



OXBOW FISH HATCHERY

2005 Fall Chinook Salmon Brood Year Report



**Kent Hills
Hatchery Assistant Manager**

**Arny Koski
Biological Aide**

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ABSTRACT

The production of sub-yearling fall Chinook salmon smolts at Oxbow Fish Hatchery (OFH) partially fulfills Idaho Power Company's (IPC) mitigation responsibility for impacts to anadromous fish associated with the construction and operation of the Hells Canyon Dam Complex. Brood Year 2005 was the sixth consecutive year of fall Chinook salmon production at OFH using eggs received from Lyons Ferry Hatchery (LFH).

On December 12, 2005, OFH staff picked up 210,000 eyed eggs at LFH. They were transported to OFH and placed in incubation trays with ten trays in each stack. The well water supplied to each stack was aerated to decrease the dissolved gas pressure with the hope of decreasing fry mortality. The water flow to each stack was adjusted to five gpm. Well water ranged from 52° F - 54° F until button up. The resulting fry were moved to two outdoor raceways on January 28, 2006. They were reared on water from well #2 at 53° F until reaching 83.56 fish per pound (fpp), at which time river water was introduced. A density index of 0.30 lbs/ft³/inch and a flow index of 1.0 gallons/minute/inch were used as upper limits for adjusting flows and raceway volumes. This year the Snake River flows were exceptionally high and turbid due to high snow pack in the mountains. A decision was made to delay the addition of river water to the Chinook salmon rearing raceways until after fish marking was completed. It was believed this decision would avert problems with the automated tagging trailer. Unfortunately, the supply of well water to the raceways was insufficient to sustain the fish. This situation, combined with poor feed consumption, lead to an anoxic condition during raceway cleaning and 673 fish were lost just before tagging. A supply of river water was added and there was no further mortality due to low dissolved oxygen.

The fish were fed a diet of Skretting feed from swim-up to release as smolts. They were started on Nutra Plus Mash and ended consuming 1.2-mm pellets. Skretting 1.2 ProActive feed was used for two weeks before fin clipping. The automated marking trailer was used again this year to adipose fin clip and coded wire tag all of the fingerlings. On May 2, 2006 a total of 191,135 smolts were transported from OFH for release into the Snake River below Hells Canyon Dam. They averaged 80.28 fpp and 3.22 inches in length at release. Total weight was 2,381 pounds. On the day of release, the raceway water volume was 2671 ft³. The flow was 227 gpm of well water and 613 gpm of river water. The density index was 0.28 lbs/ft³/inch and the flow index was 0.88 gallons/minute/inch. Survival from eyed egg to release was 91%.

The Oregon Department of Fish and Wildlife received 940,750 eyed eggs from LFH in three lots for rearing at their Umatilla Fish Hatchery. The first lot of 420,000 was received on December 6, the second lot of 420,000 on December 13, and the third lot of 100,750 on December 15, 2005. A total of 332,165 sub-yearlings were transported from Umatilla and released below Hells Canyon Dam between May 9 and May 10, 2006. These fish were 57.9 fpp and 3.7 inches long. Another 398,343 were transported to Pittsburg Landing between May 1 and May 5, 2006 for acclimation and release at the Nez Perce Tribe's acclimation ponds.

Authors:

Kent Hills
Assistant Hatchery Manager

Arny Koski
Biological Aide

HATCHERY OVERVIEW

Introduction

The Oxbow Fish Hatchery (OFH) is part of the Idaho Power Company (IPC) hatchery system and has been in operation since 1962. The OFH is owned and funded by IPC and operated by the Idaho Department of Fish and Game (Department). The OFH was constructed by IPC as part of mitigation required by the Federal Energy Regulatory Commission for impacts to anadromous fish resulting from the construction and ongoing operation of Brownlee, Oxbow, and Hells Canyon dams on the Snake River. Adult steelhead (*Oncorhynchus mykiss*) trapped below Hells Canyon Dam are held, spawned, and the resulting eggs incubated at OFH. Eggs and button up fry are then transported to the Niagara Springs Fish Hatchery (NSFH) for final rearing before release. Adult spring Chinook salmon (*Oncorhynchus tshawytscha*) are trapped and held at OFH until they can be shipped to Rapid River Fish Hatchery (RRFH) in Riggins, Idaho for spawning. Fall Chinook salmon (*O. tshawytscha*) are reared to sub-yearling smolts from eyed eggs received from the Washington Department of Fish and Wildlife's Lyons Ferry Hatchery (LFH). The sub-yearling smolts are released into the Snake River below Hells Canyon Dam.

Location

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, Oregon. It is located at the eastern most end of Oregon State Highway 86 and is approximately 67 highway miles east of Baker City, Oregon and approximately 150 highway miles northwest of Boise, Idaho. The Hells Canyon trap, which is used for interrogating adult fish for the OFH is located 23 miles downstream at the base of Hells Canyon Dam on the Oregon shoreline of the Snake River.

Objectives

The primary purpose for OFH is to meet the Hells Canyon mitigation requirements for adult anadromous fish returns to the upper Snake River. This involves three main objectives:

1. Trap and spawn adult steelhead to provide eggs and fry to NSFH to produce two hundred thousand pounds of smolts annually.
2. Trap adult spring Chinook salmon for transfer to RRFH to supplement broodstock needed to release three million smolts annually.

3. Rear one million sub-yearling fall Chinook salmon smolts annually for release into the Snake River.

Facility Description

The OFH facility consists of the following: A hatchery building which houses the office, shop, and incubation room; four adult holding ponds including fish loading and off-loading facilities; an incubation water chiller; a spawning building; a dormitory; an Assistant Fish Hatchery Manager's residence; two concrete raceways; and an off-site fish trap. A more detailed description of the main components of the facility 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 shop and office space, and the other half is space for egg incubation. The incubation room has the capacity to incubate 4.6 million eggs by placing eggs from two females in each of the 448 vertical stack incubator trays. Two 64 ft² sheds provide storage.

Adult fish trapping and holding facilities include four holding ponds and a fish trap. 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 ft³ of holding space. The two smaller divisions measure 55-ft x 35-ft x 5-ft, providing 19,250 ft³ 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. The center raceway has a small crowd rack that is used to move the fish into the spawning building. The OFH uses a fish transport truck to transport fish from the fish trap to OFH.

The fish trap is located 23 road-miles downstream of 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 fish 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.

A 60 horsepower (hp) water chiller allows regulation of well water temperature for incubating eggs and fry. The chiller is enclosed by a 12-ft x 17-ft metal building to the west of the hatchery building. It has the capacity to chill 120 gpm of well water from a temperature of 52 °F or 54 °F to 40 °F.

The spawning building is located adjacent to the holding ponds. It is partially recessed into the ground to provide holding areas for fish that are to be spawned. The remaining portion is at ground level where the adult steelhead are spawned and the eggs fertilized and processed.

Two concrete raceways provide rearing space for juvenile fall Chinook salmon. They each measure 130-ft long x 6-ft wide x 4-ft deep. A concrete wall divides the first 30 feet of each raceway into two smaller units. The head-box and outlet of the raceways reduce the useable length of rearing space to 109 feet. The capacity of the raceways is 156,309 sub-yearling smolts at 42 fpp. Well water and river-water are plumbed to the raceways in order to achieve required flows and to allow limited control of water temperature.

Water Supply

Outside Operation Water Source

Water for adult fish holding and spawning is pumped from the Snake River. A platform adjacent to the hatchery supports two 100-hp production pumps. They each produce 17.5 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 salmon 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. One well (#1) serves as a primary water source, while the other (#2) is an emergency backup with a separate power source. The well water temperatures are fairly stable and range from 52° F – 54° F. Both wells have 10-hp pumps and together provide approximately 750 gpm for incubation and 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 via gravity flow through two 4-inch PVC water lines to the 28 incubator stacks. Non-chilled well water is piped directly to 25 of the incubator stacks to provide warmer water if desired.

Staffing

One permanent Assistant Fish Hatchery Manager staffs OFH. Two four-month Biological Aides, one eight-month Biological Aide, and one eight-month Fishery Technician share 3,760 hours budgeted for temporary help to assist with hatchery operation and maintenance. The eight-month Biological Aide positions assists with steelhead production, but is primarily assigned to fall Chinook salmon production.

Hatchery Improvements

Accomplished

Over the last few years IPC Oxbow maintenance personnel have been responsible for 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) New Gravel was applied to the road to the hatchery.
- 2) The old spawning channels were filled in and leveled.
- 3) To address public safety concerns, fencing has been placed around the fall Chinook salmon raceways and in front of the old cinder block raceways. Life rings were also installed on the perimeter fences at the adult ponds and the fall Chinook salmon raceways.
- 4) The trap stairs and the mezzanine were painted.
- 5) A replacement fish transport truck was purchased and placed in operation.
- 6) Both river water pumps have been replaced with pumps that don't require oil.

Recommendations

Several improvements to equipment and structures at OFH are recommended to improve the overall operation of the facility. These recommendations include:

1. The spawning building needs to be enlarged and lowered four feet. This would reduce potential falls or injuries while climbing ladders within the building. It would also enable return of unripe fish to the ponds without dropping them over a fence, thus lowering potential injury and stress to the fish. Finally, an enlarged work space would make the collection of fish health samples more efficient.
2. The hatchery needs more maintenance space. The current office building contains the office, a workshop, a freezer, and a small conference area. The result is very limited space for working on equipment and projects. Construction of a shop and removal of shop items from the office and conference area would solve this. The addition of a concrete slab (approximately 15-ft x 40-ft) is needed in front of the hatchery building for performing vehicle maintenance and other hatchery projects.

3. The holding ponds need to be modified to create a better holding environment and to reduce fish stress and injuries during routine handling.
4. The hatchery alarm system should be modified to directly sense the holding pond water level and to be able to register multiple alarm signals.
5. Both aeration towers need to be sand blasted and repainted.
6. The hatchery needs gravel on the driveways and application of a dust abatement material.
7. A walk-in cooler should be placed in the outside storage area to provide storage for salmon food.
8. Six cinder block raceways located behind the office should be removed and the remaining hole filled.
9. To increase operating efficiency and reduce the chance of chiller failure during the summer months, we recommend two modifications: build a shade structure over the chiller building and paint it white.

FALL CHINOOK SALMON PRODUCTION

Egg Development

Brood Year 2005 marks the sixth consecutive year that OFH has produced sub-yearling fall Chinook salmon smolts from eyed-eggs provided from LFH. This year, the Department received 210,000 eyed-eggs from the LFH in Starbuck, WA. Eyed eggs with 700 temperature units (TU) were picked up by OFH personnel and transported to the OFH on December 12, 2005. Seven coolers were used to transport the eggs at approximately 30,000 eyed eggs per cooler. Well water from LFH was used for transporting the eggs at 52° F. When they arrived at OFH, they were disinfected for approximately 30 minutes in a 100 ppm solution of well water and iodophore. After disinfection, the temperature of the water in the coolers was measured and warmed with well water as needed. Then the eggs were placed in 60 vertical stack incubator trays. Each tray received approximately 3,500 eggs. Well water ranged from 52 F – 54 F during incubation and was set to a flow of 5 gpm. Dead eggs were picked at 847 TU, and again at 1,330 TU. A total of 2,483 dead eggs and fry were removed before fry were placed in the raceways. Survival from eyed egg to hatch was 98.8%.

Fry to Smolt Development

This year, fall Chinook salmon eggs were received six days later than in 2004. In the first year of production, button-up fry were placed in the raceways and started on feed January 30, 2001. Brood Year 2005 was started on feed January 31, 2006. Rearing flows and density were comparable to 2004. The Integrated Hatchery Operations Team (IHOT) recommends a maximum flow index of 1.0 lb/gpm /inch and a maximum density index of 0.30 lb/ft³/inch at this facility. These recommendations were followed as closely as possible; however, the recommended flow index was exceeded for most of the rearing cycle and density index was exceeded in four samples (Appendix 1). Pound count and length frequency data were collected weekly to monitor fish growth (Appendix 2). Fish were raised in the outside raceways on well water until reaching 83.56 fpp on April 13, 2006. On this date, 351.2 gpm of river water (51 °F) was introduced to the raceways to supplement the supply of well water. The raceway water temperature decreased from 54 °F to 51 °F. During the rearing period, water temperatures were monitored at the hatchery adult head box for river water, at the well for well water, and at the raceway head box for mixed water (Appendix 4).

Fall Chinook salmon were fed Skretting feed from button-up to release (Appendix 3). A combination of hand feeding and belt feeders was used to supply food to each raceway. Skretting feed that contained beta glucan was fed for two weeks prior to marking. Skretting research indicates that beta glucan helps promote activation of the fish's immune system and may reduce infection due to stress such as fin-clipping or marking. High runoff and turbid conditions of Snake River water are believed to have contributed to poor feed conversion this year by hindering the fish's ability to see food in the water column. This problem was exacerbated during the use of Skretting Pro Active feed which sinks more rapidly than the regular pellets.

Hatchery personnel were concerned that turbid river water would also affect the performance of the automated tagging trailer and an effort was made to delay the addition of river water to the raceways until fish marking was complete. Apparently, the available volume of well water was not sufficient to sustain the fish. During routine raceway cleaning on April 11, 2006, the fish became stressed from a combination of waste material in the water and low dissolved oxygen conditions. Feeding and cleaning operations were stopped and the Department's Eagle Fish Health Lab was notified. After measuring dissolved oxygen in the raceways, river water was introduced to supplement the supply of well water. Mortality diminished the next day and fish were gradually put back on feed after two days. Total mortality from this event was limited to 673 fish.

On May 2, 2006, 191,135 sub-yearling fall Chinook salmon smolts were transported and released into the Snake River at the U.S. Forest Service boat ramp located one mile below Hells Canyon Dam. At release, these fish averaged 3.22 inches fork length and 80.28 fpp. Fish disposition is shown in Appendix 6 and a summary of production data is shown in Appendix 7. The release weight for Brood Year 2005 was slightly lower than for Brood Year 2004 due to receiving eggs later in the season and to poor feed conversions. High snow pack and increased flow in the Snake River may have influenced Snake River water temperatures. In response to warmer than expected water temperatures, the release target date of June 1, which was used for preliminary project design, was not used. Depending on conditions next year, we will adjust release timing as we become more familiar with the affect water temperature has on movement of sub-yearling smolts down the migration corridor.

Predators

There were no known predators associated with the Brood Year 2005 fall Chinook salmon program.

Fish Marking

Marking operations commenced on April 17 and were completed on April 21, 2006. All fall Chinook salmon were adipose fin clipped. Once all the smolts were clipped and counted, hatchery inventory records were adjusted down from 194,067 to 191,135 (Appendix 6). A total of 12,085 Passive Integrated Transponder (PIT) tags were placed in the sub-yearlings that were to be released into the Snake River below Hells Canyon Dam. At release, two shed PIT tags were found in the raceways bringing the PIT tag number at release to 12,083 smolts. The remaining sub-yearlings were implanted with coded wire tags (CWT). On May 1, 2006, a clip evaluation was performed on 500 fish. The results were 1 no clip (0.2%) and 14 with a partial fin clip (2.8%). The remaining 485 (97%) were clipped satisfactorily. A total of 436 CWT tagged fish were evaluated for tag loss. A total of 429 (98.4%) tags were found and 7 (1.7%) had been shed.

Fish Health

Disease Testing

Personnel at the Department's Eagle Fish Health Lab performed health examinations on these fish prior to release. Disease events were not encountered during the reporting period. Treatments were not applied to Brood Year 2005 fall Chinook salmon at OFH.

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 2005 fall Chinook salmon are presented in Appendix 8.

Acute Losses/Chronic Losses

Neither acute nor chronic losses were experienced during the 2005-2006 rearing cycle. The hatchery did have an episode of poor water quality along with poor feed quality that caused the loss of 673 fish.

Other Assessments

The eggs received this year were from females that were spawned later in the season. We observed a lower early mortality but the average mortality stayed higher than usual. Release size this year was smaller due to reduced growth.

Well water was degassed before use on the eggs in the incubation room again this year. All eggs were disinfected when they arrived at OFH and eggs were isolated into small groups during incubation.

Ceratomyxa shasta (CS) has not been isolated from these fish. In April 2004, the Eagle Fish Health Laboratory initiated a series of exposure trials to establish the onset of parasitism by CS in sentinel rainbow trout (*Oncorhynchus mykiss*). This myxosporean parasite has been established as a main source of mortality for migrating Chinook salmon and it is present in the Snake River. Since OFH utilizes Snake River water to rear fall Chinook salmon, it is imperative that the Department and IPC are informed about the timing of CS in this portion of the river. The objectives of this research project are to obtain data pertaining to timing of emergence and prevalence of CS. We will make recommendations about timing of release for the fall Chinook salmon and investigate increasing the availability of well water at this facility.

Season Mortality

Mortalities were removed and recorded on a daily basis. As previously stated, 2,483 dead eggs were removed prior to hatch. After hatch, 24 dead sac fry were removed. After being placed in the raceways, 13,426 fry died and were removed. Weekly mortality after placement in the raceways is listed in Appendices 9 and 10.

Smolt Transport

A total of 191,135 marked sub-yearling fall Chinook salmon survived to release and were transported by Niel Ring Trucking Company, Inc. These sub-yearlings were released into the Snake River below Hells Canyon Dam.

Cost of Fall Chinook Salmon Production

The cost of fall Chinook salmon production is calculated as a portion of IPC's total monthly expenditures for the operation of OFH during those months that fall Chinook salmon are on station (December through the first part of May). A portion of the monthly expenditure is used because adult steelhead are also on station when fall Chinook salmon are present. Total personnel costs for one Biological Aide, and a percentage of the remaining staff expenses during the fall Chinook salmon rearing period are included in these calculations. The total amount for other specific expenditures (e.g. feed and transportation) are also included. The remaining monthly expenditures (letter dated September 26, 2006, from Paul Abbott, IPC Hatchery Biologist, P.O. Box 70, Boise, Idaho) are reduced by a percentage that reflects a proportion of expenditures allocated to fall Chinook salmon production. Production cost for Brood Year 2005 fall Chinook salmon at OFH totaled \$50,417.94 or \$21.18 per pound of fish (Appendix 11).

IPC Fall Chinook Salmon at Umatilla Fish Hatchery

During years when the number of eyed fall Chinook salmon eggs available to IPC exceeds OFH's rearing capacity, IPC has contracted with the Oregon Department of Fish and Wildlife (ODFW) to rear the remaining portion of eyed eggs received from LFH. ODFW rears these fish at their Umatilla Fish Hatchery (UFH). Since IPC's fall Chinook salmon program began in 2000, UFH has reared fish for IPC three years (brood years 2002, 2004 and 2005). Brood Year 2004 was the first year that IPC received a full 1 million fall Chinook salmon eggs from LFH for IPC's mitigation program.

In December 2005, UFH received a total of 940,750 eyed eggs from LFH for IPC's fall Chinook salmon program. These eggs were received in three shipments with 420,000 eyed eggs received on December 6th, another 420,000 eyed eggs received on December 13th and 100,750 eyed eggs received on December 15th. Following incubation, these fish were reared in outdoor Oregon or Michigan style ponds supplied with water from a Ranney well system and four separate wells. Water from the well system averages 54° F. All fish were adipose fin clipped and 225,413 fish received CWTs. On April 17 – 21, 2006, Biomark, Inc. PIT tagged 48,430 fish as part of the U.S. Army Corps of Engineers fall Chinook salmon transportation study. A mark and tag retention

check was conducted on April 28, 2006. The results indicated a 99.4% tag retention rate for CWTs, a 99.8% tag retention rate for PIT tags and an adipose fin clip success rate of 99.4%.

On May 1, 3 and 5, 2006, a total of 398,343 sub-yearling fall Chinook salmon smolts were transported using IPC transport tankers to the Nez Perce Tribe's Pittsburg Landing Acclimation Ponds (PLAP) for acclimation until their release in late May. At the time of transfer, these fish averaged 66.9 fpp and 3.50 inches in length. There were 222,083 fish with CWTs and 24,369 fish with PIT tags. These fish were acclimated for approximately 3 weeks and then released from the PLAP into the Snake River on May 22 and 24, 2006. A total of 397,085 fish were released at an average 52.5 fpp and 3.80 inches in length.

On May 9 and 10, 2006, the remaining sub-yearling smolts reared at UFH were transported to their release site at the Snake River below Hells Canyon Dam using IPC transport tankers. A total of 332,165 fish were released below the dam at an average 57.9 fpp and 3.68 inches in length. The only tags for this group were 23,969 PIT tags.

The total contract cost of rearing Brood Year 2005 fall Chinook salmon to smolt at UFH was \$116,607.00. In addition, smolt transportation from UFH to release sites totaled \$12,327.00 bringing the total cost of smolt production and distribution from UFH to \$128,934.00.

ACKNOWLEDGEMENTS

The OFH staff would like to thank the staff from LFH, IPC and the Department who 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. Weekly flow and density indices during rearing of Brood Year 2005 fall Chinook salmon at Oxbow Fish Hatchery.

| Date | Raceway Volume (ft ³) | Flow (gpm) | Flow Index | Density Index |
|---------|-----------------------------------|------------|------------|---------------|
| 1/31/05 | 455 | 150 | 0.62 | 0.21 |
| 2/06/05 | 455 | 150 | 0.85 | 0.28 |
| 2/13/06 | 911.3 | 200 | 1.10 | 0.18 |
| 2/20/06 | 911.3 | 200 | 1.04 | 0.23 |
| 2/27/06 | 911.3 | 200 | 1.24 | 0.27 |
| 3/06/06 | 1,491.5 | 300 | 0.79 | 0.21 |
| 3/13/06 | 1,491.5 | 300 | 1.43 | 0.29 |
| 3/20/06 | 1,491.5 | 300 | 1.62 | 0.33 |
| 3/27/06 | 1,491.5 | 300 | 2.00 | 0.40 |
| 4/03/06 | 1,491.5 | 300 | 2.62 | 0.53 |
| 4/10/06 | 2,384 | 300 | 2.55 | 0.32 |
| 4/17/06 | 2,671 | 578 | 1.26 | 0.27 |
| 4/24/06 | 2,671 | 841 | 0.83 | 0.26 |
| 5/01/06 | 2,671 | 841 | 0.88 | 0.28 |

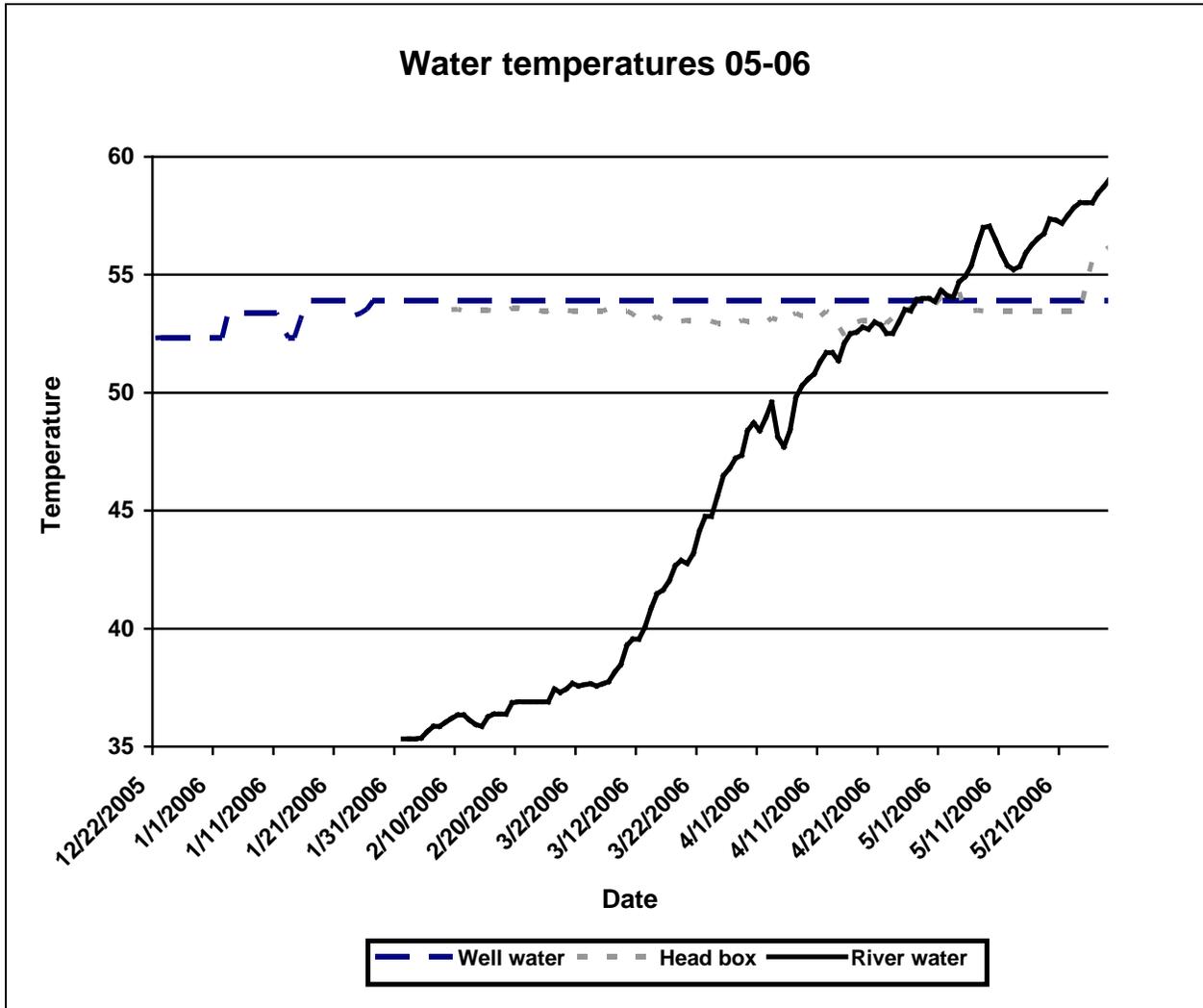
Appendix 2. Weekly length and weight data for Brood Year 2005 fall Chinook salmon reared at Oxbow Fish Hatchery.

| Date | Number | Weight (lbs) | Fish/Pound | Average Length (mm) | Minimum Length (mm) | Maximum Length (mm) | Standard Deviation (mm) |
|---------|--------|--------------|------------|---------------------|---------------------|---------------------|-------------------------|
| 2/06/06 | 661 | 0.63 | 1,041.99 | 39.40 | 36 | 44 | 1.74 |
| 2/13/06 | 303 | 0.41 | 747.62 | 41.84 | 36 | 49 | 2.39 |
| 2/20/06 | 212 | 0.41 | 523.09 | 46.72 | 40 | 54 | 2.59 |
| 2/27/06 | 288 | 0.70 | 408.6 | 50.10 | 43 | 57 | 3.16 |
| 3/06/06 | 235 | 0.82 | 286.8 | 55.58 | 46 | 67 | 4.17 |
| 3/13/06 | 269 | 1.30 | 207.7 | 55.94 | 47 | 67 | 4.54 |
| 3/20/06 | 220 | 1.33 | 165.36 | 61.98 | 45 | 76 | 6.33 |
| 3/27/06 | 190 | 1.53 | 124.29 | 66.80 | 49 | 83 | 5.70 |
| 4/03/06 | 185 | 2.10 | 88.04 | 72.04 | 50 | 93 | 8.11 |
| 4/10/06 | 180 | 2.15 | 83.56 | 77.52 | 50 | 95 | 8.84 |
| 4/17/06 | 208 | 2.43 | 85.54 | 79.12 | 59 | 90 | 7.48 |
| 4/24/06 | 197 | 2.19 | 90.16 | 77.66 | 63 | 99 | 7.79 |
| 5/01/06 | 232 | 2.89 | 80.28 | 81.80 | 54 | 109 | 12.59 |

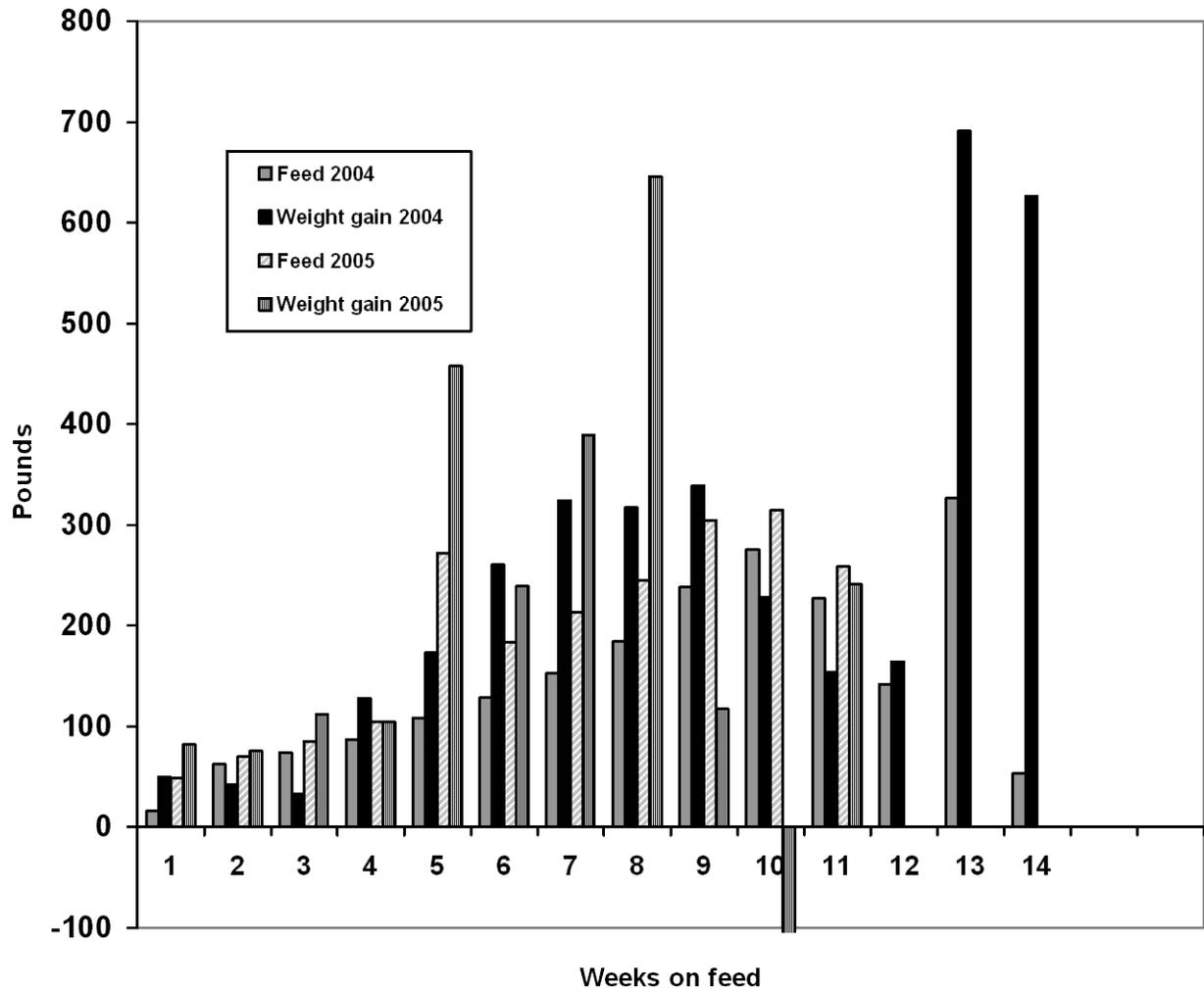
Appendix 3. Feed used during the Brood Year 2005 fall Chinook salmon rearing program.

| Month | MASH Starter | #0 Starter | #1 Starter | # 2 Crumb | 1.2 mm | 1.2 mm Beta Glucan |
|-------|--------------|------------|------------|-----------|--------|--------------------|
| Jan | 4.0 | | | | | |
| Feb | 84.0 | 220 | 10.4 | | | |
| Mar | | | 429.60 | 396 | | |
| April | | | | 264 | 258.4 | 410.9 |
| Total | 88 | 220 | 440 | 660 | 258.4 | 410.9 |

Appendix 4. Well, river, and mixed water temperatures measured at Oxbow Fish Hatchery, February, 2006 through May, 2006.



Appendix 5. Comparison of pounds of food fed and weight gained during production of Brood Years 2004 and 2005 fall Chinook salmon at Oxbow Fish Hatchery.



Appendix 6. Brood Year 2005 fall Chinook salmon disposition.

| Number | Disposition |
|----------|--|
| 210,000 | Eyed eggs received from Lyons Ferry |
| -2,507 | Dead eggs and sac-fry picked from incubation trays |
| 207,493 | Fry placed in raceways |
| -2,932 | Adjustment from hatchery count to actual clipping counts |
| -13,426 | Total fry motility |
| 191,135 | Fry on station |
| -12,083 | PIT tagged fry released |
| -179,050 | CWT tagged fry released |
| -2 | Fry that lost PIT tag and released |
| 0 | Fry remaining on station |

Appendix 7. Brood Year 2005 fall Chinook salmon production summary.

| Fish on hand at end of month | | | | | Mortality | | Fish Feed | | Weight Gain | | Feed Conversion | |
|------------------------------|---------|---------|--------|-----------|-----------|---------|-----------|---------|-------------|---------|-----------------|---------|
| Month | Number | Weight | Length | Fish/ lb. | Month | To Date | Month | To Date | Month | To Date | Month | To Date |
| Jan | 206,760 | 114.87 | 1.23 | 1,800 | 757 | 3,240 | 4 | 4 | 0.9 | 0.9 | 4.62 | 4.62 |
| Feb | 198,797 | 486.5 | 1.97 | 408.6 | 7,963 | 11,203 | 320 | 324 | 371.7 | 372.6 | 0.86 | 0.87 |
| Mar | 195,561 | 1,573.4 | 2.63 | 124.3 | 3,236 | 14,439 | 820 | 1,144 | 1,087 | 1,459.5 | 0.76 | 0.78 |
| Apr | 191,148 | 2,381 | 3.22 | 80.3 | 1,421 | 15,860 | 933.3 | 2,077.3 | 807.6 | 2,267.1 | 1.16 | 0.92 |

Eggs were received December 12, 2005.

After tagging in April, the total smolt number was adjusted down 2,992 to reflect tagging counts.

Smolts were planted below Hells Canyon Dam on May 2, 2006.

Appendix 8. Summary of Brood Year 2005 fall Chinook salmon pre-liberation fish health examinations.

| | | | |
|---------------------------|--------------|---------------|----------------|
| Accession No: | 06-136 | Location: | Oxbow Hatchery |
| Species: | Chinook Fall | Autopsy Date: | 04/17/2006 |
| Strain: | Lyon's Ferry | Age: | Juv |
| Unit: Reason for Autopsy: | Prelib | Sample Size: | 60 |
| Investigator: | Munson | | |

Values As Percents Of Total Sample

| Eyes | | Gills | | Pseudo-branchs | | Thymus | | Mesen. Fat | | Spleen | | Hind gut | | Kidney | | Liver | | Bile | |
|------|----|-------|----|----------------|----|--------|----|------------|----|--------|----|----------|----|--------|----|-------|----|------|-----------|
| N | 60 | N | 60 | N | 60 | 0 | 60 | 0 | 0 | B | 0 | 0 | 60 | N | 60 | A | 12 | 0 | 60 |
| B1 | 0 | F | 0 | S | 0 | 1 | 0 | 1 | 1 | R | 60 | 1 | 0 | S | 0 | B | 48 | 1 | 0 |
| B2 | 0 | C | 0 | L | 0 | 2 | 0 | 2 | 29 | G | 0 | 2 | 0 | M | 0 | C | 6 | 2 | 0 |
| E1 | 0 | M | 0 | S&L | 0 | | | 3 | 30 | NO | 0 | | | G | 0 | D | 0 | 3 | 0 |
| E2 | 0 | P | 0 | I | 0 | | | 4 | | E | 0 | | | U | 0 | E | 0 | | |
| H1 | 0 | OT | 0 | OT | 0 | | | | | OT | 0 | | | T | 0 | F | 0 | | |
| H2 | 0 | | | O | 0 | | | Mean 2.48 | | | | | | | | OT | 0 | | |
| M1 | 0 | | | | | | | | | | | | | | | | | | Mean=0.00 |
| OT | 0 | | | | | | | | | | | | | | | | | | |

Summary of normal's

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

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

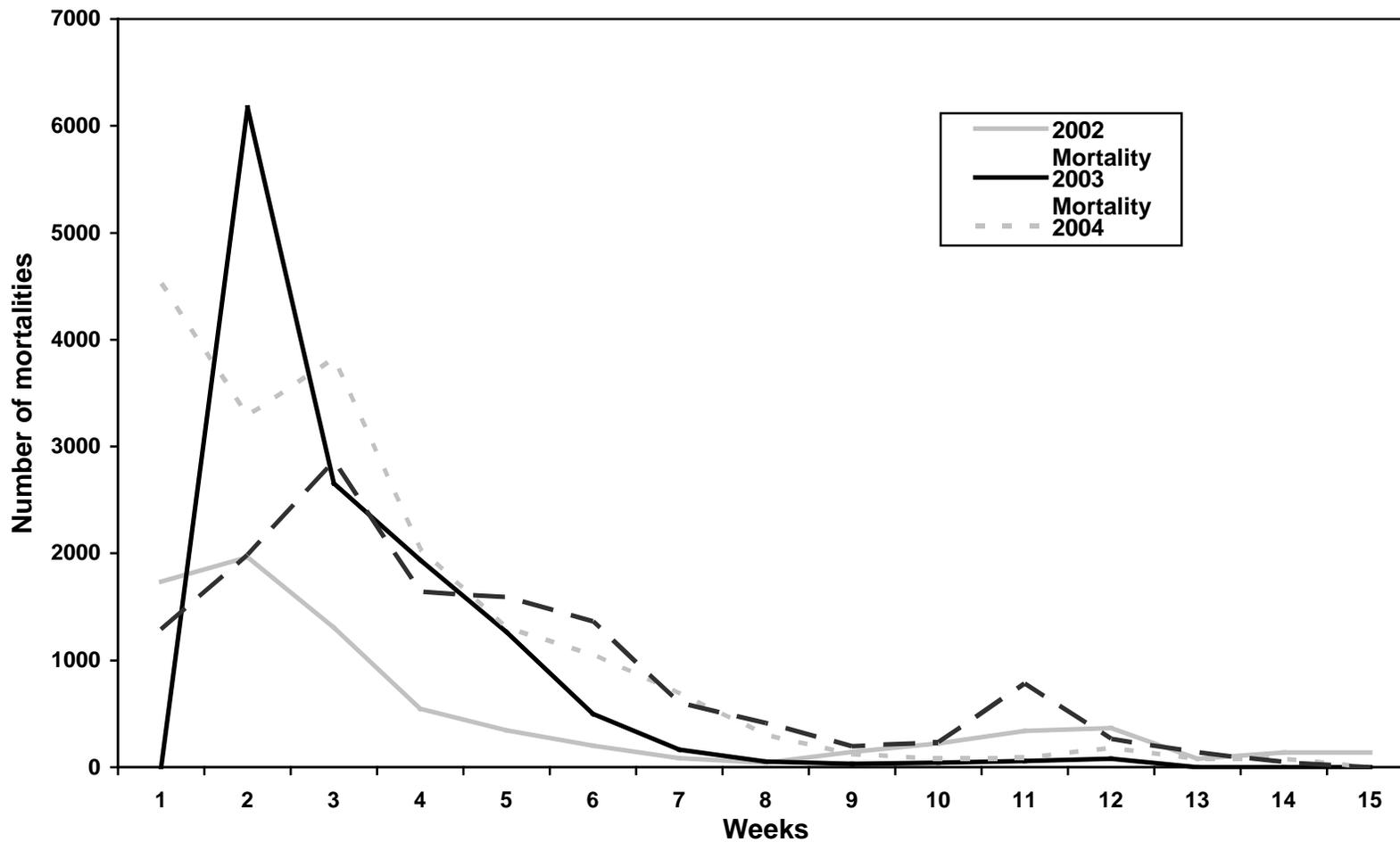
Bile: 0 = yellow bile < full bladder

Appendix 9. Weekly mortality of Brood Year 2005 fall Chinook salmon reared at Oxbow Fish Hatchery.

| Week | 1/29 | 2/05 | 2/12 | 2/19 | 2/26 | 3/05 | 3/12 | 3/19 |
|-----------|-------|-------|-------|-------|-------|-------|------|------|
| Mortality | 1,512 | 2,183 | 2,682 | 1,626 | 1,540 | 1,263 | 621 | 349 |

| Week | 3/26 | 4/02 | 4/09 | 4/16 | 4/23 | 4/30 |
|-----------|------|------|------|------|------|------|
| Mortality | 209 | 221 | 781 | 315 | 75 | 49 |

Appendix 10. Comparison of mortality in fall Chinook salmon for brood years 2002, 2003, 2004 and 2005.



Appendix 11. Cost of production at Oxbow Fish Hatchery for Brood Year 2005.

| Number of fish | Weight of fish (lb) | Weight of feed (lb) | Cost of feed | Feed Conversion | ^a Total cost | Cost/ thousand fish | Cost/ Pound |
|----------------|---------------------|---------------------|--------------|-----------------|-------------------------|---------------------|-------------|
| 191,135 | 2,381 | 2,077.3 | \$3,007.57 | .90 | \$50,417.94 | \$263.97 | \$21.18 |

^aThe total represents a portion of the total cost incurred by IPC from 12/1/05 through 5/06/06. For information regarding how this was calculated, see the discussion in the Cost of Production section. These costs include funds provided to the Department by IPC, as well as internal costs incurred by IPC. It does not include IPC capital outlay expenditures.