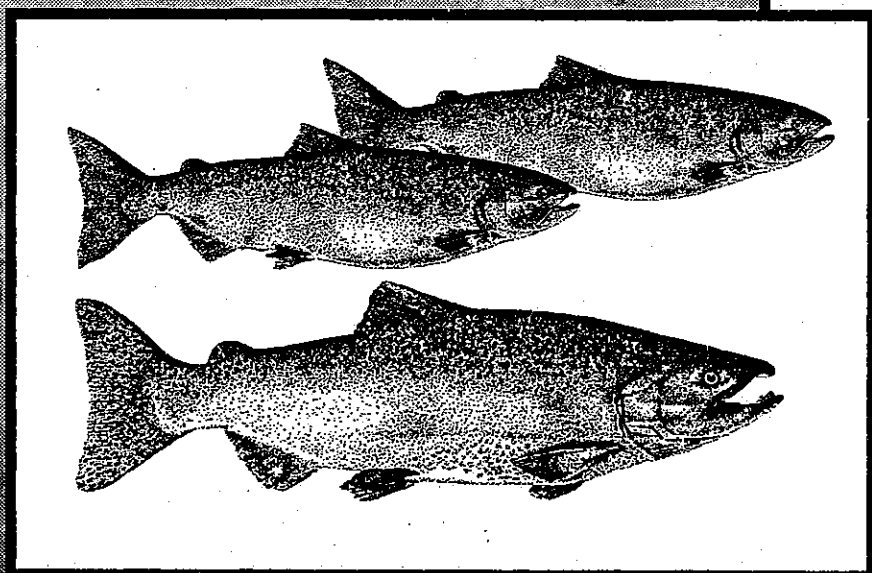


Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 1998 and 1999



by Deborah Milks, Lorna Wargo
and Michelle Varney



Washington Department of
FISH AND WILDLIFE
Fish Program
Science Division

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to

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Abstract

Fall chinook salmon broodstock were obtained from two sources: voluntary returns to the Lyons Ferry Fish Hatchery (LFH) ladder and fish trapped and transported to LFH from Lower Granite (LGR) Dam. Only coded wire tagged (CWT), blank wire tagged (BWT), and ventral fin clipped salmon were collected at LGR Dam and transported to the hatchery. In 1998 the total number fall chinook processed at spawning was 3,614, including 2,047 adults and jacks that had voluntarily returned to the hatchery, and 1,567 salmon transported from trapping operations at LGR Dam. The actual number transported from LGR was 1,573 fish. During processing, six of the LGR fish could not be accounted for and were most likely processed as volunteers. There were an additional five fish that were sacrificed at LGR for CWT recovery that will also be included in this report. In 1999, the total number processed at spawning was 4,184, including 2,250 adult and jack chinook that had voluntarily returned to the hatchery, and 1,934 salmon transported from trapping operations at LGR Dam. The actual number collected and transported from LGR Dam was 1,983. During processing at LFH, 49 of the LGR fish could not be accounted for and were most likely processed as volunteers.

In 1998 and 1999, as in previous years, we were able to evaluate a portion of straying to the Snake River by using CWTs, BWTs, and ventral fin clips recovered from fish trapped at LFH and fish trapped and hauled to LFH from LGR. In 1998 there were 212 strays processed at LFH, 145 of which were from the Umatilla River, 10 from Klickitat Hatchery, and the remainder of the fish were strays from within or outside of the Snake River basin. In 1999 there were 279 strays processed at LFH, 227 of which were from the Umatilla River, 2 from Klickitat Hatchery, and the remainder of fish were strays from within or outside of the Snake River basin.

Coho were caught incidentally at LFH and accidentally hauled from LGR to LFH. In 1998 there were 2 coho that volunteered into LFH and 1 coho transported from LGR. National Marine Fisheries Service (NMFS) staff at LGR Dam incorrectly identified the coho as a fall chinook and sacrificed it. In 1999, there were 21 coho that volunteered into LFH and one accidentally transported from LGR. The Nez Perce Tribe (NPT) was notified and the fish were transferred to the tribe. Coho will not be discussed further in this report.

Fall chinook were spawned at LFH from October 20 to December 8, 1998, and October 19 to December 14, 1999. Peak of spawning was November 3 in 1998 and November 9 and 10 in 1999. CWTs were removed from marked hatchery fish and read to determine the fish's origin prior to fertilization of the eggs. In 1998 all CWTs were read. In 1999 to expedite spawning, we read 50% of the CWTs associated with red elastomer fish. These fish were Lyons Ferry origin and used at spawning as such, without their CWTs being read. In addition, we read 100% of the other (non-red elastomer) CWT fish. Matings consisted of single female/single male lots (with a backup male). Only salmon verified to be of LFH origin were used for broodstock. All marked (CWT) hatchery strays and unmarked fish were spawned together as "strays".

Egg take from all fish was 2,521,135 in 1998 and 4,668,267 in 1999. The 1998 egg take from Lyons Ferry origin salmon was 2,085,155 with 1,978,704 of these eggs surviving to the eyed stage. The 1999

egg take from Lyons Ferry origin salmon was 3,980,455 with 3,761,834 surviving to eye-up. During incubation, 156,352 eggs from females with positive enzyme linked immunosorbent assay (ELISA) results were destroyed, leaving 3,605,482 eyed eggs for production. Progeny from stray and unmarked salmon were transferred to Klickitat Fish Hatchery (414,286 eyed eggs in 1998 and 687,812 green eggs in 1999) for subsequent release into the Klickitat River.

Sex, age, and mean length information was compiled for Lyons Ferry origin fall chinook salmon adults and jacks. LFH origin fall chinook returns continued to be dominated by younger age classes, primarily age 3 and 4. Females dominate the older age class of returning LF origin salmon because few males return at age 5 or older.

All yearling fall chinook salmon released from Lyons Ferry or the acclimation sites were adipose clipped (marked), coded wire tagged, and elastomer tagged. The LFH yearling release was tagged with a red elastomer tag in the clear tissue behind the left eye (LR). Fish from Pittsburg Landing had right green (RG) elastomers, fish from Big Canyon had left green (LG) elastomers, and fish from Captain John had left blue (LB) elastomers. Snake River Lab (SRL) staff participated in planning and coordinating the release of fall chinook from the NPT acclimation sites.

All subyearlings released from Lyons Ferry were adipose clipped and coded wire tagged. Only a portion of the subyearlings released from acclimation facilities upstream of LGR Dam were tagged. The tagged fish were coded wire tagged without any fin clips; externally these fish appeared wild.

In 1999, LFH volitionally released 432,166 yearling (1997 brood) fall chinook salmon from the hatchery March 25 - April 13. The NPT released a total of 529,503 fall chinook yearlings (1997 brood) March 25 - April 15, 1999 from acclimation facilities upstream of LGR Dam. LFH also released 204,194 subyearling (1998 brood) fall chinook salmon from the hatchery June 15. The NPT released 670,033 subyearling (1998 brood) fall chinook from Big Canyon and Captain John acclimation facilities May 26 - June 5. Only 57.2% of the fish released from Big Canyon were coded wire tagged (without an associated fin clip). The remaining releases from Big Canyon and Captian John consisted of untagged/unmarked fish.

In 2000, LFH volitionally released 456,401 yearling fall chinook salmon (1998 brood) from the hatchery March 24 - April 14. The NPT released 397,339 fall chinook yearlings (1998 brood) in April 1 - 13 from acclimation facilities upstream of LGR Dam.

Surveys were conducted to count fall chinook redds in the Tucannon River. In 1998, we observed 40 redds (5.3 redds/km below Rk 9.6) and 14 carcasses, including one that originated from Umatilla Hatchery and seven that originated from Lyons Ferry Hatchery. The remaining six fish were unmarked and of natural origin based on scale samples. In 1999, we observed 21 redds (2.5 redds/km below Rk 9.6) and 11 carcasses, which included six that originated from LFH and one from Umatilla Hatchery. The remaining four unmarked fish consisted of two hatchery origin and two natural origin fish based on scale samples.

We are unable to account for 21.8 percent (1,698 salmon) and 25.8 percent (2,606 salmon) of fall chinook escapement past Ice Harbor Dam (IHR) in 1998 and 1999, respectively. These estimates are calculated as the difference between the number of fish crossing IHR Dam and the numbers of fish entering LFH, spawning in the Tucannon River, and counted at LGR Dam.

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Introduction

Program Objectives

This report summarizes activities by the Washington Department of Fish and Wildlife's (WDFW) Lower Snake River Hatchery Evaluation Program from May 1, 1998 to April 15, 2000. This work was completed with Fiscal Year 1998 and 1999 funds provided by the U.S. Fish and Wildlife Service (USFWS) under the Lower Snake River Compensation Plan (LSRCP). The fall chinook salmon program at Lyons Ferry Fish Hatchery (LFH), and some related natural production in tributaries of the Snake River are described in this report. We have also incorporated information about salmon trapping at Lower Granite (LGR) Dam.

Congress authorized the LSRCP in 1976. As a result of that plan, LFH was constructed and has been in operation since 1984. One objective of the hatchery was to compensate for the loss of 18,300 adult, Snake River stock, fall chinook salmon (U.S. Army Corps of Engineers 1975). An evaluation program was initiated in 1984 to monitor the success of LFH in meeting the LSRCP compensation goals and to identify any production adjustments required to accomplish those goals.

The WDFW has two general goals in its evaluation program: (1) monitor hatchery practices at LFH to ensure quality smolt releases, high downstream migrant survival, and sufficient contribution to fisheries with escapement to meet the LSRCP compensation goals, and (2) gather genetic information to help maintain the integrity of Snake River Basin fall chinook salmon stocks (WDF 1994). Specific program objectives were outlined previously (Mendel et al. 1995).

Description of Facilities

LFH is located at the confluence of the Palouse and Snake rivers at river kilometer (Rk) 95.1 (Lower Monumental Pool, Figure 1). Design capacity for the fall chinook salmon program was 101,111 pounds (9,100,000 subyearling smolts at 90 fish per pound), based upon the goal to return 18,300 fall chinook adults. Fall chinook are spawned, hatched, and reared at LFH and then released as yearlings and subyearlings. Release locations have included the hatchery (on-station), downstream of Ice Harbor Dam (barged), and upstream of Lower Granite Dam (acclimated releases). Broodstock are obtained from various sources (see: Broodstock Collection and Management).

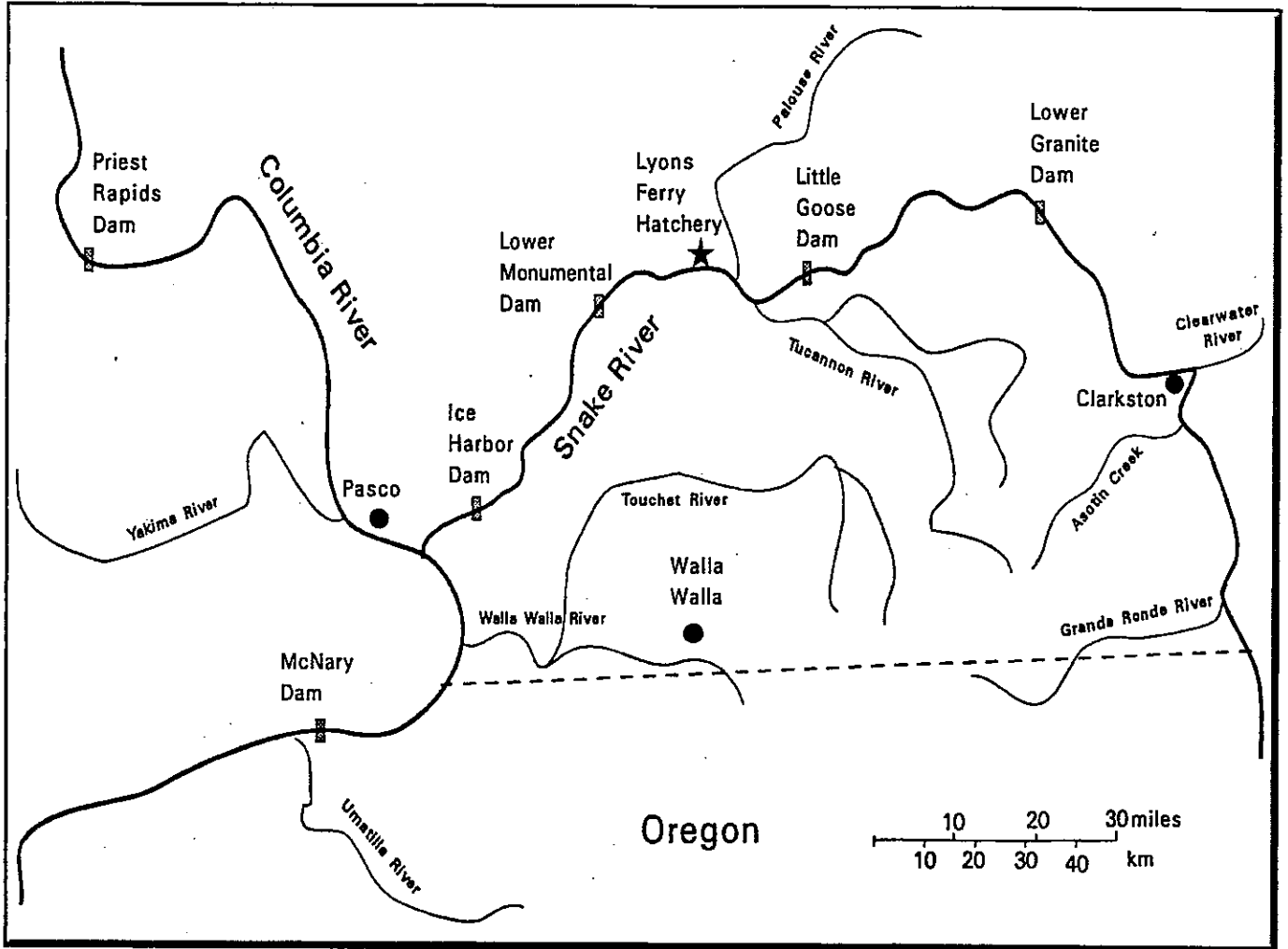


Figure 1. Lower Snake River Basin, showing the location of Lyons Ferry Fish Hatchery and major tributaries in the area.

Broodstock Collection And Management

LFH has been developing its broodstock since the facility began operating in 1984. Broodstock collection, from 1984-1990 and during the egg bank program (1977-1984), has been summarized previously (Bugert and Hopley 1989, Bugert et al. 1991, Bugert et al. 1995). Until 1990, salmon were obtained from two primary sources: 1) returns to the LFH ladder; and 2) adults trapped at IHR Dam (Bugert and Hopley 1991). LFH broodstock collection from these two sources averaged 37 percent of total escapement to the Snake River above IHR Dam (Bugert et al. 1991). Beginning in 1990, salmon were collected at Lower Granite Dam (LGR), providing a third source for broodstock. Collection of salmon from IHR Dam ceased in 1994 because of the high incidence of stray salmon, concerns about salmon passage delay caused by trapping, and personnel safety issues. The first year of adult (≥ 3 years old) returns from LFH production was 1986.

NMFS and WDFW personnel have cooperatively trapped and transported adult salmon since 1990 and jack salmon¹ since 1992 at LGR Dam for the following reasons: (1) to obtain information about run composition, (2) to reduce the number of stray hatchery salmon spawning naturally upstream of LGR Dam, and (3) to collect broodstock for LFH. LFH broodstock collected from the LFH trap and the LGR trap have averaged 44.7 % of total escapement to the Snake River above IHR Dam over the last five years. A detailed account of LFH broodstock collection and spawning protocol can be found in Appendix A for 1998, and in Appendix B for 1999 broodstocks.

The number of fish counted at LFH at the time of collection is considered a preliminary estimate of return (Table 1). The final estimate of total return to LFH is determined using the number of fish actually processed. Despite continual efforts to improve accounting procedures, discrepancies occur between the number of salmon estimated at collection and the number actually processed. This is due, in part, to misidentification of chinook, steelhead, and coho while sorting using the partially automated sorting system at LFH. Also, small jacks can pass through crowders and escape.

Discrepancies also occur between the number of salmon trapped at LGR and the number actually processed at LFH. In 1998, jaw tags and operculum punches were placed on LGR trapped fish bound for LFH. This enabled us to distinguish them at processing from voluntary returns and determine their date of collection. Occasionally, jaw tags fell off or were missed during processing. As a result, some fish originally trapped at LGR might have been documented at processing as being volunteers to LFH. After 1998 data was collected and assessed, we determined that jaw tags and opercle punches were detected at similar rates. In 1999 we elected to only use operculum punches to mark LGR collected and transported fish. Occasionally data was not recorded for this mark, making tracking of those fish impossible.

¹ Throughout this report, jacks were distinguished only by size at the time of collection. The length criterion for jacks collected at the dams was < 56 cm total length (53 cm fork length), whereas the criterion at LFH was < 49 cm fork length. Mini-jacks were ≤ 30 cm fork length.

Table 1. Fall chinook returns estimated at collection from Ice Harbor Dam, Lyons Ferry Hatchery (LFH) ladder, and Lower Granite Dam, 1990-1999. Dam counts in November have been updated from past reports.

Year	Collection location	Daytime dam counts ^b					
		Number collected		(through Oct.)		(Nov. & Dec.)	
		adults	jacks ^a	adults	jacks	adults	jacks
1990	LFH	521	602				
	Ice Harbor Dam	1,092	0	3,470	1,847	-	-
	Lower Granite Dam	49	0	354	181	31	9
1991	LFH	863	675				
	Ice Harbor Dam	361	71	4,500	1,526	-	-
	Lower Granite Dam	37	0	613	379	17	18
1992	LFH	898	176				
	Ice Harbor Dam	256	71	4,636	894	-	-
	Lower Granite Dam	178	26	797	97	58	5
1993	LFH	714	157				
	Ice Harbor Dam	127	-	2,805	332	-	-
	Lower Granite Dam	218	4	1,129	39	41	0
1994	LFH	656	-				
	Ice Harbor Dam ^c	-	-	2,069	1,033	-	-
	Lower Granite Dam	328	-	764	237	27	18
1995	LFH	2,231	-				
	Ice Harbor Dam	-	-	2,750	2,452	-	-
	Lower Granite Dam	693	-	1,047	301	20	7
1996	LFH	1,359	-				
	Ice Harbor Dam	-	-	3,810	808	41 ^d	3
	Lower Granite Dam	396	-	1,272	415	36	9
1997	LFH	1,221	-				
	Ice Harbor Dam	-	-	2,752	1,726	15	128
	Lower Granite Dam	653	-	1,434	469	17	35
1998	LFH	2,023 ²⁰⁴⁷	-				
	Ice Harbor Dam	-	-	4,220	3,491	32	33
	Lower Granite Dam	1,578	-	1,852	1,920	57	82
1999	LFH	1,989 ²²⁵⁰	-				
	Ice Harbor Dam	-	-	6,532	3,489	54	32
	Lower Granite Dam	1,983	-	3,302	1,790	79	66

^a Salmon were not classified by size at time of collection from 1993-1999 (1994, Lower Granite Dam).

^b Classification of adults and jacks is based upon size at the counting window at each dam.

^c Trapping at Ice Harbor Dam ceased in 1994.

^d Prior to 1996, Ice Harbor Dam did not conduct daytime dam counts in November.

LGR Dam Trapping Operations

Trapping operations at LGR began mid-August. Salmon with coded wire tag (CWT), blank wire tag (BWT), or other metal objects activated the door to the trap in the south shore fish ladder at LGR Dam. Also, fin clipped (right or left ventral; RV or LV) salmon without wire were captured and retained during periods when the trap door was kept open to sample a portion of the steelhead passing the dam. In 1999, the holding tanks at LGR were lined with plastic mesh to assure all fish trapped for LFH were hauled to LFH.

Stray salmon were collected at the trap for transport to LFH². Lyons Ferry origin fish were also collected to supplement broodstock at LFH. Some small fish (jacks and mini jacks) not needed as broodstock were killed and frozen for CWT recovery, and to prevent their upstream passage. Prior to transport, NMFS staff anesthetized the stray and LFH salmon, gathered length and sex data, and marked the fish by cutting a hole in the operculum with a paper punch. In 1998 the fish were also tagged with numbered metal jaw tags. In 1999, jaw tags were not used. The fish were then hauled to the hatchery by WDFW personnel in a 5,678 L aerated, unrefrigerated tank truck, in water from LFH.

1998

The number of fall chinook trapped for LFH was 1,578 (Table 1). Five mini jacks (< 30 cm fork length) were killed at LGR Dam to recover CWTs. The remaining salmon were transported to LFH for spawning. LFH staff processed 1,567 salmon, leaving six fish unaccounted for. At least 122 (7.9%) of the fish processed originated from Umatilla Hatchery (Appendix C).

1999

Nineteen-hundred-eighty-three fall chinook were trapped and hauled for LFH (Table 1). We were unable to account for 49 of these fish at processing. Of the 1,934 fish identified as LGR transports at processing, 157 (8.1%) fish were determined to be of Umatilla origin (Appendix D).

LFH Trapping Operations

The trap was opened in September to permit salmon to voluntarily enter the hatchery. Several times a week, salmon that had entered the trap were directed into a holding pond.

1998

The final count (and the number processed) of adults and jacks that voluntarily returned to LFH was 2,047 fish, which may include 6 LGR fish that were unaccounted for as transported. The number of

² NMFS requires that stray salmon trapped at LGR be removed from the Snake River system. These fish are taken to LFH for spawning. Progeny of these strays are reared and released at Klickitat Hatchery.

voluntary returns initially estimated at collection was 2,023 fish. Duration of trapping was 95 days (Table 2). Entry peaked on October 29 when 93 adults entered the hatchery.

1999

We processed 2,250 adults and jacks that voluntarily returned to LFH. Note that 49 of the fish processed were probably hauled from LGR, but due to incomplete data collection we were unable to distinguish these fish. Throughout this report we will use 2,250 as the number trapped at LFH. Voluntary returns were initially estimated at 1,989 fish. Duration of trapping was 84 days (Table 2). Entry peaked on September 29 and again on October 5 when 90 adults entered the hatchery.

Table 2. Voluntary returns of fall chinook to Lyons Ferry Hatchery estimated at collections, 1986-1999.

Year	Number of return			Trapping Dates	Peak return day	
	adults	jacks ^a	total		date	adults
1986	245	1,125	1,370	Sept 5 - Nov 15	Sept 18	24
1987	1,654	543	2,197	Sept 13 - Dec 12	Sept 26	202
1988	327	1,053	1,380	Sept 9 - Dec 5	Sept 16	95
1989	704	670	1,374	Sept 6 - Dec 4	Oct 1	56
1990	521	602	1,123	Sept 5 - Nov 14	Nov 7	57
1991	863	675	1,538	Sept 13 - Dec 4	Oct 1	54
1992	898	176	1,074	Sept 14 - Dec 7	Oct 19	181
1993	714	157	871	Sept 8 - Dec 7	Nov 11	42
1994	1,310	—	1,310	Sept 11 - Nov 29	Nov 13	80
1995	2,231	—	2,231	Sept 8 - Dec 3	Oct 17	42
1996	1,354	—	1,354	Sept 1 - Dec 1	Oct 11	109
1997	1,224	—	1,224	Aug 18 - Nov 25	Oct 31	77
1998	2,023	—	2,023	Sept 1 - Dec 4	Oct 29	93
1999	1,989	—	1,989	Sept 1 - Nov 23	Sept 29 & Oct 5	90

^a Jacks were classified by size (≤ 61 cm fork length) at the time of collection prior to 1994. After 1994, adults and jacks were not classified at time of collection.

Hatchery Operations

Spawning Operations

Spawning and Egg Take

Fall chinook collected at LGR Dam were held separately from those that voluntarily entered the hatchery (Appendix A and Appendix B). At spawning, ripe fish were killed and their gametes collected and set aside unmixed. CWTs were removed from marked fish and read to determine the fish's origin prior to fertilization of the eggs. Fish were spawned in two groups: 1) Lyons Ferry origin fish, identified through examination of CWTs or the presence of elastomer tags; and 2) all others. This latter category included unmarked fish, and strays identified by BWT, CWT, or ventral clips. Lyons Ferry origin fish were mated together and retained for subsequent Snake River releases. All fish were mated as single male/single female pairs (with a back up male 15-30 seconds later). Fertilized eggs from Lyons Ferry fish were incubated separately from unknown origin or stray fish. Chilled water was not used in 1998 or 1999 on fall chinook eggs because of limited chiller capacity.

1998

Fish were spawned from October 20 through December 8, 1998. The peak of spawning was November 3, when 776,585 eggs were taken (Table 3). The total egg take at LFH was 2,521,135³; initial mortality to the eyed stage was 5.08% (Table 4). Lyons Ferry origin salmon produced 2,085,155 total eggs ("green" or unfertilized eggs), while the total from stray fish was 435,980 green eggs.

1999

Fish were spawned from October 19 through December 14, 1999. The peak of spawning was November 9 and 10, when approximately 1,317,679 eggs were taken (Table 5). The total egg take at LFH was 4,668,267. Lyons Ferry origin salmon produced 3,980,455 total eggs ("green" or unfertilized eggs), 156,352 of which were destroyed because of positive ELISA values. Initial mortality of Lyons Ferry origin eggs was 5.5 percent (Table 4), which does not include loss due to destruction of eggs with positive ELISA values. The total number of green eggs from stray fish was 687,812 eggs.

³ This is the number of eggs counted after picking. A preliminary estimate of eggtake using 3,100 eggs per female is used at the hatchery before picking.

Table 3. Weekly spawning summary for fall chinook broodstock processed at Lyons Ferry Hatchery, 1998. Volunteer and transported fish are included. Jacks are included with males.

Week Ending	Mortality ^a		Spawned ^b		Surplussed ^d	Egg take
	M	F	M	F ^c		
Sept 5						
Sept 12						
Sept 19	2					
Sept 26	2	2				
Oct 3	8	7				
Oct 10	6	4				
Oct 17	21	14				
Oct 24	50	31	34	35	362	117,369
Oct 31	22	14	96	102	30	388,041
Nov 7	102	24	238	244	32	776,585
Nov 14	231	23	164	170	11	533,551
Nov 21	310	15	127	128	48	381,335
Nov 28	279	12	75	78	69	224,449
Dec 5	143	1	32	31	38	81,191
Dec 12	48		8	8	82	18,614
Totals	1,224	148	774	796	672	2,521,135

^a Mortality includes fourteen males and ten females crushed in the elevator during processing.

^b Prior 1998, males that were collected (stripped for milt) for use in spawning were classified as spawned even if they were not used.

^c Includes twenty-nine females that had bad eggs, were not ripe when killed, or had spawned in pond: one fish on Oct. 20, six fish on Oct. 27, eight on Nov. 3, six on Nov. 10, one on Nov. 17, three on Nov 24, three on Dec. 1 and one on Dec. 8.

^d Surplus includes two females accidentally killed as males. Surplus also includes males stripped for milt that were not used in matings.

^e The number of salmon broodstock accounted for during processing at LFH was 3,614 adults and jacks. This does not include the five fish sacrificed at LGR for CWT analysis.

Table 4. Duration and peak of spawning, egg take, and percent egg mortality at Lyons Ferry Hatchery (LFH), 1984-1999.

Year	Spawning duration	Peak of spawning	Total egg take	Initial egg loss (%)		
				Total	known LFH	other/Stray
1984	Nov 8 - Dec 5	Nov 21	1,567,823	21.58		
1985	Nov 2 - Dec 14	Nov 7	1,414,342	3.99		
1986	Oct 22 - Dec 17	Nov 19	592,061	3.98		
1987	Oct 20 - Dec 14	Nov 17	5,957,976	3.82		
1988	Oct 18 - Dec 6	Nov 12	2,929,748	3.41		
1989	Oct 21 - Dec 16	Nov 11	3,518,107	5.75		
1990	Oct 20 - Dec 8	Nov 6	3,512,571	8.28		
1991	Oct 15 - Dec 10	Nov 12	29,946,76 ^a	8.30		
1992	Oct 20 - Dec 8	Nov 21	22,655,57 ^a	5.96	5.06	9.29
1993	Oct 19 - Dec 7	Nov 2	2,181,879	6.69	9.60	6.10
1994	Oct 18 - Dec 6	Nov 8	1,532,404	5.09	5.40	4.90
1995	Oct 25 - Dec 5	Nov 14	1,461,500	5.64 ^b	3.22	12.13
1996	Oct 22 - Dec 3	Nov 5	1,698,309	4.56	3.95	7.85
1997 ^c	Oct 21 - Dec 2	Nov 4	1,451,823	5.22	4.18	9.80
1998	Oct 20 - Dec 8	Nov 3	2,521,135	5.08	5.11	4.98
1999 ^d	Oct 19 - Dec 14	Nov 9 & 10	4,668,267	-	5.49 ^e	-

^a Plus 9,000 eggs from stray females given to Washington State University.

^b Doesn't include loss from 10,000 stray eggs give to University of Idaho. The egg loss from strays was 8.63% excluding eggs used in fertilization experiments.

^c Total egtake includes eggs from one coho females crossed with a fall chinook.

^d Stray eggs were shipped prior to picking for loss, therefore initial loss for strays can not be calculated.

^e Initial loss does not include 156,352 eggs destroyed due to positive ELISA values.

Table 5. Weekly spawning summary for fall chinook broodstock processed at Lyons Ferry Hatchery, 1998. Volunteer and transported fish are included. Jacks are included with males.

Week Ending	Mortality ^a		Spawned ^b		Surplussed	Egg take
	M	F	M	F ^c		
Sept 4		1				
Sept 11						
Sept 18	1	1				
Sept 25	3	3				
Oct 2	1	3				
Oct 9	5	4				
Oct 16	3					
Oct 23	10	5	25	26	11	95,461
Oct 30	35	10	122	126	8	513,023
Nov 6	11	24	339	343	33	1,014,683
Nov 13	68	8	435	441	47	1,317,679
Nov 20	212	16	300	325	21	930,911
Nov 27	215	24	204	216	20	598,300
Dec 4	117	6	67	66	63	183,359
Dec 11 ^c	84	11				
Dec 18	32	6	6	7	14	14,851
Totals	797	122	1,498	1,550	217	4,668,267

^a Mortality included prespawning mortality of six males and two females crushed during processing.

^b Includes 23 females (not ripe when killed or had spawned in pond): one fish on Oct. 19, four on Oct 26, four on Nov. 2, two on Nov. 9, two on Nov 10, eight on Nov 16, three on Nov. 23, two on Nov 30, and one on Dec. 14.

^c No spawning the week ending Dec 11 due to hatchery staff limitations.

Cryopreservation

In 1998 and 1999, we did not cryopreserve any semen. Data and results from past experiments will be presented in a separate report.

Incubation, Rearing, Marking, and Transfer

1997 Brood Year

Yearlings

Progeny of 1997 Lyons Ferry origin broodstock numbered 1,101,070 fish at ponding (Table 6). The majority of yearlings were marked from September through October of 1998. Due to size, marking was held off until January and February of 1999 for 78,785 fish to be released at Big Canyon for a second release. Both groups of fish were marked with an adipose fin clip, CWT, and elastomer tag. Depending on the eventual release site and time of release for yearlings, a red, blue, or green elastomer tag was placed in the clear tissue behind the eye (Appendix E).

Table 6. Estimated salmon progeny from known Lyons Ferry origin adults, 1990-1999 brood years. These fish were released at various locations in the Snake and Clearwater rivers by WDFW, NPT, NMFS, and USFW.

Brood Year	Total green eggs	Eyed eggs	Fry ponded	Subyearlings released	Yearlings	
					marked	released
1990	1,103,745	1,011,998	958,241	224,439	694,388	689,601
1991	906,411	828,514	807,685	-0-	765,207	760,018
1992	901,232	855,577	835,171	206,775	611,107	603,050
1993	400,490	363,129	352,574	-0-	349,805	349,024
1994	583,871	553,189	542,461	25,858	536,867	521,822
1995 ^a	1,056,700	1,022,700	959,773	28,855	817,290	803,491
1996	1,433,862	1,377,202	1,361,577	336,482	904,332	755,183
1997 ^b	1,184,141	1,134,641	1,101,070	60,125	1,039,448	961,669
1998	2,085,155	1,978,704	1,926,605	918,015	926,581	868,179
1999	3,980,455	3,605,482	3,869,707 ^c	--	--	--

^a Includes 83,183 fry up to ponding that were accidentally released.

^b Includes eggs from a coho female mated to a known LFH chinook. These eggs were mixed with other known LFH eggs at picking.

^c After ponding, an overage of fish (264,225) was realized resulting in more fish being ponded than eyed.

A red elastomer was placed behind the left eye of fish that were to be released into the Snake River at LFH. The 1997 brood fish were reared in raceways until marking in September and October 1998. As the fish were marked they were placed into Lake 2, a 18,900 cubic meter earthen pond previously used for rearing steelhead.

A green elastomer was placed behind the right eye of fish for acclimation and release at Pittsburg Landing. Pittsburg Landing acclimation site is located on the Idaho shore in the Hells Canyon portion (Rk 346) of the Snake River. WDFW reared these fish in raceways at LFH until transfer. On March 1-2, 1999, WDFW transferred 145,364 yearlings (11.5 fish per pound [fpp]) to the Nez Perce Tribe (NPT).

After transfer, the fish were acclimated in 6.1 meter diameter aluminum ponds at Pittsburg Landing until release.

A green elastomer was placed behind the left eye of fish for acclimation and release at Big Canyon. Big Canyon acclimation site is located on the Clearwater River (Rk 57) in Idaho. WDFW reared these fish in raceways at LFH until transfer. On March 1-4, 1999, WDFW transferred 155,193 yearlings (11.6 fpp) to the NPT. An additional 77,148 yearlings (10.6 fpp) to be used in a second release were transferred to NPT on April 13-15. After transfer, the fish were acclimated in 6.1 meter diameter aluminum ponds at Big Canyon until release.

A blue elastomer was placed behind the left eye of fish for acclimation and release at Captain John. Captain John acclimation site is located on the Washington shore of the Snake River near Captain John Rapids (Rk 263). WDFW reared these fish in raceways at LFH until transfer. On March 3, 1999, WDFW transferred 157,510 yearlings (11.9 fpp) to the NPT. After transfer, the fish were acclimated in an earthen pond at Captain John until release.

1998 Brood Year

The final estimate of the 1998 egg take was 2,085,155 green eggs from Lyons Ferry origin broodstock (Table 6). Loss to the eyed stage was 5.1 percent, leaving 1,978,704 eyed eggs of Lyons Ferry origin for hatchery production. "Eye up" to ponding loss was estimated to be 2.6 percent. Total number of fry ponded was 1,926,605. Stray or unmarked fall chinook from the 1998 brood produced 435,980 unfertilized eggs. Loss to the eyed stage for strays was 5.0 percent. Klickitat Hatchery received the balance (414,286) of eyed eggs.

Subyearlings

Subyearling salmon to be released at LFH were adipose fin clipped and coded wire tagged in April 1999. These fish were reared in raceways until release from LFH.

Salmon to be released by the NPT at Big Canyon acclimation site as subyearlings were not fin clipped. Only a portion of salmon (201,049 fish) were coded wire tagged in April 1999. These fish were reared in raceways at LFH until transfer. On May 12, WDFW transported 351,562 subyearlings (108.8 fpp) to Big Canyon for acclimation. At transfer, 43.1% (200,049 fish) of the fish had CWTs. After transfer to Big Canyon, the fish were held in 6.1 m diameter aluminum ponds until release.

Salmon to be released by the NPT at Captain John acclimation site as subyearlings were not fin clipped or coded wire tagged. These fish were reared in raceways at LFH until transfer. The transfer of 358,667 subyearlings (108.5 fpp) to Captain John for acclimation occurred May 3, 1999. There was a loss of 35,000 fish during transfer when an uncleaned tank truck being used by the NPT was used. After transfer, the fish were held in an earthen pond at Captain John until release.

351562
358667
710229

(207786

Yearlings

Yearling salmon for on-station and off-station releases were marked with clipped adipose fins, CWTs and elastomer tags from September through October 1999 (Appendix E).

A red elastomer was placed behind the left eye of fish that were to be released into the Snake River at LFH. The fish were reared in raceways until marking. As the fish were marked, they were placed into Lake 2, a 18,900 cubic meter pond, for rearing until release.

A green elastomer was placed behind the right eye of fish for acclimation and release at the Pittsburg Landing site. These fish were reared in raceways at LFH until transfer. WDFW transferred 140,757 fish (12.7 fpp) to Pittsburg Landing on February 29 and March 3, 2000. After transfer, the fish were acclimated in 6.1 m diameter aluminum ponds at Pittsburg Landing until release.

A green elastomer was placed behind the left eye of fish for acclimation and release at the Big Canyon site. These fish were reared in raceways at LFH until transfer. WDFW transferred 136,160 fish (12.4 fpp) to Big Canyon on March 3, 2000. After transfer, the fish were acclimated in 6.1 m diameter aluminum ponds at Big Canyon until release.

A blue elastomer was placed behind the left eye of fish for acclimation and release at the Captain John site. These fish were reared in raceways at LFH until transfer. WDFW transferred 134,861 fish (12.2 fpp) on February 3, 2000. After transfer, the fish were acclimated in an earthen pond at Captain John until release.

1999 Brood Year

The final estimate of the 1999 egg take from Lyons Ferry origin broodstock is provided in Table 6. There were 156,352 green eggs, from LFH origin ELISA positive (low-high values) females, destroyed prior to eye up. Loss to the eyed stage was 5.5 percent (not including the loss from the destroyed eggs). Loss from eye-up to ponding was 179,827 fish. After all fish were ponded and splitting occurred, an overage of 264,225 fish was noticed. The overage could be due to an underestimate of eyed eggs, or an overestimate of loss, or some combination of both. By adding the number of eyed eggs estimated for production, plus the loss from eye-up to ponding, plus the overage, the estimate of the number of LFH origin fry ponded was 3,689,880 fish. Stray or unmarked fall chinook from the 1999 brood produced 687,812 unfertilized eggs. All stray eggs were fertilized then shipped to Klickitat FH.

Disease Incidence and Prophylaxis

Broodstock

The 1998 and 1999 broodstocks were injected at capture with Erythromycin 200 (20 mg/kg of fish), and again every 30 days to reduce infection levels of *Renibacterium salmonarum* (causative agent of Bacterial Kidney Disease [BKD]). While at LFH, salmon were treated with a formalin flush (167 ppm) every other day as prophylaxis for *Saprolegnia sp.* (Fungus).

All females were examined for BKD using the enzyme linked immunosorbent assay [ELISA] technique. In 1998, only five females (0.7%) had high ELISA values (>0.45 optical density, [OD]) and two females (0.3%) had moderate ELISA values (0.2 - 0.45 OD). In 1999, nineteen females (1.2%) had high ELISA values and nine females (0.6%) had moderate ELISA values. Results from most females were low (0.11 - 0.199 OD) or below low levels (< 0.11OD) in both brood years.

A sample of sixty female broodstock to detect viral pathogens occurred each year on November 7, 1998 and November 16, 1999. No viral pathogens were detected either year from the samples.

Eggs

Eggs from the 1998 and 1999 broodstocks were initially disinfected and water hardened for one hour in iodophor (1:100; 100 ppm). During incubation, formalin (1:600; 1,667 ppm) was added every other day for 15 minutes to control fungus on the eggs.

In December 1999, eggs from fifty-six LFH origin females with high, moderate, and low ELISA values were destroyed to prevent the spread of BKD.

Juveniles

1997 Brood Year

The 1997 brood year were diagnosed with BKD in June, 1998. Fish documented as having BKD were treated with Aquamycin 100 (erythromycin) once a day, administered in feed. The fish were fed at a rate of 100mg/kg of fish per day, for 28 days beginning in June. BKD was confirmed again in December, and a second cycle of Aquamycin 100 treatments began. Mortality decreased following treatment and remained low at release.

1998 Brood Year

Bacterial gill disease was observed in the 1998 brood year fall chinook in March, 1999. The fish were treated with 1.0 ppm potassium permanganate in a flow through treatment administered on three consecutive days.

In August 1999, BKD was diagnosed in the fingerlings. Following marking, all fish were treated with Aquamycin 100 (fed at 100 mg/kg of fish) once a day for 28 days. Mortality from the disease continued throughout the rearing cycle.

1999 Brood Year

Bacterial gill disease was observed in the 1999 brood year fall chinook in March and April, 2000. Fish were treated with potassium permanganate in a flow through treatment on three consecutive days. The treatment regimen was 0.5 ppm on day one, 1.0 ppm on day two, and 1.5 ppm on day three.

BKD was diagnosed near the end of April 2000 in fall chinook slated for yearling production. Aquamycin 100 was prescribed and administered in feed at a rate of 100mg/kg of fish per day for 28 days in May.

Juvenile Releases and Migration

The current fall chinook production goal for LFH, which began with the 1995 brood, is 900,000 fish for release as yearlings. Half of the yearlings are to be released on-station; the other half are to be released from acclimation sites upstream of LGR Dam. If the number of eggs available is insufficient to meet the goal, the first priority is to produce 450,000 yearlings for release at LFH.

Any production beyond the full yearling program is to be reared for release as subyearlings. Subyearlings may be released either above LGR Dam, or at LFH. WDFW continues, however, to emphasize yearling releases as a means to increase the number of adult salmon returning to the Snake River. Nonetheless, we wish to evaluate subyearling releases (size and time of release experiments) and also compare them with yearling releases in an attempt to improve subyearling survival and maintain natural age and sex composition of adult returns.

1997 Brood Year

Yearling Release

The 1997 brood yearlings were released from LFH and three NPT acclimation facilities above LGR Dam: Big Canyon, Pittsburg Landing, and Captain John. Snake River Lab staff assisted NPT with PIT tagging at Pittsburg Landing and Captain John acclimation sites in 1999. There was also a second release of yearlings at the Big Canyon facility. Prior to release, the yearlings were sampled to collect size and condition data as well as to evaluate tag loss. A portion of the fish were PIT tagged to allow collection of PIT tag data throughout the migration corridor in the Snake and Columbia rivers.

The 1997 brood yearlings (432,166 fish; 8.3 fpp) were volitionally released March 25 - April 13, 1999 into the Snake River from Lake 2 at LFH (Appendix E). Mean fork length was 161.8 mm (SD 13.1) and mean weight was 54.5 gm (SD 12.7) or 8.3 fpp. The coefficient of variation (CV) for length was 8.1 %. Fork lengths were taken from a different group of fish than those that had weights taken, so condition factor was not calculated. Elastomer loss was 14.9 %. PIT tagging occurred March 23, 1999 on 983 fish. These fish were placed back into the lake and allowed to volitionally migrate with the rest of the release. PIT tag retention was estimated at 100 percent at time of release.

Sampling of Lyons Ferry fall chinook yearlings (left red elastomer) at juvenile bypass collection facilities at Lower Monumental and McNary Dams, and PIT tag interrogation units at downstream Snake and Columbia River Dams provided passage data (Table 7). An estimated 130,867 left red VI tagged fish (based on sample rate) were collected at Lower Monumental Dam, which represented 30.3 % of the fish released from LFH. By comparison, 323 unique PIT tags were detected at Lower Monumental, which represented 32.9 % of the 983 tagged fish released from LFH. PIT tag interrogation units at all

dams combined detected 526 (53.5%) different PIT tagged fish of the 983 tags released from Lyons Ferry⁴.

The passage data derived from sampling VI tagged fish at Lower Monumental and McNary dams were similar to PIT tag passage data at those dams⁵.

Table 7. Passage data for on-station release (March 25-April 13) of Lyons Ferry Hatchery yearling (97 BY) fall chinook at Snake and Columbia River dams, 1999.

Tag type - group no.	No. Sampled / Detected	Mean Travel Days ^a	Peak Passage Date ^b	Passage Date Range 1999	Passage Dates		
					10%	90%	
Lower Monumental Dam							
Left Red VI tag	6,422	-	April 15	April 2-July 17	April 11	May 2	
PIT - 1	323	4	April 14	April 4-May 26	April 14	April 30	
McNary Dam							
Left Red VI tag	1,498	-	April 22	April 1-June 12	April 14	May 3	
PIT - 1	187	10	April 22	April 4-May 25	April 18	May 8	
John Day Dam							
PIT - 1	145	15	April 25	April 15-May 26	April 22	May 13	
Bonneville Dam							
PIT - 1	58	17	May 4	April 24 - May 20	April 26	May 14	

^a Mean Travel Days calculated using median day of release, April 3, 1999. These fish were PIT tagged prior to migration from Lake 2 and, therefore, were part of the volitionally released production group released April 1-13, 1999.

^b Peak passage date refers to the first peak documented.

The NPT released 529,503 fall chinook yearlings (97 brood) in March and April 1999 from acclimation facilities upstream of LGR Dam (Appendix E). Information regarding migration will be covered by NPT in an upcoming tribal report (Steve Rocklage personal communication).

At Pittsburg Landing, 142,885 yearlings were released from April 12 - 15. Mean fork length was 163.7 mm (SD 18.1) and mean weight was 45.2 gm (SD 14.2) or 10.0 fpp. The CV for length was 11.1 % and the condition factor was 1.0. Elastomer loss was 17.2%. PIT tagging occurred April 5-8, 1999 on 9,943 fish.

At Big Canyon, 153,222 yearlings were released from April 12 - 15. Mean fork length was 158.5 mm (SD 16.9) and mean weight was 43.7 gm (SD 13.2) or 10.4 fpp. The CV for length was 10.7 % and the condition factor was 1.1. Elastomer loss was 11.2%. PIT tagging occurred April 5-8, 1999 on 9,659 fish. A second release of 76,386 fish occurred April 26-28 at Big Canyon. Mean fork length was 149.5 mm (SD 21.1) and mean weight was 40.7 gm (SD 15.9) or 11.1 fpp. The CV for length was 14.1 % and

⁴ Numbers of detections presented in Table 7 include multiple detections of the same tag as a fish migrated downstream.

⁵ Peak passage dates for VI tagged salmon were based on passage indices for each dam. A passage index is calculated by assuming a 100 percent collection efficiency at the turbine intake diversion screens, and by adjusting based on the proportion of river flow that is spilled at a dam.

the condition factor was 1.2. Elastomer loss was 2.4%. PIT tagging occurred April 1, 1999 on 2,523 fish.

The Captain John release (March 25 - April 14) totaled 157,010 yearlings. Mean fork length was 147.4 mm (SD 17.7) and mean weight was 38.4 gm (SD 13.7) or 11.8 fpp. The CV for length was 12.0 % and the condition factor was 1.2. Elastomer loss was 18.9%. PIT tagging occurred March 23, 1999 on 2,493 yearlings.

1998 Brood Year

Subyearling Release

The 1998 brood subyearlings were released from LFH and two NPT acclimation facilities above LGR Dam in 1999; Big Canyon and Captain John. Prior to release, the subyearlings were sampled to collect size and condition data as well as to evaluate tag loss. A portion of the fish were PIT tagged to allow collection of migration data through the Snake and Columbia rivers.

The 1998 brood subyearlings (204,194 fish) were released from LFH on June 15, 1999. Mean fork length was 90.2 mm (SD 9.6) and mean weight was 9.1 gm (SD 2.9) or 50.1 fpp. The CV for length was 10.6 %. Condition factor was 1.2. Included in the release were 1,566 fish that were PIT tagged June 10, 1999. PIT tag retention was estimated at 100 % at time of release on June 15, 1999.

PIT tag interrogation units at downstream Snake and Columbia River dams provided passage data for Lyons Ferry subyearling fall chinook (Table 8). There were 506 unique PIT tags detected at Lower Monumental, which represented 32.3 % of the PIT tagged fish released from LFH. PIT tag interrogation units at all dams combined detected 662 (42.3 %) different PIT tagged fish of the 1,566 released from LFH⁶.

Table 8. Passage data for on-station release (June 15) of Lyons Ferry Hatchery subyearling (98 BY) fall chinook at Snake and Columbia River dams, 1999.

Tag type/group	No. Sampled/ Detected	Mean Travel Days	Peak Passage Date ^a	Passage Date Range 1999	Passage Dates	
					10%	90%
Lower Monumental Dam						
PIT - 1	506	32	July 19	June 16 - Sept 1	June 16	Aug 4
McNary Dam						
PIT - 1	174	39	July 20	June 20 - Sept 27	July 3	Aug 21
John Day Dam						
PIT - 1	98	35	July 23	June 22 - Sept 10	June 28	Aug 15
Bonneville Dam						
PIT - 1	50	35	July 25	June 25 - Aug 30	July 2	Aug 4

^a Peak passage date refers to the first peak documented.

⁶ Numbers of detections in Table 8 include multiple detections of the same tag as a fish migrates downstream.

The NPT released 670,033 fall chinook subyearlings (1998 brood) in May and June 1999 from acclimation facilities upstream of LGR Dam (Appendix E). Information regarding migration will be covered by NPT in an upcoming tribal report (Bill Arnsberg personal communication).

At the Captain John site, 322,928 subyearling fall chinook were released from May 30 through June 5. Mean fork length was 82.1 mm (SD 6.6) and mean weight was 5.5 gm (SD 1.3) or 82.2 fpp. The CV for length was 8.1 % and the condition factor was 1.0. Included in the release were 2,046 fish that were PIT tagged in May, 1999.

At the Big Canyon site, 347,105 subyearling fall chinook were released from June 2 through 3. Mean fork length was 80.9 mm (SD 7.5) and mean weight was 5.4 gm (SD 1.7) or 83.8 fpp. The CV for length was 9.3 % and the condition factor was 1.0. Included in the release were 1,997 fish that were PIT tagged in May, 1999.

Yearling Release

The 1998 brood yearlings were released from LFH and three NPT acclimation facilities above LGR Dam: Big Canyon, Pittsburg Landing, and Captain John. Prior to release, the yearlings were sampled to collect size and condition data as well as to evaluate tag loss. Samples were also collected by NPT and USFWS for smoltification index (organosomatic index and ATPase levels) and will be presented in an upcoming report by WDFW. A portion of the fish were tagged with PIT tags to allow collection of migration data through the Snake and Columbia rivers.

At LFH, 456,401 yearlings were volitionally released March 24 - April 14, 2000, from Lake 2. Mean fork length was 166.4 mm (SD 14.5) and mean weight was 49.2 gm (SD 13.2) or 9.2 fpp. The CV for length was 8.7 %. Condition factor was 1.1. These fish were marked with a red elastomer tag behind the left eye. Elastomer loss was estimated at 10.6 %. Data and analyses of ATPase results will be included in a subsequent report. PIT tagging occurred March 31 and April 11 when 491 and 495 fish respectively were tagged. PIT tag retention was estimated at 100 % at time of release on March 31 and April 11. Passage and travel times of 98 brood yearlings released on-station will be included in the next evaluation report.

The NPT released a total of 397,339 fall chinook yearlings (1998 brood) in April 2000 from acclimation facilities upstream of LGR Dam (Appendix E). Information regarding migration will be covered by NPT in an upcoming tribal report (Steve Rocklage personal communication).

At Captain John, 131,324 yearling fall chinook were released from April 1 - 12, 2000. Mean fork length was 172.9 mm (SD 17.5) and mean weight was 55.3 gm (SD 15.5) or 8.2 fpp. The CV for length was 10.1% and the condition factor was 1.1. These fish were marked with a blue elastomer tag behind the left eye. Elastomer loss was estimated at 13.1%. Included in the release are 2,489 fish that were PIT tagged on April 7, 2000. Snake River Lab staff assisted NPT with PIT tagging at Captain John in 2000.

At Big Canyon, 131,306 yearling fall chinook were released from April 11 - 13, 2000. Mean fork length was 157.5 mm (SD 18.7) and mean weight was 43.1 gm (SD 15.0) or 10.5 fpp. The CV for length was 11.9 % and the condition factor was 1.1. These fish were marked with a green elastomer tag behind the

left eye. Elastomer loss was estimated at 12.4 %. Included in the release are 7,424 fish that were PIT tagged April 4 - 6, 2000.

At Pittsburg Landing, 134,709 yearling fall chinook were released from April 11 - 13, 2000. Mean fork length was 165.0 mm (SD 16.9) and mean weight was 47.2 gm (SD 14.2) or 9.6 fpp. The CV for length was 10.2 % and the condition factor was 1.1. These fish were marked with a green elastomer tag behind the right eye. Elastomer loss was estimated at 16.8 %. Included in the release are 7,477 fish that were PIT tagged April 4 - 6, 2000.

Survival Rates

We used the estimated number of eggs and fish present at life stages in the hatchery for 1990-1999 broods (Table 6) to estimate survival rates within the hatchery environment (Table 9). Smolt – adult survivals for recent broods are generally incomplete at this time, but will be included in the next report. However, we have documented that fall chinook smolt – adult survival rates from LFH are several times higher for yearling releases than for subyearling releases (Bugert et al. 1997).

Table 9. Estimated survivals (%) between various life stages at Lyons Ferry Hatchery for fall chinook of Lyons Ferry origin, 1990-1998 brood years.

Brood year	Release Stage	Green egg – Poned fry	Poned fry – release	Green egg – release
1990	yearling	86.8 ^a	94.5	82.1
	subyearling	86.8 ^a	98.0	85.1
1991	yearling	89.1 ^a	94.1	83.8
	subyearling	92.7	96.5	89.5
1992	yearling	92.7	98.4	91.2
	subyearling	88.0 ^a	99.0	87.1
1993	yearling	92.7	99.3	92.1
1994 ^b	yearling	90.8	94.8	86.1
	subyearling	90.8	99.0	89.9
1996	yearling	95.0	76.6	72.8
	subyearling	95.0	89.5	85.0
1997	yearling	93.0	92.5	86.0
	subyearling	93.0	97.6	90.8
1998	yearling	92.4	94.8	87.6
	subyearling	92.4	95.1	87.9
yearling mean: %		91.1	93.6	85.2
SD		2.7	6.7	5.5
subyearling mean: %		91.8	96.3	88.3
SD		2.8	3.6	2.8

uses Avg of (85.2)
Avg (88.3)

^a Based on back calculation to estimate green eggs taken.
^b Estimated after partitioning loss in that raceway for subyearlings (33,459 eggs), yearlings, and escaped fry (83,183). Survivals for accidentally released fry are not included.

Stock Profile Evaluation

Lyons Ferry origin fall chinook returns continue to be dominated by younger age classes. Since 1991, age 2 and age 3 fish together have made up on average 50 percent or more of a year's return (Table 10). Females dominate the older age classes of returning Lyons Ferry origin salmon. Few males return at age 5 or older. Age 3 and 4 males tend to be smaller than females of the same age, and adults returning from subyearling releases tend to be larger than adults from yearling releases (Appendix F). The sex ratio of Lyons Ferry origin fish processed at LFH over the last six years averaged 1.6 males/female (Table 11). Including jacks with males, the sex ratio averages 3.4 fish/female.

Table 10. Mean percentages of Lyons Ferry origin salmon returning from 1991-1999 by age and sex. Included are transported and volunteer fish processed at Lyons Ferry Hatchery. For numbers of fish returning per year, see Wargo et al. 1999.

Sex	Age						Total
	2	3	4	5	6	7	
<u>Means of Percentages</u>							
Male	26.8	24.9	13.2	4.1	0.3	0.0	69.4
(SD)	(17.4)	(12.4)	(7.1)	(2.7)	(0.3)	(0.0)	
Female	0.0	2.6	19.9	7.8	0.4	0.0	30.6
(SD)	(0.0)	(2.4)	(10.0)	(4.7)	(0.5)	(0.0)	
Sum%	26.8	27.5	33.1	11.9	0.7	0.0	100.0

Table 11. Sex ratios for Lyons Ferry origin salmon processed at LFH in 1994-99. Fish from acclimation sites are included.

Return Year	LFH ladder		LGR trucked ^a		Total processed	
	M/F	J+M/F	M/F	J+M/F	M/F	J+M/F
1994	2.3	4.6	1.1	4.1	2.1	4.5
1995	1.6	9.2	1.6	3.2	1.6	6.8
1996	1.4	2.8	0.8	1.0	1.2	2.2
1997	1.3	3.1	0.7	1.5	1.1	2.4
1998	2.2	2.8	2.3	3.3	2.3	3.0
1999	1.2	1.8	0.9	1.3	1.1	1.6
mean	1.7	4.1	1.2	2.4	1.6	3.4
(std)	(0.47)	(2.68)	(0.61)	(1.29)	(.53)	(1.93)
range	1.2-2.3	1.8-9.2	0.7-2.3	1.0-4.1	1.1-2.3	1.6-6.8

^a Sex ratio only applies to those fish hauled to LFH. The sex ratio of fish returning to LGR Dam is different because a portion of Lyons Ferry origin fish are passed upstream, and others are not marked or trackable.

1998

The 1998 return was comprised primarily of males (75.1%). Jacks (age-2) accounted for 6.5 percent, age 3 males were 55.3 percent, and age 4 males were 9.0 percent of returning fish (Table 12). Males of other ages, mainly age 5, accounted for 4.3 percent of the return. As a single age/sex class, age 3 males were most numerous, representing 55.3 % of the return in 1998. Females were composed primarily of age 5 fish (10.9% of the run) and age 4 fish (9.4% of the run). Females of other ages, mainly age 3, accounted for 4.6 percent of the return. Lyons Ferry origin fish tended to be smaller than stray salmon (Figures 2 and 3). Overall, strays were older aged with fewer jacks. The sex ratio of Lyons Ferry origin males at processing was the highest since 1994 (Table 11). The sex ratio including jacks with males was similar to the six year average.

Table 12. Age and sex of Lyons Ferry origin salmon processed at Lyons Ferry Hatchery, 1998 and 1999. Jacks are included with males.

Year / Sex	Age						Total
	2	3	4	5	6	7	
1998							
Male	207	1,775	290	136	2	0	2,410
Female	1	143	300	351	3	0	798
Percent	6.5	59.8	18.4	15.2	0.2	0	3,208
1999							
Male	383	542	571	43	11	0	1,550
Female	0	59	745	96	27	0	927
Percent	15.5	24.3	53.1	5.6	1.5	0	2,477

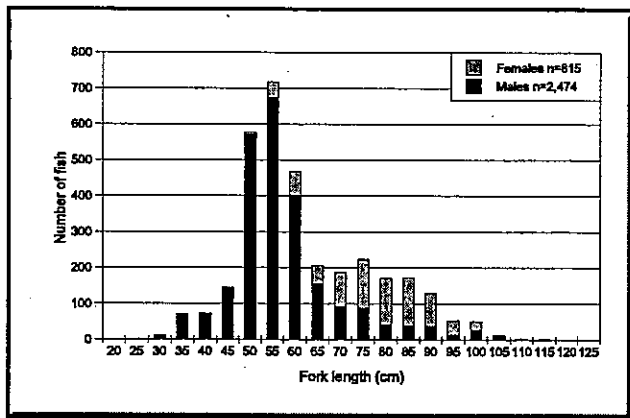


Figure 2. Length frequencies of known Lyons Ferry origin fish, 1998.

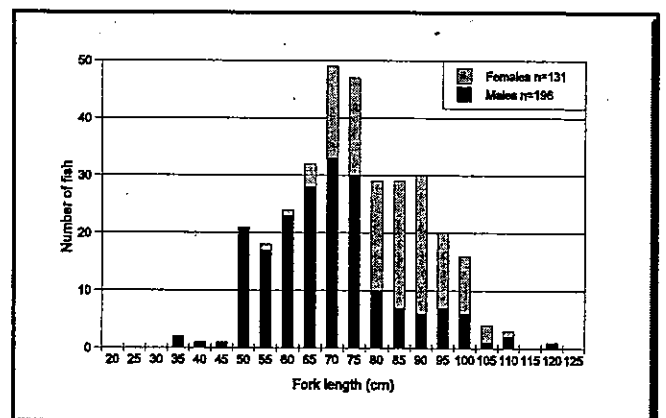


Figure 3. Length frequencies of stray fish, 1998.

1999

The 1999 return was also comprised primarily (62.6%) of males (Table 12). As a single age/sex class, age 4 females were most numerous, representing 30.1 percent of the entire return in 1999. Females of other ages, mainly age 5, accounted for 7.3 percent of the return. Lyons Ferry origin fish tended to be smaller than stray salmon (Figures 4 and 5). Overall, strays were older aged with fewer jacks. The sex ratio of Lyons Ferry origin males at processing was similar to the six year average (Table 11). The sex ratio including jacks with males was the lowest since 1994.

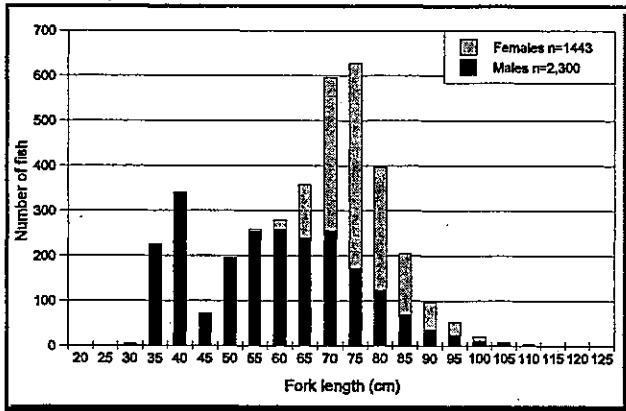


Figure 4. Length frequencies of known Lyons Ferry origin fish, 1999.

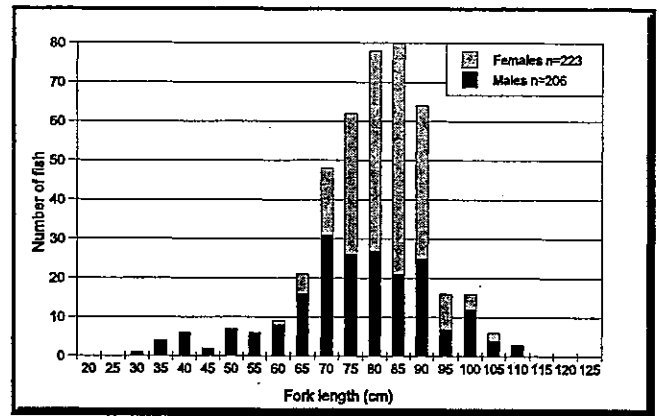


Figure 5. Length frequencies of stray fish, 1999.

Natural Production

1998

The Tucannon River was surveyed by WDFW personnel weekly from October 19 to November 30, 1998. Surveys generally covered the river from Rk 1.3 to Rk 28.0 (Table 13). The first 1.3 kilometers of the Tucannon River are deep slack water from the Snake River's reservoir between Lower Monumental and Little Goose dams. The habitat is poor in this area and we assume no spawning occurs there. Also, due to restricted access, we were unable to survey 1.1 kilometers of river below Fletcher's Dam (Rk 9.6) and 5.0 kilometers of the survey section above the dam. Through most of the spawning season, survey conditions were good. However, during the last two weeks survey conditions deteriorated.

Landmark	River kilometer	Landmark	River kilometer
Highway 261 Bridge	2.7	Kessel's Bridge	17.7
Tucannon smolt trap	3.0	Krouse's Bridge	20.1
Power's Bridge	3.7	Highway 12 Bridge	22.0
Starbuck Bridge	7.1	Enrich Bridge	28.0
Fletcher's Dam	9.6	King Grade	34.1
Smith Hollow Bridge	12.7		

The total estimated escapement to the Tucannon River in 1998 was 120 fall chinook (Table 14). Forty redds, 51 live salmon and 14 carcasses were observed during spawning surveys (Table 15). Spawning density was 8.5 redds/mile (5.3 redds/km) downstream of Fletcher's Dam. Only two of the forty redds observed were located upstream of Fletcher's Dam.

The fourteen carcasses recovered in 1998 included six unmarked, and eight hatchery origin fish. All of the carcasses were found below Fletcher's Dam. Results from scale samples indicate that all of the unmarked fish were five year old wild fish. One of the unmarked fish was a reservoir reared outmigrant. Snouts were collected on all hatchery fish. Based on CWTs, seven of the carcasses originated from yearling on-station releases at Lyons Ferry Hatchery. The eighth carcass was determined to be from the Umatilla Hatchery based on an RV clip.

Table 14. Number of redds and estimated escapement to the Tucannon River, and redd densities below Fletcher's Dam, 1985-1999.

Year	Tucannon River		Redds below Fletcher's Dam			
	Total redds	Estimated escapement ^a	Total	(%)	Redds/km	Redds/mile
1985	0	0	0	(100)	0	0
1986	0	0	0	(100)	0	0
1987	16	48	16	(100)	1.9	3.1
1988	26	78	26	(100)	3.1	5.0
1989	48	144	48	(100)	5.8	9.3
1990	61	183	61	(100)	7.3	11.8
1991	50	150	50 ^b	(100)	6.0	9.7
1992 ^c	23	69	21	(91)	2.5	4.1
1993	28	84	21	(75)	2.5	4.1
1994	25	75	25	(100)	3.0	4.8
1995	29	87	28 ^d	(97)	3.4	5.4
1996 ^e	43	129	31	(72)	4.3	6.9
1997	27	81	24	(89)	3.3	5.4
1998 ^f	40	120	38	(95)	5.3	8.5
1999	21	63	18 ^d	(86)	2.5	4.0

^a This estimate was derived using three fish per redd.

^b We observed several other redds during the last survey that were not counted because of high turbidity and uncertainty whether they had been counted before. Thus, this should be considered a minimum estimate.

^c Fletcher's Dam, identified as a passage barrier, underwent modification to improve fish passage in 1992 (Mendel et al. 1994).

^d We were unable to survey after the peak of spawning because of high water and turbidity. This should be considered an incomplete estimate.

^e Beginning in 1996, the river surveyed area below Fletcher's Dam decreased by 1.1 km because of landowner restrictions.

^f Beginning in 1998, and additional 5 km of river was not surveyed above Fletcher's Dam because of landowner restrictions.

Table 15. Date, location surveyed, number of redds, and fall chinook carcasses found during spawning surveys on the Tucannon River in 1998.

Survey date	River Kilometer	Redds	Live fish	Carcasses	
				Females	Males
10-19	34.1 - 9.6	0	0	0	0
	9.6 - 1.3	1	1	0	0
10-27	18.0 - 9.6	0	0	0	0
	9.6 - 7.1	0	0	1	0
	7.1 - 1.3	0	0	0	0
11-02	22.2 - 17.7	0	0	0	0
	17.7 - 12.7	0	0	0	0
	12.7 - 9.6	1	1	0	0
	9.6 - 7.1	0	0	0	0
	7.1 - 3.7	2	0	0	0
	3.7 - 1.3	0	0	0	0
11-09	12.7 - 9.6	0	2	0	0
	9.6 - 7.1	0	0	0	0
	7.1 - 3.7	3	0	1	0
	3.7 - 1.3	3	3	1	1
11-16 & 19	18.0 - 12.7	0	0	0	0
	12.7 - 9.6	0	0	0	0
	9.6 - 7.1	1	1	0	0
	7.1 - 3.7	9	15	1	2
	3.7 - 1.3	10	20	2	2
11-23	18.0 - 12.7	0	0	0	0
	12.7 - 9.6	1	0	0	0
	9.6 - 7.1	0	1	0	0
	7.1 - 3.7	2	6	0	0
	3.7 - 1.3	1	0	0	0
11-30	7.1 - 3.7	3	1	1	0
	3.7 - 1.3	3	0	1	0
12-17 ^a	3.0	-	-	1	0

^a Carcass caught in smolt trap.

1999

The Tucannon River was surveyed by WDFW personnel weekly from October 25 to November 22, 1999. The sections of river surveyed and associated restricted access areas were the same as in 1998. Survey conditions were good through November 22. High flows and low visibility precluded further surveys, therefore, redd and carcass counts should be considered minimums.

The total estimated escapement to the Tucannon River in 1999 was 63 fall chinook (Table 14). Twenty-one redds, 34 live salmon and 11 fall chinook carcasses were observed during spawning surveys (Table 16). Spawning density was 4.0 redds/mile (2.5 redds/km) downstream of Fletcher's Dam. Only three of the twenty-one redds observed were located upstream of Fletcher's Dam.

Table 16. Date, location surveyed, number of redds, and fall chinook carcasses found during spawning surveys on the Tucannon River in 1999.

Survey date	River kilometer	Redds	Live fish	Carcasses	
				Females	Males
10 - 22 ^a	17.8	-	0	0	1
10-25	18.0 - 12.7	0	0	0	0
	12.7 - 9.6	1	1	0	0
	9.6 - 7.1	1	0	0	0
	7.1 - 1.3	0	0	0	0
11-01	25.4 - 9.6	0	0	0	0
	9.6 - 1.3	0	0	0	0
11-08	18.0 - 12.7	0	0	0	0
	12.7 - 9.6	2	0	0	0
	9.6 - 7.1	0	0	0	0
	7.1 - 3.7	1	1	0	0
	3.7 - 1.3	2	3	0	0
11-15	18.0 - 9.6	0	0	0	0
	9.6 - 7.1	4	1	0	0
	7.1 - 3.7	3	8	0	1
	3.7 - 1.3	2	14	1	1
11-22	18.0 - 9.6	0	0	0	0
	9.6 - 7.1	0	0	1	0
	7.1 - 3.7	2	3	3	1
	3.7 - 1.3	3	3	0	1
12 - 30	4.5 - 2.7	0	0	0	1

^a Carcass recovered at temporary steelhead trap.

The eleven carcasses recovered in 1999 included four unmarked, and seven hatchery origin fish. All but one of the carcasses were found below Fletcher's Dam. Unmarked fish consisted of a two year old wild jack, a five year old wild female, and two hatchery origin females based on scale samples. Snouts collected on six of the hatchery fish revealed that all originated from yearling on-station releases at Lyons Ferry Hatchery. The seventh carcass was determined to be from the Umatilla Hatchery based on an RV clip.

The WDFW no longer participates in cooperative spawning surveys upstream of LGR Dam. Personnel from Idaho Power and the USFWS jointly survey spawning grounds in the upper Snake, Grande Ronde, and Imnaha Rivers (Garcia et al. 2000). Personnel from the NPT conduct spawning surveys in the Clearwater and Salmon rivers (Bill Arnsberg, personal communication). Spawning surveys in the tail races below the four dams on the Snake River have not occurred since 1997 (Dauble et al. 1999).

Summary of Fall Chinook Run Size and Composition

Return to Ice Harbor (IHR) Dam

1998

An estimated 7,776 fall chinook passed IHR Dam in 1998. Of those, 2,047 (26.3%) fish voluntarily returned to LFH; 3,911 (50.3%) escaped to LGR Dam and an estimated 120 (1.5%) spawned naturally in the Tucannon River. The remaining 1,698 (21.8%) fall chinook were not accounted for. This is less than the 27-56 % estimated losses above IHR in 1992-1997⁷.

1999

In 1999, an estimated 10,107 fall chinook passed IHR Dam. Of those, 2,201 (21.8%) fish voluntarily returned to LFH, 5,237 (51.8%) escaped to LGR Dam and 63 (0.6%) spawned naturally in the Tucannon River. The remaining 2,606 (25.8%) fall chinook were not accounted for. This result is slightly less than the 27-56 % estimated losses above IHR 1992-1997, but more than in 1998.

Return to Lyons Ferry Fish Hatchery (LFH)

1998

Voluntary returns to LFH numbered 2,047 fish, representing 26.3 % of the estimated escapement over IHR Dam. This was similar to 1997, but less than 1996 when 25.8 % and 30.7 %, respectively, of the return above IHR voluntarily entered the hatchery. We have only been able to estimate the percent escapement to LFH from IHR Dam since 1993. In 1993 trapping ceased at IHR Dam. Prior to 1994, we were unable to estimate what percentage of the fish trapped at IHR and hauled to LFH would have volunteered into LFH if they had not been trapped.

Of the 2,047 fish processed as volunteers into LFH, 1,915 fish (93.6%) were LF origin (Appendix C). The majority of LF origin returns (1,862 fish; 97.2%), came from on-station releases at LFH. Only 33 of the fish (1.6%) processed were strays from other hatcheries. The majority of strays processed came from Umatilla Hatchery (69.7%, 6 fish with CWTs and 17 fish with BWTs or ventral fin clips). Strays also included five fish from NMFS research/Asotin, two from Tanner Creek, one from Klickitat FH, one spring chinook from the Tucannon, and one fish from the Clearwater River (based on CWT recoveries). There were 16 fish processed that were of unknown hatchery origin. There were also 83 unmarked fish processed. Twenty six of these fish were scale sampled. Results indicated 23 fish were of natural

7 Salmon "loss" is the difference between the total count at IHR Dam and the sum of counts (or estimates) at various locations to LGR. Possible disposition of missing fish includes fall back at IHR Dam (Mendel et al. 1993), mortality, or spawning in tributaries or tailraces of the lower Snake River dams.

origin, 2 were hatchery origin, and 1 fish had unreadable scales. We were unable to determine origin of the remaining 57 unmarked fish. These fish could be unmarked hatchery fish from LFH or any other hatchery, or they could be of natural origin.

1999

Voluntary returns to LFH numbered 2,201 fish, representing 21.8 percent of the estimated escapement over IHR Dam. This was the smallest percentage estimated to have voluntarily entered the hatchery since trapping and hauling fish from IHR ceased in 1993.

Of the 2,250 fish processed as volunteers into LFH, 49 were probably LGR fish but we were unable to determine which fish they were. Therefore, return composition will be based on 2,250 fish processed. Of the 2,250 fish processed as volunteers, 2,064 fish (91.7%) were LF origin (Appendix D). The majority of LF origin returns, 2,014 fish (97.6%) came from on station releases at LFH. Only 73 of the fish (3.2%) processed were strays from other hatcheries. The majority of strays processed came from Umatilla Hatchery (95.9%, 17 fish with CWTs and 53 fish with ventral fin clips or BWTs). Strays also included one fish from Tanner Creek, one from Klickitat FH, and one fish from Lake Oroville (California). There were 18 fish processed that were of unknown hatchery origin. Also, there were 95 unmarked fish processed. Scale samples were collected from 75 of these fish. Results indicated 61 were of natural origin, 1 was of hatchery origin, and 13 had unreadable scales. We were unable to determine origin for the remaining 20 unmarked fish. These fish could be unmarked hatchery fish from LFH or another hatchery, or they could be of natural origin.

Return to Lower Granite Dam and Composition of Fish Hauled to LFH from Lower Granite Dam

In recent years, WDFW has estimated the Snake River fall chinook run composition, in part, using CWTs and BWTs from marked hatchery salmon collected at LGR Dam and spawned at LFH. This report focuses on the final composition of fall chinook processed at LFH that were hauled from Lower Granite Dam. A brief account of escapement to, and above Lower Granite Dam is also provided here. For complete details and discussion regarding escapement to and above Lower Granite Dam, see Mendel (1999 and 2000).

1998

The 1998 count of fall chinook at LGR Dam (August 18 to December 15) was 1,909 adults, 2,002 jacks⁸, and an undetermined number of mini jacks (< 30 cm; U.S. Army Corps of Engineers 1999). This adult count was higher than any other since 1976 (Figure 6). Mendel (1999) estimated the run composition of salmon reaching LGR. An estimated 306 adults and 321 jack salmon were of natural origin. The hatchery run totaled 3,284 fall chinook to LGR; adults and jacks numbered 1,603 and 1,681, ³⁹¹¹ _{627 NAT} _{3284-HAT}

8 Mendel used the same criteria as the dams did for determining adults and jacks (adults measure \geq 53 cm fork length and jacks measure < 53 cm).

respectively. Hatchery origin salmon included 1,266 adults from LFH, 170 adults from Klickitat FH, 117 adults from Umatilla Hatchery, 48 adults from NMFS research groups, one adult from the Yakima River, and one adult from the Columbia River. There were also 1,619 jacks from LFH, 42 jacks from Klickitat FH, and 20 jacks from Umatilla Hatchery in 1998.

A portion of the fall chinook reaching LGR were hauled to LFH. There were 1,567 fish processed at LFH as LGR hauled fish. An additional 5 fish, sacrificed at LGR for tag recoveries, were also included in the following stock composition. Of the 1,572 fish processed, 1,375 fish (87.5%) were LF origin (Appendix C). The majority of LF origin fish processed, 1,113 fish (80.9%), came from on-station releases at LFH. Only 179 fish (11.4%) processed were strays from other hatcheries. The majority of strays processed came from Umatilla Hatchery (68.2%, 23 fish with CWTs and 99 fish with BWTs or ventral clips). Strays also included 23 fish from NMFS research/Asotin, 21 fish from NMFS/Pittsburg, nine from Klickitat, one from the Columbia River near Turtle Rock, one from NMFS research/McNary, one from Ringold, and one fish from the Yakima River. There were 17 fish processed that were of unknown hatchery origin. There was also one unmarked fish processed that was either accidentally hauled from LGR or had jumped from an adjacent pond into the LGR pond. This fish could have been a Ringold spring chinook because it died September 21 and was spawned out.

1999

The 1999 count of fall chinook at LGR Dam (August 18 to December 15) was 3,381 adults, 1,856 jacks, and an undetermined number of mini jacks (< 30 cm; U.S. Army Corps of Engineers 2000). The adult count was higher than all other years since 1976 (Figure 6). Mendel (2000) estimated the number of natural fish reaching LGR as 905 adults and 817 jacks. Hatchery adults and jacks numbered 2,476 and 1,039, respectively. LFH production comprised 55.5% of the hatchery portion of the adult return. Umatilla and Klickitat river releases contributed 8.5% and 0.1%, respectively, of the adult hatchery run. Jack chinook numbered approximately 8,127 natural and 1,038 hatchery origin fish, including 1,035 from LFH. More details regarding CWT codes or fin clips of fish processed at LFH from LGR Dam are provided in Appendix F.

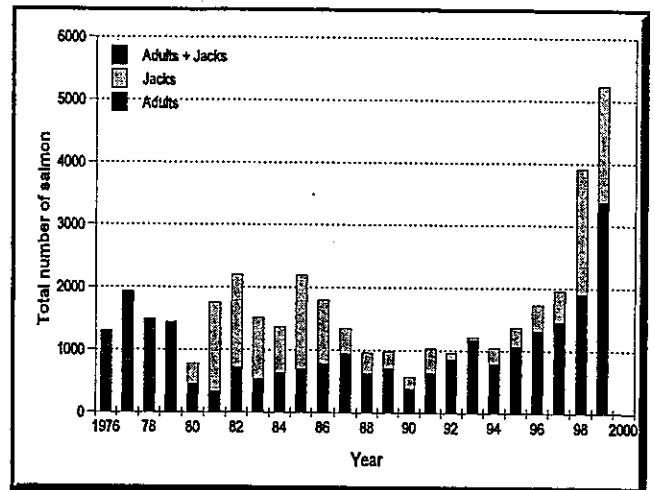


Figure 6. Fall chinook counts at Lower Granite Dam, 1976-99.

There were 1,934 fish processed at LFH as LGR hauled fish. Of the fish processed, 1,689 fish (87.3%) were LF origin (Appendix D). The majority of LF origin fish processed, 1,276 fish (75.5%), came from on-station releases at LFH. Only 206 of the fish (10.7%) processed were strays from other hatcheries. The majority of strays processed came from Umatilla hatchery (76.2%, 36 fish with CWTs and 121 fish with BWTs or ventral clips). Strays also included 24 fish from NMFS research/Asotin, 17 from NMFS research/Pittsburg, two from NMFS research/McNary, two from Yakima River, one from Tanner Creek,

one from Klickitat FH, one from Priest Rapids, and one spring chinook from Sawtooth Hatchery. There were 36 fish processed that were of unknown hatchery origin. There were also three unmarked fish processed that were accidentally hauled from LGR. The unmarked fish were of natural origin based on scale analysis.

Escapement above Lower Granite Dam

1998

Mendel (1999) estimated that escapement, including both natural and hatchery origin fish, above LGR Dam was 962 adult and 1,371 jack fall chinook in 1998. An estimated 304 adult and 316 jack salmon were of natural origin. Hatchery origin salmon included 481 adults from LFH, 162 adults from Klickitat FH, 12 adults from Umatilla Hatchery, and three adults from other hatcheries. There were also 1,012 jacks from LFH, 40 jacks from Klickitat FH, and three jacks from Umatilla Hatchery that escaped above LGR Dam in 1998.

1999

Estimated escapement of salmon past LGR Dam in 1999 was 1,862 adults and 1,392 jacks (Mendel 2000). Estimated escapement of natural origin adult and jack salmon was 905 and 772, respectively. The escapement of hatchery origin chinook consisted of 879 adults from LFH, 48 adults from Umatilla, 25 adults from Yakima late chinook, three adults from NMFS research, two adults from Klickitat Hatchery, and 620 jacks from LFH.

Conclusions and Recommendations

The fall chinook program at LFH is unique in that there are multiple co-managers involved. The program is currently being managed to meet the requests of Tribal, state, and federal agencies. Conclusions and recommendations listed below are not in order of importance.

1. LFH is currently raceway limited due to the raising of subyearling and yearling salmon for production and research purposes. The small groups of fish requested for transfer need to be kept separate, which increases the number of raceways needed.

Recommendation: pursue additional funding to build additional raceways or rearing ponds at LFH.

2. Big Canyon, Pittsburg Landing, and Captain John facilities, all located above LGR, are currently acclimating fish near maximum capacity. There needs to be an additional outlet for the abundance of fish (yearlings and subyearlings) we could produce at LFH in the future. Currently, nothing is known about the effectiveness of a direct stream release of subyearling salmon into the Snake River.

Recommendation: propose a direct stream release of subyearlings paired with the release of subyearlings out of Captain John acclimation facility to compare survival between release strategies.

3. Bacterial Kidney Disease is a problem. In 1999 as a preventative measure, eggs from 56 females with low to high ELISA results were destroyed. The remaining brood of production fish continue to have BKD problems.

Recommendation: look at ways to reduce the incidence of BKD at LFH. For example: ponding schemes, density indexes, transfer times, treatment types, etc.

4. Smolt to adult returns using CWT recovery data have not been assessed in several years.

Recommendation: summarize the adult returns of LFH origin fall chinook beginning with the 1990 brood released at LFH in the next report.

5. The tracking of fall chinook trapped and hauled from LGR Dam continues to be challenging.

Recommendation: derive steps to improve data management and explore new tracking methods.

6. Accurate stock composition of LFH origin fish is difficult due to the large number of fish NPT is releasing that are unmarked. We will be unable to provide accurate status of the natural population or compare it with LFH origin status because of the limited numbers of fish marked by the NPT. Unfortunately, we have not been able to convince the NPT to tag more fish.

7. ATPase and Cortisol samples have been collected at LFH since 1995. This data needs to be compiled and summarized to fully understand its value in release strategies.

Recommendation: Do not take any more ATPase and Cortisol samples until a summary of the existing data has been addressed in an upcoming report in 2001.

Literature Cited

- Bugert, R. and W. Hopley. 1989. The Snake River Fall Chinook Egg Bank Program: the final chapter. Unpublished Report. Washington Department of Fisheries, Olympia, WA.
- Bugert, R. and W. Hopley. 1991. Fall Chinook Salmon Trapping on the Snake River in 1990. Completion Report, Cooperative Agreement 14-16-0001-90524, to the U.S. Fish and Wildlife Service. Washington Department of Fisheries, Olympia, WA.
- Bugert, R., C. Busack, G. Mendel, K. Petersen, D. Marbach, L. Ross, J. Dedloff. 1991. Lower Snake River Compensation Plan Lyons Ferry Fall Chinook Salmon Hatchery Program 1990 Evaluation Report to U.S. Fish and Wildlife Service, AFF 1/LSR-91-15, Cooperative Agreement 14-16-0001-91534. Washington Department of Fisheries, Olympia, WA.
- Bugert, R. M., C.W. Hopley, C. A. Busack, and G. W. Mendel. 1995. Maintenance of stock integrity in Snake River fall chinook salmon. American Fisheries Society Symposium 15:267-276.
- Bugert, R. M., G.W. Mendel, and P. Seidel. 1997. Adult returns of subyearling and yearling fall chinook salmon released from a Snake River hatchery or transported downstream. North American Journal of Fisheries Management 17:638-651.
- Dauble, D. D., R. L. Johnson, A. P. Garcia. 1999. Fall Chinook Salmon Spawning in the Tail races of Lower Snake River Hydroelectric Projects. Transactions of the American Fisheries Society 128:672-679.
- Garcia, A. 2000. Spawning distribution of fall chinook in the Snake River. Annual Report 1999 to United States Department of Energy, Bonneville Power Administration, Portland, OR by the US Fish and Wildlife Service, Idaho Fishery Resource Office, Ahsahka, Idaho. 10 p. & appendices.
- Mendel, G., D. Milks, M. Clizer, and R. Bugert. 1993. Upstream passage and spawning of fall chinook salmon in the Snake River. *In* Blankenship and Mendel, editors. Upstream passage, spawning, and stock identification in the Snake River, 1992. Project 92-046. Annual Report to Bonneville Power Administration, Portland, OR.
- Mendel, G., K. Petersen, R. Bugert, D. Milks, L. Ross, J. Dedloff, and J. Bumgarner. 1994. Lower Snake River Compensation Plan, Lyons Ferry Hatchery Evaluation Program, Fall chinook salmon 1992 annual report. Report # AFF1/LSR-93-09 to U.S. Fish and Wildlife Service, Boise, ID.
- Mendel, G., J. Bumgarner, D. Milks, L. Ross, J. Dedloff. 1995. Lower Snake River Compensation Plan, Lyons Ferry Hatchery Evaluation Program, Fall chinook salmon 1994 annual report. Washington Department of Fish and Wildlife Hatcheries Report # H95-07 to U.S. Fish and Wildlife Service, Boise, ID.

- Mendel G. 1999. Fall chinook run reconstruction at LGR for 1998. Washington Department of Fish and Wildlife.
- Mendel G. 2000. Fall chinook run reconstruction at LGR for 1999. Memo to Cindy LeFleur. Washington Department of Fish and Wildlife.
- U.S. Army Corps of Engineers. 1975. Special Report: Lower Snake River Fish and Wildlife Compensation Plan. Walla Walla, WA.
- U.S. Army Corps of Engineers. 1999. Annual Fish Passage Report, 1998. Columbia River and Snake River Projects for salmon, steelhead and shad. North Pacific Division, Walla Walla, WA.
- U.S. Army Corps of Engineers. 2000. Annual Fish Passage Report, 1999. Columbia River and Snake River Projects for salmon, steelhead and shad, draft. North Pacific Division, Walla Walla, WA.
- Wargo L., D. Milks, and G. Mendel. 1999. Lower Snake River Compensation Plan, Lyons Ferry Hatchery Evaluation Program, Fall chinook salmon 1996 and 1997 annual report. Washington Department of Fish and Wildlife Hatcheries Report # FPA 99-06 to U.S. Fish and Wildlife Service, Boise, ID.
- WDF (Washington Department of Fisheries). 1994. Lower Snake River Compensation Plan, Snake River Hatchery Evaluation Program Five-Year Plan 1994-1998. Washington Department of Fisheries, Olympia, WA.

Appendix A: Lyons Ferry Fall Chinook Broodstock Collection and Spawning Protocol 1998

1998

LGR Trap Operations

The fall chinook salmon passage period at LGR Dam is August 18 to December 15. The NMFS operates an adult trap at the dam. To the extent possible, all wire-tagged or externally marked hatchery chinook salmon (adults, jacks, and mini-jacks) entering the trap from August 18 to November 30 will be collected for transport to LFH. Last year, some of the fish with left red or yellow elastomer/filament tags of LFH origin were allowed to pass upstream. In 1998, all known fall chinook returning from releases at the hatchery (with left red elastomers) will be collected at LGR Dam and returned to Lyons Ferry because of limited broodstock availability. Trapping may continue after November 30 if marked salmon continue to arrive at the dam. Tagged hatchery fall chinook salmon will be collected by NMFS, transported, and subsequently processed by WDFW. Salmon will be trapped and anesthetized to determine marks present. Those hatchery fish to be transported will be tagged with numbered jaw tags and an operculum punch and hauled in a 1,200 L aerated, non-refrigerated tank truck. Some, or all, of the hatchery mini-jacks (≤ 30 cm) and jacks (<49 cm fork length) may be killed when trapped at the dam and frozen for later CWT processing at LFH.

LFH Trapping

Salmon that volunteer to LFH will be transferred to the holding pond every day to reduce stress to fish. Voluntary, and LGR Dam captured returns will be held separately at LFH to document broodstock composition from each capture location. The hatchery will trap salmon from early September until early or mid-December.

Spawning Groups

Salmon will be mated and accounted for in two distinct groups:

1. Marked and unmarked salmon that cannot be confirmed as Lyons Ferry origin will be spawned together as "strays." Unless a fish has a wire tag in the snout (coded-wire tag [CWT] or blank-wire tag [BWT]), or an elastomer tag [VI] behind the left eye, we will assume it is a stray). Salmon identified by CWT, BWT, or fin clip, as not of Lyons Ferry origin will be included in this group. Fertilized eggs or fry from strays or unknown origin fish will be transferred as eggs or fry to Klickitat Fish Hatchery, or elsewhere, for subsequent release outside the Snake River Basin.
2. Salmon with adipose clips and wire tags in the snout will have the CWT extracted and read prior to mixing of the gametes. However, salmon that have elastomer/filament tags behind the eye will be assumed to be of Lyons Ferry origin and their gametes may be used in matings prior to reading the CWT. CWTs would be read later to verify their origins. Salmon known to be of Lyons Ferry origin will be spawned together and kept separate from other groups. Progeny from these matings will be retained at Lyons Ferry for subsequent Snake River releases.

Spawning and Incubation Operations

All adult salmon at LFH will be checked for the presence of wire-tags and external marks. If a large number of jacks are present, at least 25-50 percent will be sampled for CWT recoveries during spawning. Salmon will receive unique numbers early in processing for individual fish identification and accounting.

Small males (jacks) will be used in the spawning population to take advantage of genetic diversity and increase genetic contribution across all age classes. However, these fish will contribute to matings at a lower proportion than they exist in the hatchery population because selectivity of downstream harvest (almost exclusively adults) and adult mortalities at downstream dams artificially inflates the proportion of jacks in Snake River returns. Also, under natural conditions, jacks would usually not be expected to contribute to a high proportion of salmon matings.

Semen from both jack (males <49 cm fork length) and adult males will be used for fertilizing eggs. We intend to take semen from a portion of the jacks each week throughout the spawning season. Our primary interest in the use of jacks is for matings of known Lyons Ferry origin salmon. However, we will ensure jacks are used to some extent in other matings groups as well. The number of Lyons Ferry origin jacks from which semen will be taken during any week will be based on the expected portion of the total females that spawn that week, and the goal of having jacks contribute to 10-25 percent of the known Lyons Ferry origin matings. This jack contribution goal would be reduced if the population in the hatchery consisted of few jacks. Conversely, the jack contribution rate could be increased substantially if few adult males were available. Semen will be collected from jacks without regard to fish size, and collected semen from jacks will be used randomly for matings each week. The jack contribution goal may be difficult to achieve logistically because small males continue to enter the population at the hatchery throughout the spawning season, and the number of females of Lyons Ferry origin that are available may not be known until after some matings are completed each week.

We will use single pair matings, with semen from a back-up male whenever possible, for all salmon spawned. Our goal is to ensure that semen from as many different males (including jacks) is used for matings of known Lyons Ferry origin salmon. We do not anticipate live spawning males in 1997. No male should be used more than twice as the primary male. Fertilized eggs from each female confirmed to be of Lyons Ferry origin will be incubated in individual trays, using chilled water whenever possible (chiller capacity limited to 40 gpm). Fish identification numbers will be attached to each tray of eggs. Eggs from unknown origin females may be pooled (eggs from several females in one incubation tray) within their respective matings groups.

Snake River Lab personnel will assist hatchery personnel with egg picking and counting at "eye up." Eggs from each female will be counted separately to identify number of live and dead eggs (fecundity) per female. A decision will be made later as to whether eggs from several females may be grouped at that time into one tray, or eggs from each female will be kept separately. Eggs or fry from females with moderate or high bacteria kidney disease (BKD) ELISA levels will not be mixed with eggs of below low and low levels. Progeny from high and moderate BKD ELISA females will be ponded together to

prevent the spread of BKD. Progeny with high and moderate BKD ELISA may be incorporated into subyearling releases to prevent holding these fish at the hatchery for an extended period.

Appendix B: Lyons Ferry Fall Chinook Broodstock Collection and Spawning Protocol 1999

1999

LGR Trap Operations

The fall chinook salmon passage period at Lower Granite Dam is 18 August to 15 December. The National Marine Fisheries Service (NMFS) operates the adult trap at the dam, and from 18 August to 30 November, collects hatchery fall chinook for transport by WDFW to Lyons Ferry Hatchery (LFH). Trapping may continue after 30 November if marked salmon continue to arrive at the dam.

Trapped fall chinook will be anesthetized and examined to detect marks present. Adults and jacks with left red elastomer tags will be collected and returned to LFH because production there is broodstock limited (mini-jacks, $\leq 30\text{cm}$, will be passed upstream). Fish that are not marked with elastomer, but that are wire tagged (CWT or blank), or fin clipped (adipose or ventral) or wire tagged and fin clipped, are considered to be of unknown origin and will be collected and taken to LFH. Fish to be transported to LFH will be given one right-side opercle punch, and hauled in a 5,229 L aerated non-refrigerated tank truck at least three times a week, or more frequently if necessary.

In the event that the fish on hand, and the number anticipated, exceed the trap's holding capacity, NMFS personnel will pass left red elastomer marked fish (adults and jacks) in order to reserve space to accommodate strays. Left red elastomer marked fall chinook passed upstream will be given two right-side opercle punches. Fall chinook with green or blue elastomers originated from acclimation pond releases above LGR, and will be passed upstream.

LFH Trapping

Salmon that volunteer to LFH will be transferred to the holding pond every day to reduce stress to fish. Voluntary and Lower Granite Dam captured salmon will be held separately at LFH to document broodstock composition from each capture location. The hatchery will trap salmon from 1 September until early to mid December.

Spawning Groups

Salmon at Lyons Ferry FH will be checked for the presence of wire tags and external marks. Salmon will be accounted for and mated in two distinct groups:

Strays

Salmon of unknown origin will be spawned together as "strays". Unless a fish has an elastomer (red, blue or green) tag behind the eye, we will initially assume it is a stray. Salmon with ventral fin clips, whether wire tagged or not, will be assumed to be of Umatilla origin. These fish will be automatically mated as strays. Likewise, untagged salmon with no external marks or fin clips will be categorized and mated as strays. But, to recover eggs from LFH origin fish missing an elastomer tag, all salmon with adipose clips and wire tags in the snout will have the CWT read before mating. Fertilized eggs or fry from strays will be transferred to Klickitat FH for release outside the Snake River Basin.

Lyons Ferry Origin

Salmon that have red, green or blue elastomer tags behind the eye will be assumed to be of Lyons Ferry origin and their gametes will be mated before reading the CWT. Later, CWTs will be read from a subsample (50%) of left red elastomer fish (adults and jacks) and all blue or green elastomer fish to verify origin and determine age.

Spawning

At processing, salmon will be numbered to allow fish to be identified and accounted for individually. All fish will be sampled for length, fin clips and tags; weights will be collected from 20 males and 20 females per spawn day.

Salmon of Lyons Ferry origin will be spawned together and kept separate from other groups. We will use single pair matings, with semen from a back up male whenever possible for all salmon spawned. Our goal is to ensure that semen from as many different males (including jacks) is used for matings of known Lyons Ferry origin salmon. Accordingly, no male should be used more than twice as the primary male. We do not anticipate live spawning males in 1999.

Semen from jacks (<49 cm fork length) will be used for fertilizing eggs to take advantage of genetic diversity and increase genetic contribution across all age classes. Our primary interest in the use of jacks is for matings of known Lyons Ferry origin salmon. However, we will ensure jacks are used to some extent in other mating groups as well. The goal each week, depending on jack abundance, is to have jacks contribute to 10-25% of the Lyons Ferry origin matings. Jacks will be selected without regard to fish size, and mated at random.

Procedures for sub-sampling left red (LR) elastomer marked fish.

Pond Mortalities

Hatchery staff will sample all pond mortalities for external marks, wire tags, sex and length. This data will be recorded on head labels provided by SRL. Pond mortalities will need to be separated and bagged into the following groups:

1. LR Volunteers
2. all other Volunteers
3. LR Lower Granite
4. all other Lower Granite

SRL staff will pick up and process all snouts from pond mortalities. From each LR big bag SRL staff will randomly select 50% of the LR snouts for CWT recovery. All head labels will be retained.

Head labels from snouts that are not slated to have the CWT read will be photocopied (6 to a page). Data from the photocopied head labels will be entered into the database.

Head labels from snouts that will have the CWT read will be kept with the snout and data will be recorded on blue Hatchery Mark Recovery forms (labeled "LR elastomer, 50% sample").

Snouts from all other big bags will have the CWT recovered and read. Data from these will be recorded on blue Hatchery Mark Recovery forms (labeled non-LR elastomer, 100% sample).

Spawning

SRL staff will sample all fish for external marks, wire-tags, length and sex. Data for all fish will be recorded on a head label. Snouts will be recovered from all non-LR fish for CWT processing. Samplers will remove the snout from every other (50%) LR fish processed without regard to sex, size, or disposition (spawned but used or not used; or killed outright).

Weights will be collected from: 10 Lower Granite males (including a percentage of jacks), 10 Lower Granite females, 10 volunteer males (including a percentage of jacks) and 10 volunteer females. Scales will be collected from all fish that are unmarked without wire. For 1999, scales will also be taken from ad/rv clipped fish at the request of Mike Hayes, ODFW.

Incubation

Fertilized eggs from each female of Lyons Ferry origin will be incubated in individual trays. Each tray of eggs will be labeled with the female identification number. Eggs from unknown origin females may be pooled (eggs from several females in one incubation tray) within their respective mating groups.

Snake River Lab personnel will assist hatchery personnel with egg picking and counting at "eye-up". Eggs from each female will be counted separately to identify number of live and dead eggs (fecundity) per female. Eggs from several females may then be grouped into one tray, usually in batches of 5,000. Eggs or fry from females with moderate or high bacterial kidney disease (BKD) ELISA levels will not be mixed with eggs of below low and low levels. Progeny from high and moderate BKD ELISA females will be ponded together to prevent the spread of BKD. Progeny with high and moderate BKD ELISA may be incorporated into subyearling releases to prevent holding these fish at the hatchery for an extended period.

Appendix C: Coded-Wire Tag Recoveries at Lyons Ferry Fish Hatchery in 1998

(and expansions according to our data to include all fish released from Lyons Ferry Hatchery). (VOL=voluntary return to the hatchery, LG=hailed from Lower Granite Dam. Release site LFH=Lyons Ferry Hatchery, CJ=Captain John Rapids acclimation site on the Snake River, PL=Pittsburg Landing acclimation site on the Snake River, and BC=Big Canyon acclimation site on the Clearwater River. Age Y=yearling release and S=subyearling release.)

Appendix C; Table C1. Recoveries of CWTs from Lyons Ferry origin fall chinook processed at Lyons Ferry Hatchery in 1998.

Vol	LG	Total	CWT codes		Release	Brood	Year	CWT	AD-only	Number	Number	Expansion	Rate	Vol	LG	Total
			data 1	data 2												
27	18	45	63	1	63	LFH	Y	96	200,215	3,309	1,782	1.03	28	18	46	
1	0	1	63	3	63	CJ	Y	96	6,798	82	47	1.02	1	0	1	
1	10	11	63	4	46	PL	Y	96	67,671	848	2,119	1.04	1	10	11	
2	8	10	63	4	48	PL	Y	96	68,187	854	2,135	1.04	2	8	10	
0	1	1	63	47	63	LFH	Y	92	50,481	1,831	104	1.04	0	1	1	
0	1	1	63	49	15	LFH	Y	92	51,258	273	0	1.01	0	1	1	
1	0	1	63	49	17	LFH	Y	92	51,702	312	0	1.01	1	0	1	
1	0	1	63	49	20	LFH	Y	92	49,248	49	155	1.00	1	0	1	
6	31	37	63	51	20	BC	S	96	119,824	1,816	7,897	1.08	6	34	40	
93	34	127	63	51	62	LFH	Y	93	89,900	85	0	1.00	93	34	127	
92	54	146	63	51	63	LFH	Y	93	101,165	300	0	1.00	92	54	146	
0	1	1	63	52	27	LFH	Y	92	51,260	413	0	1.01	0	1	1	
3	29	32	63	53	16	BC	S	96	113,932	1,727	7,509	1.08	3	31	34	
75	46	121	63	56	39	LFH	Y	93	82,624	39	195	1.00	75	46	121	
44	48	92	63	56	40	LFH	Y	93	73,986	484	346	1.01	44	49	93	
3	30	33	63	57	12	PL	Y	94	113,976	64	258	1.00	3	30	33	
213	75	288	63	58	44	LFH	Y	94	196,604	196	197	1.01	215	76	291	
208	61	269	63	58	45	LFH	Y	94	206,860	206	207	1.00	208	61	269	
0	2	2	63	59	53	BC	Y	95	29,341	698	3,529	1.14	0	2	2	
6	41	47	63	59	57	PL	Y	95	67,252	1,335	4,968	1.09	7	45	52	
5	46	51	63	59	58	PL	Y	95	67,441	1,338	4,982	1.09	5	50	55	
9	19	28	63	59	59	BC	Y	95	71,692	992	902	1.03	9	20	29	
10	30	40	63	59	60	BC	Y	95	73,110	1,012	920	1.03	10	31	41	
0	3	3	63	60	25	BC	Y	95	14,428	343	1,735	1.14	0	3	3	
28	22	50	63	63	18	LFH	Y	96	208,388	3,444	1,854	1.03	29	23	52	
523	324	847	63	63	20	LFH	Y	95	217,794	872	9,714	1.05	549	340	889	
509	391	900	63	63	21	LFH	Y	95	217,810	872	9,714	1.05	534	410	944	
3	6	9	63	63	45	CJ	Y	96	60,527	728	419	1.02	3	6	9	
3	6	9	63	63	46	CJ	Y	96	61,965	745	429	1.02	3	6	9	
1,866	1,337	3,203											1,922	1,390	3,312	

Appendix C; Table C2. Coded-Wire Tag (CWT) recoveries from stray hatchery salmon processed at Lyons Ferry Hatchery in 1998. Recoveries are of fall chinook unless otherwise noted.

Vol	I.G.	Total	CWT codes		Release	Brood Year	Number			Expansion		Expanded Recovery	I.G. Total
			data 1	data 2			CWT	AD-only	Number Unmarked	Rate	Vol		
			agency	location			(T)	(A)	(U)	(T+A+U)/T			
0	1	1	5	0101	1213 Yakima River	95	200,268	0	1,685,236	9.41	0	9	9
1	0	1	5	32	7 Clearwater spr.chin.	93	69,115	2,880	1,023	1.06	1	0	1
0	1	1	7	6	58 Umatilla River	93	24,865	943	86,009	4.50	0	4	4
0	1	1	7	6	62 Umatilla River	93	31,239	601	248,206	8.96	0	9	9
0	1	1	7	8	17 Ringold pond	93	217,184	1,774	3,247,457	15.96	0	16	16
1	0	1	7	9	21 Tanner Cr.	95	53,525	291	375,071	8.01	8	0	8
1	0	1	7	10	38 Umatilla River	94	28,521	831	187,942	7.62	8	0	8
1	0	1	7	11	54 Tanner Cr.	95	53,223	198	375,466	8.06	8	0	8
0	1	1	7	13	20 Umatilla River	95	30,015	250	273,538	10.12	0	10	10
1	2	3	7	13	22 Umatilla River	95	29,646	796	236,471	9.00	9	18	27
0	1	1	7	13	24 Umatilla River	95	30,243	449	241,902	9.01	0	9	9
0	1	1	7	13	25 Umatilla River	95	30,220	387	270,288	9.96	0	10	10
0	1	1	7	13	26 Umatilla River	95	30,238	395	150,658	6.00	0	6	6
0	2	2	7	13	27 Umatilla River	95	28,476	2,331	429,452	16.16	0	32	32
0	1	1	7	13	58 Umatilla River	95	25,983	87	25,042	1.97	0	2	2
0	2	2	7	13	59 Umatilla River	95	25,232	80	25,553	2.02	0	4	4
0	2	2	9	17	29 Umatilla River	95	25,250	0	28,743	2.14	0	4	4
2	5	7	9	17	48 Umatilla River	95	25,260	0	26,657	2.06	4	10	14
2	1	3	9	18	7 Umatilla River	95	25,258	78	25,730	2.02	4	2	6
0	1	1	9	21	26 Umatilla River	96	33,555	502	162,971	5.87	0	6	6
0	1	1	9	21	30 Umatilla River	96	32,464	1,230	260,349	9.06	0	9	9
0	21	21	23	27	12 NMFS-Pittsburg	94	14,566	591	0	1.04	0	22	22
5	23	28	23	27	13 NMFS-Asotin	94	15,205	592	0	1.04	5	24	29
0	1	1	23	30	53 NMFS-McNary	95	15,000	0	0	1.00	0	1	1
1	1	2	63	53	34 Klickitat River	93	75,273	607	2,024,120	27.90	28	28	56
0	2	2	63	53	35 Klickitat River	93	76,204	345	166,451	3.19	0	6	6
0	4	4	63	53	36 Klickitat River	93	74,501	119	2,045,380	28.46	0	114	114
0	1	1	63	55	17 Klickitat River	94	98,718	297	1,441,785	15.61	0	16	16
1	0	1	63	59	36 Tucannon spr. chin.	95	42,163	37	0	1.00	1	0	1
0	2	2	63	61	7 Klickitat River	96	105,613	529	2,129,013	21.16	0	42	42
16	80	96									76	413	489

Appendix C; Table C3. Other fall chinook salmon processed at Lyons Ferry Fish Hatchery (LFH) in 1998.

Vol	LG	Total	Coded-Wire Tag (CWT) Codes			Release Location	Brood Year
			agency	data 1	data 2		
Fish (1 total) with CWT but not adipose clipped.							
	1	1	63	51	63	Lyons Ferry	93
Mini jacks (<30cm FL) killed at the adult trap at LGR (5 total).							
	2	2	63	1	63	Lyons Ferry	96
	1	1	63	63	18	Lyons Ferry	96
	1	1	63	63	46	Captain John	96
	1	1	Lost Tag-left red elastomer			Lyons Ferry	
Fish (91 total) with "lost" CWTs.							
39	26	65	(with left red elastomer from Lyons Ferry)				
1		1	(with left green elastomer from BC release)				
10	15	25	(Ad clipped)				
Fish (23 total) without CWTs, but adipose clipped ("No Tag").							
9	5	14	(with left red elastomer from Lyons Ferry)				
6	2	8	(Ad clipped)				
	1	1	(Ad + RV clipped)				
Fish (114 total) with BWTs, all Umatilla River origin.							
9	94	103	(RV clipped)				
4	3	7	(no clips)				
2	1	3	(Ad clipped)				
	1	1	(Ad + RV clipped)				
Fish (86 total) that were not adipose clipped or CWT/BWT ("None").							
83	1	84	(no clips)				
2		2	(RV clipped)				
165	155	320					

Appendix D: Coded-Wire Tag Recoveries at Lyons Ferry Fish Hatchery in 1999

(and expansions according to our data to include all fish released from Lyons Ferry Hatchery).

(VOL=voluntary return to the hatchery, LG=hailed from Lower Granite Dam. Release site LFH=Lyons Ferry Hatchery, CJ=Captain John Rapids acclimation site on the Snake River, PL=Pittsburg Landing acclimation site on the Snake River, and BC=Big Canyon acclimation site on the Clearwater River. Age Y=yearling release and S=subyearling release.)

Appendix D; Table D1. Recoveries of CWTs from Lyons Ferry origin fall chinook processed at Lyons Ferry Hatchery in 1999

Vol.	LG	Total	CWT codes		Release	Brood	Year	CWT	AD-only	Number	Expansion	Rate	Vol	LG	Total
			data 1	data 2											
1	0	1	63	1	10	BC	Y	96	11,901	984	222	1.10	1	0	1
118	58	176	63	1	63	LFH	Y	96	200,215	3,309	1,782	1.03	121	59	180
0	1	1	63	3	63	CJ	Y	96	6,798	82	47	1.02	0	1	1
1	0	1	63	4	1	CJ	Y	96	1,438	17	10	1.02	1	0	1
0	6	6	63	4	46	PL	Y	96	67,671	848	2,119	1.04	0	6	6
1	16	17	63	4	48	PL	Y	96	68,187	854	2,135	1.04	1	17	18
0	23	23	63	4	51	PL	Y	97	134,983	3,401	4,501	1.06	0	24	24
6	27	33	63	4	53	CJ	Y	97	154,750	816	1,444	1.01	6	27	33
1	7	8	63	4	54	BC	Y	97	150,648	1,241	1,333	1.02	1	7	8
191	127	318	63	8	60	LFH	Y	97	423,772	2,026	6,368	1.02	195	130	325
1	0	1	63	9	38	BC	Y	97	75,332	603	451	1.01	1	0	1
11	83	94	63	51	20	BC	S	96	119,824	1,816	7,897	1.08	12	90	102
6	4	10	63	51	62	LFH	Y	93	89,900	85	0	1.00	6	4	10
2	7	9	63	51	63	LFH	Y	93	101,165	300	0	1.00	2	7	9
9	89	98	63	53	16	BC	S	96	113,932	1,727	7,509	1.08	10	96	106
9	3	12	63	56	39	LFH	Y	93	82,624	39	195	1.00	9	3	12
2	5	7	63	56	40	LFH	Y	93	73,986	484	346	1.01	2	5	7
0	5	5	63	57	12	PL	Y	94	113,977	64	258	1.00	0	5	5
39	32	71	63	58	44	LFH	Y	94	196,604	196	197	1.00	39	32	71
43	20	63	63	58	45	LFH	Y	94	206,860	206	207	1.00	43	20	63
1	3	4	63	59	53	BC	Y	95	29,341	698	3,529	1.14	1	3	4
0	34	34	63	59	57	PL	Y	95	67,252	1,335	4,968	1.09	0	37	37
1	41	42	63	59	58	PL	Y	95	67,441	1,338	4,982	1.09	1	45	46
4	27	31	63	59	59	BC	Y	95	71,692	992	902	1.03	4	28	32
5	23	28	63	59	60	BC	Y	95	73,110	1,012	920	1.03	5	24	29
0	2	2	63	60	25	BC	Y	95	14,428	343	1,735	1.14	0	2	2
129	44	173	63	63	18	LFH	Y	96	208,388	3,444	1,854	1.03	132	45	177
346	226	572	63	63	20	LFH	Y	95	217,794	872	9,714	1.05	363	237	600
357	243	600	63	63	21	LFH	Y	95	217,810	872	9,714	1.05	374	255	629
3	10	13	63	63	45	CJ	Y	96	60,527	728	419	1.02	3	10	13
2	11	13	63	63	46	CJ	Y	96	61,965	745	429	1.02	2	11	13
3	5	8	63	63	47	BC	Y	96	23,738	407	87	1.02	3	5	8
1,292	1,182	2,474											1,338	1,235	2,573

Appendix D; Table D2. Coded-Wire Tag (CWT) recoveries from stray hatchery salmon processed at Lyons Ferry Hatchery in 1999. Recoveries are of fall chinook unless otherwise noted.

Vol	I.G.	Total	CWT codes		Release Location	Brood Year	Number			Expansion Rate	Expanded Recovery		
			agencv. data 1	data 2			CWT	AD-only	Unmarked		Vol	I.G.	Total
0	2	2	5	0101	1213 Yakima River	95	200,268	0	1,685,236	9.41	0	19	19
1	0	1	6	25	35 Lake Oroville, CA	95	32,327	2,784	0	1.09	1	0	1
1	0	1	7	9	26 Tanner Cr.	94	49,768	1,442	366,969	8.40	8	0	8
0	2	2	7	10	40 Umatilla River	94	23,442	150	23,871	2.02	0	4	4
0	1	1	7	11	57 Tanner Cr.	95	29,852	758	362,729	13.18	0	13	13
2	1	3	7	13	20 Umatilla River	95	30,015	250	273,538	10.12	20	10	30
0	2	2	7	13	21 Umatilla River	95	28,997	1,252	268,984	10.32	0	21	21
2	0	2	7	13	22 Umatilla River	95	29,646	796	236,471	9.00	18	0	18
0	1	1	7	13	23 Umatilla River	95	29,914	285	270,178	10.04	0	10	10
0	3	3	7	13	24 Umatilla River	95	30,243	449	241,902	9.01	0	27	27
1	3	4	7	13	26 Umatilla River	95	30,238	395	150,658	6.00	6	18	24
0	1	1	7	13	27 Umatilla River	95	28,476	2,331	429,452	16.16	0	16	16
0	3	3	7	13	28 Umatilla River	95	30,455	200	151,054	6.00	0	18	18
2	2	4	7	13	58 Umatilla River	95	25,983	87	25,042	1.97	4	4	8
3	2	5	7	13	59 Umatilla River	95	25,232	80	25,553	2.02	6	4	10
0	5	5	9	17	29 Umatilla River	95	25,250	0	28,743	2.14	0	11	11
1	0	1	9	17	30 Umatilla River	95	19,842	482	37,344	2.91	3	0	3
5	4	9	9	17	48 Umatilla River	95	25,260	0	26,657	2.06	10	8	18
1	3	4	9	18	7 Umatilla River	95	25,258	78	25,730	2.02	2	6	8
0	1	1	9	21	26 Umatilla River	96	33,555	502	162,971	5.87	0	6	6
0	2	2	9	21	27 Umatilla River	96	32,764	1,026	161,246	5.95	0	12	12
0	1	1	9	21	30 Umatilla River	96	32,464	1,203	260,349	9.06	0	9	9
0	1	1	10	51	25 Sawtooth spr. chin.	97	40,727	148	0	1.00	0	1	1
0	17	17	23	27	12 NMFS-Pittsburg	94	14,566	591	0	1.04	0	18	18
0	24	24	23	27	13 NMFS-Asotin	94	15,205	592	0	1.04	0	25	25
0	1	1	23	30	49 NMFS-McNary	95	15,001	0	0	1.00	0	1	1
0	1	1	23	30	57 NMFS-McNary	95	15,000	0	0	1.00	0	1	1
0	1	1	63	53	35 Klickitat River	93	76,204	345	166,451	3.19	0	3	3
0	1	1	63	60	1 Priest Rapids	95	193,399	7,495	4,799,106	25.85	0	26	26
1	0	1	63	63	30 Klickitat spr. chin.	96	47,625	690	326,685	7.87	8	0	8
20	85	105									86	291	377

Appendix D; Table D3. Other fall chinook salmon processed at Lyons Ferry Hatchery in 1999.

Vol	LG	Total	Coded Wire Tag (CWT) Codes			Release Location	Brood Year
			agency	data 1	data 2		
Fish (2 total) with CWT but not adipose clipped.							
1	1	1	63	63	20	Lyons Ferry	95
1		2	63	63	21	Lyons Ferry	95
Fish (80 total) with "lost" CWTs.							
28	16	44	(with left red elastomer from Lyons Ferry)				
	1	1	(no clips)				
1		1	(Ad/RV clipped)				
9	25	34	(Ad clipped)				
Fish (21 total) without CWTs, but adipose clipped ("No Tag").							
6		6	(with left red elastomer from Lyons Ferry)				
1		1	(RV clip)				
7	7	14	(Ad clip)				
Fish (163 total) with BWTs, all Umatilla River origin.							
44	105	149	(RV clipped)				
1		1	(LV clipped)				
	4	4	(Ad + RV clips)				
1	7	8	(Ad clipped)				
1		1	(no clip data)				
Fish (107 total) that were not adipose clipped or CWT/BWT ("None").							
95	3	98	(no clips)				
2	4	6	(RV clipped)				
2	1	3	(LV clipped)				
Fish (4 total) only data collected was Ad-clip							
2	2	4	(Ad clipped)				
Fish (1 total) with unreadable CWT							
	1	1	(Ad clipped)				
Fish (1226 total) with left red elastomers and CWT's "not read", all Lyons Ferry origin							
733	490	1,223	(Ad clipped)				
2		2	(no clips)				
1		1	(no clip data)				
938	667	1,605	Total				

Appendix E: Lyons Ferry Chinook Releases Table

(Numbers presented do not match hatchery records for fish per pound for 1998 and 1999 direct releases from LFH because of reporting constraints put on the hatchery. The hatchery is required to report releases by month and in this report we report them by site.)

Appendix E; Table E1. Lyons Ferry fall chinook releases with number marked (adipose clipped), tagged (Coded-Wire-Tag [CWT]), and unmarked by release year and type, April 1992-April 2000. Past release years can be found in Wargo et al. 1999.

Release Year Age (brood year)	Release Type	Date	Number CWT		Cqde	Adipose only		Number unmarked	Lbs	Fish /Lb	Type	Location	Color or Brand	% Loss
			CWT	Cqde		marked	unmarked							
1992														
yearling (90)	direct	4/15	104,820	42/09	792			13,201	8.0	VT	behind left eye, red or BWT	left cheek		
								5,125	8.0	VT	behind left eye, red			
								5,207	8.0	BWT	left cheek			
								548	8.0	VT	behind left eye, red or BWT	left cheek		
			218,110	43/20	1,515		27,453	8.0	VT	behind left eye, red or BWT	left cheek			
			23,954	41/18	113		3,008	8.0	VT	behind left eye, red or BWT	left cheek			
			351,270	40/12	2,420		10,332	45,502						
	barge	4/17	98,374	42/10	560			10,993	9.0	VT	behind left eye, red or BWT	left cheek		
22,804								9.0	VT	behind left eye, red or BWT	left cheek			
2,378								9.0	VT	behind left eye, red or BWT	left cheek			
			322,185		3,394		36,175							
1993														
yearling (91)	direct	4/12	51,663	46/58	312			4,725	11.0	Elastomer	behind left eye	red	9.6	
								4,727	11.0					
								4,689	11.0	Elastomer	behind left eye	red	9.0	
								4,726	11.0					
								4,711	11.0					
								4,745	11.0	Elastomer	behind left eye	red	11.6	
			50,892	46/63	828		4,702	11.0						
			51,410	46/62	310		4,702	11.0	Elastomer	behind left eye	red	4.0		
			412,094		2,903		37,727							

Appendix E; Table E1 (continued).

Release Year Age (brood year)	Release Type* Date	Number CWT		Adipose only marked	Number unmarked	Fish /Lb	Type	Location	Color or Brand	% Loss
		CWT	Code ^b							
1993										
continued										
yearling (91)	barge 4/19	9,196	37/31	89	108	1,044	9.0	High density ELISA (BKD) group.		
		82,796	46/18	1,351	296	4,691	18.0			
		31,901	47/09	494	493	3,289	10.0			
		33,994	47/06	244	663	3,490	10.0	Elastomer	behind left eye	red 5.8
		49,656	46/56	2,449		5,211	10.0	Elastomer	behind left eye	red 5.0
		53,595	46/57	541		4,921	11.0			
		38,460	47/03		139	3,509	11.0	Elastomer	behind left eye	red 9.7
		38,170	47/05	155	231	3,505	11.0			
		337,768		5,323	1,930	29,660				
1994										
subyearling (92)	direct 6/24	203,177	50/12	3,598		3,390	61			
yearling (92)	direct 4/18	53,276	52/24	53	168	4,863	11.0	Elastomer	behind left eye	red 2.5
		49,248	49/20	49	155	4,496	11.0	"	"	red 2.5
		51,702	49/18	312		4,709	11.0	"	"	red 4.0
		51,702	49/17	312		4,709	11.0	"	"	red 4.0
		51,258	49/15	273		4,685	11.0	"	"	red 3.2
		51,168	49/12	273		4,676	11.0	"	"	red 3.2
		308,354		1,272	323	28,138				
		50,481	47/63	1,831	104	4,765	11.0	Elastomer	behind left eye	yellow 7.0
		51,160	47/60	726		4,717	11.0	"	"	yellow 3.8
		51,091	52/29	1,149		4,733	11.0	"	"	yellow 4.8
		51,260	52/27	413		4,707	11.0	"	"	yellow 5.6
		51,316	47/58	135	104	4,684	11.0	"	"	yellow 5.6
		33,736	52/63	135	206	3,074	11.0	"	"	yellow 3.9
		289,044		4,254	414	26,680				

Appendix E; Table E1 (continued).

Release Year Age (brood year)	Release Type ^a Date	Number CWT		Adipose only marked	Number unmarked	Lbs	Fish /Lb	Type	Location	Other Marks		
		Code ^b	Code ^b							Color or Brand	% Loss	
1995												
yearling (93)	direct 4/17	73,986	56/40	484	346	9,237	8.0	Elastomer	behind left eye	red	8.1	
		101,165	51/63	300		13,529	7.5	"	"	"	4.1	
		82,624	56/39	39	195	10,761	8.0	"	"	"	4.5	
		89,900	51/62	85		11,378	8.0	"	"	"	7.2	
		347,675		908	541	44,905						
1996												
fry (95)	direct 3/1-31				83,183	186	500					
yearling (94)	direct 4/9-12	196,604	58/44	196	197	18,762	10.5	Elastomer	behind left eye	red	10.2	
		206,860	58/45	206	207	19,740	10.5	"	"	"	"	
	Ice Harbor 4/8	3,230	58/44	3		308	11.0	"	"	"	"	
		406,694	58/45	405	404	38,810						
	Pittsburg 4/12-15	113,977	57/12	64	258	11,108	10.3	Elastomer	behind right eye	blue	17.9	

Appendix E; Table E1 (continued).

Release Year Age (brood year)	Release		Number			Adipose		CWT Code ^b	Date	Type	Fish /Lb	Type	Location	Color or Brand	% Loss
	Type ^a	Date	CWT	marked	only	unmarked	Lbs								
1997	yearling (95)	direct	4/4-26	217,794	63/20	872	9,714	24,583	9.3	Elastomer	behind left eye	red	12.8		
				<u>217,810</u>	63/21	<u>872</u>	<u>9,714</u>	<u>24,585</u>	9.3	"	"	"	"		
				435,704		1,744	19,428	49,168							
1997	Pittsburg	4/14-17	67,252	59/57	1,335	4,968	6,876	10.7	Elastomer	behind right eye	green	27.1			
			<u>67,441</u>	59/58	<u>1,338</u>	<u>4,982</u>	<u>6,895</u>	10.7	"	"	"	"			
			134,693		2,673	9,950	13,771								
1997	Big Canyon	4/14-17	71,692	59/59	992	902	7,138	10.3	Elastomer	behind left eye	green	11.7			
			<u>73,110</u>	59/60	<u>1,012</u>	<u>920</u>	<u>7,279</u>	10.3	"	"	"	"			
			29,341	59/53	698	3,529	2,894	11.6	"	"	blue	10.4			
1997	Big Canyon	5/14-15	610	60/24	14	73	60	11.6	"	"	"	"			
			<u>14,428</u>	60/25	<u>343</u>	<u>1,735</u>	<u>1,423</u>	11.6	"	"	"	"			
			189,181		3,059	7,159	18,794								
1998	subyearling (96)	Big Canyon	6/10-13	119,824	51/20	1,816	7,897	2,028	63.9	BWT	left cheek				
				<u>113,932</u>	53/16	<u>1,727</u>	<u>7,509</u>	<u>1,928</u>	63.9	"	"	"	"		
				233,756		3,543	15,406	3,956							
1998	yearling (96)	direct	4/3-16	208,388	63/18	3,444	1,854	21,157	10.1	Elastomer	behind left eye	red	15.7		
				<u>200,215</u>	01/63	<u>3,309</u>	<u>1,782</u>	<u>20,327</u>	10.1	"	"	"	"		
				408,603		6,753	3,636	41,484							
1998	Pittsburg	4/13-16	67,671	04/46	848	2,119	7,164	9.9	Elastomer	behind right eye	green	6.7			
			<u>68,187</u>	04/48	<u>854</u>	<u>2,135</u>	<u>7,218</u>	9.9	"	"	"	"			
			135,858		1,702	4,254	14,382								

Appendix E; Table E1 (continued).

Release Year Age (brood year)	Release		Number		CWT		Adipose		Number unmarked	Lbs	Fish /Lb	Type	Location	Color or Brand	% Loss
	Type ^a	Date	CWT	Date	only marked	Code ^b									
1998 continued															
yearling (96)	Big Canyon	4/13-16	15,367	61/26	264	56	1,646	9.5	Elastomer	behind left eye	green	9.4			
			7,980	63/43	137	29	855	9.5	"	"	"	"			
			23,738	63/47	407	87	2,543	9.5	"	"	"	"			
			11,901	01/10	984	222	436	30.0	"	"	"	3.2			
			58,986		1,792	394	5,480								
yearling (97)	Captain John	4/9-15	6,798	03/63	82	47	637	10.9	Elastomer	behind left eye	blue	19.2			
			1,438	04/01	17	10	135	10.9	"	"	"	"			
			60,527	63/45	728	419	5,670	10.9	"	"	"	"			
			61,965	63/46	745	429	5,804	10.9	"	"	"	"			
			130,728		1,572	905	12,246								
1999															
yearling (97)	direct	3/25-4/13	423,772	08/60	2,026	6,368	51,881	8.3	Elastomer	behind left eye	red	14.9			
			134,983	04/51	3,401	4,501	14,238	10.0	Elastomer	behind right eye	green	17.2			
yearling (97)	Big Canyon	4/12-15	150,648	04/54	1,241	1,333	14,761	10.4	Elastomer	behind left eye	green	11.2			
			75,332	09/38	603	451	6,854	11.1	"	"	"	2.4			
			225,980		1,844	1,784	21,615								
			154,750	04/53	816	1,444	13,292	11.8	Elastomer	behind left eye	blue	18.9			

Appendix E; Table E1 (continued).

Release Year Age (brood year)	Release		Number CWT Code ^b	Adipose only marked	Number unmarked	Lbs	Fish /Lb	Other Marks			
	Type ^a	Date						Type	Location	Color or Brand	% Loss
1999 continued											
subyearling (98)	direct	6/15	198,594	10/26	1,301	4,299	4,171	50.1			
	Big Canyon	6/2-3	n/a	10/25	n/a	198,496	2,370	83.8	CWT only was intended mark		1.6
		6/2-3	n/a	n/a	n/a	148,609	1,775	83.8	No fish marked or tagged		
						347,105	4,145				
	Captain John	5/26-6/5	n/a	n/a	n/a	322,928	3,930	82.2	No fish marked or tagged		
2000											
yearling (98)	direct	3/24-4/14	442,113	12/13	2,971	11,317	48,699	9.2	Elastomer	behind left eye	red
	Pittsburg	4/11-13	133,411	12/12	1,298	0	14,017	9.6	Elastomer	behind right eye	green
	Big Canyon	4/11-13	130,032	10/12	743	531	12,476	10.5	Elastomer	behind left eye	green
	Captain John	4/1-12	131,048	10/13	138	138	16,010	8	Elastomer	behind left eye	blue

Appendix E; Table E1 (continued).

Release Year Age (brood year)	Release		Number CWT	CWT Code ^b	Adipose only marked	Number unmarked	Lbs	Fish /Lb	Type	Location	Other Marks	
	Type ^a	Date									Color or Brand	% Loss
2000 continued												
subyearling (99)	direct	5/26	188,047	01/67	2,513	6,083	4,326	45.5				
	Pittsburg	5/24-26	n/a	n/a	n/a	400,156	7,197	55.6	No fish marked or tagged			
	Big Canyon	5/30-6/1	n/a	n/a	n/a	497,790	12,368	40.2	No fish marked or tagged			
		6/20-26	n/a	n/a	n/a	<u>392,648</u>	<u>8,726</u>	45.0	" " " "			
						890,438	21,094					
	Captain John	5/20-31	n/a	01/68	n/a	198,083	4,363	45.4	CWT only was intended mark			2.4
			n/a	n/a	n/a	292,950	6,453	45.4	No fish marked or tagged			
		6/15-23	n/a	01/69	n/a	199,420	3,835	52.0	CWT only was intended mark			2.4
			n/a	n/a	n/a	<u>202,394</u>	<u>3,892</u>	52.0	No fish marked or tagged			
						892,847	18,543					

^a Direct releases occurred on-station at Lyons Ferry Hatchery. Barged fish were released immediately downstream of Ice Harbor Dam.

^b Pittsburg, Big Canyon, and Captain John are three acclimation sites located above Lower Granite Dam and operated by the Nez Perce Tribe. All tag codes start with agency code 63.

^c Study group to test passage at dam.

**Appendix F: Mean Fork Length, Standard Deviation,
Sample Size and Range for Returning Lyons Ferry
Origin Fall Chinook Salmon that had been Released
as Subyearlings and Yearlings**

(1992-1997 Broods—Lower Granite [LGR] Dam and Lyons Ferry Fish Hatchery [LFH]).

Appendix F; Table F1. Corrected version of Table 1 in Appendix C from 1996-1997 report. Mean (cm) fork length, (standard deviation), sample size, and range for Lyons Ferry fall chinook salmon released as subyearlings. All release locations are included.

Recovery year	sex	Brood year ^a						
		1997	1996	1992	1990	1989	1988	
1993 ^b	male				68.8 (5.89) 42b 58-85	80.7 (10.31) 105 44-104	- (-) 0 -	
		female			70.5 (5.16) 20 62-79	80.7 (5.55) 176 64-94	76.5 (14.89) 2 66-87	
			1994 ^b	male		44.7 (3.92) 134 36-54	87.0 (7.16) 27 ^c 69-101	86.0 (12.13) 16 61-105
	female					- (-) 0 -	81.0 (4.41) 67 71-90	85.6 (4.08) 44 71-92
		1995	male		64.4 (8.03) 180 46-87	101.6 (6.69) 8 87.5-107	- (-) 1 104.0	
	female				67.8 (4.44) 79 54-78	101.6 (5.51) 19 82-102		
1996				male		79.8 (12.33) 68 ^b 54-102	- (-) 1 103	
	female		77.8 (6.22) 126 61.5-90					
		1997	male			94.8 (23.68) 6 59-121		
female				85.9 (5.61) 12 75-93				

^a There were no subyearling groups released for brood years 1991, 1993, 1994, or 1995.

^b Includes BWTs

^c Plus one fish with no length measurement.

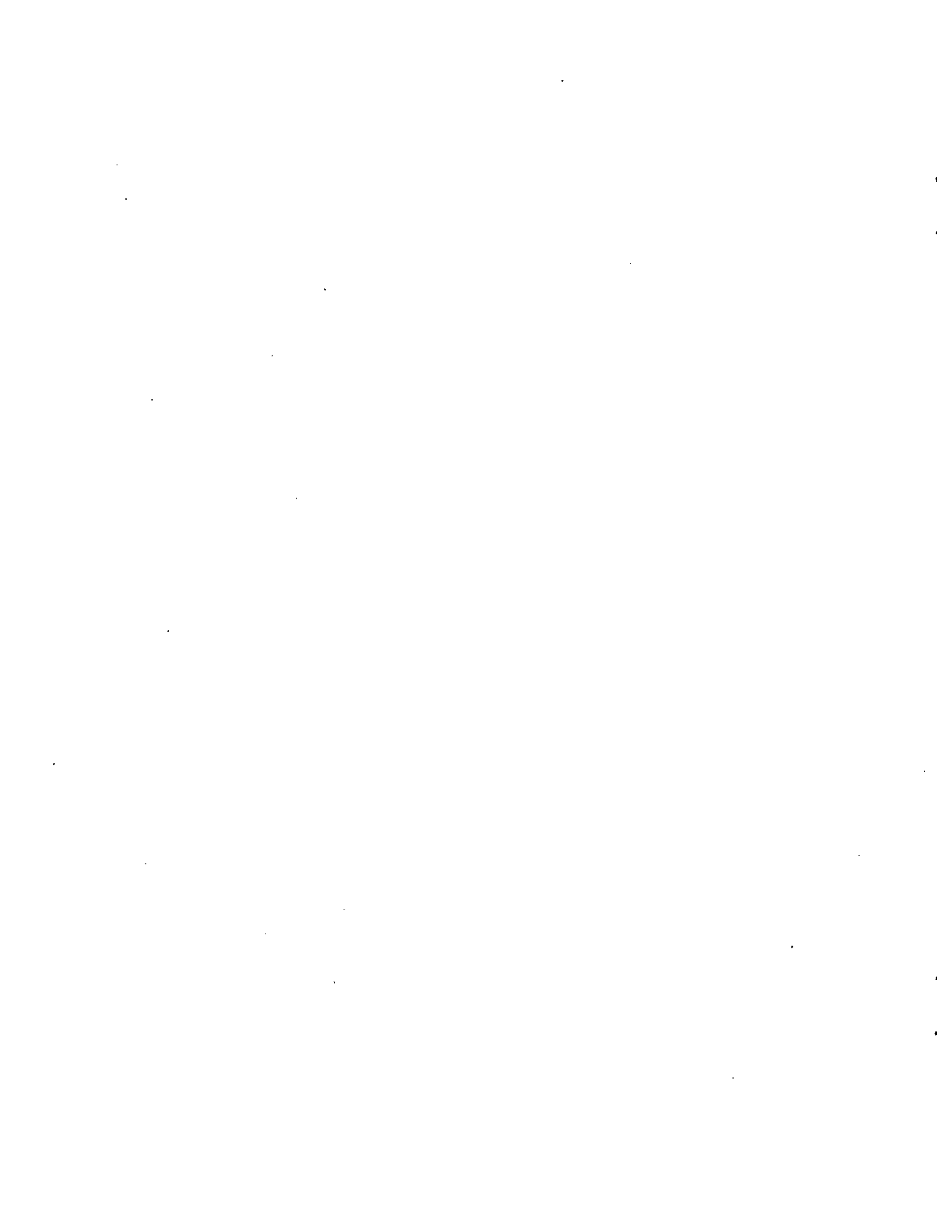
Appendix F; Table F2. Mean (cm) fork length, (standard deviation), sample size, and range for returning Lyons Ferry origin fall chinook salmon released as subyearlings. All release locations are included.

Recovery year	sex	Brood year ^a				
		1997	1996	1995	1994	1993
1994	male					44.7 (3.9) 134 36-54
	female					— (—) 0
1995	male					64.4 (8.0) 180 46-87
	female					67.8 (4.4) 79 54-78
1996	male					79.8 (12.3) 68b 54-102
	female					77.8 (6.2) 126 61.5-90
1997	male					94.8 (23.7) 6 59-121
	female					85.9 (5.6) 12 75-93
1998	male		46.0 (4.7) 69 35-58			
	female		— (—) 0			
1999	male		60.7 (8.1) 146 44-89			
	female		68.9 (3.9) 45 60-76			

^a There were no subyearling groups released for brood years 1993, 1994, 1995, or 1997.

Appendix F; Table F3. Mean (cm) fork length, (standard deviation), sample size, and range for returning Lyons Ferry origin fall chinook salmon released as yearlings. All release locations are included.

Recovery year	sex	Brood year ^a					
		1997	1996	1995	1994	1993	1992
1994	male						35.0 (3.0) 241 29-51
	female						— (—) 0 —
1995	male					35.4 (2.4) 1782 22-47	55.4 (5.0) 230 41-71.5
	female					— (—) 1 75.0	61.4 (3.8) 14 56.68
1996	male				33.7 (2.2) 380 24-47	51.0 (4.9) 374 37-65.5	72.2 (8.7) 238 54-98
	female				— (—) 0 —	60.3 (5.8) 20 54-80	73.8 (5.2) 314 56-92
1997	male			33.6 (2.1) 434 27.5-40	49.6 (4.6) 402 28-68	70.5 (8.3) 224 48-93	86.6 (12.0) 55 56.5-104
	female			— (—) 1 70	— (—) 0 —	72.9 (5.6) 347 54.5-89	80.6 (7.2) 116 57-97
1998	male		35.1 (4.8) 138 22-72	52.3 (5.3) 1775 33-73	69.7 (9.6) 289 45-97	87.6 (12.0) 136 56-121	97.0 (1.4) 2 96-98
	female		— (—) 1 34	57.8 (4.7) 143 48.5-77.5	72.9 (6.0) 300 49-90.5	83.7 (7.6) 351 61-106	78.7 (2.9) 3 77-82
1999	male	52.0 (4.8) 368 30-49	52.8 (5.5) 394 37-70	69.5 (8.8) 571 35-95	85.5 (11.9) 43 50-104	93.2 (14.6) 11 60-108	
	female	— (—) 0 —	60.1 (5.0) 14 49-70	72.3 (5.3) 741 53-86	84.1 (6.0) 96 64-96	86.9 (7.1) 27 74-99	





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