



OXBOW FISH HATCHERY

2004 Fall Chinook Salmon Production Brood Year Report



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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. The number of adult fall Chinook salmon trapped at Lyons Ferry Hatchery (LFH) in the fall of 2004 was higher than in recent years. The improvement may be the result of more favorable ocean climate conditions. Brood Year 2004 was the fifth consecutive year of fall Chinook salmon production at OFH utilizing eggs received from LFH.

On December 6, 2004, OFH personnel picked up 211,000 eyed-eggs at LFH. They were transported to the OFH and placed in incubation trays with ten trays in each stack. Well water was supplied to each incubator stack at a rate of 5 gallons per minute (gpm). The water supply was aerated to decrease dissolved gas pressure in an effort to decrease mortality of emergent fry. The resulting fry were moved to two outdoor raceways on January 26, 2005. They were reared on water from well #2 at 53 °F. 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 water flows and raceway volumes. The fry were raised on 100% well water until reaching 103 fish per pound (fpp). As the fish grew larger, the supply of well water was supplemented with river water to maintain flow indices \leq 1.0 gallons/minute/inch.

The fish were fed a diet of Skretting feed. They were started on Nutra™ Plus # 0 Crum and ended consuming 1.2-mm pellets. Skretting 1.2 ProActive™ feed was fed for two weeks before fin clipping. An automated marking trailer was used for adipose-clipping and coded-wire-tagging of the fingerlings. All were adipose-clipped, 179,355 were coded-wire-tagged (CWT), and 9,973 received Passive Integrated Transponders (PIT-tags). On April 28, 2005 a total of 189,119 smolts were transported from OFH for release into the Snake River below Hells Canyon Dam. They averaged 61.5 fpp and 3.7 inches in length at release. Total weight was 3,077 pounds. On the day of release the raceway water volume was 2,671 ft³. The flow was 285 gpm of well water and 205 gpm of river water. The density index was 0.31 lbs/ft³/inch and the flow index was 1.73 gallons/minute/inch. Survival from eyed egg to release was 89.9%.

In addition to 211,000 eyed-eggs transferred from LFH to OFH, the Oregon Department of Fish and Wildlife received 842,278 eyed-eggs from LFH in two lots for rearing at their Umatilla Fish Hatchery. The first lot of 421,400 was received on December 7, and the second lot of 394,055 was received on December 14, 2004. A total of 394,055 sub-yearlings were transported from Umatilla Fish Hatchery and released below Hells Canyon Dam between May 10 and May 12, 2005. They were 59.4 fpp and 3.7 inches long at release. Another 399,861 were transported to Pittsburg Landing on the Snake River between May 2 and May 6, 2005 for acclimation in holding tanks operated by the Nez Perce Tribe. These fish were 68.8 fpp and 3.7 inches long when they were transferred. The Nez Perce Tribe released 397,704 sub-yearlings from the acclimation tanks on May 26, 2005 at 50 fpp and 3.8 inches long. All were adipose-clipped and 212,546 of the Pittsburg Landing release group had CWT.

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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 eggs incubated at OFH. Eggs and button-up fry are then transported to the Niagara Springs Fish Hatchery (NSFH) for final rearing to smolt. Spring Chinook salmon (*Oncorhynchus tshawytscha*) adults trapped below Hells Canyon Dam are 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).

LOCATION

The OFH is located in Eastern Oregon adjacent to the confluence of Pine Creek and 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 Fish Trap, which is used to trap fish for the OFH, is located twenty three miles downstream from OFH at the base of Hells Canyon Dam on the Oregon shore 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 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 Hatchery Manager's residence; two concrete 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 shop space 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 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 5ft providing 36,750 ft³ of holding area. 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 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 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 the fish that are to be spawned. The remaining portion is at ground level where the adult steelheads are spawned and the eggs fertilized and processed.

Two concrete raceways provide rearing space for 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 allow limited control of water temperature.

Recommended Facility Improvements

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 safety hazards associated with climbing ladders within the building. It would also enable the return of unripe fish to the holding ponds without dropping them over a fence. 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. A fence needs to be installed around the salmon raceways.

To reduce the chance of chiller failure during the summer months, a shade structure should be built over the chiller building and the building painted white to reduce solar heating.

Water Supply

Adult Operation Water Source

Water for adult fish holding and spawning is pumped from the Snake River. A pumping platform adjacent to the hatchery entrance holds two 100-hp production pumps that each produces 17.5 ft³/s of water. One pump is powered by the Pine Creek substation, and the second is powered by the Oxbow Power Plant substation. Only one pump operates at a time. The other is used for a backup. Water temperatures range from a winter low of 34° F to a late summer high of 72 °F. The water passes through two aeration-pump platforms before entering the four adult holding ponds.

Incubation Water Source

Two wells provide water for egg incubation. One well serves as a primary water source, and the other is used as an emergency backup with a separate power source. The primary well water is a constant 53 ° F and the backup is a constant 54 ° F. Both wells have 10-hp pumps that produce 330 gpm each. 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 28 incubator stacks. Non-chilled well water is also piped directly to 11 of the incubator stacks to facilitate incubation temperature control.

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 assists with fall Chinook salmon incubation and rearing and steelhead spawning. The eight-month Fishery Technician assists with data entry, the spring Chinook salmon program and adult steelhead trapping.

FALL CHINOOK SALMON PRODUCTION

Egg Development

Brood year 2004 marks the fifth consecutive year that OFH has produced sub-yearling fall Chinook salmon smolts from eyed eggs provided from LFH. In 2004 fall Chinook salmon eggs were received sixteen days earlier than in 2003. Personnel from OFH picked up 211,000 eyed eggs at LFH in Starbuck, WA on December 6, 2004. The eggs had accumulated 680 temperature units (TU) at that time. Eggs were transported to OFH in seven coolers containing approximately 30,000 eyed eggs per cooler using 52°F well water from LFH. Upon arrival at OFH, the temperature of the water in the coolers was measured and warmed with well water as needed. Eggs were then disinfected for approximately 30 minutes in a 100 ppm solution of well water and Argentyne™ followed by transfer to 59 vertical stack incubator trays. Each tray received approximately 3,576 eggs. The eggs were incubated with 53 °F well water at 5 gpm. Dead eggs were picked at 827 TU, and again at 1,142 TU. A total of 3,613 dead eggs were removed. Survival from eyed egg to hatch was calculated at 98.3%.

Fry to Smolt Development

Button-up fry were placed in the raceways and started on feed on January 26, 2005. Conditions of water flow and rearing density were maintained at levels similar to those used for Brood Year 2003. The Integrated Hatchery Operations Team (IHOT) recommends a maximum flow index of 1.0 lbs/gpm/inch and a maximum density index of 0.30 lbs/ft³/inch for fall Chinook salmon at this facility. These recommendations were followed as closely as possible; however, the recommended flow index was exceeded for most of the rear period and density index was exceeded in two 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 103 fpp on March 28, 2005. On this date, 78 gpm of river water (45 °F) was introduced to the raceways to supplement the 300 gpm supply of 53 °F well water. Following a procedure similar to that used for Brood Year 2003, the river water was added slowly to minimize temperature change in the raceways. The resulting mixed water supply measured 52 °F. During the rearing period, water temperatures were monitored at the hatchery 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. In previous years, feed response was observed to decline along with raceway water temperature as cold river water was introduced to the raceways. By introducing river water slowly, feed response was stable and there was no drop in feed consumption in the raceways (Appendix 5). Skretting ProActive™ feed containing beta glucan was fed for two weeks before marking. Skretting's research shows that beta glucan may help promote activation of the fish's immune system and reduce the effects of stressors such as fish marking.

On April 28, 2005 189,119 sub-yearlings smolts were loaded onto a transport vehicle for release into the Snake River below Hells Canyon Dam. At release, the fish averaged 3.7 inches in length and 61.5 fpp. A summary of production data is shown in Appendix 6. The release weight was slightly lower than in 2004. The eggs were received eight days earlier this year but the release date was moved up 35 days.

Predators

There were no known predators associated with the 2004 fall Chinook salmon program.

Fish Marking

Marking operations commenced on April 11, and were completed on April 15, 2005. All fall Chinook salmon were adipose fin clipped. Of this total, 9,973 were marked with PIT tags. The remaining 179,355 were marked with CWTs. On April 26, 2005, fin clip evaluation and tag retention was performed on 500 fish. We observed 472 full fin clips, 21 partial fin clips and 7 that had not been clipped at all. We found 431 fish with CWT's, 47 with just PIT tags and 22 with no tags at all.

Fish Health

Diseases Encountered and Treatment

Personnel from the Department's Eagle Fish Health Lab performed health tests on these fish prior to release. Emerging fall Chinook salmon fry had an elevated mortality due to gas bubble disease. As soon as these fish were placed on de-gassed well water in the concrete raceways, mortality subsided. Medicated feed treatments were not applied to these fish. Pathogens were not detected in fall Chinook salmon reared at OFH.

Organosomatic Index

See Appendix 7.

Acute Losses/Chronic Losses

Acute losses were not experienced at this facility. Chronic losses were limited to the mortality in the fall Chinook salmon fry due to gas bubble disease.

Other Assessments

Personnel from the Eagle Fish Health Lab conducted exposure trials using sentinel rainbow trout (*Oncorhynchus mykiss*) in live-boxes placed in the Snake River for 7 days at a time. The live-box was placed at the OFH's water intake. These trials took place approximately twice a month. The trials were used to document the emergence timing of *Ceratomyxa shasta*, a myxosporidan parasite of salmonids known to be established in the Snake River below Oxbow Dam. We found that the infective actinospore stage of the parasite was present as the Snake River warmed in the spring to approximately 50 °F. This occurred at the end of April or the beginning of May, 2005. From these findings, we suggest continuing releases of fall Chinook salmon in early May to avoid host parasite contact and to provide maximum growth before release.

Season Mortality

Mortalities were tracked on a daily basis (Appendices 8 and 9).

Smolt Transport

All of the 189,119 sub-yearling fall Chinook salmon released by OFH were transported by Niel Ring Trucking Company, Inc. using a smolt fish tank provided by IPC. The sub-yearlings were released into the Snake River below Hells Canyon Dam.

SUMMARY

This year completes the fifth year of the evaluation period to determine if fall Chinook salmon can be raised at OFH. The five-year average for survival from eyed egg to release was 92.4 %. The average size at release was 47.1 fpp. The program has been successful each year. We recommend the hatchery evaluation phase be terminated and the facility be expanded to fully accommodate the production of one million sub-yearling fall Chinook salmon smolts annually.

ACKNOWLEDGEMENTS

The staff at OFH would like to thank the staff at LFH for providing eyed eggs. We would also like to thank the employees of IPC and the Department who have contributed to the successful operation of the fall Chinook salmon project.

APPENDICES

Appendix 1. Flow and density index changes for Brood Year 2004 fall Chinook salmon at OFH.

Date	Raceway Volume (ft ³)	Flow (gpm)	Flow Index	Density Index
1/31/05	616	150	0.81	0.20
2/07/05	616	150	0.95	0.23
2/14/05	616	200	0.88	0.29
2/21/05	616	200	1.12	0.36
2/28/05	1,198	230	1.21	0.23
3/07/05	1,638	300	1.16	0.21
3/14/05	1,638	300	1.50	0.27
3/21/05	2,671	300	1.79	0.20
3/28/05	2,671	358	1.69	0.23
4/04/05	2,671	358	1.84	0.25
4/11/05	2,671	444	1.49	0.25
4/18/05	2,671	444	1.49	0.25
4/25/05	2,671	485	1.73	0.31

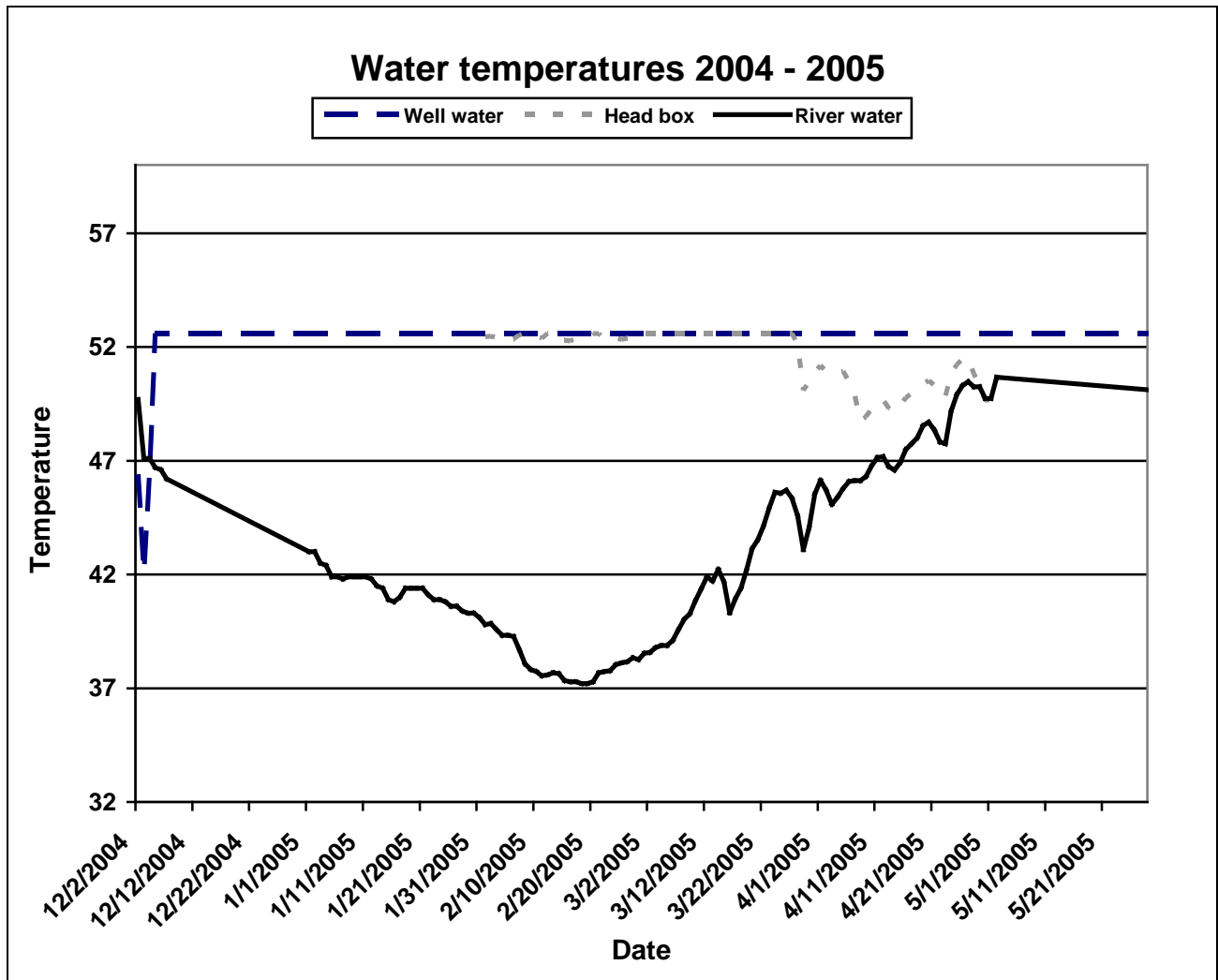
Appendix 2. Pound counts and lengths for Brood year 2004 fall Chinook salmon at OFH.

Date	Number	Weight (lbs)	Fish/Pound	Average Length (mm)	Minimum Length (mm)	Maximum Length (mm)	Standard Deviation (mm)
1/31/05	534	0.48	1,101.98	38.60	35	42	1.84
2/07/05	448	0.51	884.31	40.16	35	46	3.09
2/14/05	384	0.59	655.40	43.32	34	52	4.23
2/21/05	288	0.63	454.00	48.56	39	56	4.81
2/28/05	284	0.89	320.74	54.88	44	63	4.72
3/07/05	236	1.06	222.29	60.06	45	70	5.86
3/14/05	195	1.21	160.96	66.96	49	80	6.61
3/21/05	171	1.35	126.85	71.02	50	85	6.48
3/28/05	148	1.43	103.37	77.38	66	93	5.95
4/04/05	135	1.47	92.03	79.94	65	99	8.09
4/11/05	130	1.52	85.54	85.18	60	103	7.95
4/18/05	108	1.36	79.34	91.65	77	113	8.75
4/25/05	172	2.80	61.49	92.96	78	110	7.48

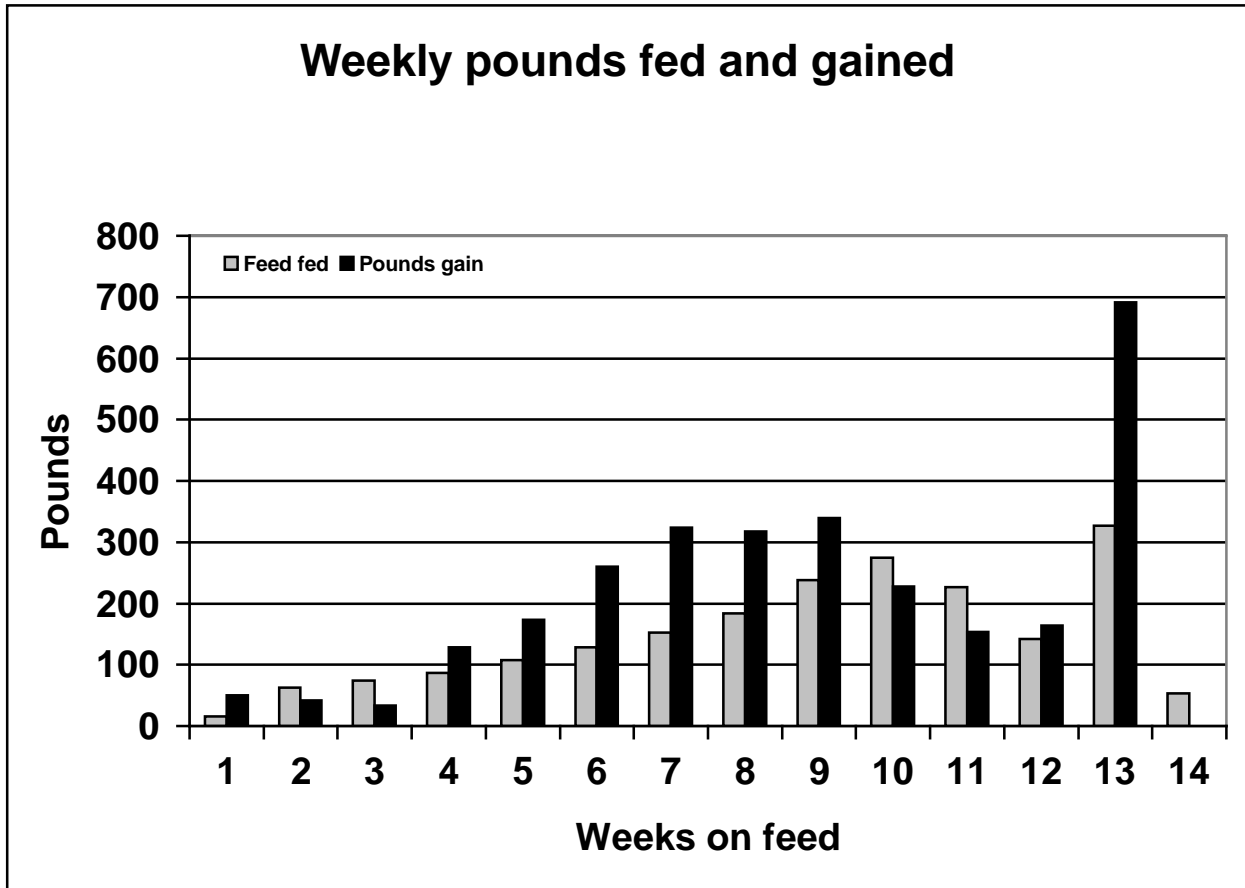
Appendix 3. Pounds of Skretting feed used by month and pellet size for Brood Year 2004 fall Chinook salmon.

Month	#0 Starter	#1 Starter	#2 Starter	# 2 Bio-product	1.2 mm	1.2 mm Pro Active	1.5 mm
Jan	24						
Feb	108	188.75		44			
Mar		119.3	529.5			186.2	
April			308.7		135.6	429.8	
Total	132	308	838.2	44	135.6	616	0

Appendix 4. Temperatures for well, river, and mixed water at OFH, December 2004 through May 2005.



Appendix 5. Brood Year 2004 fall Chinook salmon feed use and weight gain



Appendix 6. Oxbow Hatchery production summary for brood year 2004 fall Chinook salmon.

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	202,565	183.82	1.52	1,101.98	4,822	4,822	24	24	1.7	1.7	13.72	13.72
Feb	192,235	599.35	2.16	320.74	10,330	15,152	340.75	364.75	415.5	599.35	0.82	0.61
Mar	190,174	1,931.09	3.09	98.5	2,061	17,213	834.9	1,199.7	1,331.7	1,931.0	0.63	0.62
April	189,119	3,075.61	3.66	61.5	1,055	18,268	874.1	2,073.8	1,144.5	3,075.5	0.76	0.67

EGGS WERE RECEIVED DECEMBER 6, 2004

Appendix 7. Summary of Brood Year 2004 fall Chinook salmon pre-liberation fish health examinations.

Summary of Fish Autopsy

ACCESSION NO:	05-099	LOCATION:	Oxbow
SPECIES:	fc	AUTOPSY DATE:	4/4/2005
STRAIN:	Lyons Ferry	AGE:	juv
UNIT:		SAMPLE SIZE:	60
RIVER FOR AUTOPSY:	Prelib.		
INVESTIGATOR(S):	Munson		
REMARKS:	Blood parameters not assayed		

	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			
LEUCOCRIT	0.00	0.00	0.00
SERUM PROTEIN			

*EXPRESSED AT KTL TIMES 10 TO THE FIFTH POWER

**CONVERTED FROM KTL; EXPRESSED AS CTL TIMES 10 TO FOURTH POWER

EYES		GILLS		PSEUDO-BRANCHS		THYMUS		FAT		MESEN. SPLEEN		GUT		HIND KIDNEY		LIVER		BILE	
N	60	N	60	N	60	0	60	0	0	B	0	0	60	N	60	A	7	0	46
B1	0	F	0	S	0	1	0	1	19	R	60	1	0	S	0	B	53	1	14
B2	0	C	0	L	0	2	0	2	24	G	0	2	0	M	0	C	6	2	0
E1	0	M	0	S&L	0			3	15	NO	0			G	0	D	0	3	0
E2	0	P	0	I	0	Mean=0.00		4	2	E	0	Mean=0.00		U	0	E			
H1	0	OT	0	OT	0					OT	0			T	0	F	0	Mean=0.23	
H2	0			O	0			Mean=2.0								OT	0		
M1	0																		
OT	0																		

SUMMARY OF NORMALS

SEX	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
		M: 0				F: 0													

Appendix 8. Weekly mortality of Brood year 2004 fall Chinook salmon at OFH.

Week	1/24	1/31	2/07	2/14	2/21	2/28	3/07	3/14
Mortality	4,523	3,285	3,822	2,041	1,306	1,050	688	304
Week	3/21	3/28	4/4	4/11	4/18	4/25		
Mortality	121	81	89	183	78	79		

Appendix 9. Comparison of brood year 2000, 2001, 2002, 2003 and 2004 fall Chinook salmon mortality.

