Excludes 10 hatchery morts that were not measured or sexed.

Appendix 5. Age and gender of steelhead trapped at Hells Canyon Dam during fall 2001 and spring 2002.

Age-Class	Hatchery Males	Wild/Natural Males	Hatchery Females	Wild/Natural Females	Total
1-Ocean	2,332	28	2,049	8	4,417
2-Ocean	265	12	278	6	561
Total	2,597	40	2,327	14	4,978

Excludes 10 hatchery morts that were not measured or sexed.

Appendix 6. Disposition of Brood Year 2002 steelhead trapped at Hells Canyon Dam.

4,988	Trapped (3,799 fall, 1,189 spring (Wild and Hatchery))
4,921	Ponded
13	Trap Morts (included in total trapped but not in ponded, three were measured)
4,093	Outplanted
54	Wild/natural released

Includes 10 hatchery trap morts that were not measured or sexed.

Appendix 7. Steelhead disposition

MALES		FEMALES	
360	Spawned	296	Killed and spawned
0	Rejected and killed	4	Rejected and killed
^a 24	Unaccounted	0	Unaccounted
78	Mortalities	69	Mortalities
40	Wild released	14	Wild released
2,135	Outplanted	1,958	Outplanted
2,637	Total males	2,341	Total females

^aWe believe that these fish were miscounted onto trucks during outplanting.

Appendix 8. Brood year 2002 steelhead spawning summary for Oxbow Fish Hatchery.

Lot	Spawn Date	Females Spawned	Females Culled	^a Females Retained	Total Green Eggs Spawned	Surplus Green Eggs Culled	Green Eggs Retained	Eyed Eggs	Percent Eyed	Eggs/Female	Eyed Eggs Shipped	Fry Shipped
1	3/19/02	4	0	4	21,154	0	21,154	16,098	76	5,289	0	15,615
2	3/25/02	12	0	12	62,587	0	62,587	39,044	62	5,216	0	37,873
3	3/28/02	9	0	9	48,443	0	48,443	33,642	69	5,383	0	32,633
4	4/01/02	11	0	11	66,845	0	66,845	51,213	77	6,077	0	49,677
5	4/04/02	20	0	20	103,816	0	103,816	72,313	70	5,191	0	50,193
6	4/08/02	28	0	28	169,526	0	169,526	135,639	80	6,055	0	50,580
7	4/11/02	30	4	26	180,152	24,020	156,132	129,630	83	6,005	0	75,223
8	4/15/02	58	0	58	351,179	0	351,179	278,449	79	6,055	72,771	132,776
9	4/18/02	51	0	51	297,159	0	297,159	244,894	82	5,827	244,894	0
10	4/22/02	32	9	23	179,057	46,208	132,849	118,834	89	5,776	118,834	0
11	4/25/02	33	3	30	169,359	0	169,359	146,318	86	5,645	118,909	26,611
12	4/29/02	12	0	12	67,036	0	67,036	59,423	89	5,586	59,423	0
Total		300	16	284	1,716,313	70,228	1,646,085	1,325,497	81	5796	614,831	471,181

^aIncludes 4 females from lot 7 and 8 females from lot 10 that were discarded as surplus to production needs, as well as 1 female from lot 10 and 3 females from lot 11 that were discarded due to bloody or green eggs. The latter 4 discarded females are listed as rejected in Appendix 7.

Appendix 9. Brood year 2002 steelhead egg and fry disposition from Oxbow Hatchery.

Number	Disposition
1,716,313	Green eggs
70,228	Green eggs culled
312,424	Initial pick off
8,164	Secondary pick off
1,325,497	Eyed eggs
470,896	Eyed eggs shipped to Niagara Springs
143,935	Eyed eggs shipped to Hagerman State
710,666	Eyed eggs remaining on station
21,296	Eyed eggs to fry loss (3%)
689,370	Fry on station
444,570	Fry shipped to Niagara Springs
26,611	Fry shipped to Hagerman State
218,189	Excess fry disposed of

Appendix 10. Oxbow Hatchery steelhead trapping and disposition summary.

Fish Trapped ^a		Age-classes ^b	
Males	2,637	1-Ocean	4,417
Females	2,341	2-Ocean	561
Total	4,978	Total	4,978

Fish Disposition	Males	Females	Total
Prespawn mortality	14	18	32
Trap & pond mortality	64	51	54
Spawned only	360	296	656
Released	40	14	54
Outplanted	2,135	1,958	4,093
Other ^c	24	4	28
Total	2,637	2,341	4,978

Carcass disposition	Males	Females	Total
Hauled to landfill	488	369	807

^a Does not include 10 trap mortalities that were not measured or sexed

^b Age Class Breakdown: 1 Ocean: males ≤ 67 cm (2,360), females ≤ 64 cm (2,057)
2 Ocean: males ≥ 68 cm (277), females ≥ 65 cm (284)

^c The 24 males are unaccounted for males and the 4 females were rejected at spawning. They are also listed in Appendix 7.

Appendix 11. Summary of Brood Year 2001 Rapid River spring Chinook eggs incubated at Oxbow Fish Hatchery.

Lot Number	Spawn Date	Females Spawned	Females Culled ^a	Females Retained	Fecundity	Green Eggs Culled ^b	Green Eggs Retained	Eyed Eggs	Eye-up Rate
6	9/3/01	247	65	182	3,600	233,994	655,182	616,705	94.1%
7	9/4/01	50	17	33	3,235	55,003	106,770	103,155	96.6%
8	9/6/01	148	68	80	3,342	227,271	267,378	252,912	94.6%
9	9/10/01	24	14	10	3,370	47,181	33,701	29,547	87.7%
Total/ Avg.		469	164	305	3,485	563,449	1,063,031	1,002,319	94.3%

^a Females were culled due to high levels of BKD.

^b Number of eggs culled is based on fecundity.

Appendix 12. Weekly flow and density indices during rearing of Brood Year 2001 fall Chinook at Oxbow Fish Hatchery.

Date	Volume	Flow	Flow index	Density index
2/6/02	616	160	0.69	0.18
2/11/02	616	160	0.84	0.22
2/18/02	1198	220	0.79	0.15
2/25/02	1198	300	0.76	0.19
3/4/02	1198	300	0.97	0.24
3/11/02	1198	375	0.98	0.31
3/18/02	1635.5	375	1.16	0.26
3/25/02	1635.5	452	1.15	0.32
4/1/02	2671.1	550	1.09	0.23
4/8/02	2671.1	792	0.81	0.24
4/15/02	2671.1	792	0.92	0.27
4/22/02	2671.1	792	1.01	0.30
4/29/02	2671.1	792	0.96	0.29
5/6/02	2671.1	925	0.95	0.33
5/13/02	2671.1	925	0.99	0.34
5/20/02	2671.1	925	1.03	0.36

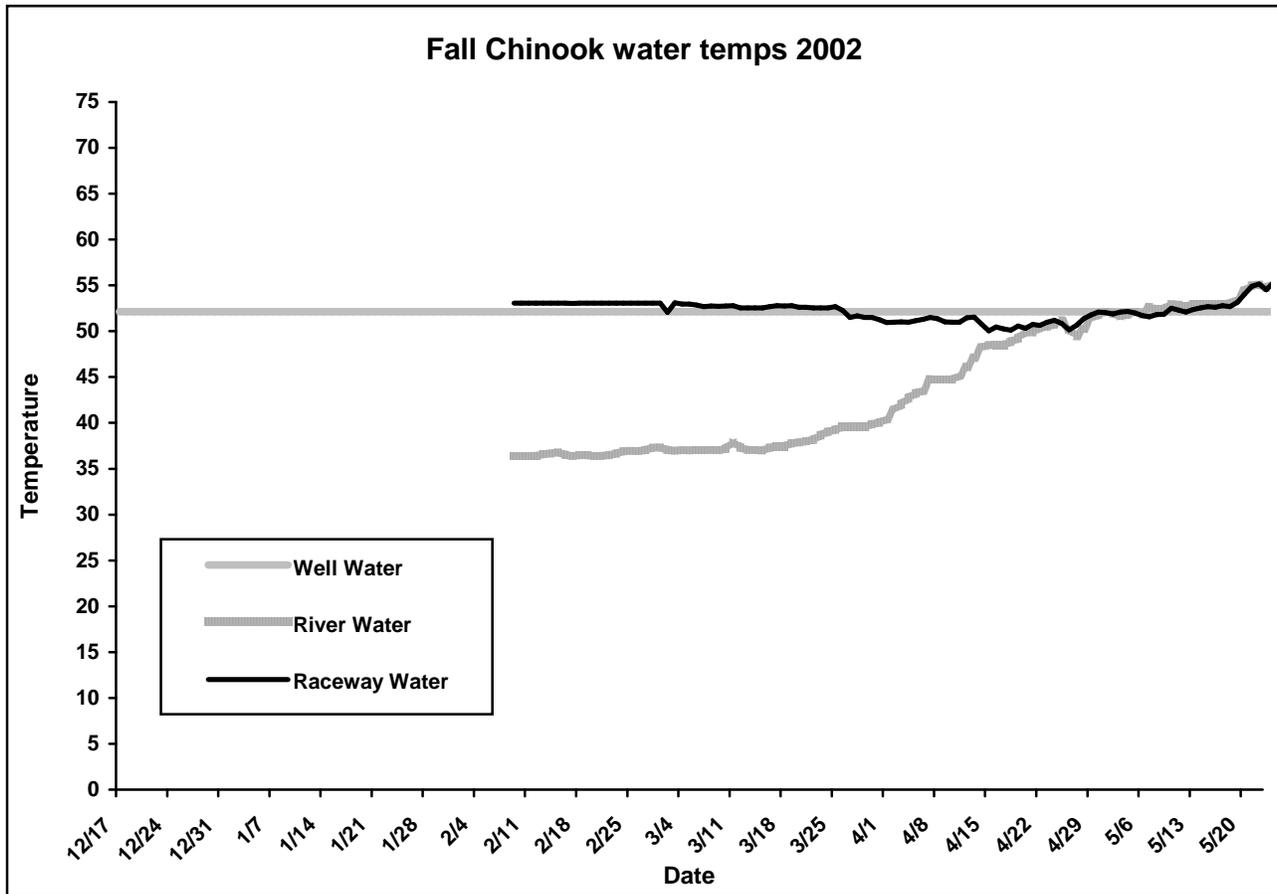
Appendix 13. Weekly length and weight data for Brood Year 2001 fall Chinook reared at Oxbow Hatchery.

Date	Number of fish	Weight (g)	Weight (lb.)	Fish/g	Fish/lb	Average (mm)	Minimum (mm)	Maximum (mm)	Standard Deviation
2/6	330	144	0.32	2.29	1040.4	38.62	36.0	43.0	1.63
2/11	306	172	0.38	1.78	807.70	40.64	38.0	45.0	1.44
2/18	371	296	0.65	1.25	569.03	44.46	40.0	49.0	2.09
2/25	313	378	0.83	0.83	375.93	51.06	47.0	56.0	2.03
3/4	324	544	1.20	0.60	270.40	55.60	51.0	61.0	2.21
3/11	315	756	1.67	0.42	189.17	63.16	59.0	67.0	2.14
3/18	385	1190	2.62	0.32	146.88	68.62	63.0	74.0	2.71
3/25	392	1524	3.36	0.26	116.78	71.88	66.0	80.0	3.73
4/1	346	1580	3.48	0.22	99.42	78.94	71.0	87.0	3.97
4/8	316	1708	3.76	0.19	84.00	80.84	74.0	94.0	4.45
4/15	305	2078	4.58	0.15	66.64	89.52	81.0	103.0	4.69
4/22	320	2460	5.42	0.13	59.06	91.96	83.0	105.0	5.72
4/29	372	2944	6.48	0.13	57.37	93.66	78.0	107.0	6.31
5/6	351	3214	7.08	0.11	49.58	99.62	90.0	114.0	5.83
5/13	346	3440	7.58	0.10	45.66	104.70	94.0	122.0	5.59
5/20	311	3340	7.36	0.09	42.27	107.62	92.0	128.0	7.60

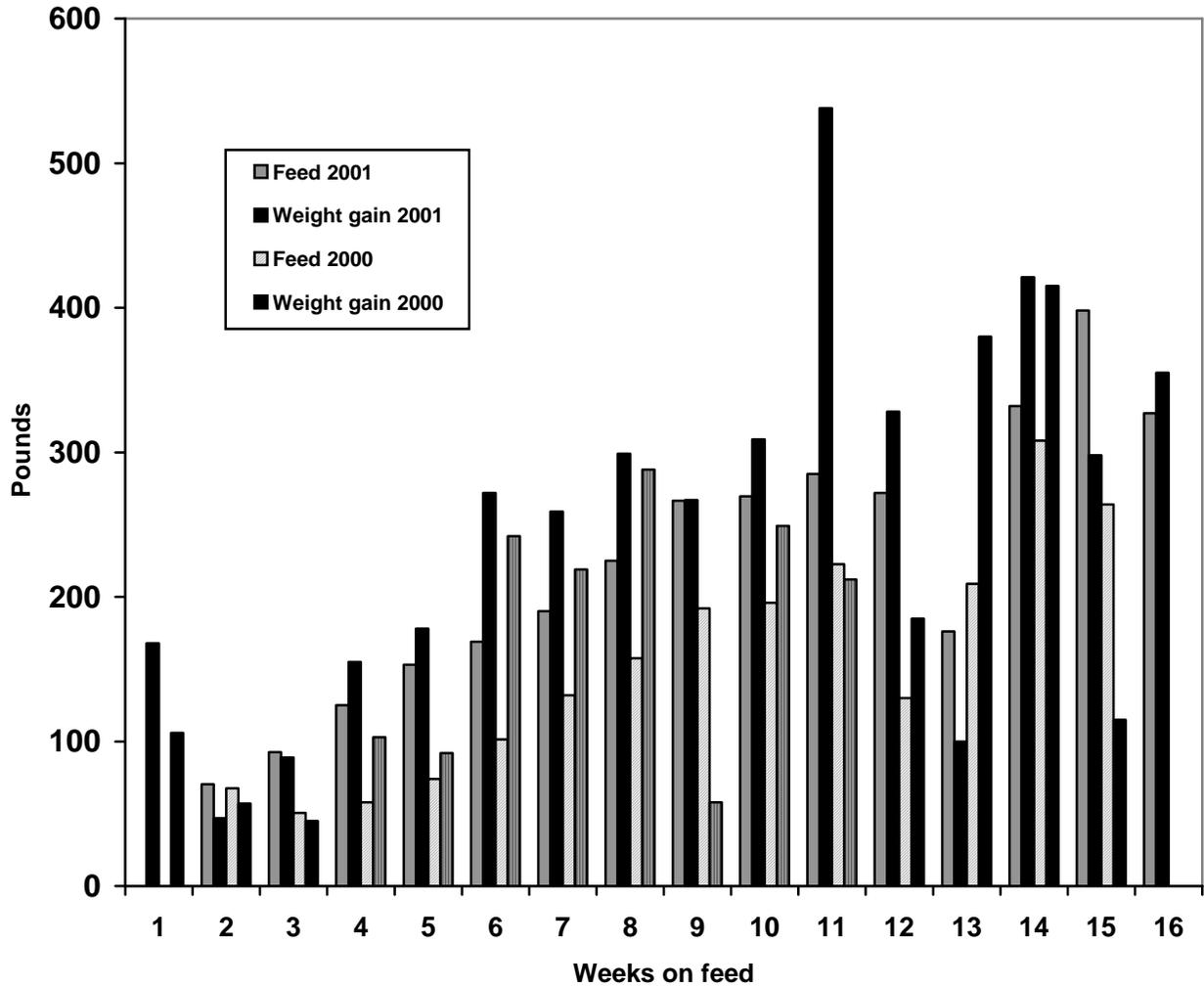
Appendix 14. Feed used during Brood Year 2001 fall Chinook rearing program.

Month	# 0 starter	#1 starter	#2 starter	1.2 mm	1.2 mm med	1.5 mm
Feb	88 lbs	264 lbs				
Mar			682 lbs	236.0 lbs		
Apr				490.7 lbs	602.8 lbs	
May				372.8 lbs		594 lbs
Total	88 lbs	264 lbs	682 lbs	1099.5 lbs	602.8 lbs	594 lbs

Appendix 15. Well, river, and mixed water temperatures measured at Oxbow Fish Hatchery, February through May, 2002



Appendix 16. Comparison of pounds of food fed and weight gained during production of Brood Years 2000 and 2001 fall Chinook at Oxbow Fish Hatchery.



Appendix 17. Brood year 2001 fall Chinook production summary

Month	Fish on hand at end of month				Mortality		Fish Feed		Weight Gain		Feed Conversion	
	Number	Weight	Length	Fish/Lb	Monthly	To Date	Monthly	To Date	Monthly	To Date	Monthly	To Date
Feb	172,692	536	2.09	322	2,716	2,716	374	374	347	347	1.08	1.08
Mar	171,778	1,735	2.87	99	914	3,630	918	1292	1,199	1,546	0.77	0.84
Apr	171,561	2,989	3.92	57	217	3,847	1,094	2,386	1,254	2,800	0.87	0.85
May	171,463	4,082	4.24	42	98	3,945	967	3,353	1,093	3,893	0.88	0.86

Eggs were received December 10, 2001.

Appendix 18. Brood Year 2001 fall Chinook autopsy summary

Accession No:	02-161	Location:	Oxbow Hatchery
Species:	Chinook Fall	Autopsy Date:	04/23/2002
Strain:	Lyon's Ferry	Age:	Fry
Unit:Reason for Autopsy:	Prelib	Sample Size:	60
Investigator:	Munson		

Values As Percents Of Total Sample

Eyes		Gills		Pseudo-branches		Thymus		Mesen. fat		Spleen		Hind gut		Kidney		Liver		Bile	
N	20	N	20	N	20	0	20	0	0	B	20	0	20	N	20	A	0	0	0
B1	0	F	0	S	0	1	0	1	12	R	0	1	0	S	0	B	20	1	0
B2	0	C	0	L	0	2	0	2	20	G	0	2	0	M	0	C	0	2	0
E1	0	M	0	S&L	0			3	22	ON	0			G	0	D	0	3	0
E2	0	P	0	I	0			4	6	E	0			U	0	E	0		
H1	0	OT	0	OT	0					OT	0			T	0	F	0		
H2	0			O	0											OT	0		
M1	0							Mean=0.00	Mean=2.07			Mean=0.00						Mean=0.00	
OT	0																		

Summary of normals

20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
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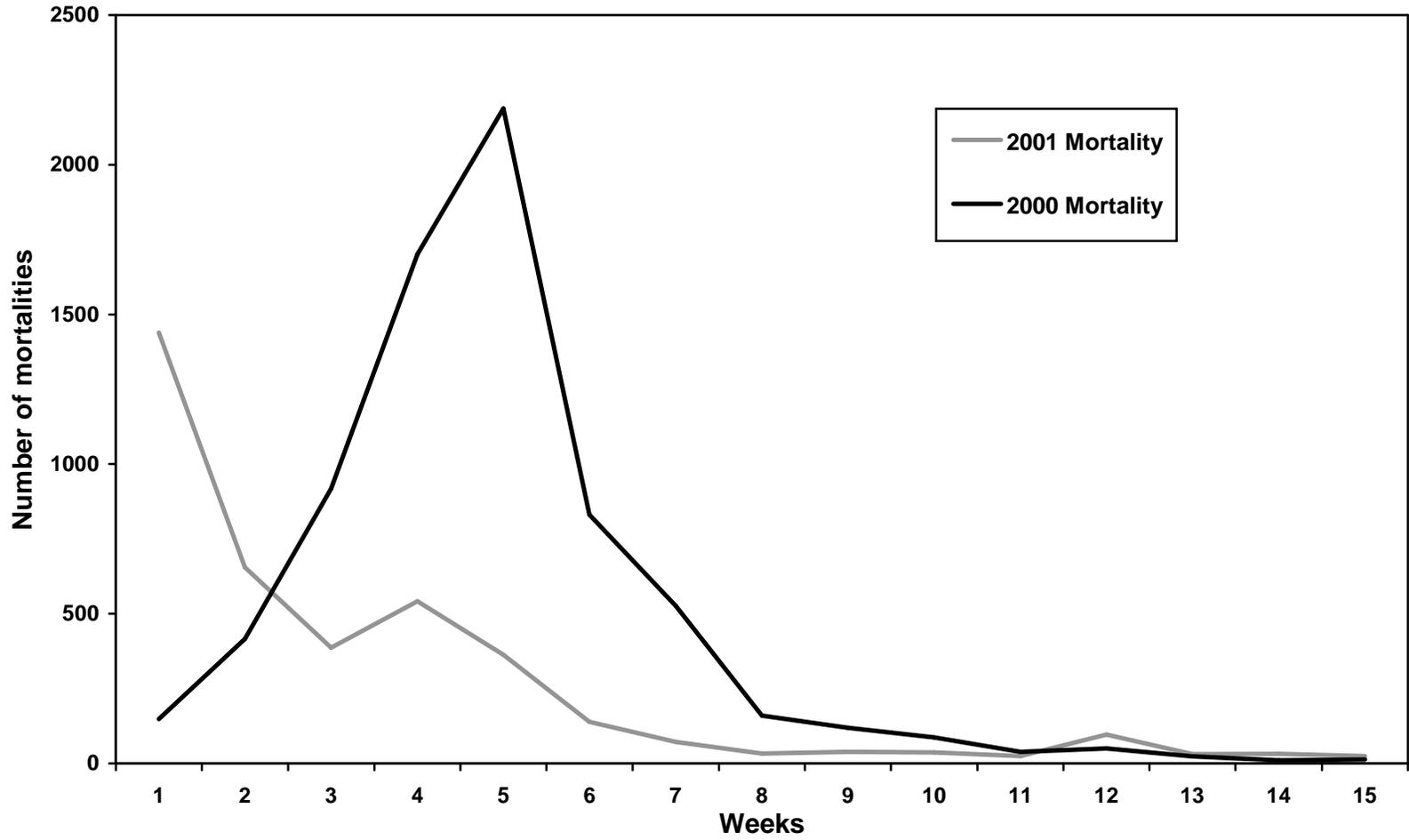
N = normal
 OT = other
 Thymus: 0 = no hemorrhage
 Mesenteric fat: 0 = none, 1 = < 50% coverage, 2 = 50%, 3 = > 50%, 4 = 100%
 Spleen: R = red, E = enlarged (EIBS enlarges spleens)
 Hind gut: 0 = no inflammation
 Liver: B = pail red
 Bile: 0 = yellow bile < full bladder

Appendix 19. Weekly mortality of Brood Year 2001 fall Chinook reared at Oxbow Fish Hatchery.

Week	2/11	2/18	2/25	3/4	3/11	3/18	3/25	4/1
Mortality	1,449	655	387	542	363	139	72	33

Week	4/8	4/15	4/22	4/29	5/6	5/13	5/20	5/21
Mortality	39	37	25	96	31	32	25	20

Appendix 20. Comparison of mortality in fall Chinook for brood years 2000 and 2001.



Appendix 21. Snake River historic release and return data

Year	Rapid River Hatchery Spring Chinook Released	Steelhead Spring Releases	Steelhead Fall Releases	Chinook Returns	Steelhead Returns
1966			29,400		
1967		587,513			1,681
1968		342,114			1,609
1969		109,200	757,500	344	1,122
1970		385,900	670,960		136
1971			215,625		279
1972			630,900	3	650
1973				2	435
1974				1	125
1975			40,977	14	34
1976			85,510		224
1977		126,000	301,644		243
1978			344,944		186
1979			548,987		36
1980		348,520	191,900	1	339
1981	1,001,700	614,160			158
1982		354,150			203
1983	250,020	92,750	220,270	16	872
1984	500,850	458,917	630,500	3	1,116
1985	437,360	414,712	387,353	699	1,343
1986	140,000	819,495	39,995	395	2,438
1987	103,000	800,000	672,235	543	3,209
1988	400,600	877,400	75,814	458	2,524
1989	500,000	735,500	603,000	84	2,729
1990	551,200	947,200	351,400	30	2,728
1991	500,500	912,000		22	1,151
1992	550,500	243,900		912	1,714
1993	200,300	660,500		431	1,259
1994	380,504	609,115		29	1,403
1995	499,536	614,560		36	1,597
1996	67,818	630,152		78	1,383
1997	13,470	660,651		944	1,270
1998	304,096	653,276		74	2,407
1999	300,000	657,665		79	2,042
2000		601,220		1,174	2,250
2001		579,467	115,220		3,256
2002	500,195	526,168	171,483	34	3,781
2003	299,854		541,472	141	4,010

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Hatchery Assistant Manager

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