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Lyons Ferry Hatchery Evaluation
Fall Chinook Salmon
Annual Report: 2003 and 2004

by Deborah Milks, Michelle Varney,
Jeromy Jording, and Mark Schuck

Washington Department of
FISH AND WILDLIFE
Fish Program
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to

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Introduction

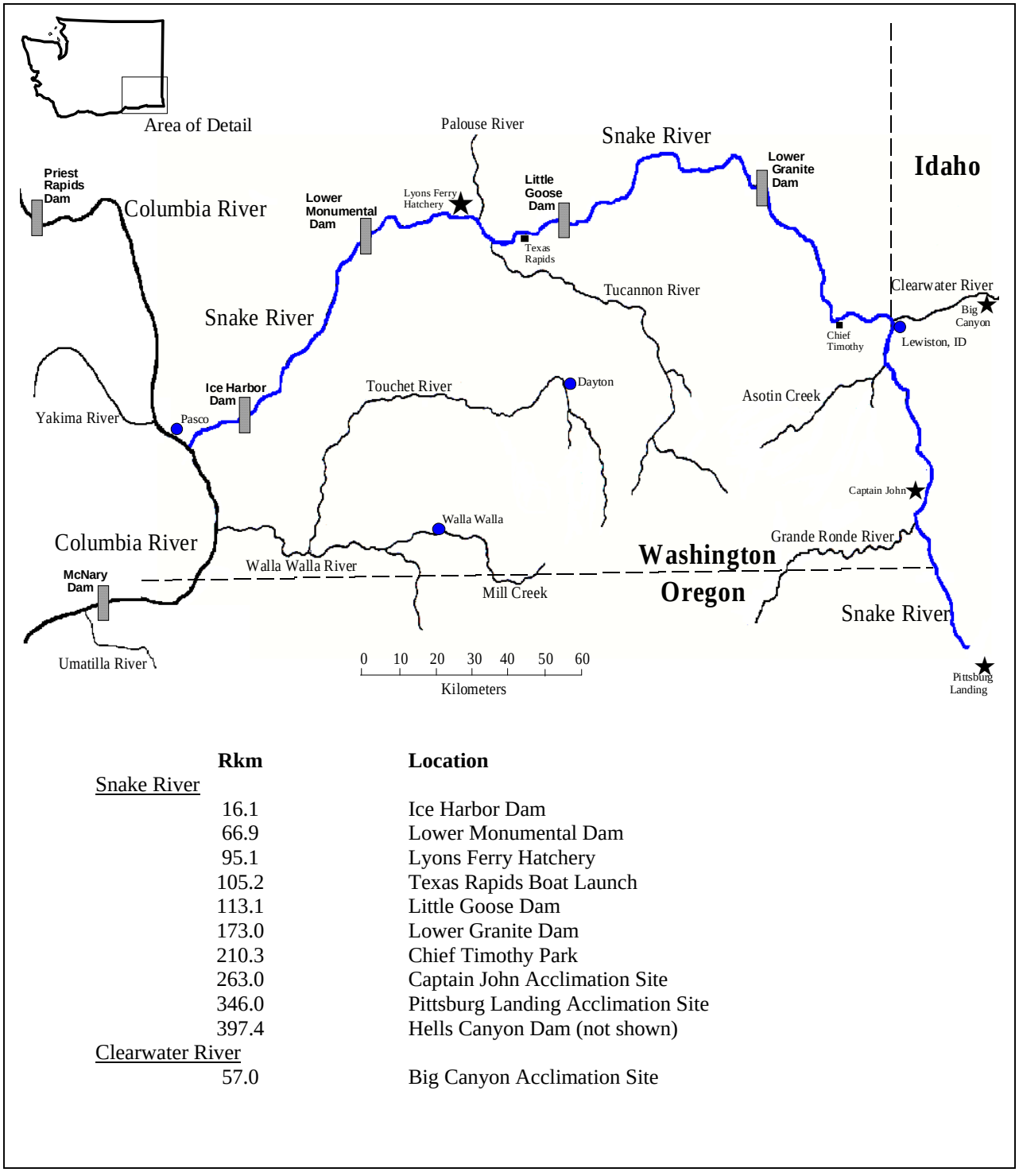
Program Objectives

This report summarizes activities by the Washington Department of Fish and Wildlife's (WDFW) Lower Snake River Hatchery Fall Chinook Evaluation Program from 16 April 2003 to 15 April 2005. This work was completed by WDFW's Snake River Lab (SRL) staff with Federal fiscal year 2003 and 2004 funds provided through the U.S. Fish and Wildlife Service (USFWS), under the Lower Snake River Compensation Plan (LSRCP).

Congress authorized the LSRCP in 1976. As a result of that plan, Lyons Ferry Hatchery (LFH) was constructed and has been in operation since 1984 (Figure 1). One objective of the hatchery was to compensate for an annual loss of 18,300 adult (non-juvenile)[1], 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. This mitigation program was modified in the early 1990s by agreement of the *United States v. Oregon* parties to supplement natural fall Chinook production above LGR (14,363 fall Chinook were expected to persist through natural production), an action consistent with the U.S. Endangered Species Act and Washington's Wild Salmonid Policy.

The WDFW has two general goals in its fall Chinook evaluation program: (1) monitor hatchery practices at LFH to ensure quality smolt releases, high downstream migrant survival, and sufficient adult fish contribution to fisheries, with escapement, to meet the LSRCP compensation goals; and (2) gather genetic information to help maintain the integrity of the Snake River Basin fall Chinook salmon stock (WDF 1994). Our efforts have contributed to evaluating the status of Snake River fall Chinook by monitoring population abundance, distribution, genetics, and life history (sex and age information of returns) as well as by removing strays at Lower Granite Dam (LGR) on the Snake River to minimize the effects of out-of-basin strays on the population (NMFS 1993). Specific annual program objectives can be obtained from the Snake River Lab Project office.

[1] The LSRCP Special Report has language referring to adult recoveries. That language was intended to differentiate adults from juveniles in the document (Dan Herrig personal communication). The LSCRP mitigation goal was based upon 97,500 fall Chinook counted at McNary Dam in 1958. At that time adult and jack counts were combined to give a total count. Therefore the mitigation goal consists of jacks and adults, not just adults. Since minijacks (fish < 30 cm total length) are not counted at the dams, they were excluded from the calculations which determined the mitigation goal.



Rkm	Location
Snake River	
16.1	Ice Harbor Dam
66.9	Lower Monumental Dam
95.1	Lyons Ferry Hatchery
105.2	Texas Rapids Boat Launch
113.1	Little Goose Dam
173.0	Lower Granite Dam
210.3	Chief Timothy Park
263.0	Captain John Acclimation Site
346.0	Pittsburg Landing Acclimation Site
397.4	Hells Canyon Dam (not shown)
Clearwater River	
57.0	Big Canyon Acclimation Site

Figure 1. Lower Snake River Basin showing location of LFH and major tributaries in the area.

Broodstock Collection and Management

Fall Chinook are collected at LFH and LGR for broodstock (Appendix A). The number of fish counted at LFH at the time of collection is considered a preliminary estimate of return, often under-estimating the number of fish on hand (Table 1). The final estimate of total return to LFH is determined using the number of fish processed during spawning. Each year, there is a discrepancy between the numbers of fish recorded as trapped and hauled at LGR when compared to the number of fish processed at LFH. This likely occurs because of indistinguishable or overlooked marks on fish from LGR at processing. Those LGR trapped fish that are unaccounted for at processing are included in the number of LFH fish processed overall.

Table 1. Number of fall Chinook collected at or hauled to LFH and how they were accounted for in 2003 and 2004.

Year	Trap Location	Number Collected/Hauled	Processed	Returned to River	Difference from Number Collected/Hauled [a]
2003	LFH	3,722	3,436	306	+20
	LGR	776	752	0	-24
2004	LFH	4,825	3,369	1,499	-43
	LGR	2,114	1,321	785	+8

[a] Inflated counts at LFH were due to trapping procedures. Numbers of fish unaccounted for from LGR are assumed to be mixed in with the LFH trapped fish during processing.

LGR Dam Trapping Operations

Trapping protocols for each year are available upon request. In general, prior to transport, NOAA Fisheries staff anesthetized the stray and LFH salmon, gathered length and sex data, and marked the fish with a hole in the operculum using a paper punch. The fish were then hauled to the LFH by WDFW personnel in a 5,678 L aerated tank truck.

2003

High water temperatures at the LGR trap delayed the start of trapping from 18 August to 9 September; trapping continued until 19 November. The trap was opened 11% of each hour to obtain a systematic sample of the run.

2004

LGR Dam began systematically trapping 15% of the run on 2 September. Trapping was interrupted for 2 hours on 3 September, and again on 5 September for another 2 hours due to ESA permitting issues. The Corp of Engineers required a section 10 permit to operate the trap. Although we had submitted an application, NOAA Fisheries had not issued the permit prior to initiating trapping. We were approved to begin trapping by Corps of Engineers staff on the assumption a submitted application was sufficient. That decision was subsequently overturned and the trap was shut down because the COE wanted the actual permit in hand. More discussions between NOAA, WDFW, and the COE occurred and the trap was re-opened. Two days later the trap was shut down again for the same reason. In the end, the COE allowed us to continue trapping efforts. On 10 September the trapping rate was decreased to 13% because there were more fall Chinook and steelhead than were anticipated in the initial run prediction. Trapping continued at this rate for the remainder of the season until the trap was closed on 22 November.

LFH Trapping Operations

2003

The trap was opened 4 September. Several times a week, salmon that had entered the trap were directed into a holding pond. Hatchery staff operated the trap continuously until 1 December.

2004

The trap at LFH was open from 1 September through 18 November.

Hatchery Operations

Spawning Operations

Spawning and Egg Take

At spawning, ripe fish were killed and their gametes collected and set aside unmixed. All matings consisted of a single male/single female cross. Coded wire tags were removed from marked fish and read to determine origin prior to fertilization of the eggs. Lyons Ferry origin fish identified either through examination of CWTs or the presence of visible implant elastomer (VIE) tags were spawned, mated, and retained for subsequent Snake River releases. For disposition of strays, refer to the yearly sections below. For a detailed composition of processed and hauled fish, see the stock composition section presented later in this report.

2003

Fish were spawned weekly (Tables 2, 3, and 4). Broodstock consisted primarily of Lyons Ferry hatchery origin fish. Unmarked/untagged females trapped at LFH were included in broodstock if the scale reading indicated the fish was from the Snake River; either hatchery or natural origin. Two Snake River natural origin females were included in the broodstock. Unfortunately three unmarked/untagged/unknown origin females were also included in the broodstock. Jacks (any male <49cm) constituted 7.1% of matings. The definition of a jack was changed in 2004 to any male fish <53cm to be consistent with the criterion used at the dams when fish are enumerated. If we apply the 2004 criterion to 2003, jacks were incorporated in 27.3% of the matings, well above the desired maximum of 25%. All eggs from stray/unknown origin fish (based on wire tags or scale readings) were destroyed.

During the first two weeks of spawning we released excess unmarked/untagged fish back to the river (Table 5). We began retaining unmarked/untagged females from the third through seventh weeks of spawning while hauling unmarked/untagged males back to the river. During the last week of spawning we also returned one unripe female and many excess males to the river.

Table 2. Duration and peak of spawning, eggtake, and percent egg mortality at LFH, 1984-2004.

Year	Spawning duration	Peak of spawning	Total eggtake	Initial Egg loss (%) All fish[a]	Initial Egg loss (%) Known LFH
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	2,926,748	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	2,994,676[b]	8.30	
1992	Oct 20 - Dec 8	Nov 21	2,265,557[b]	5.96	5.06
1993	Oct 19 - Dec 7	Nov 2	2,181,879	6.69	9.60
1994	Oct 18 - Dec 6	Nov 8	1,532,404	5.09	5.40
1995	Oct 25 - Dec 5	Nov 14	1,461,500	5.64[c]	3.22
1996	Oct 22 - Dec 3	Nov 5	1,698,309	4.56	3.95
1997	Oct 21 - Dec 2	Nov 4	1,451,823[d]	5.22	4.18
1998	Oct 20 - Dec 8	Nov 3	2,521,135	5.08	5.11
1999	Oct 19 - Dec 14	Nov 9 &10	4,668,267		9.42[e]
2000	Oct 24 - Dec 5	Nov 7 & 8	4,190,338		5.92[e]
2001	Oct 23 - Nov 27	Nov 13 & 14	4,734,234		3.47[f]
2002	Oct 22 - Nov 25	Nov 12 & 13	4,910,467		3.08[f]
2003[g]	Oct 21 -Dec 2	Nov 10 & 12	2,812,751		3.09
2004[g]	Oct 19 -Nov 22	Nov 9 & 10	4,625,638		3.26

[a] From 1984-1991 loss was calculated on all fish because of hatchery records. Beginning in 1999, strays were transferred before picking occurred so egg loss cannot be calculated.

[b] An additional 9,000 eggs from stray females were given to Washington State University.

[c] Doesn't include loss from 10,000 stray eggs given to University of Idaho. The egg loss from strays was 8.63% excluding eggs used in fertilization experiments.

[d] Total eggtake includes eggs from one coho female crossed with a fall Chinook.

[e] Initial loss includes eggs destroyed due to positive ELISA values: 156,352 eggs in 1999 and 53,176 eggs in 2000.

[f] Loss percentage *does not* include eggs destroyed due to positive ELISA values: 144,530 in 2001, 44,900 in 2002.

[g] Unmarked fish incorporated into broodstock; out of basin strays were not included in broodstock.

Table 3. Spawning dates and numbers of fall Chinook contributing to LFH broodstock in 2003. Volunteer and transported fish are combined and jacks are included with males.

Spawn Dates	Male[a]	Female[b]	Non-Viable[c]	Eggtake
Oct 21	7	7		24,124
Oct 28 and 29	67	65		239,638
Nov 4 and 5	185	187	2	667,417
Nov 10 and 12	258	250	3	883,083
Nov 18	196	195		695,488
Nov 24	120	72		245,676
Dec 2	20	18		57,325
Totals	**853**	**794**	**5**	**2,812,751**

[a] Males include 66 males and 7 jacks used solely by NPT, and one jack used by both NPT and WDFW.

[b] Female numbers include 46 unmarked fish presumed to be either Lyons Ferry origin (44 fish) or natural origin (2 fish) via scale analysis. Included are 14 females whose gametes were used by the NPT to supplement their broodstock.

[c] Non-viable females--not ripe when killed.

Table 4. Weekly Summary of fall Chinook processed at LFH and 2003 (LFH and LGR trapped fish are combined; jacks are included with males) that were not used for broodstock.

	Mortality				Killed outright				Research			
Week	Lyons Ferry		Other		Lyons Ferry		Other		Lyons Ferry		Other	
Ending	M	F	M	F	M	F	M	F	M	F	M	F
Sept 21	5	8	6[a]	2[a]								
Oct 5	5	3	1	4								
Oct 12	5	2	4									
Oct 19	8	5	2									
Oct 26	15	9	2	1	456	1	9	7				
Nov 2	19	7	1	1	325	2	14	22				
Nov 9	27	17		3	81	2	11	40	4	1	1	4
Nov 16	120	18	15	7	72	1	26	68	4			3
Nov 23	288	18	35	2	53	10	36	68				
Nov 30	181	2	33		62	2	20	14				
Dec 7	69	5	18		111	2	27	4				
Totals	**742**	**94**	**117**	**20**	**1,160**	**20**	**143**	**223**	**8**	**1**	**1**	**7**

[a] Includes one natural origin fish.

Fish in excess of broodstock needs were given two left operculum punches, then were hauled and released back to the Snake River. There were 445 haul events documented (Table 5) which includes 137 events of fish trapped again (recaptured) at LFH. We present the number of haul events to demonstrate the amount of work that was done to manage excess broodstock. The operculum punches allowed us to distinguish recaptured fish from fish trapped only once. Unfortunately since the mark was not unique for each fish we were unable to determine the number of recapture events per fish, rather we only know how many haul events and recapture events occurred.

Of the total number of fish trapped at LFH and released below LGO Dam, 5% were spawned at LFH after being re-trapped, 10% were estimated to have spawned in the Tucannon, and 26% were estimated to cross LGR Dam. We believe the occurrence of these fish in the Tucannon was due to the close proximity of the Tucannon River to the release site as well as their release being late in the season (Table 5). Overall, we cannot account for approximately 59% of the LFH trapped, hauled, and released fish. Since the last two releases occurred after the trapping operation ceased at LGR, it is possible that some of those fish continued upstream. If the percentage of fish trapped at LGR Dam during the last part of the season was similar to early in the season, as many as 36% of the fish may have passed LGR: leaving 49% of the release unaccounted for.

To estimate the recapture rate of fish trapped at LFH, which were hauled back to the river and trapped again at LFH, the 7 December haul cannot be used in the calculations because the hatchery trap was closed prior to that date. The recapture rate is estimated at 37.4% (137 recapture events/366 haul events). Of the recaptured fish, 89.1% (122 fish) were hauled back to the Snake River a second time. We were unable to differentiate between fish trapped twice and those caught more times, so for this report we assumed each recapture event was one fish.

Table 5. Release locations, trapping sites, sex, numbers and dates that fish were hauled back to the Snake River in 2003. Recaptures are included.

			Date hauled back to Snake River								
	Trap		October			November				December	
Release location	**site**	**Sex**	**1**	**21**	**28**	**4**	**10**	**18**	**24**	**7**	**Grand Total**
Texas Rapids	LFH	male	18	60	30	45	56	51	8	73	341
		female	14	22	4	1				1	42
		jack <53	9	21	4	4	13	5	1	5	62
Grand Total			**41**	**103**	**38**	**50**	**69**	**56**	**9**	**79**	**445**

2004

SRL staff PIT tagged (in the pelvic girdle) all of the fish that had been hauled to LFH prior to the change in the trapping rate. This was done so that data could be expanded appropriately by trapping rate for the run composition estimates.

Fish were spawned weekly (Tables 6 and 7). This was the second year that Snake River natural origin fish have been included in the broodstock. Broodstock included 127 females, 2 males, and 1 jack of Snake River natural origin based upon scale readings (4.9% contribution, number of wild fish spawned/total number of fish spawned). The majority (121 fish) of the natural origin fish were hauled from LGR Dam. Jacks (all origins) were used in 11.7% of the matings. Our spawning protocol indicates that jacks should be included in about 10% of the matings, but are not to exceed 25% of the matings. This year we returned a large number of males to the river early in the season. We subsequently were not able to trap any more males so more jacks were incorporated than desired. All strays were destroyed.

Table 6. Spawning dates and numbers of fall Chinook contributing to LFH broodstock in 2004. (LFH and LGR trapped fish are combined and jacks are included with males).

Spawn Dates	Males[a]	Females[b]	Non-Viable[c]	Eggtake
Oct 19 and 20	36	33	1	121,209
Oct 26 and 27	155	154	1	561,270
Nov 2 and 3	469	472	6	1,684,852
Nov 9 and 10	506	505	3	1,742,405
Nov15 and 17	158	157	2	515,902
Nov 22[d]				
Totals	**1,324**	**1,321**	**13**	**4,625,638**

[a] Includes 6 unmarked and 1 ad-only male presumed to be either Lyons Ferry origin or wild via scale analysis.
[b] Includes 349 unmarked and 8 ad-only females presumed to be either Lyons Ferry origin or wild via scale analysis.
[c] Non-viable females--not ripe when killed.
[d] On November 22, 10 males and 10 females of Lyons Ferry origin were spawned and used for research.

Table 7. Weekly summary of non-broodstock Chinook processed at LFH in 2004 (LFH and LGR trapped fish are combined and jacks are included with males).

	Mortality [a]				Surplus				Spawned for Research				
Week	Lyons Ferry[b]		Other		Lyons Ferry		Other		Lyons Ferry		Other		Eggtake
Ending	M	F	M	F	M	F	M	F	M	F	M	F	
Sept 19	2			1									
Sept 26	2	1	1	3									
Oct 3	8	3	1	1									
Oct 10	16	18		5									
Oct 17	17	19	2	6									
Oct 24	124	12	2	2	40		5	7					
Oct 31	23	9	2	2	97		13	6					
Nov 7	21	8	5		85	1	16	29				16	56,000
Nov 14	59	15	7	1	136	5	32	51					
Nov 21	184	21	11	4	480	40	27	18				2	7,000
Nov 28	78	15	6	1	164	12	8	3	10	10			35,000
Totals	**534**	**121**	**37**	**26**	**1002**	**58**	**101**	**114**	**10**	**10**		**18**	**154,000**

[a] Seven summer Chinook captured incidentally are included in the mortality and surplus columns.
[b] Lyons Ferry includes known LFH origin (from CWT and/or VI), and wild or presumed LFH origin (from scale analysis).

We trapped more fish at LFH and LGR than were needed for broodstock. To ensure representative sampling throughout the run we continued trapping and returned excess fish to the river weekly (Table 8). Excess fish from LFH trapping were marked with a top caudal clip (TC) to monitor recaptures. Fish from LGR trapping were marked with a bottom caudal clip (BC) to monitor recaptures.

The primary release site was changed from Texas Rapids (below Little Goose Dam) to Bryan's Landing (Rkm 113.1, above Little Goose Dam) in 2004 in hopes of decreasing the recapture rate

of LFH trapped fish. Initially we released LGR trapped fish at Central Ferry, but that site was changed to Bryan's Landing so that the hatchery could haul more fish per day.

We hauled 2,418 unique (excluding recaptures) fish back to the river. There were 47 additional haul events but we are unable to determine if it was one additional event per fish or many. Comparing LFH trapped and released fish to LGR trapped and released fish is necessary to develop hauling criteria for the future. Unfortunately, 1% of the LGR released fish were clipped with the same mark as the LFH released fish. The following estimates were made assigning all TC data to the LFH group and BC data to the LGR group.

Of the total number of fish trapped at LFH and released below LGR Dam, 8% were spawned at LFH after re-entering the trap, 8% were estimated to have spawned in the Tucannon, and 5% were estimated to have continued upstream past LGR Dam. We believe the occurrence of these fish in the Tucannon was due to the close proximity of the lower release site (LF State Park) to the Tucannon River as well as the releases being late in the season (Table 8). Overall, we cannot account for approximately 79% of the LFH trapped, hauled, and released fish. Since the last group of fish was released after the trapping operation ceased at LGR, it is possible some of these fish continued upstream. If the fish released late in the season traveled to LGR at the same rate as the early season releases we estimate up to 48% of the fish may have passed LGR Dam: leaving 36% of the release unaccounted for.

The calculations for the recapture rate of LFH trapped fish do not include the fish released on November 22 because they were not subject to recapture. The percentage of LFH trapped fish that were trapped a second time was 8.8%, a significant reduction from the 37.4% recapture rate estimated for 2003. Apparently, changing the release location to Bryan's Landing reduced the occurrence of recaptures at the LFH trap. In the future it is important to minimize the number of fish trapped for broodstock to reduce the need to release fish at the end of the season.

Of the total number of fish trapped at LGR and released below LGR Dam (Central Ferry and Bryan's Landing), 93% of the fish were estimated to have returned to and crossed LGR Dam. We are unable to determine if this success is due to the early release date or if the fish released returned to their original trapping location.

Table 8. Release locations, trapping sites, sex, dates, and total number of fish that were hauled back to the Snake River in 2004 (Recaptures are included).

			Date hauled back to Snake River						
	Trap		October			November			
Release location	site	Sex	19	26	3	10	17	22	Grand Total
Bryan's Landing	LFH	male	250	175	62	40			527
(above LGO Dam)		jack<53	183	1		1			185
	LGR	male		114	352	121			587
		jack<53		6	38	3			67
		Total	**433**	**296**	**452**	**185**			**1366**
Central Ferry	LGR	male		57					57
(above LGO Dam)		jack<53		5					5
		Total		**62**					**62**
Lyons Ferry Park	LFH	male					364	439	803
(below LGO Dam)		female					56	88	144
		jack<53						5	5
		Total					**420**	**532**	**952**
Rooster's Landing	LGR	male					8		8
(above LGR Dam)		jack<53					77		77
		Total					**85**		**85**
Grand Total			**433**	**358**	**452**	**185**	**505**	**532**	**2465**

Incubation, Rearing, Marking, and Transfer

Historical information regarding eggtake, early life stage survival (Table 9), and marking and transfer numbers (Table 10) are provided. Rearing followed standard operating procedures that are available upon request. Detailed information regarding type and size of vessels used for rearing can be found in Lyons Ferry Hatchery Annual Reports.

Historically, yearling fall Chinook were 100% AD/CWT/VIE tagged. The use of VIE tags gave us flexibility regarding the trapping/passing of fish at adult traps, and allowed us to determine the origin of the fish at spawning before a CWT was extracted. Beginning with the 2003 adult return to LGR, the trapping protocol was changed to randomly sample the run for run reconstruction purposes. Because all CWT fish randomly trapped must be killed, the use of the VIE tag as an indicator of which fish to pass is no longer needed. Thus, the Nez Perce Tribe (NPT) decided to discontinue use of that tag. LFH and SRL staffs find that the use of VIE tags expedite the spawning process, so WDFW's onstation yearlings continue to be marked with a VIE.

Another change to tagging began with the 2003 brood year yearlings. The *United States v. Oregon* parties agreed to a modification of the marking protocols (Appendix B) that ensures each release group/location is represented by a CWT group. The total number of fish released with an AD clip remains the same for the overall release of fall Chinook into the Snake River.

Table 9. Eggtake and survival numbers by life stage of Lyons Ferry origin fall Chinook spawned at LFH, broodyears 1996-2004.

Brood Year	Eggs taken	ELISA Loss [a]	Eggs Shipped [b]	Eyed Eggs retained	Fry ponded	Intended Program
1996	1,433,862	0	0	1,377,202	941,900 419,677	Yearling Subyearling
1997	1,184,141	0	0	1,134,641	1,037,221 63,849	Yearling Subyearling
1998	2,085,155	0	0	1,978,704	916,261 1,010,344	Yearling Subyearling
1999	3,980,455	156,352	0	3,605,482	991,613 2,541,759	Yearling Subyearling
2000	3,576,956	53,176	115,891	3,249,377	998,768 2,159,921	Yearling Subyearling
2001	4,734,234	144,530	200,064	4,230,432	1,280,515 2,697,406 125,600	Yearling Subyearling Research
2002	4,910,467	44,900	1,195,067	3,540,000	1,032,205 2,376,251 73,229	Yearling Subyearling Research
2003	2,812,751	0	250,400	2,476,825	985,956 1,455,815 0	Yearling Subyearling Research
2004	4,625,638	0[a]	1,053,278	3,421,751	- - -	Yearling Subyearling Research

[a] Eggs from ELISA positive females were incorporated into the rest of the brood stock in 1996-1998 and 2003-2004.

[b] The destination of shipped eggs prior to 2003 can be found in previous Annual Reports. In 2003 eggs were shipped to NPTH (50,400) and Oxbow Hatchery (200,000). During 2004 eggs were shipped to Oxbow Hatchery (211,000) and Umatilla Hatchery (842,278).

Table 10. Snake River fall Chinook marked by WDFW and/or transferred from LFH, 2002-2004 broodyears.

Brood Year	Release Site	Marking				Transfer		
		Date	Type [a]	Number	Fpp	Date	Number	Fpp
2002	LFH	9/30/03	AD+CWT+ LR	455,257	30.0	-	-	-
Yearling	Big Canyon (BC)[b]	10/22/03	AD+CWT+ LG	109,239	65.0	3/03/04	108,420	13.2
Age	Captain John (CJ)	10/13/03	AD+CWT+ LB	154,185	25.0	2/09/04	153,654	12.5
	Pittsburg Landing PL)	10/1/03	AD+CWT+ RG	154,711	30.0	3/01/04	154,151	12.3
2003								
Subyearling	LFH	4/05/04	AD+CWT	201,795	150.0	-	-	-
	BC	4/09/04	CWT	201,489	180.0	5/11/04	481,671	80.0
	CJ	4/14/04	CWT	202,194	150.0	5/10/04	500,940	83.0
	PL	-	-	-	-	5/10/04	200,245	75.3
Yearling	LFH	10/5/04	AD+CWT+ LR	227,524	30.0	-	-	-
	LFH	10/22/04	CWT+ LR	228,384	30.0	-	-	-
	LFH	1/10/05	AD+CWT+ LR	16,620	20.0	-	-	-
	BC	10/12/04	AD+CWT	72,113	20.0	2/16/05	66,155	12.1
	BC	10/20/04	CWT	82,706	20.0	2/17/05	75,872	12.1
	PL	10/27/04	CWT	82,823	30.0	2/28/05	80,674	13.0
	PL	10/29/04	AD+CWT	72,411	25	2/28/05	70,532	13.0
2004[c]								
Subyearling	LFH	4/07/05	AD+CWT	200,810	160.0	-	-	-
	Couse Cr.	3/30/05	AD+CWT	201,262	170.0	-	-	-
	Gr. Ronde	4/18/05	AD+CWT	202,116	150.0	-	-	-
	BC	4/12/05	AD+CWT	99,875	150.0	5/03/05	257,881	77.6
	BC	4/12/05	CWT	100,232	150.0	5/03/05	259,051	77.6
	CJ	3/22/05	AD+CWT	103,823	170.0	5/03/05	256,716	69.7
	CJ	3/22/05	CWT	100,733	170.0	5/03/05	249,018	69.7
	DNFH-Research	-	-	-	-	4/11/05	175,524	180.0
	USF&W-Research	-	-	-	-	2/04/05	3,310	662.0
	NOAA-Research	-	-	-	-	4/18/05	1,500	100.0

[a] In the mark type column, visible implant elastomers (VIE) are designated by side and then color, i.e. LR denotes left red, LB denotes left blue and RG denotes right green.

[b] Big Canyon yearlings were marked at two different times and sizes (82,453 in October @65 fpp and 26,786 in January @20 fpp.

[c] The 2004 brood year also has a yearling component which will be tagged in 2005 and presented in a future report.

Juvenile Releases and Migration

Numbers of fish released, along with lengths and weights of fall Chinook produced at LFH are listed in Table 11. Historical releases by WDFW, NPT, IDFG, and NOAA are presented in Appendix C for release years 1996-2005.

Table 11. WDFW juvenile fall Chinook releases from brood years 2002-2003.

	Brood Year	**2002**		**2003**	
Release site		subyearling	yearling	subyearling	yearling
LFH	# Released	**200,092**	**446,355**	**201,534**	**453,200**
	Release Date	6 June 2003	12 April 2004	21 June 2004	28 March 2005
	Mean Length (mm)	92.8	162.9	93.5	163.1
	CV of Length	9.82	10.23	8.23	7.76
	Mean Weight (gm)	9.1	45.9	8.9	48.4
	Fish per pound	50.0	9.9	51.1	9.4
	# PIT tagged	1,504	0	0	0
	Snake R. flow at LMO (kcfs) [1]	112.6	46.4	50.6	41.4
	Spill (kcfs)	22.7	0	0	0
Snake River at Roosters Landing	# Released	**33,500**	--	--	--
	Release Date	4 March 2003	--	--	--
	Mean Length (mm)	--	--	--	--
	CV of Length	--	--	--	--
	Mean Weight (gm)	--	--	--	--
	Fish per pound	1,200	--	--	--
	Snake R. flow at LGR (kcfs) [1]	28.9	--	--	--
	Spill (kcfs)	0	--	--	--
Snake River at Couse Creek boat launch	# Released	**100,019**	--	--	--
	Release Date	9 June 2003	--	--	--
	Mean Length (mm)	98.83	--	--	--
	CV of Length	10.09	--	--	--
	Mean Weight (gm)	11.24	--	--	--
	Fish per pound	40.36	--	--	--
	# PIT tagged	2,993	--	--	--
	Snake R flow at LGR (kcfs) [1]	109.0	--	--	--
	Spill (kcfs)	31.27	--	--	--
Totals		**333,611**	**446,355**	**201,534**	**453,200**

1 - Flows have been highly variable during releases with yearlings generally released during lower flows than subyearling releases. They are provided here for informational and comparison purposes.

Survival Rates to Release

We used the estimated number of eggs and fish present at life stages in the hatchery for 1990-2003 broods presented in Table 9 to calculate survival rates within the hatchery environment (Table 12).

Table 12. Estimated survivals (%) between various life stags at LFH for fall Chinook of LFH/Snake River hatchery origin, 1990-2003 brood years.

Brood year	Release stage	Green egg-ponded fry	Ponded 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
1992	Yearling	92.7	96.5	89.5
	Subyearling	92.7	98.4	91.2
1993	Yearling	88.0[a]	99.0	87.1
1994	Yearling	92.7	99.3	92.1
1995[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
1999	Yearling	92.4	66.3[c]	61.3[c]
	Subyearling	92.4	95.2	87.9
2000	Yearling	92.8	91.3	84.8
	Subyearling	92.8	94.9	88.1
2001	Yearling	93.6	79.5	74.5
	Subyearling	93.6	97.7	95.8
2002	Yearling	95.3	86.8	82.8
	Subyearling	95.3	94.8	90.3
2003	Yearling	95.5	75.7	72.3
	Subyearling	95.5	95.1	90.8
Yearling mean:	**%**	**92.2**	**88.7**	**81.6**
	SD	2.6	10.2	8.4
Subyearling mean:	**%**	**92.8**	**95.9**	**89.3**
	SD	2.4	2.7	3.1

[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.

[c] Avian predation of yearlings released at LFH was estimated at 25%. This loss occurred between tagging and release while fish were in the rearing lake.

Stock Profile Evaluation

Sex Ratio, Age Structure, and Size at Age

Trapping protocols change annually making it difficult to track stock profile variables such as sex ratios, age structure, and size at age. Jacks and minijacks have been trapped at different rates than adults. To accurately depict the stock profile, jacks and minijacks will need to be sampled in a similar manner to adults. This would mean sacrificing more fish at LFH. Since the trap at LFH is not designed to hold minijacks or small jacks, it may be necessary to sacrifice the minijacks as they are trapped. Sub-sampling at the LFH trap is not an option because the trap is not set up to handle and release fish. Further, unless the released fish are marked, and subsequent recaptures recorded, we would be unable to determine the actual number of fish trapped at LFH, the sex ratio of the stock or the overall age at return for subyearlings and yearlings. We recommend the trap at LFH be modified to address the concerns listed above.

Fork lengths of fish returning from tagged subyearling and yearling releases are listed in Appendix D. Reservoir rearing (based on scale pattern analysis) has been documented as occurring in subyearling hatchery releases as well as in natural origin fish. However, the data does not separate out reservoir-reared subyearlings because scales were not collected from tagged returns, thus total age not ocean age is reported. The total length at age may differ because of this life history strategy. Therefore the reader should be cautious when comparing yearlings with subyearlings since reservoir-reared subyearlings may appear more similar to yearlings for size at return because of similar ocean age.

The integration of LFH/Snake River natural origin fish and unmarked/untagged LFH/Snake River hatchery origin fish into the hatchery broodstock has added complexity to natural origin stock versus hatchery broodstock profiling. Our ability to distinguish these groups at spawning has decreased because of the co-manager's decision to release increased numbers of unmarked/ untagged subyearlings in the basin. Tribal managers desire to increase the numbers on unmarked fish to the basin to prevent downstream harvest in selective fisheries. This decision makes the distinction of hatchery from natural origin fish difficult. Fish origin now must rely on CWT recovery or scale pattern analysis. Future reports will examine the profile of LF/Snake River natural origin fish as a separate group since little is known about these fish. An adequate genetic profile of these fish will be critical to long-term evaluation of the genetic effects of the hatchery program.

Fecundity

The data presented here are meant to give the reader a general idea of fecundities for different age classes and origins of fish spawned at LFH; as well as provide data for determining trapping protocols. Three distinct groups of fish are used for broodstock all of which are LFH/Snake River origin; hatchery fall chinook with CWTs, unmarked/untagged hatchery fall chinook (based on scale readings), and natural origin fish (based on scale readings). Age at return and fecundities of these groups may be different so they are monitored to assure trapping protocols

are sufficient to provide fish to fulfill broodstock needs and to maximize the numbers of fish returned to the river.

Fecundity was evaluated for LFH/Snake River origin females by age class (Tables 13-15). Seven fish were selected from each age class for each release strategy (yearling or subyearling) for each spawn week. Within each age class each week, fish were selected for fecundity analysis proportionally according to length category (i.e., 50-60 cm). Additional fish were sampled on either end of the fork length spectrum to quantify fecundity data for small and large fish, which tend to be rare in the sample population. Fish evaluated for fecundity generally had 0-25 eggs left in the body cavity whereas fish excluded from this evaluation contained an obvious amount of eggs (a couple of hundred or more) still in the skein.

For this report, egg loss was estimated based upon egg-picking criteria used at LFH. Any dead, haploid or non-fertilized eggs were included in the loss estimate. To estimate fecundity, loss was counted for each female and 100 fully eyed live eggs were weighed. The total volume of live eggs was also weighed, and divided by average weight per egg to yield total number of live eggs. This estimate was decreased by 4% to compensate for excess water (Snake River Lab unpublished data, 1994). The numbers of live and dead eggs were added to yield an estimated total fecundity for each fish.

The data in the tables below are not statistically representative of the cumulative hatchery population because we sampled more fish at the upper and lower fork lengths; the averages may be skewed. Rather, they are representative of each age class and release type. Caution should be used when using these data. We will standardize data representation and population (BY) fecundity in a future report.

Average fecundity was highly variable for each age class. Scatter plots (Figures 2-5) were generated based upon fork length and fecundity. We made no effort here to determine whether significant differences in fecundity exist among age classes. Even if differences occur it will be very difficult to determine if the differences are due to genetic influences, environmental influences, or incomplete collection of gametes (eggs still attached to the skein after spawning or partial spawning occurring prior to processing). We will address fecundity differences in a future report. We recommend monitoring fecundity every 5 years.

2003

Fecundities for fish returning from subyearling and yearling releases are listed in Table 13. Fish that were released as subyearlings but reared for an additional year in a reservoir prior to ocean entry are included with subyearlings. In future reports reservoir-reared fish will be separated into their own category. There was a strong relationship between fecundity and fork length (Figure 2). Excluded from the evaluation was a 91 cm LFH/Snake River hatchery origin female with 1,261 eggs and an egg size of 3.5 gm/egg.

Table 13. Average fecundity by age class of LFH/Snake River hatchery origin fall Chinook (CWT) and two LFH/Snake River natural origin fall Chinook spawned at Lyons Ferry Hatchery, as determined by weight samples and egg counts in 2003.

Brood year	Age at release	Total age	Years in salt water	# Females sampled	Average # eggs	SD	Median # eggs	Average egg size (gm)	Average Fork ln (cm)	SD
1997	Y	6	4	2	3,970	981.8	3,970	0.30	88	3.5
1998	S	5	4	14 [a]	4,752	888.5	4,691	0.31	89	3.9
	Y	5	3	40	3,703	823.5	3,867	0.32	83	6.8
1999	S	4	3	40 [b]	4,132	1011.9	4,143	0.28	82	6.9
	Y	4	2	58	3,390	841.4	3,268	0.29	75	6.5
2000	S	3	2	10 [c]	3,306	549.1	3,274	0.24	69	3.3
	Y	3	1	44	2,482	641.1	2,455	0.21	62	6.2

[a] Scales taken from this brood year include 2 fish rearing in the reservoir prior to immigration to the ocean.
[b] Scales taken from this brood year include 19 fish rearing in the reservoir prior to immigration to the ocean and one fish of Snake River natural origin.
[c] Scales taken from this brood year include 5 fish rearing in the reservoir prior to immigration to the ocean and one fish of Snake River natural origin.

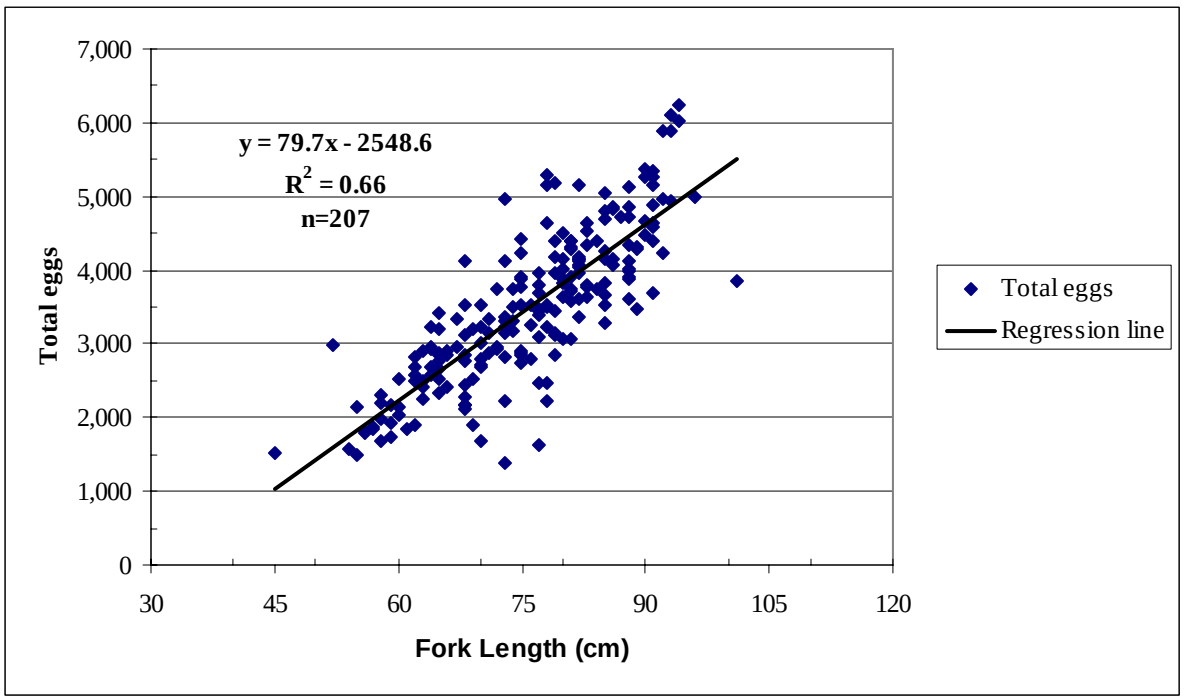


Figure 2. Relationship of fecundity to fork length for LFH/Snake River hatchery origin fall Chinook (origin verified by CWT), 2003.

2004

The fecundities of LFH/Snake River hatchery origin fall Chinook with CWTs, LFH/Snake River hatchery origin fall Chinook that were unmarked/untagged, and LFH/Snake River natural origin fall Chinook are presented in Tables 17-19. There continues to be a strong relationship between fork length and fecundity (Figures 3-5). Excluded from the evaluation was a 78 cm unmarked/untagged LFH/Snake River hatchery origin female with a total egg count of 531 and an egg size of 5 gm/egg.

Table 14. Average fecundity by age class of LFH/Snake River origin fall Chinook (CWT) spawned at Lyons Ferry Hatchery as determined by weight samples and egg counts in 2004.

Brood year	Age at release	Total age	Years in salt water	# Females sampled	Average # eggs	SD	Median # eggs	Average egg size (gm)	Average Fork ln (cm)	SD
1998 [a]	Y	6	4	4	4,087	1201.6	4,399	0.29	85	10.6
1999 [b]	S	5	4	8	4,407	480.4	4,277	0.29	88	6.6
	Y	5	3	38	3,942	811.0	3,929	0.33	83	7.4
2000 [c]	S	4	3	22	3,966	708.4	3,988	0.29	81	5.4
	Y	4	2	67	3,366	1029.0	3,315	0.28	74	8.2
2001 [d]	S	3	2	60	2,976	764.5	2,919	0.23	68	4.3
	Y	3	1	46	2,821	675.9	2,762	0.23	65	6.4

[a] Scales taken from this brood year include 1 fish rearing in the reservoir prior to immigration to the ocean.
[b] Scales taken from this brood year include 9 fish rearing in the reservoir prior to immigration to the ocean.
[c] Scales taken from this brood year include 41 fish rearing in the reservoir prior to immigration to the ocean.
[d] Scales taken from this brood year include 22 fish rearing in the reservoir prior to immigration to the ocean.

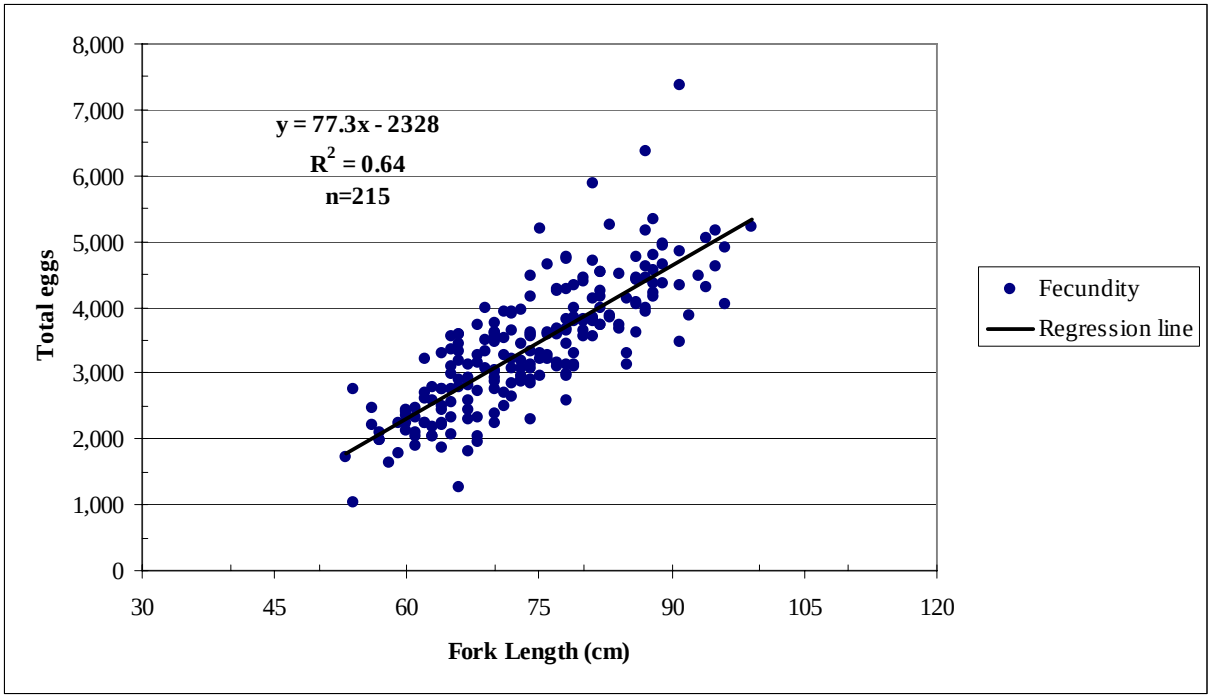


Figure 3. Relationship of fecundity to fork length for LFH/Snake River hatchery origin fall Chinook (origin verified by CWT), 2004.

Table 15. Average fecundity by age class of unmarked/untagged LF/Snake River hatchery origin fall Chinook spawned at Lyons Ferry Hatchery as determined by weight samples and egg counts in 2004.

Brood year	Age at immigration	Total age	Years in salt water	# Females sampled	Average # eggs	SD	Median # eggs	Average egg size (gm)	Average Fork ln (cm)	SD
1999[b]	S	5	4	19	4,716	839.7	4,701	0.32	90	7.8
2000[c]	S	4	3	56	3,778	780.6	3,626	0.28	79	6.5
2001[d]	S	3	2	48	2,865	755.2	2,939	0.22	67	6.9

[a] Scales taken from this brood year include 1 fish rearing in the reservoir prior to immigration to the ocean.
[b] Scales taken from this brood year include 9 fish rearing in the reservoir prior to immigration to the ocean.
[c] Scales taken from this brood year include 39 fish rearing in the reservoir prior to immigration to the ocean.
[d] Scales taken from this brood year include 20 fish rearing in the reservoir prior to immigration to the ocean.

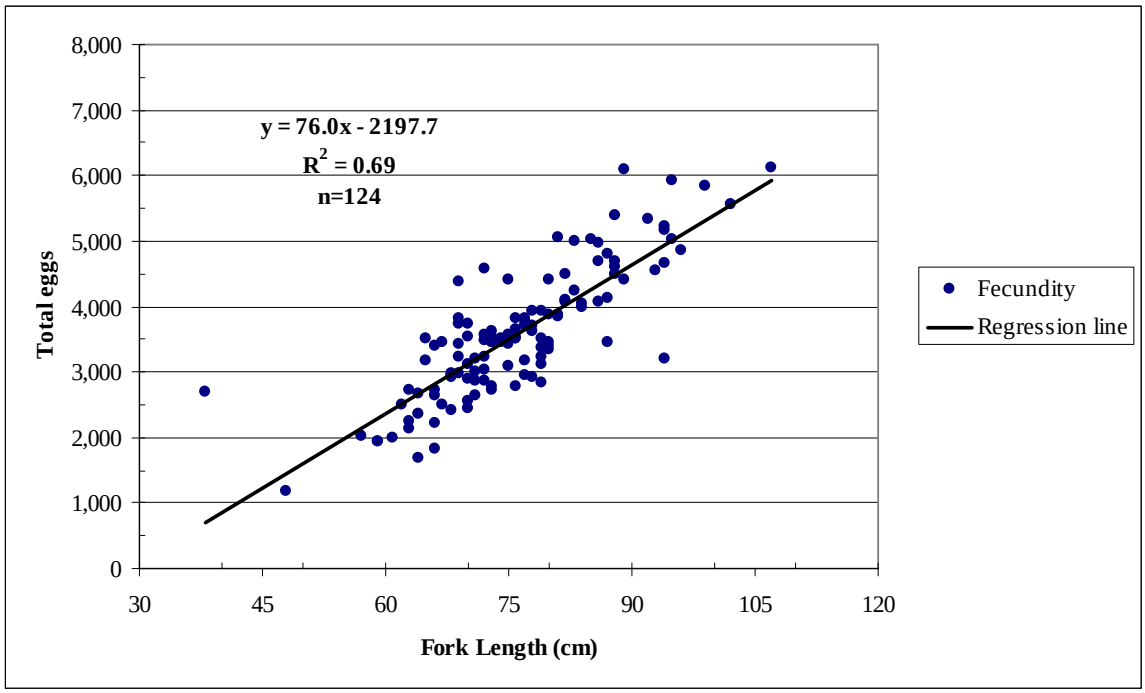


Figure 4. Relationship of fecundity to fork length for LFH/Snake River hatchery origin unmarked/untagged fall Chinook (origin determined by scale analysis), 2004.

Table 16. Average fecundity by age class of natural origin fall Chinook spawned at Lyons Ferry Hatchery as determined by weight samples and egg counts in 2004.

Brood year	Age at immigration	Total age	Years in salt water	# Females sampled	Average # eggs	SD	Median # eggs	Average egg size (gm)	Average Fork ln (cm)	SD
1998[a]	S	6	4	2	4219.8	211.6	4219.8	0.30	91	9.2
1999[b]	S	5	4	61	4888.4	956.7	4731.1	0.31	91	6.1
2000[c]	S	4	3	51	3963.2	862.1	3812.5	0.27	80	7.0
2001	S	3	2	2	3599.9	1130.7	3599.9	0.28	81	17.0

[a] Scales taken from this brood year include 2 fish rearing in the reservoir prior to immigration to the ocean.
[b] Scales taken from this brood year include 42 fish rearing in the reservoir prior to immigration to the ocean.
[c] Scales taken from this brood year include 30 fish rearing in the reservoir prior to immigration to the ocean.

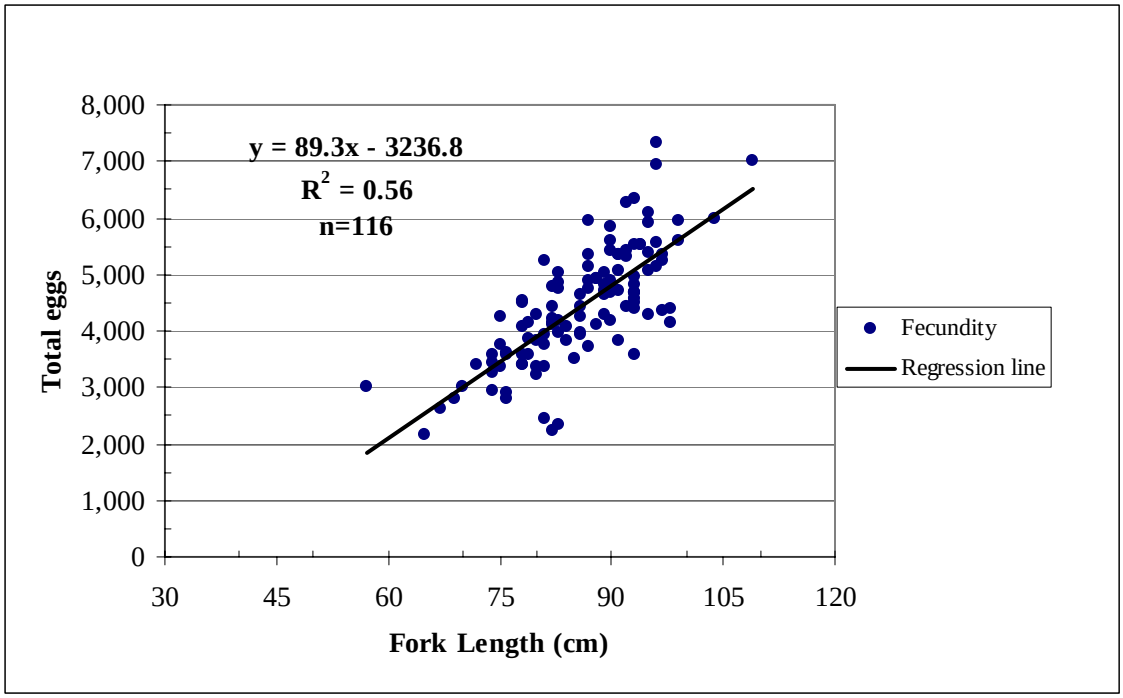


Figure 5. Fecundity by fork length for LFH/Snake River natural origin fall Chinook (origin determined by scale analysis), 2004.

Genetic Profile

Comparison results from genetic sampling of broodstock at LFH, strays from Umatilla Hatchery, unmarked/untagged subyearlings and yearlings trapped at LFH, and natural origin fish trapped at LGR Dam are presented in Appendices E and F. A brief summary of the conclusions is provided here.

The 2004 broodstock was not significantly different from 2002 and 2003 broodstock. Broodstock collected in 2002, 2003, and 2004 were not significantly different from unmarked/untagged hatchery subyearlings trapped at LFH in 2002 and 2003, but they were different than Umatilla broodstock. These results were anticipated because we believed these fish (unmarked/untagged subyearlings) originated primarily from unmarked Snake River stock hatchery releases upstream of LGR Dam, and Umatilla fish have been excluded from LFH broodstock since 1990.

Unmarked/untagged hatchery yearlings trapped at LFH in 2002 and 2003 were not significantly different from Umatilla broodstock samples. Again, this was anticipated because releases of LFH/Snake River fall Chinook yearlings are nearly 100% tagged/marked at release. The occurrence of an unmarked/untagged fish that is also missing an elastomer is extremely low.

The 2002 and 2003 LFH broodstocks were significantly different than the natural origin fish trapped at LGR Dam in 2002 and 2003. These results were anticipated because strays have been

excluded from the hatchery broodstock since 1990, while significant numbers of strays (primarily Umatilla River) have been documented upstream of LGR Dam. To further support this result, Umatilla broodstock was not significantly different from the natural origin fish trapped at LGR Dam in 2002 and 2003.

The 2004 LFH broodstock were not significantly different from natural-origin fish trapped at LGR Dam in 2003 after a Bonferroni correction was applied to the data. However, we believe real genetic differences exist even though the results (after a Bonferroni correction was applied) are not significant (see Appendix F for a more detailed discussion). Similarly, Umatilla broodstock and the unmarked/untagged subyearlings trapped at LFH were not significantly different after a Bonferroni correction; however, these should also be considered genetically different.

Tucannon River Natural Production

Adult Salmon Surveys

Fall Chinook Redd Surveys

WDFW personnel have conducted adult salmon surveys on the lower Tucannon River since 1985 (Table 17). Surveys generally covered the river from Rk 1.3 to Rk 18.0 (Table 18). The first 1.3 kilometers of the Tucannon River are deep slack water from the Snake River's Lower Monumental Dam reservoir. The habitat is poor in this area and we assume no spawning occurs there. Landowner access restrictions prevented the surveying of 1.1 kilometers of river below Fletcher's Dam near Starbuck. River conditions for viewing were good throughout the spawning season.

Table 17. Number of redds, estimated escapement to the Tucannon River, and redd densities below Fletcher's Dam, 1985-2004.

	Tucannon River		Redds below Fletcher's Dam			
Year	Total redds	Estimated escapement[a]	Total	(%)	Redds/Rk	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	43	129	31	(72)	4.3	6.9
1997	27	81	24	(89)	3.3	5.4
1998	40	120	38	(95)	5.3	8.5
1999[d]	21	63	18[d]	(86)	2.5	4.0
2000	19	57	15	(79)	2.1	3.3
2001[e]	65	195	54	(83)	6.3	10.2
2002	183	549	156	(85)	18.2	29.4
2003	146	438	124	(85)	16.8	27.1
2004	111	333	86	(77)	11.2	18.0

[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 turbid water. This should be considered an incomplete estimate.
[e] Beginning in 2001, river kilometers for Tucannon River sections were revised.

Table 18. Tucannon River survey section descriptions and numbers of redds by location.

River Section Number and Description	Rk Surveyed	Number of redds 2003	Number of redds 2004	Redds/Rkm 2003	Redds/Rkm 2004
1. Mouth of Tucannon R. to highway 261 Bridge	1.7	34	38	19.7	22.1
2. Highway 261 Bridge to smolt trap	0.3	5	2	16.3	6.5
3. Smolt trap to Powers Bridge	0.5	13	10	24.7	19.0
4. Powers Bridge to upper hog barns	1.3	22	14	17.4	11.0
5. Hog barns to boundary fence above Starbuck	3.2	30	17	9.4	5.3
6. Upper boundary fence to Fletcher's Dam	1.5	20	5	13.1	3.3
7. Fletcher's Dam to Smith Hollow	3.6	13	7	3.6	1.9
8. Smith Hollow to Sheep Ranch Bridge	5.3	5	18	1.0	3.4
9. Sheep Ranch Bridge to Highway 12[a]	5.7	1	0	0.2	0.0
10. Highway 12 to Enrich Bridge[a]	6.7	3	0	0.5	0.0
Totals	**29.8**	**146**	**111**	**--**	**--**

[a] Section not surveyed in 2001

Escapement and Composition

The total escapement to the Tucannon River is based on carcass recoveries and an expansion factor of three fish per redd. This expansion factor is a conservative estimate of fish spawning in the Tucannon River. Other methods have been used to estimate adults per redd upstream of LGR Dam based on estimates of adult salmon above LGR Dam and redd counts from the Clearwater, Snake, Imnaha, Salmon, and Grande Ronde Rivers (Garcia et al. 2005). Garcia has estimated adults per redd at 4.7 (10 year average). Groves has estimated adults per redd at 3.1 since 1993 (Phil Groves, IPC personal communication), using adjustments for over counts of fall Chinook at LGR Dam and pre-spawning mortality estimates as indicated in a radio telemetry study on the Snake River (Mendel et al. 1993).

SRL staff tries to complete all survey sections on the same day of the week (Table 19). Although the Tucannon River is a small river, locating carcasses can be difficult because of removal by predators (like river otter), or carcasses washing into deep holes where they are difficult to see and recover. We collect heads and scales from each carcass to determine origin from CWT and scale readings (Tables 20 and 22). Composition of the run (Table 21 and Appendices G and H) is determined by applying the composition of the carcasses recovered, to the estimated escapement into the Tucannon River. We believe our estimates of escapement are bias toward adults since the recovery efficiency of jacks is low.

Table 19. Date, number of fall Chinook redds counted, live fish seen, and carcasses on the Tucannon River in 2003 and 2004.

	Redds counted		Live fish seen		Carcasses sampled	
Week beginning	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**
November 1	12	2	7	0	0	0
November 8	41	13	32	7	1	0
November 15	37	18	57	21	12	20
November 22	30	47	41	80	29	9
November 29	22	31	18	26	43	22
December 6	4	0	4	0	14	0
December 13	0	-	1	-	11	-
Totals	**146**	**111**	**--**	**--**	**110**	**51**

Natural origin fish have not been DNA tested to determine origin, although scale pattern analysis indicates these fish are more similar to in-basin Chinook than out-of-basin fish. In 2004 we were unable to sample any jacks although jacks were observed during surveys. For information regarding the assignment of fish to specific origins please refer to Appendices G and H.

Any yearling recoveries from unmarked/untagged/no VIE fish are assumed to be strays, since all LF/Snake River hatchery origin fish have been AD/CWT/VIE tagged. Strays from out-of-basin releases were often blank wire tagged. The BWTs could have originated from either Klickitat Hatchery or Umatilla River releases. Since there were no recoveries of Klickitat Hatchery CWTs from our carcass surveys, we assumed these fish were of Umatilla River origin.

Table 20. Age structure (total age) of fall Chinook carcasses sampled on the Tucannon River. 2003.

	Subyearling				Yearling			Reservoir-Reared	
Origin	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 3**	**Age 4**	**Age 5**	**Age 3**	**Age 4**
Lyons Ferry Hatchery	1	1	4		6	8	5	2	1
Natural (wild)			5						1
Blank Wire Tag			6	1		9	21		
Umatilla Hatchery			1						
Bonneville Hatchery				2					
Yakima Hatchery			1						
Out-of-basin [a]	2	2	19	7		1	6		
Undetermined Hatchery (inbasin or out-of-basin)					1				
Unknown origin (inbasin or out-of-basin, hatchery or natural)			1			1			
Totals	**3**	**3**	**37**	**10**	**7**	**19**	**32**	**2**	**2**

[a] The out-of-basin subyearlings were not hatchery origin although the yearlings were.

Out of Snake River basin fish historically have dominated the run to the Tucannon River. In 2004, there was a significant shift in the run composition to LF/Snake River hatchery origin fish. This change is believed to have resulted because of the large numbers of fish that were returned to the Snake River from LFH during spawning. Recoveries of fish with caudal clips represented 41.2% of the run. The only caudal clips encountered were top caudal clips indicating they were from fish trapped at LFH that were later released into the Snake River. Since 85.7% of the released fish were of LF/Snake River hatchery origin, the run composition for 2004 is skewed towards LF/Snake River hatchery origin. If LFH minimizes the number of late-season excess brood releases, we anticipate the run to the Tucannon River will continue to consist primarily of strays in coming years.

Table 21. Estimated run composition of fall Chinook in the Tucannon River, 2003 and 2004.

	Percent Composition of Run		
	2003		2004
Origin	Adults	Jacks (<53cm)	Adults
Lyons Ferry Hatchery	23.5	20.0	60.4
Natural (wild)	5.2	0.0	5.6
Out-of-basin (strays)	67.0	40.0	32.1
Unassigned hatchery origin	1.7	20.0	
Unassigned unknown origin (wild or hatchery)	2.6	20.0	1.9
Total	**100**	**100**	**100**

Table 22. Age structure of fall Chinook carcasses sampled on the Tucannon River, 2004.

	Subyearling				Yearling				Reservoir-Reared	
Origin	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 5
Lyons Ferry Hatchery		1	1	1	17	10		1	1	
Natural (wild)		1	1							1
Blank wire tagged			2			2	5	1		
Umatilla Hatchery	1									
Bonneville Hatchery								2		
Undetermined hatchery (out-of-basin)			1		2					
Totals	**1**	**2**	**5**	**1**	**19**	**12**	**5**	**4**	**1**	**1**

Coho

2003

The NPT re-introduced Coho into the Clearwater River in 2001 with the release of 118,678 juveniles. Annual releases have continued since that time. Numbers of Coho observed in the Tucannon River have increased annually since 2002. The Coho are spawning in the same areas as the fall Chinook. Eleven coho redds were observed; nine were located below Fletcher's Dam (Rkm 9.8). Six Coho carcasses were recovered during 2003 surveys. All of the fish were

unmarked/untagged. Scale results indicate one of these fish was a natural origin 3-year-old. The remaining were hatchery yearling 3-year-old fish.

2004

Sixteen coho redds were observed; five were located below Fletcher's Dam. Two carcasses were collected, and scale readings indicated both were hatchery yearling 3-year-old fish.

Juvenile Salmon Emigration

WDFW staff operates a 1.5 m rotary screw trap continuously at Rkm 3.0 on the Tucannon River to estimate numbers of migrating juveniles. Each week during the fall Chinook smolt emigration, we attempted to determine trap efficiency by clipping a portion of the caudal fin on captured migrants and releasing them about one kilometer upstream of the trap. The percent of marked fish recaptured was used as an estimate of weekly trapping efficiency. When insufficient fish were captured for trap efficiency estimates, stream flow data (provided from United States Geological Survey gauge station) were used in a correlation analysis that related out-migration to stream flow. To estimate potential juvenile migrants passing when the trap was not operated (because of debris load or flood flows), we calculated the average number of fish trapped for three days before and three days after non-trapping periods. The mean number of fish trapped daily was then divided by the estimated trap efficiency to calculate fish passage. Total daily estimated fall Chinook out-migrating from the Tucannon River was calculated by expanding the daily catch by the corresponding weekly trap efficiency. For a more complete discussion of our smolt trapping refer to Gallinat and Ross (2005).

To estimate the total emigration from the Tucannon River, smolt trap estimates are applied to redd counts above the trap, resulting in a smolts per redd estimate, which is then applied to the total number of redds (above and below the trap). The river below the smolt trap is slow flowing, and with the high sediment load to which the lower river can be subjected, redd sedimentation could occur. Therefore, the survival of eggs/fish below the smolt trap may be less than eggs/fish incubated/reared above the smolt trap. No data are currently available to determine if such a differential exists for any production year. Because of these concerns, we suggest the following production estimates be used cautiously.

2003

Based upon the capture of 5,579 fall Chinook, we estimate that 14,310 naturally produced fall Chinook smolts passed the Tucannon River smolt trap. The estimated number of smolts produced per redd was 135. Applying the smolt per redd estimate to the total number of redds observed, yields an estimate of 19,526 fall Chinook smolts emigrating from the Tucannon in 2003.

2004

We captured 19,365 fall Chinook, and estimate that 55,683 naturally produced fall Chinook smolts passed the Tucannon River smolt trap. The estimated number of smolts produced per redd was 784. Applying the smolt per redd estimate to the total number of redds observed, yields an estimate of 87,054 fall Chinook emigrating from the Tucannon in 2004.

Coho

Coho salmon were incidentally captured at the smolt trap. Mark-recapture trap efficiency estimates were not done for this species, so estimates of total emigration could not be calculated. During 2003 and 2004, SRL staff identified 135 and 224 coho smolts, respectively.

Summary of Fall Chinook Run Size and Composition

Returns to Ice Harbor Dam

The fish counting schedule at Ice Harbor (IHR) Dam changed from 24-hour coverage from 1 August through 15 December in 2002 to a daily 16 hour count from 1 August through 31 October for 2003 and 2004. Historical counts at IHR Dam are listed in Appendix A, Table 1. **Counts at IHR Dam should not be used in estimating the number of Snake River fall Chinook** because of Columbia River dip-ins inflating the number of fish counted at the dams (Mendel et al. 1993). On average from 2000-2003 we estimate the IHR count over estimated actual Snake River fall Chinook passage by 21% (Appendix A, Table 2).

Returns to LMO Dam

2003

Fall Chinook counts at Lower Monumental Dam (LMO) were made 16 hours each day from 1 August through 31 October, then 10 hours a day from 1 November through 31 December in 2003 and 2004. To determine how similar in-season window counts were to end-of-season estimates of fish in the Snake River, we combined fish accounted for at LFH with estimated spawners into the Tucannon River and the adjusted numbers of fall Chinook to LGR Dam from run reconstruction estimates. We estimate the fall Chinook run above LMO Dam at 25,227 (Table 23). LMO window counts of fall Chinook were 22,851 (US Army Corps of Engineers 2003).

Although the LMO fall Chinook counts underestimated fall Chinook escapement into the Snake River by 9.5%, we suggest it gives a better basis for estimating the run to the Snake River than using the IHR count that is inflated due to Columbia River dip-ins. From 2000-2003 the window counts at LMO overestimated the fall Chinook run to the Snake River by an average of 3% (Appendix A, Table 2).

Because of the time involved to collect in-season data and complete the LGR run reconstruction, if in-season monitoring of run size is needed, we suggest those in-season estimates of fall Chinook be made using LMO window counts. **Ice Harbor Dam counts are misleading for managers to base management decisions on**. The final run composition and run estimate to the Snake River should continue to come from post-season LGR run reconstruction. We provide an analysis of the relationship of LMO fish counts to run size from LGR run reconstruction in Appendix A, Table 2.

Table 23. Estimated run to the Snake River based upon broodstock collected at LFH, the run estimates into the Tucannon River, and run reconstruction estimates of unique fish to LGR Dam in 2003.

Fall Chinook estimates	Adults	Jacks (<53cm)	Total
Fish trapped at LFH, processed, retained for broodstock [a]	2,403	1,339	3,742
Fish estimated as spawned in the Tucannon River [b]	420	18	438
Unique fish to LGR Dam	13,963	7,084	21,047
Estimated run size in the Snake River	**16,786**	**8,441**	**25,227**

[a] Data excludes 2 adults and 10 jacks trapped at LGR Dam that were mixed in with the LFH trapped fish at processing.

[b] Adults and jack determinations are excluded from this table because of the difficulty in recovering jacks in the Tucannon River.

2004

LMO window counts of fall Chinook were 25,878 in 2004 (US Army Corps of Engineers 2004). A final run reconstruction estimate of passage at LGR was not available for this report. A comparison between window counts at LMO Dam and the run reconstruction estimate (using the methodology described for 2003) will be completed in an upcoming report.

Return to LFH

2003

Fish trapped at LFH that were processed (killed) during fall Chinook spawning are listed in Appendix I. Nine of the fish processed were minijacks (<30cm). We estimate that 20 of the fish (9 adults and 11 jacks) listed as trapped at LFH were actually fish trapped at LGR Dam. All fish returned to the Snake River were excluded from the LFH run composition, since they may be included in Tucannon River recoveries or the LGR run composition. Moreover, these fish were not reported to the Regional Mark Information System (RMIS).

The composition presented in Table 24 is based on data from the fish trapped and processed at LFH (Appendix I), which is not representative of the Snake River run at large and is not a representative sample of what was trapped at LFH. Both Umatilla and Klickitat hatcheries released fish that were identically marked (blank wire tag only). Since there was only one recovered CWT from Klickitat Hatchery, we assume the majority of BWT recoveries in 2003 were from Umatilla Hatchery. Spring/summer Chinook incidentally captured are also listed below.

Table 24. Composition of fish trapped at LFH and processed (killed) in 2003 and 2004.

Origin	2003 Adults	2003 Jacks	2003 Comp of Adults	2003 Comp of Jacks	2004 Adults	2004 Jacks	2004 Comp of Adults	2004 Comp of Jacks
LF/Snake River Hatchery	1,789	1,230	**82.4%**	**97.3%**	2,677	496	**93.5%**	**98.0%**
LF/Snake River natural	4		**0.2%**		10		**0.4%**	
Strays (out-of-basin)	316	8	**14.6%**	**0.6%**	147	3	**5.1%**	**0.6%**
Hatchery origin (unassigned)	47	24	**2.2%**	**1.9%**	11	6	**0.4%**	**1.2%**
Unknown origin (natural or hatchery)	8	2	**0.3%**	**0.2%**	12	1	**0.4%**	**0.2%**
Spring/Summer Chinook	8		**0.3%**		6		**0.2%**	
Totals	2,172	1,264			2,863	506		

2004

Fish trapped at LFH that were processed (killed) during fall Chinook spawning are listed in Appendix J and Table 24. We estimate eight adult fall Chinook listed as trapped at LFH were actually LGR Dam trapped fish.

Returns to LGR Dam and Composition of Fish Hauled to LFH from LGR Dam

In recent years, WDFW has estimated the Snake River fall Chinook run composition at LGR Dam, in part using CWTs and BWTs from marked hatchery salmon collected at LGR Dam and spawned at LFH. In 2003, the *United States v. Oregon* Technical Advisory Committee (TAC) accepted the task of generating the run reconstruction for LGR Dam, which is derived from CWT recoveries and data presented in Appendices G and I. This is an abbreviated account of escapement to LGR Dam and the final composition of fall Chinook processed at LFH that were hauled from Lower Granite Dam, as estimated by WDFW. **Please note that the TAC Run Reconstruction should be the primary document used when doing any analysis of the fall Chinook run to Lower Granite Dam.**

From 1994-2002, counts of fall Chinook at the LGR Dam window covered 24 hours each day. In 2003 the window counts were changed to monitor 16 hours of the day from August – October, and 10 hours of the day from November – 15 December. When fish are counted at the window they are tallied according to total length (adults $\geq$56 cm, jacks 30 cm-55 cm). In addition, US Army Corps of Engineers (COE) counts of fall Chinook do not include minijacks (fish <30cm long). Therefore, the total number of fall Chinook in the Snake River is underestimated. As a result, the estimated numbers of fish available for upcoming fisheries will be under estimated as well since run predictors rely heavily on jack ratios in the population, and exclude minijacks. Fish managers have expressed interest in the number of minijacks in the Snake River since it will give them better data on which to base future fishery recommendations.

2003

The 2003 run reconstruction for fall Chinook to LGR Dam was finalized in February of 2006 (Appendix K). The following fallback information was not included in the run reconstruction, but rather was mentioned as something to consider. Future run reconstruction efforts will subtract fallbacks from the number of fish passing the dam. Based on radio telemetry data in 1993, we assume fallback is occurring primarily in yearling fall Chinook released at LFH, and out-of-basin fish.

The adult window counts at LGR Dam are shown in Figure 6. Fallback events are not deducted from the window counts. Fallbacks were documented from August-October at the juvenile smolt project, downstream of LGR. Fallback events (13 adults and 5 jacks) documented during the month of August will not be included since data were not recorded regarding the run of Chinook encountered (summer Chinook may have been included). Combining detections of fallback events at the separator and occurrence of adult/jack/minijacks during sampling periods at the juvenile facility, **we estimate 157 adult** (76 clipped and 81 unclipped), **400 jack (**334 clipped and 66 unclipped)**, and 2 minijack** (unclipped) **fallback events occurred in 2003** (Fred Mensik personal communication). Since these fish were not examined for operculum punches we do not know if these fish were counted at the LGR Trap during sampling for the run reconstruction. Likewise, we do not know if these fish re-crossed the dam after falling back or if they continued downstream.

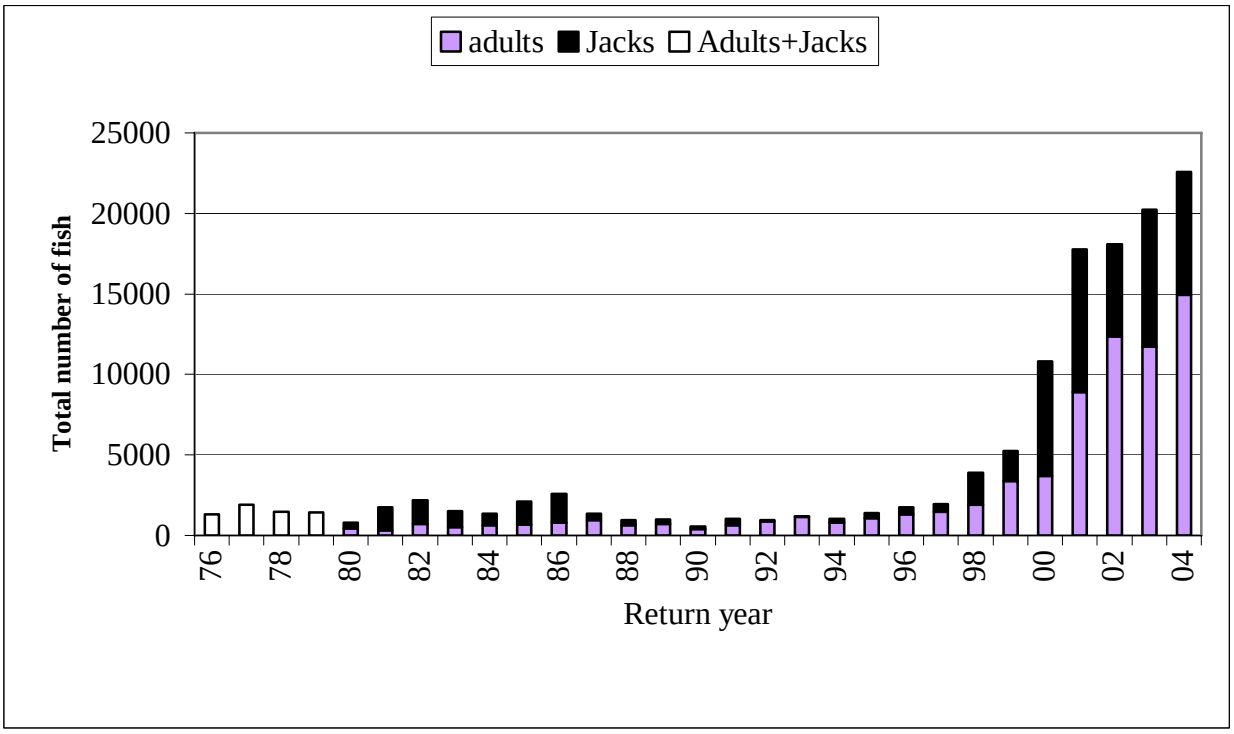


Figure 6. Fall Chinook window counts at LGR Dam, 1976-2004.

Fish hauled from LGR to LFH that were processed (killed) are listed in Appendix I. Data presented in Table 25 are not expanded for missing fish (20 fish) that were incorrectly identified as volunteers to LFH, and only represents the fish we processed, not the run to LGR Dam. Non-Snake River origin hatchery fish included were composed primarily of hatchery fish released into the Umatilla River. One minijack is included in the composition of fish trapped at LGR, and another five were encountered during the trapping period. We estimate at least 54 minijacks arrived at LGR in 2003.

Table 25. Composition of fish trapped at LGR Dam that were hauled to LFH and processed (killed) to determine composition in 2003 and 2004.

	2003				2004			
Origin	**Adults**	**Jacks**	**Comp of Adults**	**Comp of Jacks**	**Adults**	**Jacks**	**Comp of Adults**	**Comp of Jacks**
LF/Snake River Hatchery	318	313	**75.7%**	**94.3%**	835	181	**74.8%**	**88.7%**
LF/Snake River natural					148	10	**13.3%**	**4.9%**
Strays (out-of-basin)	93	14	**22.1%**	**4.2%**	102	8	**9.1%**	**3.9%**
Hatchery origin (unassigned)	8	5	**1.9%**	**1.5%**	4	3	**0.4%**	**1.5%**
Unknown origin (natural or hatchery)					26	2	**2.3%**	**1.0%**
Spring/Summer Chinook	1		**0.3%**		1		**0.1%**	
Totals	420	332			1,116	204		

This is the first year the run reconstruction estimate was greater than the window count (Table 26). The run reconstruction estimated the return based on trapping a set percentage over 24 hours of each day, whereas window counts only monitor from 10-16 hours per day. Therefore, the window count under estimated the run to LGR Dam by 4%.

The estimation procedure for the run reconstruction is unpublished at this time, although the estimates have been completed (Table 27). Prior to 2003 the trap at LGR Dam trapped only wire tagged fish and window counts were used to estimate the remainder of the run. In 2003 the trap collected a random sample of the run regardless of the occurrence of wire. It is believed that the new method provides a more accurate estimate than prior methods.

Table 26. Comparison of fall Chinook run to LGR Dam using TAC estimate to the number of fish observed at the ladder window (COE) in 2003.

Data origin	**Adults**	**Jacks (<53 cm)**	**Total**
TAC unique count (actual run)	13,963	7,084	21,047
COE window count	11,732	8,481	20,213
Difference	**+2,231**	**-1,397**	**+834**

Table 27. Run size and composition of the run to, and past, LGR Dam in 2003.

	Run to LGR Dam				Run Past LGR Dam			
Origin	**Adults**	**Jacks**	**Comp of Adults**	**Comp of Jacks**	**Adults**	**Jacks**	**Comp of Adults**	**Comp of Jacks**
LF/Snake River Hatchery	8,913	6,265	**63.8%**	**88.4%**	8,565	5,946	**63.4%**	**88.1%**
LF/Snake River natural	3,856	477	**27.6%**	**6.7%**	3,856	477	**28.6%**	**7.1%**
Strays (out-of-basin)	1,193	343	**8.5%**	**4.8%**	1,083	326	**8.0%**	**4.8%**
Totals	13,963	7,084			13,505	6,748		

Combining data from fish processed at LFH, encountered in the Tucannon River, and the estimates of the run to LGR Dam, an estimated number of strays to the Snake River was calculated (Table 28). We estimate the stray rate to the Snake River basin at 8.4%.

Table 28. Estimated total number of strays (out-of-basin) to the Snake River Basin in 2003.

Origin/Release area [a]	**LFH processed**	**Tucannon River** [b]	**LGR processed**	**Past LGR** [c]	**Total to Snake**
Umatilla	32	4	8	44	88
Klickitat	2		1	8	11
Bonneville	3	7	2	54	66
Ringold			1		1
Priest Rapids	1		1		2
Yakima		4			4
Little White Salmon			1		1
Columbia River				351	351
Salmon ID				27	27
McCall summer [d]	8		1	9	18
Unknown, BLANK [e] (wire tag)	268	138	86	850	1,342
Unknown, 09blank [e] (wire tag)	5		7	67	79
Stray Hatchery (AD only)	1				1
Unknown (Unm/untag sub)	5	109			114
Unknown (Unm/untag yrl)	14	26			40
Total	339	288	108	1,410	2,145

[a] Unknown origin age 4 yrl are assumed to be strays because LF/Snake River hatchery origin yearlings are AD/CWT/VIE tagged, resulting in nearly 0 unmarked/untagged returns.
[b] Actual recoveries, not expanded for run to Tucannon River.
[c] Run reconstruction estimate
[d] Summer Chinook is included in this area because it was part of the run reconstruction.
[e] BLANK and 09BLANK wire tags are listed separately because they cannot be assigned to specific release data.

2004

The fish were counted 24 hours per day during August, 16 hours per day from September - October, and 10 hours per day from November-15 December resulting in 14,960 adults and 7,600 jacks counted. Window counts at LGR do not take into account fallback events. The run reconstruction estimates for fall Chinook to LGR Dam was not finalized at the time of printing of this report.

Fallbacks were documented from August-October at the juvenile smolt project, downstream of LGR. Fallback events (12 adults and 3 jacks) documented during the month of August will not be included since data were not recorded regarding run of Chinook encountered (summer Chinook may have been included). Combining detections of fallback events at the separator and occurrence of adult/jack/minijacks during sampling periods at the juvenile facility, we estimate **439 adult** (301 clipped and 138 unclipped), **and 314 jack** (258 clipped and 56 unclipped) **fallback events occurred in 2004** (Fred Mensik personal communication). Since these fish were not examined for operculum punches we do not know if these fish were counted at the LGR trap during sampling for the run reconstruction. Likewise, we do not know if these fish re-crossed the dam after falling back or if they continued downstream.

Fish hauled from LGR to LFH that were processed (killed) are listed in Appendix J and Table 25. We did not process any minijacks from LGR although one minijack was released at the LGR trap. This would expand to approximately seven minijacks during the trapping period. Additional fish trapped at LGR that were hauled to Nez Perce Tribal Hatchery (NPTH) and specific data about those fish will be included in an upcoming NPT Annual Report (Bill Arnsberg personal communication). An estimate of the composition of the fall Chinook run to LGR will require the additional NPT data be added to what is presented in this report.

Final Location of Wire Tagged LFH/Snake River Hatchery Fall Chinook

Coded wire tags from fishery recoveries, spawning ground recoveries from the Tucannon and Palouse Rivers, broodstock collected at LFH, as well as the run reconstruction estimates of wire tagged fish processed from LGR Dam and fish passed upstream of LGR Dam have been totaled in Appendix L. No expansions were made for untagged fish associated with the wire recoveries. Comparing yearling data with subyearling data is difficult since the two groups of fish were marked differentially; yearlings are 100% AD/CWT, while subyearlings included unmarked/untagged, wire tagged without a fin clip, as well as AD/CWT groups. Some ocean fisheries only visually sample fish for fin clips (indicator for presence of a CWT) while others sample electronically for wire. This may result in an underestimation of harvest by ocean fisheries for unclipped CWT subyearlings. To address this, paired releases of ADCWT and CWT tagged fish began in 2005. Upcoming reports will document the differences in estimating harvest for ADCWT groups versus CWT only groups.

2003

The final locations of wire tagged LFH/Snake River hatchery origin fish were summarized in Appendix L. For yearling releases, approximately 48% of adult return detections were in the Snake River, 35% in the Columbia River, and 17% in ocean fisheries. Detections of adults returning from subyearling releases indicated 75% were from the Snake River, 14% in the Columbia River, and 11% in ocean fisheries. The majority of ocean recoveries for yearlings as well as subyearling occur in British Columbia and Washington waters.

2004

Appendix L does not contain Snake River recoveries for 2004 since that data were not finalized. Because we do not have final estimates for the Snake River, we are unable to compare freshwater to ocean recoveries. Once again, the majority of adult fish ocean recoveries for yearling and subyearling smolt releases occurred in British Columbia and Washington waters.

Status of Mitigation Requirements

2003

We estimate that the LSRCP mitigation goal of 18,300 hatchery fall Chinook was met in 2003 (Table 29). Fish released as part of the NPT hatchery and IPC programs are not part of LSRCP: therefore are not included below. We estimate the natural run (Table 30) to the Snake River was approximately 30% of what the population was expected to be (14,363 natural origin fish) when mitigation goals were set.

Table 29. Estimated number of LF/Snake River hatchery origin fall Chinook to the Snake River in 2003 contributing to LSRCP mitigation goals.

Sex	LFH processed	Tucannon River [a]	LGR processed [b]	Past LGR [b]	Total to Snake
Adults	2,596	99	487	8,422	11,604
Jacks (<53cm)	1,031	4	265	5,594	6,894
Total	3,627	103	752	14,016	18,498

[a] Estimated run to Tucannon River.
[b] Run reconstruction estimate.

Table 30. Estimated number of LF/Snake River natural origin fall Chinook to the Snake River in 2003.

Sex	LFH processed	Tucannon River [a]	LGR processed	Past LGR [b]	Total to Snake
Adults	9	22	0	3,856	3,887
Jacks (<53cm)	2	0	0	477	479
Total	11	22	0	4,333	4,336

[a] Estimated run to Tucannon River.
[b] Run reconstruction estimate.

2004

Combining run reconstruction estimates to LGR Dam with recoveries at LFH and estimated returns to the Tucannon River provides the best estimate of mitigation returns. Unfortunately there is often a delay in the completion of the run reconstruction. We completed a **preliminary estimate** for the LGR trapping period using WDFW and NPT data (Bill Arnsberg personal communication) since some of the adults trapped at LGR Dam were hauled to NPTH. This estimate does not include fish reaching LGR Dam before Sept 6 or after November 22 when the trap was not operating. Therefore this estimate **is a minimum and should be used with caution until the finalized TAC run reconstruction is completed.**

We estimate a minimum of 14,880 adult and 2,391 jack LF/Snake River hatchery origin fall Chinook returned to the Snake River in 2004. This represents 94.4% of the LSRCP mitigation goal. We anticipate the LSRCP contribution will meet the goal once run reconstruction estimates are finalized and include estimates of fall Chinook reaching LGR Dam prior to and post trapping.

Smolt-to-Adult Return Estimates

Smolt-to-adult return (SAR) estimates for BY1983-BY1989 were previously documented by Bugert et al. (1996). Smolt-to-adult return estimates of fish released by WDFW as part of the LSRCP program for BY1990-BY2002 are presented in Appendix M for subyearling releases and Appendix N for yearling releases.

Estimates were derived from our database, which is complete through the 2003 run year. Estimates for BY1998 are considered substantially complete since we have adult return data for these fish through age 5. Although incomplete, available 2004 return data are included in the estimates presented in Appendices M and N.

Estimates were primarily derived from Regional Mark Information System (RMIS) downloads through 22 April 2005: although recoveries at LFH and from LGR were modified to include the estimated composition of lost tags (not a standard procedure for RMIS data). Also included are estimates for the run past LGR, which is based on run reconstruction estimates for CWTs in the return. The run reconstruction is based upon the composition of fall Chinook trapped at LGR Dam that were hauled to LFH for processing. Also included are estimated CWT returns to the Tucannon and Palouse rivers. See the natural production section of this report for how returns to the Tucannon and Palouse rivers were estimated. All harvest data were derived solely from RMIS.

The weighted mean SAR to the Snake River was 0.53% for yearlings (brood years 1990-1998) released onstation at LFH. When all recovery and return data are included, the total mean SAR was 0.96%. Survivals have improved in recent years. The 5-year weighted mean SAR to the Snake River (brood years 1994-1998) was 0.84% for yearlings released onstation at LFH: contributing to a total mean SAR of 1.56% when all recovery and return data were included.

Survivals appear to have improved in recent years for subyearlings also (Fig. 7). The weighted mean SAR to the Snake River was 0.35% for subyearlings (BY90, BY92, and BY98) released onstation at LFH, with a total weighted mean SAR of 0.62%.

Yearling releases out performed subyearling releases in all but two brood years (1990 and 1992) (Figures 7 and 8). Overall yearling survival has increased except for BY1994 and BY1996. (Note: The 1996 flood event could have contributed to low returns from the BY1994 releases). The SAR data presented here will be compared with survivals of fish released from upstream NPT acclimation facilities in a future cooperative report.

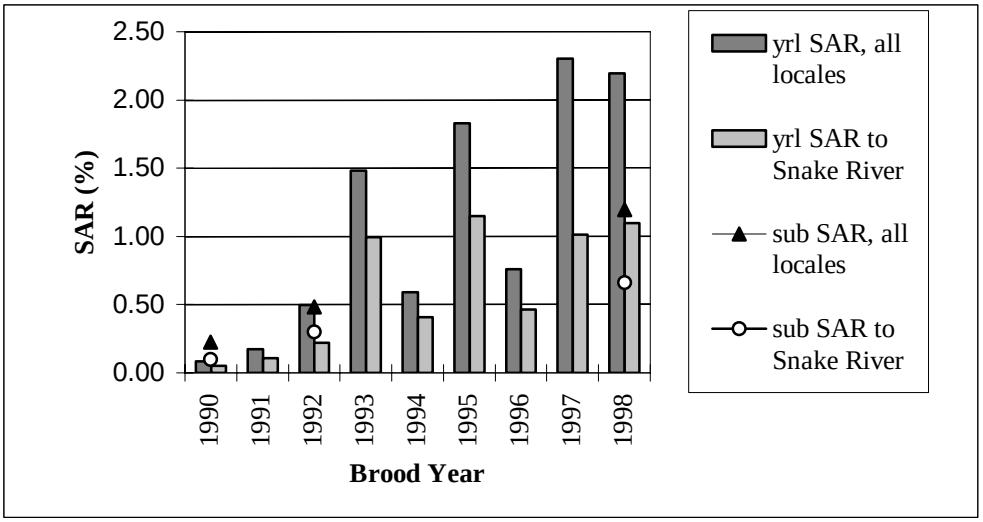


Figure 7. Survivals by broodyear of WDFW released LF/Snake River hatchery fall Chinook yearlings and subyearlings to the Snake River and all locations combined, brood years 1990-1998.

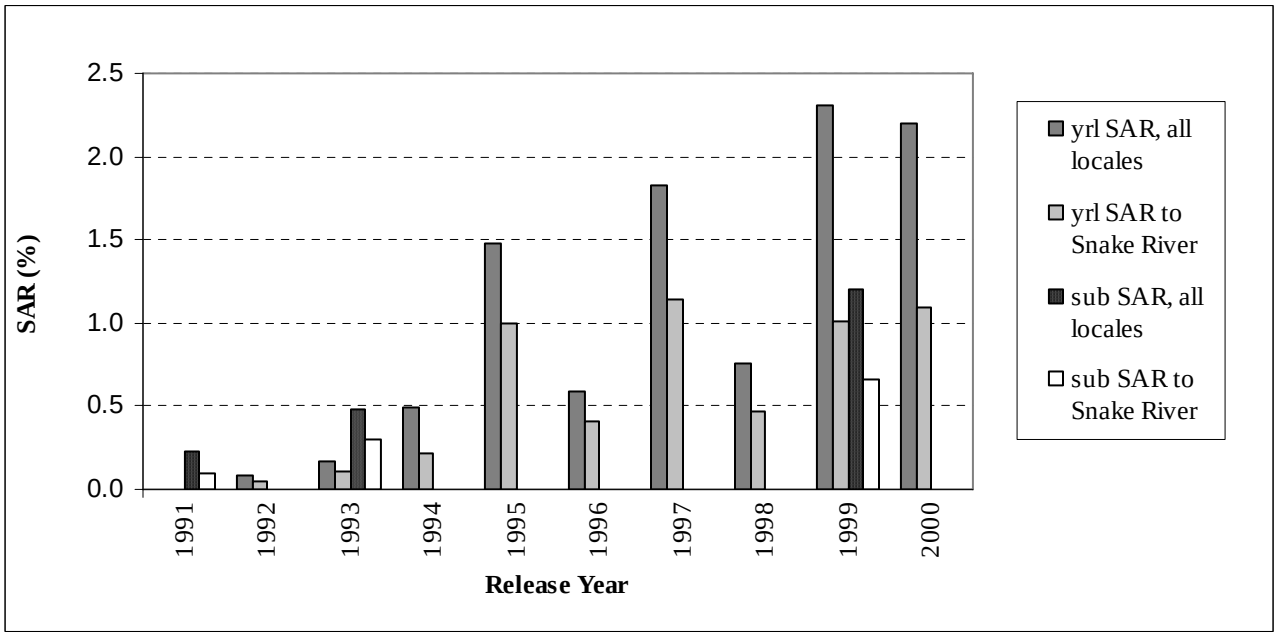


Figure 8. Survivals by release year of WDFW released LF/Snake River hatchery fall Chinook yearlings and subyearlings to the Snake River and all locations combined, brood years 1990-1998.

Conclusions and Recommendations

The fall Chinook program at LFH requires substantial coordination. The program is currently being managed to meet the requests of Tribal, state, and federal co-managers. Conclusions and recommendations listed below are not in order of importance.

1. Estimates of Snake River Fall Chinook to the Snake River basin have historically been based upon IHR counts. Past radio telemetry studies and annual reports have documented that IHR counts are inflated due to Columbia River fall Chinook dipping into the Snake River then falling back to the Columbia to spawn.

   Recommendation: Use LMO dam counts to estimate in-season fall Chinook returns to the Snake River.

2. To assure that broodstock is representative of the run to LFH it is important that salmon trapping occur over the duration of the season. This may result in trapping more fish than are needed for broodstock, which will require us to return a portion to the Snake River. We want to minimize recaptures of these fish at LFH to minimize hauling and stress on, or possible displacement of, this listed population.

   Recommendation: Adjust trapping schedule at LFH to systematically sample the run, minimizing the numbers of fish trapped, and decreasing the number of fish that must be returned to the river at seasons end.

   Recommendation: If fish trapped at LFH need to be released, release them downstream of LGO to minimize the number of fish that are not accounted for.

3. Broodstock management and run reconstruction efforts are closely linked. Decisions that are useful for broodstock handling may have a negative effect on the run reconstruction.

   Recommendation: If fish need to be released from the LGR trapped group after trapping has ceased, release fish upstream of the trap so the released fish will not skew dam counts or require estimates of what the re-ascent rate might have been for the released fish.

4. Fish ladder counts at IHR Dam were reduced to 16 hours per day in 2003. Counts at LMO Dam occur over a longer duration of the run, although we have shown that the LMO count underestimated the run to the Snake by 9.5% in 2003.

   Recommendation: The COE should extend the LMO ladder-window counting period to better reflect the run to the Snake River. Counts from this dam should be used to represent the Snake River fall Chinook run in-season.

   Recommendation: In the following report as soon as the run reconstruction for 2004 is completed and an estimate of the run to the Snake River is completed, compare it with the window count at LMO and determine if a similar underestimate occurs.

5. Fecundities are listed in this report for LFH/Snake River hatchery origin and natural origin fish. The data presented shows all of the data collected but the data does not represent the return.

   Recommendation: Complete a detailed, report of fall Chinook fecundities that will address both age class and fork length variation, as well as represent the return.

6. Elastomer (VIE) tags have been used for many years as a management tool when fish return as adults to LFH. A summary of VIE retention by age has not been done.

   Recommendation: Complete a manuscript brief to be published in a refereed fish management journal so others can understand the usefulness and limitations of using VIE tags in anadromous salmon.

7. Comparisons of smolt releases from LFH (on-station) production and NPT acclimation facilities have not been accomplish to date.

   Recommendation: Complete a summary report that compares SARs from each release location. Provide recommendations regarding future releases to maximize production benefits (increased SARs and adult returns).

8. Hatchery origin fish have met the mitigation goal but the natural origin component has not.

   Recommendation: Hatchery/natural interaction studies upstream of LGR Dam need to be designed, funded, and implemented to determine why the natural origin component is not meeting the mitigation goal.

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Appendix A: Fall Chinook Run to LFH, IHR, LMO, and LGR Dams: 2002-2004

(Numbers of fall Chinook observed at Snake River Dams and numbers of fall Chinook trapped and processed at LFH. LGR trapped fish that were processed at LFH are listed under LGR Dam data with COE window counts).

Appendix A; Table 1. Numbers of Chinook processed at LFH and window counts at Ice Harbor, Lower Monumental, and Lower Granite dams, 2000-2004.

		Daytime Counts				Night Video				Totals	
		Through October		Nov and Dec		Through Oct		Nov and Dec			
Year	Location	Adults	Jacks	Adults	Jacks	Adults	Jacks	Adults	Jacks	Adults	Jacks
2000	IHR Dam	6,485	9,864	48	59	167	502	46	29	6,746	10,454
	LOMO Dam	5,447	9,701	nc [a]	nc	nc	nc	nc	nc	5,447	9,701
	LFH									1,821	558
	LGR Dam	3,635	6,947	59	183	88	316	44	83	3,826	7,529
2001	IHR Dam	13,516	10,170	119	26	500	609	105	24	14,240	10,829
	LOMO Dam	13,297	8,512	nc	nc	nc	nc	nc	nc	13,297	8,512
	LFH									2,012	268
	LGR Dam	8,621	8,707	294	127	271	344	193	73	9,379	9,251
2002	IHR Dam	15,248	6,079	71	32	514	360	71	13	15,904	6,484
	LOMO Dam	15,193	6,185	nc	nc	nc	nc	nc	nc	15,193	6,185
	LFH									1,783	482
	LGR Dam	12,215	5,630	136	97	226	308	86	64	12,663	6,099
2003	IHR Dam	20,998	10,666	nc	nc	nc	nc	nc	nc	20,998	10,666
	LOMO Dam	13,641	8,922	157	134	nc	nc	nc	nc	13,798	9,056
	LFH									2,172	1,264
	LGR Dam	11,595	8,387	137	94	nc	nc	nc	nc	11,732	8,481
2004	IHR Dam	21,109	11,167	nc	nc	nc	nc	nc	nc	21,109	11,167
	LOMO Dam	19,812	5,921	114	30	nc	nc	nc	nc	19,926	5,951
	LFH									2,863	506
	LGR Dam	14,560	7,478	400	122	nc	nc	nc	nc	14,960	7,600

[a] No counts (nc) were completed at the dam during that time of year.

Appendix A; Table 2. Percent of fall Chinook run detected if solely use window counts at LMO Dam and IHR Dam.

Return year	Run to LGR (run reconstruction estimates)	LFH processed	Tucannon Escapement	Estim # to Snake	LMO count	LMO counting schedule	% of Estim run to Snake	IHR count	IHR counting schedule	% of Estim run to Snake
2000	10,994	2,379	57	13,430	15,148	16 hour, Aug-Oct	112.8	17,200	24 hour, Aug-Dec	128.1
2001	17,915	2,280	195	20,390	21,809	16 hour, Aug-Oct 10 hour Nov-Dec	107.0	25,069	24 hour, Aug-Dec	122.9
2002	18,478	2,265	549	21,292	21,378	16 hour, Aug-Oct 10 hour Nov-Dec	100.4	22,388	24 hour, Aug-Dec	105.1
2003	21,047	3,436	438	24,921	22,854	16 hour, Aug-Oct 10 hour Nov-Dec	91.7	31,664	16 hour, Aug-Oct	127.1

Appendix B: *United States v. Oregon* Production and Marking Table

Appendix B; Table B4 in Interim Management Agreement for Upriver Chinook, Sockeye, Steelhead, Coho, and White Sturgeon. Snake River fall Chinook production for Brood Years 2005-2007 for the Lower Snake River Compensation Program (LSRCP) at Lyons Ferry Hatchery, the Fall Chinook Acclimation Program (FCAP), the Idaho Power Program (IPC) and the Nez Perce Tribal Hatchery (NPTH).[1]

Production Priority	Rearing Facility [2]	Release Number	Release Location	Life stage	Mark
Tier One assumes rearing of 2.2 million subyearlings at Lyons Ferry Hatchery and 1.0 million eggs for IPC program.[7]					
1	Lyons Ferry	450,000	On-station	yearling	225K CWT, AD, VIE 225K CWT, VIE
2	Lyons Ferry	450,000	Pittsburg Landing Captain John Rapids Big Canyon	yearling	Each Group: 70K CWT, AD 80K CWT
3	Lyons Ferry	200,000	On-station	subyearling	200K CWT, AD
4	Lyons Ferry	1,000,000	Big Canyon Captain John Rapids	subyearling	Each Group: 100K CWT, AD 100K CWT
5	IPC [2] (Oxbow)	200,000	Pittsburg Landing Hells Canyon Dam if Priority # 13 is in effect	subyearling	200K CWT, AD
6	IPC (Umatilla)	200,000	Hells Canyon Dam	subyearling	200K CWT, AD
7	IPC (Umatilla)	200,000	Pittsburg Landing Hells Canyon Dam if Priority # 13 is in effect	subyearling	200K CWT, AD if released at Pittsburg and #5 reared at Oxbow 200K AD only if released at Hells Canyon Dam, combine with # 6 if reared at Umatilla
8	Lyons Ferry	400,000 [5]	Direct release @ Captain John Rapids	subyearling	200K CWT, AD
9	Lyons Ferry	200,000	Grande Ronde	subyearling	200K CWT, AD
10	IPC (Umatilla)	400,000	Hells Canyon Dam	subyearling	400K AD
11	Lyons Ferry	100,000	Grande Ronde	subyearling	None, combine with # 9
12	Lyons Ferry	300,000	Grande Ronde And/or Captain John Rapids	subyearling	None if released at Grande Ronde, combine with # 9&11 200K CWT, AD if released at Captain John Rapids
Tier Two assumes rearing of up to 2.6 million subyearlings at Lyons Ferry Hatchery[6,7]					
13	Lyons Ferry	400,000 [3]	Pittsburg Landing	subyearling	100K CWT, AD 100K CWT Combine with # 4
NPTH tier [7]					
1	NPTH	1,000,000	On-station North Lapwai Valley	subyearling	Each Group: 100K CWT, AD 200K CWT
2	NPTH	400,000 [4]	Cedar Flats Luke's Gulch	subyearling	Each Group: 100K CWT, AD 100K CWT
Subtotal Snake Basin		**5,900,000**			

Footnotes for Table B4:

1. All programs except the IPC program are directly or indirectly funded by Bonneville Power Administration.
2. IPC program may be implemented at IPC Oxbow Hatchery and/or other hatcheries, such as Umatilla Hatchery. Priority 5 production may be implemented at Oxbow Hatchery and, priorities 6, 7 and 10 production may be implemented at Umatilla Hatchery if broodstock shortage limits full implementation of Tier 1.
3. These would replace subyearlings released by IPC under priorities 5 and 7, and all IPC releases would occur at Hells Canyon Dam. These will be combined with the Priority # 4 Big Canyon and Captain John marking groups for harvest evaluation.
4. Early spawning component of NPTH program.
5. This is likely two release groups at two locations of 200K each depending on final study design. If so, they will have appropriate tags and AD clips for evaluation of the study.
6. The parties acknowledge that facilities improvements will be required to achieve all the releases in Tier 2.
7. For Broodstock collected at Lower Granite Dam, the parties will determine annually the broodstock collection protocol.

Appendix C: LFH/Snake River Origin Fall Chinook Releases Table Brood Years: 1994-2003

(Numbers presented do not match hatchery records for fish per pound because of reporting constraints put on the hatchery. Release information for some NPT release sites that had multiple CWT codes was estimated by WDFW based upon proportions of fish at tagging since that data was not available at the time this report was printed).

Appendix C.
LFH/Snake River hatchery origin fall Chinook releases with number marked, tagged, and unmarked by release year and type, April 8, 1996-May 27, 2005.

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released				FPP	VIE Mark	% VIE
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged			
1996	yearling	1994	IHR Dam-direct	08 Apr	635844	1,615	-	2	-	11.0	LR	89.8
1996	yearling	1994	IHR Dam-direct	08 Apr	635845	1,615	-	1	-	11.0	LR	89.8
1996	yearling	1994	LFH-volitional	09-12 Apr	635844	196,604		196	197	10.5	LR	89.8
1996	yearling	1994	LFH-volitional	09-12 Apr	635845	206,860		206	207	10.5	LR	89.8
1996	yearling	1994	Pittsburg-direct	12-15 Apr	635712	113,977	-	64	258	10.3	RB	82.1
1996	fry	1995	LFH-direct	01-31 Mar	no CWT			-	83,183	500		
1997	yearling	1995	Big Canyon-direct	14-17 Apr	635959	71,692	-	992	902	10.3	LG	88.3
1997	yearling	1995	Big Canyon-direct	14-17 Apr	635960	73,110	-	1,012	920	10.3	LG	88.3
1997	yearling	1995	Big Canyon-direct	14-15 May	635953	29,341	-	698	3,529	11.6	LB	89.6
1997	yearling	1995	Big Canyon-direct	14-15 May	636024	610	-	14	73	11.6	LB	89.6
1997	yearling	1995	Big Canyon-direct	14-15 May	636025	14,428	-	343	1,735	11.6	LB	89.6
1997	yearling	1995	LFH-volitional	04-26 Apr	636320	217,794		872	9,714	9.3	LR	87.2
1997	yearling	1995	LFH-volitional	04-26 Apr	636321	217,810		872	9,714	9.3	LR	87.2
1997	yearling	1995	Pittsburg-direct	14-17 Apr	635957	67,252	-	1,335	4,968	10.7	RG	72.9
1997	yearling	1995	Pittsburg-direct	14-17 Apr	635958	67,441	-	1,338	4,982	10.7	RG	72.9
1997	subyearling	1996	Big Canyon-direct	10-13 Jun	635120	119,824	-	1,816	7,897	63.9	(BWT left cheek)	
1997	subyearling	1996	Big Canyon-direct	10-13 Jun	635316	113,932	-	1,727	7,509	63.9	(BWT left cheek)	
1998	yearling	1996	Big Canyon-direct	13-16 Apr	636347	23,738	-	407	87	9.5	LG	90.6
1998	yearling	1996	Big Canyon-direct	13-16 Apr	636126	15,367	-	264	56	9.5	LG	90.6

Appendix C; (continued).

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released				FPP	VIE Mark	% VIE
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged			
1998	yearling	1996	Big Canyon-direct	13-16 Apr	636343	7,980	-	137	29	9.5	LG	90.6
1998	yearling	1996	Big Canyon-direct	13-16 Apr	630110	11,901	-	984	222	30.0	LG	96.8
1998	yearling	1996	Captain John-volitional	13-15 Apr	630401	1,438	-	17	10	10.9	LB	80.8
1998	yearling	1996	Captain John-volitional	13-15 Apr	630363	6,798	-	82	47	10.9	LB	80.8
1998	yearling	1996	Captain John-volitional	13-15 Apr	636345	60,527	-	728	419	10.9	LB	80.8
1998	yearling	1996	Captain John-volitional	13-15 Apr	636346	61,965	-	745	429	10.9	LB	80.8
1998	yearling	1996	LFH-volitional	03-16 Apr	636318	208,388		3,444	1,854	10.1	LR	84.3
1998	yearling	1996	LFH-volitional	03-16 Apr	630163	200,215		3,309	1,782	10.1	LR	84.3
1998	yearling	1996	Pittsburg-direct	13-16 Apr	630446	67,671	-	848	2,119	9.9	RG	93.3
1998	yearling	1996	Pittsburg-direct	13-16 Apr	630448	68,187	-	854	2,135	9.9	RG	93.3
1999	yearling	1997	Big Canyon-direct	12-15 Apr	630454	150,648	1,333	1,241	-	10.4	LG	88.8
1999	yearling	1997	Big Canyon-direct	26-28 Apr	630938	75,332	451	603	-	11.1	LG	97.6
1999	yearling	1997	Captain John-volitional	25 Mar-15 Apr	630453	154,750	1,444	816	-	11.8	LB	81.1
1999	yearling	1997	LFH-volitional	25 Mar-13 Apr	630860	423,772	6,368	2,026	-	8.3	LR	85.1
1999	yearling	1997	Pittsburg-direct	12-15 Apr	630451	134,983	4,501	3,401	-	10.0	RG	82.8
1999	subyearling	1998	Big Canyon-direct	02-03 Jun	631025	-	195,231	-	151,874	83.8		
1999	subyearling	1998	Captain John-volitional	30 May-05 June	no CWT	-	-	-	322,928	82.2		
1999	subyearling	1998	LFH-direct	15 Jun	631026	198,594	4,299	1,301	-	50.1		
2000	yearling	1998	Big Canyon-direct	11-13 Apr	631012	130,032	531	743	-	10.5	LG	87.6

Appendix C; (continued).

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released				FPP	VIE Mark	% VIE
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged			
2000	yearling	1998	Captain John-volitional	01-12 Apr	631013	131,048	138	138	-	8.2	LB	86.9
2000	yearling	1998	LFH-volitional	24 Mar-14 Apr	631213	442,113	11,317	2,971	-	9.4	LR	89.4
2000	yearling	1998	Pittsburg-direct	11-13 Apr	631212	133,411	-	1,298	-	9.6	RG	83.2
2000	subyearling	1999	Big Canyon-direct	30 May-01 June	no CWT	-	-	-	497,790	40.2		
2000	subyearling	1999	Big Canyon-direct	20-26 Jun	no CWT	-	-	-	392,684	45.0		
2000	subyearling	1999	Captain John-volitional	20-31 May	630168	-	193,476	-	297,557	45.4		
2000	subyearling	1999	Captain John-volitional	15-23 Jun	630169	-	194,717	-	207,097	52.0		
2000	subyearling	1999	LFH-direct	26-26 May	630167	188,125	6,083	2,435	-	45.5		
2000	subyearling	1999	Pittsburg-direct	24-26 May	no CWT	-	-	-	400,156	55.6		
2001	yearling	1999	Big Canyon-direct	09-11 Apr	630477	112,933	94	188	-	10.2	LG	94.6
2001	yearling	1999	Captain John-volitional	04-13 Apr	630478	100,461	1,010	505	-	10.1	LB	88.9
2001	yearling	1999	LFH-volitional	01-20 Apr	630476	326,669	10,440	1,648	-	8.7	LR	92.8
2001	yearling	1999	Pittsburg-direct	10-12 Apr	630479	102,980	761	-	-	10.4	RG	86.7
2001	subyearling	2000	Big Canyon-direct	29 May	630271	-	196,507	-	303,099	53.3		
2001	subyearling	2000	Big Canyon-direct	13 Jun	no CWT	-	-	-	357,362	78.2		
2001	subyearling	2000	Captain John-volitional	26 May	no CWT	-	-	-	501,129	49.5		
2001	subyearling	2000	Col. R.-below BONN Dam-barged	01 Jun	630270	188,085	10,357	1,534		45.7		
2001	subyearling	2000	LFH-direct	03 Jul	no CWT			-	3,994	52.2		
2001	subyearling	2000	Pittsburg-direct	28 May	630272	-	197,182	-	176,888	84.1		

Appendix C; (continued).

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released				FPP	VIE Mark	% VIE
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged			
2001	subyearling	2000	Snake R. below HC Dam-direct	16 May	no CWT	-	-	113,770	-	42.0		
2001	subyearling	2000	Snake R. below HC Dam-direct	19 Jun	no CWT	-	-	1,450	-	23.0		
2001	suyearling	2000	Research – Snake near Couse Cr – direct	18-26 May	no CWT				74,245	(PIT tag only)		
2002	yearling	2000	Big Canyon-direct	10-12 Apr	630677	155,827	523	1,440	-	12.9	LG	86.2
2002	yearling	2000	Big Canyon-direct	10-12 Apr	630625	1,661	6	15	-	12.9	LG	86.2
2002	yearling	2000	Captain John-volitional	16 Apr	630183	155,692	4,463	-	-	16.6	LB	80.3
2002	yearling	2000	LFH-volitional	01-11 Apr	631273	421,390	6,612	4,509	-	9.3	LR	93.1
2002	yearling	2000	Pittsburg-direct	15-17 Apr	630678	156,372	2,687	672	-	13.4	RG	83
2002	subyearling	2001	Snake R. below HC Dam-direct	21 May	no CWT	-	-	171,120	343	42.3		
2002	subyearling	2001	Big Canyon-direct	27-28 May	612639	-	197,763	-	297,452	193.0		
2002	subyearling	2001	Big Canyon-direct	18-19 Jun	no CWT	-	-	-	505,674	178.0		
2002	subyearling	2001	Captain John-volitional	28 May	610106	-	185,010	-	313,917	215		
2002	subyearling	2001	Captain John-volitional	20-28 Jun	610105	-	182,429	-	316,519	152		
2002	subyearling	2001	LFH-direct	24 Jun	630890	188,874	3,373	2,335	-	52.0		
2002	subyearling	2001	Pittsburg-direct	27-29 May	612501	-	199,965	-	199,350	166		
2002	subyearling	2001	Snake R at Roosters Landing-direct	02 Dec	no CWT	-	-	-	24,573	26.0		
2002	subyearling	2001	Snake R. at Chief Timothy-direct	16 Oct	no CWT	-	-	-	29,059	24.6		
2002	subyearling	2001	Research–near Couse Creek–direct	29 May-14 Jun	no CWT	-	-	-	97,916	(PIT tag onlyl)		
2003	yearling	2001	Big Canyon-direct	14-15 Apr	610119	140,217	3,449	1,665	0	10.6	LG	91.0
2003	yearling	2001	Captain John-volitional	30 Mar-07 Apr	610118	147,987	2,502	1,430	0	10.0	LB	88.9

Appendix C; (continued).

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released						
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged	FPP	VIE Mark	% VIE
2003	yearling	2001	LFH-volitional	01-09 Apr	631585	499,387	14,503	4,546	-	9.7	LR	58.7
2003	yearling	2001	Pittsburg-direct	13-14 Apr	610120	136,455	2,195	1,733	0	9.1	RG	84.3
2003	subyearling	2002	Big Canyon-direct	03 Jun	610122	-	193,255	-	313,233	94.5		
2003	subyearling	2002	Captain John-volitional	28 May	610121	-	196,068	-	316,617	81.3		
2003	subyearling	2002	Captain John-volitional	12 Jun	612654	-	186,937	-	104,465	74.4		
2003	subyearling	2002	LFH-direct	06 Jun	631545	193,848	4,517	1,727	-	50.0		
2003	subyearling	2002	NLV1-volitional	28-31 May	610109	-	77,855	-	9,862	61.3		
2003	subyearling	2002	NLV1-volitional	28-31 May	612657	-	72,009	-	9,146	61.3		
2003	subyearling	2002	NLV1-volitional	28-31 May	612648	-	9,303	-	1,178	61.3		
2003	subyearling	2002	NLV1-volitional	28-31 May	612649	-	9,259	-	1,172	61.3		
2003	subyearling	2002	NPTH1-volitional	02-04 Jun	610107	-	193,643	-	5,989	38.2		
2003	subyearling	2002	NPTH2-volitional	19-20 Jun	610110	-	97,932	-	17,032	81.4		
2003	subyearling	2002	Pittsburg-direct	04 Jun	610123	-	189,782	-	200,401	129.6		
2003	subyearling	2002	Snake R. at Roosters Landing-direct	04 Mar	no CWT	-	-	-	33,500	1200		
2003	subyearling	2002	Snake R. at Couse Cr. boat launch-direct	09 Jun	631391	96,073	2,631	1,315	-	40.4		
2003	subyearling	2002	Snake R. below HC Dam-direct	22 May	no CWT	-	-	199,246		46.6		
2003	subyearling	2002	Snake R. below HC Dam-direct	15-16 May	no CWT	-	-	332,226	-	41.4		
2003	subyearling	2002	Research – near Couse Creek - direct	28 Mar-05 Jun	no CWT			53,583		(PIT tag only)		
2004	yearling	2002	LFH-direct	12-14 Apr	632167	425,316	2,397	18,376	266	9.9	LR	90.4
2004	yearling	2002	PL1-direct	12-13 Apr	612502	143,257	1,488	186	186	9.9	RG	81.9

Appendix C; (continued).

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released				FPP	VIE Mark	% VIE
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged			
2004	yearling	2002	CJ1-volitional	02-07 Apr	612503	150,569	192	-	-	9.1	LB	86.0
2004	yearling	2002	BC1-direct	14-15 Apr	612659	106,657	270	-	-	9.4	LG	91.3
2004	subyearling	2003	LFH-direct in evening	21 Jun	631786	195,046	2,209	4,279	-	51.1		
2004	subyearling	2003	BC1-direct	03 Jun	612500	-	198,190	-	275,366	79.6		
2004	subyearling	2003	CJ1-volitional	29 May-01 Jun	612600	-	192,649	-	308,090	55.3		
2004	subyearling	2003	PL1-direct	31 May	no cwt	-	-	-	197,687	48.2		
2004	subyearling	2003	PL1-IPC-direct	24 May	106973	37,473	-	-	-	54.3		
2004	subyearling	2003	PL1-IPC-direct	24 May	107976	67,080	-	-	-	54.3		
2004	subyearling	2003	PL1-IPC-direct	24 May	108076	64,894	-	-	-	54.3		
2004	subyearling	2003	Snake R. below HC Dam-direct	28 May	no cwt	-	-	9,957	-	48.0		
2004	subyearling	2003	NPTH1-direct	04-11 Jun	612675	-	163,830	-	5,766	55.2		
2005	yearling	2003	PL1-direct	13-14 Apr	610146	-	80,316	-	91	9.9		
2005	yearling	2003	PL1-direct	13-14 Apr	600149	57,274	-	12,743	282	9.9		
2005	yearling	2003	BC1-direct	04-05 Apr	610145	-	72,805	-	1,722	10.4		
2005	yearling	2003	BC1-direct	04-05 Apr	610147	63,007	-	1,715	260	10.4		
2005	yearling	2003	LFH-direct	28-30 Mar	631769	213,142	4,565	240	-	9.4	LR	83.4
2005	yearling	2003	LFH-direct	28-30 Mar	631770	-	218,150	-	623	9.4	LR	84.1
2005	yearling	2003	LFH-direct	28-30 Mar	632368	16,365	33	82	-	9.4	LR	86.7
2005	subyearling	2004	BC1-direct	30-31 May	612504	96,630	98,657	1,377	313,562	55.3		
2005	subyearling	2004	CJ1 Acclimated [vs. CC]-volitional	28-31 May	610154	94,164	87,888	9,015	314,020	46.8		
2005	subyearling	2004	Snake R. below HC Dam-IPC-direct	28 April		179,335	-	9,973	-	61.5		
2005	subyearling	2004	PL1-IPC-direct	25-26 May	073336	211,302	-	186,402	-	50.4		
2005	subyearling	2004	Snake R. below HC Dam-IPC-direct			-	-	399,861	-			
2005	subyearling	2004	NPTH1-volitional	17 May	612669 612672	106,079	140,171	-	115,326	120.8		

Appendix C; (continued).

Release Year	Age	Brood Year	Release Location-Type	Release Date	CWT Code	Number of Fish Released						
						AD+CWT	CWT Only	Ad Clip Only	Unmarked Untagged	FPP	VIE Mark	% VIE
2005	subyearling	2004	NPTH1-volitional	17 May	610108 612670	101,580	194,334	-	154,046	115.3		
2005	subyearling	2004	NPTH1-volitional	17 May	no cwt	-	-	-	57,764	110.0		
2005	subyearling	2004	Research Transport Study (NOAA)-direct			-	-	-	-	-		
2005	subyearling	2004	Couse Creek Direct [vs. CJ1 Accl.]-direct	26 May	610155	183,401	1,937	14,853	-	49.2		
2005	subyearling	2004	Snake R. at Couse Creek boat launch-direct	23 May	no cwt	-	-	-	234,030	59.0		
2005	subyearling	2004	Grande Ronde R. -direct	25 May	632782	191,868	610	8,050	244	56.0		
2005	subyearling	2004	Grande Ronde R. unmarked-direct	24 May	no cwt	-	-	-	281,688	66.0		
2005	subyearling	2004	LFH-direct	27 May	632787	195,367	934	3,870	-	51.0		

Appendix D: Mean Fork Length, Standard Deviation, Sample Size, and Range for Returning LFH/Snake River Origin Fall Chinook Salmon Released as Subyearlings and Yearlings

Appendix D; Table 1. Mean (cm) fork length, (standard deviation), sample size, and range for returning Lyons Ferry origin (verified by CWT) fall Chinook salmon released as **subyearlings**. All release locations are included.

		Brood year					
Recovery Year	**Sex**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997[a]**
2000	male					**46.0**	
						(4.4)	
						635	
						34-64	
	female					**-**	
						(-)	
						0	
						-	
2001	male				**46.1**	**65.2**	
					(4.3)	(6.6)	
					516	568	
					32-70	29-89	
	female				**-**	**69.7**	
					(-)	(4.1)	
					0	375	
					-	57-87	
2002	male			**43.5**	**63.9**	**82.7**	
				(4.5)	(6.8)	(9.2)	
				181	434	144	
				35-55	40-91	60-101	
	female			**-**	**70.9**	**82.2**	
				(-)	(4.6)	(5.4)	
				0	130	499	
				-	55-81	50-99	
2003	male		**43.1**	**63.5**	**80.1**	**102.0**	
			(5.4)	(6.1)	(9.4)	(5.3)	
			149	61	32	3	
			32-87	47-78	67-100	98-108	
	female		**-**	**69.1**	**82.0**	**88.2**	
			(-)	(3.2)	(6.3)	(5.2)	
			0	11	88	21	
			-	63-73	65-97	78-97	
2004[b]	male	**48.5**	**61.3**	**68.3**	**-**		
		(5.8)	(6.0)	(7.5)	(-)		
		91	162	4	0		
		32-62	41-78	57-73	-		
	female	**-**	**67.4**	**79.1**	**85**		
		(-)	(4.4)	(7.5)	(10.9)		
		0	41	27	10		
		-	56-77	51-88	59-99		

[a] There were no subyearling groups released for brood year 1997.
[b] 2004 recovery data includes fish processed at NPTH.

Appendix D; Table 2. (continued)

Recovery Year	Sex	Brood Year 2002	2001	2000	1999	1998	1997
1999 [a]	male						**36.2**
							(2.5)
							383
							30-49
	female						**-**
							(-)
							0
2000	male					**36.4**	**58.5**
						(2.6)	(5.2)
						412	1066
						28-44	34-72
	female					**-**	**64.4**
						(-)	(3.7)
						0	110
						-	54-74
2001	male				**34.4**	**57.2**	**76.0**
					(2.0)	(4.9)	(8.3)
					14	858	221
					32-40	39-74	57-98
	female				**-**	**62.2**	**77.3**
					(-)	(4.8)	(5.1)
					0	60	614
					-	52-76	55-95
2002	male			**35.4**	**55.0**	**74.3**	**94.5**
				(4.3)	(4.7)	(8.7)	(13.8)
				220	471	241	37
				27-83	40-67	51-96	55-112
	female			**-**	**65.8**	**76.8**	**85.5**
				(-)	(7.4)	(5.6)	(5.2)
				0	6	505	94
				-	60-80	51-93	73-97
2003	male		**34.5**	**54.1**	**72.2**	**85.4**	**-**
			(2.3)	(5.2)	(7.7)	(14.0)	(-)
			698	847	230	25	0
			27-53	29-78	47-90	44-105	-
	female		**-**	**61.0**	**75.8**	**83.5**	**90.3**
			(-)	(4.3)	(5.4)	(6.0)	(5.5)
			1	63	269	151	3
			70	45-68	52-88	68-101	85-96
2004[a]	male	**35.5**	**58.8**	**69.9**	**90.1**	**95.3**	
		(2.3)	(4.9)	(8.0)	(14.9)	(8.1)	
		329	1448	261	21	3	
		30-43	40-87	31-97	60-113	86-101	
	female	**-**	**63.6**	**74.3**	**83.4**	**85.0**	
		(-)	(4.3)	(5.4)	(6.8)	(10.6)	
		0	249	513	104	4	
		-	44-84	57-91	65-98	70-95	

[a] Data corrected from past reports.
[b] 2004 recovery data includes fish processed at NPTH.

Appendix E: A Microsatellite DNA Analysis of Snake River Fall Run Chinook, 2002 & 2003

A Microsatellite DNA Analysis of Snake River fall-run Chinook (2002 & 2003)

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Introduction

Genetic characteristics of Chinook salmon within the Snake River and Columbia River basins have been examined extensively (Blankenship et al. 1997, Blankenship and Mendel 1994, Bugert et al. 1995, LaVoy and Mendel 1996, Marshall et al. 1995, Marshall et al. 2000, Utter et al. 1982, and Utter et al. 1995). A spring/summer-run of Chinook salmon and a fall-run were determined to be in separate ESUs (Waples 1991) and Snake River fall-run Chinook salmon were listed as threatened under ESA in 1992 (NMFS 1992). Management and conservation of these stocks have, therefore, been of interest to biologists in the Snake River Basin.

Returns of Chinook salmon trapped at Lyons Ferry Hatchery (LFH) include adipose clipped CWT fish that are determined to be hatchery broodstock, unmarked/untagged fish that volunteer to the hatchery, and marked/tagged strays from other hatcheries. The unmarked/untagged fish could be of hatchery origin or naturally reared origin. Reading scales allows biologists to differentiate hatchery-produced from naturally produced ("wild") fish but will not determine the specific origin of those hatchery fish because of similar sizes at release and scale patterns. Straying of hatchery origin salmon into the Snake River has been documented at Lyons Ferry Hatchery (Milks et al. 2003, Bugert et al. 1991). Scale patterns also allow for the identification of Chinook released from the hatchery as subyearlings and yearlings (Connor et al. In Press).

The unmarked/untagged hatchery origin subyearling Chinook that return to Lyons Ferry Hatchery are thought to be predominantly from the Nez Perce Tribe (NPT) acclimation sites (Lyons Ferry Hatchery origin fish; Debbie Milks, WDFW personal communication). The unmarked/untagged hatchery origin yearling Chinook that return to Lyons Ferry Hatchery (included in the samples from 2002 and 2003) are thought to be out-of-basin strays because all of the yearling releases from Lyons Ferry Hatchery are adipose clipped, coded wire tagged, and VIE (visual implanted elastomer) tagged.

In 2001 and 2002, the run of fall Chinook at Lower Granite Dam, in conjunction with large steelhead runs, effectively shut down the adult trap at times, which allowed hatchery origin stray fish to pass the dam. As a result, it is unknown at what level strays have been infused into natural production in the Snake River Basin. Historically, the Umatilla Hatchery program was the major contributor of stray fall-run Chinook to the Snake River. Genetic comparison of the Umatilla Hatchery broodstock to the Lyons Ferry Hatchery broodstock would help determine how effectively the Lyons Ferry Hatchery program is maintaining the genetic integrity of the Snake River stock. Additional analysis of the naturally produced Chinook collected at Lower Granite Dam and of the Umatilla Hatchery broodstock would indicate if strays from the Umatilla Hatchery are impacting the naturally spawning Snake River stock.

A growing number of studies have used variation at microsatellite DNA loci to investigate stock structure (Small et al. 1998, Beacham et al. 1999, Shaklee et al. 1999, Balloux and Lugon-Moulin 2002, Beacham et al. 2003, and Beacham et al. 2004). Microsatellite markers typically exhibit high numbers of alleles and high heterozygosities, and are, therefore, statistically powerful markers to characterize stocks, estimate interrelationships among populations, and analyze mixtures. Microsatellite loci are tandemly repeated arrays of short (commonly di-, tri-,

and tetra-nucleotide) sequences and are considered to be non-coding in that they do not encode RNA or proteins, and, therefore, are assumed to be selectively neutral.

Because these DNA markers offer the potential of higher resolution analyses, WDFW initiated a study of microsatellite DNA variation in the Snake River fall-run Chinook to characterize groups of fish relevant to the Lyons Ferry Hatchery: Lyons Ferry Hatchery broodstock, unmarked/untagged adults from yearling and subyearling releases that volunteered to Lyons Ferry Hatchery, unmarked/untagged adults of natural origin from collections at Lower Granite Dam in 2002 and 2003, and Umatilla Hatchery broodstock to conduct the following analyses:

a. Pairwise analyses from collections made in 2002: adults from Lyons Ferry Hatchery (LFH) broodstock, unmarked/untagged hatchery adults volunteering to Lyons Ferry Hatchery (yearling and sub-yearling releases), and adults of natural origin sampled at Lower Granite Dam (LGD).

b. Pairwise analyses from collections made in 2003: adults from Lyons Ferry Hatchery (LFH) broodstock, unmarked/untagged hatchery adults volunteering to Lyons Ferry Hatchery (yearling and sub-yearling releases), and adults of natural origin sampled at Lower Granite Dam (LGD).

c. Pairwise analyses of Umatilla Hatchery broodstock 2003 to the collections made in 2002 and 2003.

Microsatellite DNA loci are valuable genetic markers not only because of their high levels of genetic variability but also because they (like other DNA markers) can be analyzed using fin clip and other non-lethal biopsy samples. Non-lethal methods may prove to be essential for this application because of the critically low abundance of the Snake River fall-run Chinook stock.

Material and Methods

Collections

In 2002, staff from Snake River Lab collected samples of Lyons Ferry Hatchery broodstock and unmarked/untagged adult volunteers to Lyons Ferry Hatchery. In addition, staff from NOAA collected scales from unmarked/untagged adults as fish were passed upstream at Lower Granite Dam (Table 1).

In 2003, the collection of LFH broodstock samples was repeated because of a change in spawning protocol to include unmarked/untagged subyearlings in LFH broodstock.

In addition, sampling was expanded to include a random sample of Umatilla broodstock. Samples consisted of operculum punches, fin clips, and scales. Tissue samples were stored in 100% ethanol, and scales were stored dry on scale cards.

DNA Extraction Methods

Genomic DNA was extracted by digesting a small piece of fin tissue or one or more scales using silica membrane based kits obtained from Clontech Incorporated using the following conditions: incubate tissue fragment or scale 6 hours to overnight at 56°C in 200 µL Proteinase K solution, add 200 µL Buffer B3 and 200 µL 100% ethanol, mix and transfer the supernatant into a Tissue Binding Plate containing the silica binding membranes, centrifuge 10 minutes, add 500 µL Buffer BW, centrifuge 2 minutes, add 700 µL Buffer B5, centrifuge 4 minutes, place Tissue Binding Plate on a collection rack, incubate 10 minutes at 70°C to remove residual ethanol, add 100 µL Buffer BE (elution buffer) at 70°C, incubate 1 minute, centrifuge 2 minutes, dispose of Tissue Binding Plate, refrigerate eluted DNA or store at –20°C.

PCR Methods

The polymerase chain reaction mixture contained the following for a 10 µL reaction: approximately 25 ng template DNA, 1X Promega buffer, 1.5 mM $MgCl_2$, 200 µM each of dATP, dCTP, dGTP, and dTTP, 0.09 – 0.42 µM of each oligonucleotide primer (concentrations for each primer are in Table 2), and 0.05 units *Taq* polymerase (Promega). Amplification was performed using an MJ Research PTC-200 thermocycler. The thermal profile was as follows: an initial denaturation step of 3 minutes at 95°C; 30 - 35 cycles of 15 seconds at 95°C, 30 seconds at 50 - 63°C, and 1 minute at 72°C; plus a final extension step at 72°C for 30 minutes, followed by a final indefinite holding step at 4°C.

Fifteen microsatellite DNA loci of interest were amplified via the polymerase chain reaction (PCR; see Saiki et al., 1988) using fluorescently labeled primers with vector-based tails (obtained from Applied Biosystems or Integrated DNA Technologies).

Data were collected using an ABI-3730 semi-automated sequencer. Applied Biosystems software (ABI-Collection, Genemapper v.3.0) was used to collect and analyze the raw data to determine genotypes at each locus (based on estimated size in base pairs using an internal size standard). The output tables from Genemapper were imported into MS Excel where allele calling was accomplished using size bins. Allele binning and naming were accomplished using MicrosatelliteBinner 1.f (S.F. Young, WDFW pers. com., available from the author). MicrosatelliteBinner creates groups (bins) of alleles with similar mobilities (alleles with the same number of repeat units). The upper and lower bounds of the bins are determined by identifying clusters of alleles separated by gaps (nominally 0.4 base pairs in size) in the distribution of allele sizes. The bins are then named as the mean allele size for the cluster rounded to an integer.

Statistical Methods

Tests for conformance to Hardy Weinberg expectations were calculated using GENEPOP (version 3.3, Raymond and Rousset 1995) to determine if any loci should be excluded from subsequent analyses. Pairwise tests of genotypic differentiation were calculated using FSTAT (version 2.9.3, Goudet 2001). A non-sequential Bonferroni correction for multiple tests was used to adjust alpha values to determine significance levels for the pairwise comparisons (Rice 1989) for both the Hardy Weinberg tests and genotypic differentiation tests. The Bonferroni correction is a conservative approach to determine significance levels versus identifying all P-values less than 0.05 as significant.

Results

Two of the fifteen loci screened were excluded from any statistical analyses. One locus (Ots-G474) was not resolved for all samples and a second locus (Omy-1011) did not meet Hardy-Weinberg expectations for all collections. Observed heterozygosity ranged from 0.628 – 0.969 (Ots-9 and Omm-1080 respectively) among the thirteen loci that were scored (Table 2). The number of alleles observed ranged from 11 – 50 (Ots-9 and Omm-1080 respectively) and the observed allele size range at each locus is shown in Table 2.

Hardy Weinberg Tests

Tests for conformance to Hardy Weinberg expectations revealed few significant deviations. Deviation for Ots-201b occurred in the unmarked/untagged hatchery adults from sub-yearling releases volunteering to Lyons Ferry Hatchery 2003 while deviation for Ots-212 occurred at one collection of adults from Lyons Ferry Hatchery broodstock 2003**.**

Tests of Population Differentiation

Analyses were conducted on the Lyons Ferry Hatchery broodstock, hatchery unmarked/untagged adults (subyearlings and yearlings) volunteering to Lyons Ferry Hatchery, and unmarked/untagged adults at Lower Granite Dam. Analysis of the hatchery unmarked/untagged adults (yearlings) volunteering to Lyons Ferry Hatchery included samples sizes that were small in both 2002 (N = 17) and 2003 (N = 43). The results for the unmarked/untagged hatchery yearling volunteers were different for the 2002 and 2003 collections (Table 4 (A and B)). In 2002, the unmarked/untagged hatchery yearling volunteers were not significantly different from the unmarked/untagged hatchery subyearling volunteers or Lower Granite Dam samples while in 2003 they were significantly different. All other results were consistent between the 2002 and 2003 collections. The Lyons Ferry Hatchery broodstock were significantly different from the unmarked/untagged hatchery yearling volunteers and not significantly different from the unmarked/untagged hatchery subyearling volunteers, as was expected. The unmarked/untagged hatchery subyearling volunteers were not significantly different from the Lower Granite Dam collections, also expected.

A collection of samples from Umatilla Hatchery broodstock in 2003 were compared to the Lyons Ferry Hatchery broodstock, unmarked/untagged hatchery yearling and subyearling volunteers, and Lower Granite Dam samples (Table 4 (C-1 and C-2)). The Umatilla Hatchery broodstock was significantly different from Lyons Ferry Hatchery broodstock and from unmarked/untagged hatchery subyearling volunteers while not significantly different from unmarked/untagged hatchery yearling volunteers or from the Lower Granite Dam samples.

An analysis was also conducted on a combined collection of unmarked/untagged hatchery yearling volunteers from both 2002 and 2003 to compare to Umatilla Hatchery broodstock 2003 and Lyons Ferry Hatchery broodstock 2003 (Table 4 (C-3)). The results were the same as with the individual collection of unmarked/untagged hatchery yearling volunteers from 2003. The Lyons Ferry Hatchery broodstock in 2003 was significantly different while the Umatilla Hatchery broodstock in 2003 was not significantly different.

Discussion

Genetic characterization of hatchery and natural origin fall-run Chinook salmon in the Snake River is an important component of conserving genetically different stocks in the Columbia River Basin. A management goal of the stocks within the Snake River is to allow for a sustainable and harvestable resource, while also protecting the individual genetic stocks. The microsatellite analysis of the Lyons Ferry Hatchery collections (broodstock and volunteers) in conjunction with scale analysis has provided a means to evaluate the stocking program and influence of strays on natural origin Chinook in the Snake River.

Analyses of collections from 2002 and 2003 were consistent between years. As expected the Lyons Ferry Hatchery broodstock was not significantly different than the unmarked/untagged hatchery volunteers (subyearlings) trapped at LFH. The unmarked/untagged hatchery subyearling volunteers are thought to be predominantly from the Nez Perce Tribe acclimation sites (that is, they are Lyons Ferry Hatchery origin fish). Interestingly, the Lyons Ferry Hatchery broodstock was significantly different from the natural origin Lower Granite Dam samples while the unmarked/untagged hatchery volunteers (subyearlings) were not significantly different from the natural origin Lower Granite Dam samples. The hatchery origin volunteers (subyearlings) that are unmarked/untagged could include genotypes shared with the Lyons Ferry Hatchery broodstock while having different genotypes that were shared with the natural origin samples from Lower Granite Dam. The Lyons Ferry Hatchery volunteers (subyearlings) would, therefore, not be significantly different to either the broodstock or the Lower Granite Dam samples, but those two collections would be significantly different to each other.

Analysis of the unmarked/untagged hatchery subyearling and yearling volunteers at Lyons Ferry Hatchery revealed different results for the two groups between the 2002 and 2003 collections. The analysis of the unmarked/untagged hatchery yearling volunteers from 2002 resulted in a significant difference to the Lyon Ferry Hatchery broodstock only. The different results for the two years could simply be due to the increased statistical power due to the larger sample size in the 2003 sample or due to genetic differences between the two different years' samples.

The collection of unmarked/untagged hatchery yearling volunteers is thought to consist of out-of-basin origin fish. It is not surprising then, that this group is significantly different from all of the collections in the Snake River Basin. Analyses of fall-run Chinook in the Columbia River Basin and Snake River Basin have documented genetic differences between the populations in these two basins (Marshall et al. 2000).

The Umatilla Hatchery broodstock origin is from the Columbia River, therefore the Umatilla Hatchery broodstock would be genetically different from collections in the Snake River. The Umatilla Hatchery program is considered to be the primary source of stray Chinook to Lyons Ferry Hatchery. If fall-run Chinook from the Umatilla Hatchery were straying into the Snake River and being included with the Lyons Ferry Hatchery broodstock then the two populations might be indistinguishable or at least exhibit some similarity. The Umatilla Hatchery broodstock and Lyons Ferry Hatchery broodstock were significantly different in both the 2002 and 2003 collections suggesting the infusion of strays from the Umatilla has neither swamped nor

significantly altered the genetic structure of the Lyons Ferry Hatchery broodstock. The unmarked/untagged hatchery subyearling volunteers that originated from the Lyons Ferry Hatchery are also significantly different from Umatilla Hatchery again suggesting that any strays from Umatilla Hatchery have not had a large impact on the genetics of the Lyons Ferry Hatchery stock. The unmarked/untagged hatchery yearling volunteers from out of the Snake River basin and natural origin samples from Lower Granite Dam are not significantly different from the Umatilla Hatchery broodstock suggesting these samples are similar and may reflect the presence of Umatilla Hatchery progeny in these collections.

The analysis comparing the combination of unmarked/untagged hatchery yearling volunteers from both 2002 and 2003 to Lyons Ferry Hatchery broodstock from 2003 and Umatilla Hatchery broodstock from 2003 reveals a similar result for the 2003 collection to earlier analyses. The unmarked/untagged hatchery yearling volunteers are significantly different from Lyons Ferry Hatchery broodstock 2003, but not to Umatilla broodstock 2003. It appears the larger sample size from the combined collection supports the results for the 2003 collection instead of the results for the 2002 collection.

Conclusions

Snake River fall-run Chinook from Lyons Ferry Hatchery broodstock appear to be genetically distinguishable from the out-of-basin samples (unmarked/untagged hatchery yearling volunteers and Umatilla Hatchery broodstock) that were analyzed. Chinook that volunteer to Lyons Ferry Hatchery that are from unmarked/untagged hatchery subyearling releases and identified as hatchery origin appear to be similar to Lyons Ferry Hatchery broodstock and could be used to supplement the broodstock. Identification of the hatchery or natural origin and subyearling or yearling status would be necessary for inclusion into Lyons Ferry Hatchery broodstock. Natural origin fall-run Chinook collected at Lower Granite Dam appear to have some out-of-basin influence based on the lack of difference to the unmarked/untagged hatchery yearling volunteers and Umatilla Hatchery broodstock.

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Table 1. Collections analyzed, number anlayzed, and the tissue used for the analysis.

Collection Location	Collection Code	# Analyzed	Tissue collected
2002 Lyons Ferry Hatchery broodstock	02GL	96	Fin
2003 Lyons Ferry Hatchery broodstock	03BR	96	Fin
2002 Unmarked/Untagged adults volunteering to Lyons Ferry Hatchery - subyearling releases	02GK	96	Fin
2002 Unmarked/Untagged adults volunteering to Lyons Ferry Hatchery - yearling releases	02GK	17	Fin
2003 Unmarked/Untagged adults volunteering to Lyons Ferry Hatchery - subyearling releases	03BQ	96	Fin
2003 Unmarked/Untagged adults volunteering to Lyons Ferry Hatchery - yearling releases	03BQ	43	Fin
2002 Unmarked/Untagged adults collected at Lower Granite Dam	02PH	70	Scales
2003 Unmarked/Untagged adults collected at Lower Granite Dam	03HC	127	Scales
2003 Umatilla Hatchery broodstock	03BS	100	Fin

Table 2. Microsatellite DNA loci, measures of variability, and PCR conditions used to analyze collections of fall-run Chinook from the Snake River and Umatilla Hatchery.

Locus	Repeat Length (bp)	Number Alleles	Ho[b] (observed heterozygosity)	Allelic Size Range	Primer Conc [uM]	Anneal Temp °C	Number Cycles	$MgCl_2$ Conc [mM]	Taq [units/rxn]
Ogo-2 V3	2	18	0.823	228 - 280	0.09	60°	35	1.5	0.05
Ogo-4 V2	2	15	0.742	158 - 190	0.2	60°	35	1.5	0.05
Oki-100 V1	4	40	0.927	188 - 375	0.3	50°	35	1.5	0.05
Omm-1080 V1	4	50	0.969	187 - 389	0.25	50°	35	1.5	0.05
Ots-3M V2	2	14	0.790	152 - 183	0.2	63°	30	1.5	0.05
Ots-9 V3	2	11	0.628	121 - 160	0.2	63°	30	1.5	0.05
Ots-201b V2	4	48	0.901	123 - 351	0.42	50°	35	1.5	0.05
Ots-208b V3	4	46	0.954	178 - 372	0.1	50°	35	1.5	0.05
Ots-211 V3	4	30	0.949	219 - 349	0.25	60°	35	1.5	0.05
Ots-212 V2	4	32	0.893	145 - 276	0.18	63°	30	1.5	0.05
Ots-213 V3	4	48	0.965	202 - 386	0.25	60°	35	1.5	0.05
Ssa-197 V3	4	35	0.938	174 - 307	0.25	60°	35	1.5	0.05
Ssa-408 V3	4	31	0.924	204 - 326	0.18	50°	35	1.5	0.05
Omy-1011 V1	2	43		153 - 385	0.2	50°	35	1.5	0.05
Ots-G474 V3	4				0.1	60°	35	1.5	0.05

[b] = Observed heterozygosity was calculated using FSTAT (Goudet 1995).

Loci excluded from analysis.

Table 3. Pairwise comparisons of fall-run Chinook salmon collected from Lyons Ferry Hatchery, Lower Granite Dam, and Umatilla Hatchery calculated using FSTAT. Pairwise comparisons that were significantly different are highlighted in black with white type. Pairwise comparisons were defined as significant after implementation of Bonferonni correction for multiple tests (Rice 1989; 36 comparisons; alpha = 0.05/36 = 0.001389).

	LFH V02 SY	LFH B02	LGD 02	LFH V03 Y	LFH V03 SY	LFH B03	Umatilla 03	LGD 03
LFH V02 Y	0.06453	0.00056	0.04900	0.39689	0.05719	0.00736	0.57350	0.74731
LFH V02 SY		0.06731	0.19767	0.00078	0.37614	0.42400	0.00128	0.15800
LFH B02			0.00003	0.00003	0.07900	0.05461	0.00003	0.00011
LGD 02				0.00042	0.01017	0.00003	0.03464	0.21753
LFH V03 Y					0.00003	0.00003	0.01194	0.00008
LFH V03 SY						0.36914	0.00003	0.18886
LFH B03							0.00003	0.00011
Umatilla 03								0.02356

Pairwise comparisons with Lyons Ferry Hatchery volunteers (yearling releases) from 2002 and 2003 combined.

	LFH V02 SY	LFH B02	LGD 02	LFH V03 SY	LFH B03	Umatilla 03	LGD 03
LFH V02/03 Y	0.00009	0.00002	0.00104	0.00002	0.00002	0.03340	0.00367

LFH = Lyons Ferry Hatchery
V = unclipped/untagged adults volunteering to Lyons Ferry Hatchery
B = Lyons Ferry Hatchery broodstock
Y = adult returns that were released as yearlings (identified by scale analysis)
SY = adult returns that were released as sub-yearlings (identified by scale analysis)

Table 4. Population differentiation results for collections from Lyons Ferry Hatchery broodstock (LFH B), unmarked/untagged adults volunteering to Lyons Ferry Hatchery (yearling and subyearling releases, LFH V), unmarked/untagged adults from Lower Granite Dam (LGD), and Umatilla Hatchery broodstock (Umatilla).

A: How similar are LFH B, LFH V (subyearling and yearling releases), and samples taken at LGD in 2002?

Collection	Significantly Different	Not Significantly Different
LFH B02	LFH V02 Y LGD 02	LFH V02 SY
LFH V02 Y	LFH B02	LFH V02 SY LGD 02
LFH V02 SY		LFH V02 Y LFH B02 LGD 02
LGD 02	LFH B02	LFH V02 Y LFH V02 SY

B: How similar are LFH B, LFH V (subyearling and yearling releases), and samples taken at LGD in 2002?

Collection	Significantly Different	Not Significantly Different
LFH B03	LFH V03 Y LGD 03	LFH V03 SY
LFH V03 Y	LFH V03 SY LFH B03 LGD 03	
LFH V03 SY	LFH V03 Y	LFH B03 LGD 03
LGD 03	LFH V03 Y LFH B03	LFH V03 SY

C-1: Compare Umatilla broodstock 2003 with 2002 samples from Lyons Ferry Hatchery and Lower Granite Dam.

Collection	Significantly Different	Not Significantly Different
LFH B02	Umatilla 03	
LFH V02 SY	Umatilla 03	
LFH V02 Y		Umatilla 03
LGD 02		Umatilla 03

Table 4 (continued).
C-2: Compare Umatilla broodstock 2003 with 2003 samples from Lyons Ferry Hatchery and Lower Granite Dam.

Collection	Significantly Different	Not Significantly Different
LFH B03	Umatilla 03	
LFH V03 SY	Umatilla 03	
LFH V03 Y		Umatilla 03
LGD 03		Umatilla 03

Question C-3: Are LFH V02/V03 yearlings more similar to Umatilla than LFH B03?

Collection	Significantly Different	Not Significantly Different
LFH V02 Y N = 17		Umatilla 03 LFH B03
LFH V03 Y **N = 43**	LFH B03	Umatilla 03
LFH V02/03 Y N = 60	LFH B03	Umatilla 03

Appendix F: DNA Characterization of LFH Fall Chinook Broodstock, 2004

DNA CHARACTERIZATION OF LYONS FERRY HATCHERY FALL CHINOOK BROODSTOCK (04NM)

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Introduction

In 2004, scales from Lyons Ferry Hatchery fall Chinook broodstock were collected to address the following questions:

1) How genetically distinct are the 2004 Lyons Ferry Hatchery broodstock from: a) Lyons Ferry Hatchery broodstock collected in 2002 and 2003, b) Lyons Ferry Hatchery volunteers identified as yearlings collected in 2002 and 2003, c) Lyons Ferry Hatchery volunteers identified as sub-yearlings collected in 2002 and 2003, d) known naturally produced adults of unknown origin sampled at Lower Granite Dam in 2002 and 2003, and e) a collection of fall Chinook collected from Umatilla Hatchery broodstock in 2003?

Results for the comparisons between the 2002 and 2003 samples are available in Kassler and Shaklee (2003) and Kassler (2004). This memo; therefore focuses on the microsatellite DNA analysis of the fall-run Chinook salmon from Lyons Ferry Hatchery broodstock (04NM) and the comparison to the earlier samples.

Materials & Methods

Genomic DNA was extracted from 100 samples by digesting scales using silica membrane based kits obtained from Machery-Nagel. Microsatellite alleles at 13 loci were amplified using fluorescently labeled primers and the polymerase chain reaction (PCR) and the resulting products were run on an Applied Biosystems 3730 automated sequencer. Alleles were sized (basepairs, bp) using an internal lane size standard (GS500 by Applied Biosystems), using the Applied Biosystems Genemapper ver. 3.0 computer program. The raw allele size calls from Genemapper were imported into MS Excel where final allele calling was accomplished using MicrosatelliteBinner v.1.h (available from S.F. Young, WDFW).

The genetic interrelationships among all the collections was addressed using pairwise genotypic tests of population differentiation (Table 1). The tests were calculated using the program GENEPOP version 3.4 (Raymond and Rousset 1995) while tests from Kassler (2004) were performed using FSTAT version 2.9.3.1 (Goudet 2001). Pairwise calculations by FSTAT (Goudet 2001) only use individuals with complete genotypes while GENEPOP (Raymond and Rousset 1995) uses individuals with missing data. Pairwise genotypic tests calculated by GENEPOP in this analysis may therefore vary slightly from Kassler (2004) due to the differences in the programs used. Collections with little to no missing data will be similar while results for collections with missing data may vary.

Bonferroni correction for multiple testing (Rice 1989) was used for final estimate of statistical significance between comparisons. Bonferroni correction was used to provide the most conservative approach to estimate the significant difference between two collections being analyzed. There is an increased probability of finding a statistically significant difference between comparisons when calculating multiple tests, as compared with a single test. The probability of finding two or more individual P-values or alpha values that are less than or equal to 0.05, for example, is about 7% with five comparisons versus a probability of 5% for one

comparison (Rice 1989). Therefore, to maintain an error rate of 0.05 over all comparisons, the P-value for each individual comparison must be reduced. This ensures that the Type I error (error associated with incorrectly showing statistical significance) remains constant through the entire series of tests. A Bonferroni correction minimizes the potential for a significant difference by reducing the accepted P-value (usually 0.05) revealing only differences that are highly significantly different.

Results & Discussion

Results of these pairwise genotypic tests were mostly consistent with those of the earlier results (Kassler and Shaklee 2003, Kassler 2004) on samples from Lyons Ferry Hatchery. Results of this analysis revealed the 04NM samples were significantly different from the unmarked/untagged hatchery yearling volunteers to Lyons Ferry Hatchery (2002 and 2003 samples were combined), the Umatilla Hatchery broodstock, and the unmarked/untagged adults collected at Lower Granite Dam in 2002.

The 04NM samples (Lyons Ferry Hatchery broodstock) were not significantly different from the 2002 or 2003 broodstock collections, the unmarked/untagged hatchery sub-yearling volunteers to Lyons Ferry Hatchery from 2002 and 2003, or the unmarked/untagged adults collected at Lower Granite Dam in 2003.

There were two inconsistent results from the present analysis to that in Kassler (2004). The first came from comparisons of Lyons Ferry Hatchery broodstock and unmarked/untagged adults collected at Lower Granite Dam. The Lyons Ferry Hatchery broodstock from 2004 was not significantly different from the unmarked/untagged adults collected at Lower Granite Dam in 2003 while the broodstock collections in 2002 and 2003 were significantly different. The second was the comparison between the Lyons Ferry Hatchery unmarked/untagged hatchery sub-yearling volunteers to Lyons Ferry Hatchery from 2002 to the Umatilla broodstock 2003.

If a Bonferroni correction had not been applied, both of the comparisons that were different would still have been significant. The application of a Bonferroni correction in determining statistical significance reduces the possibility of Type I errors, but also reduces the power of the test to determine truly significant or subtle differences. The change in statistical significance for this comparison, therefore, results from the choice of the correction that was applied and in this case does not necessarily reflect the relationship between the collections.

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Rice, W.R. 1989. Analyzing tables of statistical significance. Evolution 43:223-225.

Table 1. Pairwise comparisons of fall-run Chinook salmon collected from Lyons Ferry Hatchery, Lower Granite Dam, and Umatilla Hatchery broodstock calculated using GENEPOP v.3.4. Pairwise comparisons that were significantly different are highlighted in black with white type. Pairwise comparisons were defined as significant after implementation of Bonferonni correction for multiple tests (Rice 1989; 36 comparisons; alpha = 0.05/36 = 0.0014). Pairwise comparisons that were not significantly different after Bonferroni correction, but reflect large genetic differences and should be considered as genetically different are highlighted in grey.

	LFH V02/03 Y	LFH V02 SY	LFH B02	LGD 02	LFH V03 SY	LFH B03	LGD 03	LFH B04
LFH V02 SY	0.0000							
LFH B02	0.0000	0.0390						
LGD 02	0.0004	0.1519	0.0000					
LFH V03 SY	0.0000	0.1812	0.0872	0.0089				
LFH B03	0.0000	0.3416	0.0368	0.0000	0.5113			
LGD 03	0.0003	0.3656	0.0000	0.6501	0.0157	0.0001		
LFH B04	0.0000	0.6843	0.3426	0.0000	0.0338	0.2366	**0.0065**	
Umatilla	0.0487	**0.0015**	0.0000	0.0412	0.0000	0.0000	0.0976	0.0000

LFH V02/03 Y - unmarked/untagged fish trapped at LFH, scales indicate hatchery yearling. We anticipated these fish were strays.

LFH V02 SY - unmarked/untagged fish trapped at LFH, scales indicate hatchery subyearling. We anticipated these fish were the unmarked/untagged portion of LF origin hatchery fish released upstream of LGR Dam.

LFH B02 - random sample of broodstock from fish collected at LFH and LGR Dam, broodstock consisted of fish verified as LF origin based on CWT or VIE (did not use any unmarked/untagged fish in broodstock). We anticipated these fish would be significantly different than Umatilla.

LGD 02 - unmarked/untagged naturally produced fish based upon scale analysis, fish collected at beginning of run (Aug 17-Sept 5) at LGR Dam, not a full representation of run, n=70. We anticipated these fish would be similar to LF hatchery origin fish but would have out-of-basin influence from Umatilla, Hanford, and Priest Rapid stocks.

LFH V03 SY - unmarked/untagged fish trapped at LFH, scales indicate hatchery subyearling. We anticipated these fish as the unmarked/untagged portion of LF origin hatchery fish released upstream of LGR Dam.

LFH B03 - random sample of broodstock from fish collected at LFH and LGR Dam, broodstock consisted of fish verified as LF origin based on CWT or VIE, and unmarked/untagged females trapped at LFH that had scales indicating subyearling hatchery production (did not use any unmarked/untagged fish from LGR Dam broodstock), two naturally produced fish (trapped at LFH) were included in broodstock

LGD 03 - unmarked/untagged naturally produced fish based upon scale analysis, fish collected throughout run at LGR Dam. Preliminary mixture analysis indicated 6-20% of the parentage of these fish consisted of Hanford Reach wilds, Priest Rapids hatchery, or Umatilla hatchery. It was anticipated these fish would be similar to LF origin fish but would have some stray influence as well.

LFH B04 - random sample of broodstock from fish collected at LFH and LGR Dam, broodstock consisted of fish verified as LF origin based on CWT or VIE, and unmarked/untagged females trapped at LFH and LGR Dam that had scales indicating subyearling hatchery production or Snake River natural origin (subyearling or reservoir-reared scales). Included in broodstock were 130 Snake River natural origin fish (127 females). The LFH B04 contains the same proportion of natural fish that were used in broodstock.

Umatilla B03 - random sample of fish collected at 3 Mile Dam that were used as broodstock at Umatilla Hatchery. Some of the fish in this sample may be of LF origin since they do not remove wire from fish unless they are adipose clipped. Umatilla Hatchery releases blank wire tagged fish that are not adipose clipped while the NPT releases CWT tagged fish that are not adipose clipped. At spawning it is assumed these wire tagged fish contain BWTs so we do not know to what extent LF origin fish are included in their broodstock. In 2002 wire was dissected from 50 snouts from fish not adipose clipped, and 1 CWT was decoded indicating LF origin.

Appendix G: Fall Chinook Processed from, and Estimated Run Composition for the Tucannon River 2003

(Origin states origin, brood year, age at release, and release site (LF97YO is a LFH hatchery origin fish from the 1997 brood year, released as a yearling, on-station at LFH)).

Appendix G; Composition and age of carcasses collected in the Tucannon River 2003 and estimated run composition.

		Carcasses Sampled				Estimated Run Composition			
Origin	**CWT**	**Male**	**Female**	**Jack (<53 cm)**	**Total**	**Adults**	**Adults (%)**	**Jacks**	**Jacks (%)**
LF/Snake River hatchery origin:							**23.5**		**20.0**
LF/Snake River Hatchery origin (CWT):									
LF99SO	630167		4		4	15			
LF00YO	631273	4	1	1	6	18		4	
LF99YO	630476	2	6		8	29			
LF98YO	631213		5		5	18			
LF/Snake River hatchery origin (unm/untag subs):									
Hatchery unm/untag sub age 2	NONE	1			1	4			
Hatchery unm/untag sub age 3	NONE	1			1	4			
Hatchery unm/untag sub res rear age 3	NONE	1	1		2	7			
Hatchery unm/untag sub res rear age 4	NONE	1			1	4			
LF/Snake River natural origin (wild):							**5.2**		
Wild sub age 4	NONE	4	1		5	18			
Wild sub res rear age 4	NONE		1		1	4			
Out-of-basin (strays):							**67.0**		**40.0**
Yakima R (CWT)									
YAKA99S_YAKIMA R	0501021004		1		1	4			
Bonneville (CWT)									
BONN98S_UMATILLA_R	092925		2		2	7			
Umatilla (CWT or BLANK wire)									
UMA99S_UMATILLA_R	093037		1		1	4			
BLANK wire stray sub age 4	BLANK	1	5		6	22			
BLANK wire stray sub age 5	BLANK		1		1	3			
BLANK wire stray yrl age 4	BLANK	3	6		9	33			
BLANK wire stray yrl age 5	BLANK	1	20		21	77			
BWT wire unk age	BLANK		1		1	3			
Stray (unm/untag subs)									
Stray unm/untag sub age 2	NONE			2	2			7	
Stray unm/untag sub age 3	NONE	2			2	7			
Stray unm/untag sub age 4	NONE	9	10		19	69			
Stray unm/untag sub age 5	NONE	5	2		7	26			

Appendix G; (continued).

Origin	CWT	Carcasses Sampled				Estimated Run Composition			
		Male	Female	Jack (<53 cm)	Total	Adults	Adults (%)	Jacks	Jacks (%)
stray (unm/untag yrl)									
Hatchery stray unm/untag yrl age 4	NONE		1		1	4			
Hatchery stray unm/untag yrl age 5	NONE	1	5		6	22			
Unassigned hatchery:							**1.7**		**20.0**
Hatchery unm/unkwire/noVI yrl unk if wire unk orig age 3	NO HEAD			1	1			4	
Hatchery unm/untag unk origin	NONE	2			2	7			
Unknown origin (natural or hatchery, inbasin or out-of-basin):							**2.6**		**20.0**
unm/unk wire/noVI, yrl unk orig age 4	NO HEAD			1	1			3	
unm/untag unk origin age 4	NONE		1		1	4			
unm/untag unk origin	NONE		1		1	3			
unk clip/untag/noVI unk origin	NONE		1		1	4			
Grand Total		38	77	5	120	420	**100.0**	18	**100.0**

Appendix H: Fall Chinook Processed from, and Estimated Run Composition for, the Tucannon River 2004

(Origin indicates: stock origin, brood year, age at release, and release site (LF99YO is a LFH hatchery origin fish from the 1999 brood year, released as a yearling, onstation at LFH). Note: There were not any jacks sampled from the Tucannon in 2004, therefore they are not estimated in the run composition.

Appendix H; Composition and age of carcasses collected in the Tucannon River, 2004.

		Carcasses Sampled				Estimated Run Composition	
Origin	**CWT**	**Male**	**Female**	**Jack <53cm**	**Total**	**Adults**	**Adults (%)**
LF/Snake River hatchery origin:							**62.7**
LF/Snake River hatchery origin (CWT)							
LF98SBCA	631025		1		1	6	
LF99YO	630476		1		1	6	
LF00YO	631273	2	7		9	59	
LF00YO (ADLR & SCALES)	NONE	1			1	6	
LF01YO	631585	12	4		16	104	
LF01YO (ADLR/LOST TAG & SCALES)	LOST		1		1	7	
LF/Snake River hatchery origin (unm/untag subs)							
Hatchery unm/untag sub res rear age 3	NONE		1		1	7	
Hatchery unm/untag sub age 4	NONE	1			1	7	
Hatchery unm/untag sub age 5	NONE		1		1	7	
LF/Snake River natural origin (wild):							**5.9**
WILD sub age 4	NONE		1		1	7	
WILD sub age 5	NONE	1			1	7	
WILD sub res. rear age 5	NONE		1		1	6	
Out-of-basin (strays):							**29.4**
Bonneville (CWT)							
BONN98Y_UMATILLA_R	092925	1			1	6	
	092926		1		1	7	
Umatilla (CWT or BLANK wire)							
UMA01S_UMATILLA_R	093503	1			1	7	
BLANK wire Stray sub age 5	BLANK		2		2	13	
BLANK wire Stray yrl age 4	BLANK	1	1		2	13	
BLANK wire Stray yrl age 5	BLANK		5		5	33	
BLANK wire Stray yrl age 6	BLANK		1		1	7	
BLANK wire Stray unk age	BLANK		1		1	6	
Stray (unm/untag sub)							
Hatchery stray unm/untag sub age 5	NONE	1			1	6	
Unknown origin (natural or hatchery, inbasin or out-of-basin) :							**2.0**
unm/untag unk origin	NONE	1			1	6	
Grand Total		23	30		51	333	**100.0**

[a] Any unmarked/untagged/no VI fish are assumed to be strays, since LF/Snake River hatchery origin yearlings are AD/CWT/VI tagged.

[b] Estimated one of these carcasses was from LF98SCJ, an unassociated release group.

Appendix I: Salmon Processed at LFH in 2003

(LFH=voluntary return to Lyons Ferry Hatchery, LGR=fish trapped at Lower Granite Dam. Origin states origin, brood year, age at release, and release site (LF99SO is a LFH hatchery origin fish from the 1999 brood year, released as a subyearling, Onstation at LFH).

Appendix I; Origin, CWT, and number of fish removed from the Snake River and retained at LFH for spawning/run composition purposes in 2003.

			Trapping Location						
			LGR			LFH			
Origin	Age/rearing	CWT/marks	Adults	Jacks<53	LGR Total	Adults	Jacks<53	LFH Total	Grand Total
LF/Snake River hatchery origin:									
	LF/Snake River Hatchery origin (CWT):								
	LF00SB	630270				49		**49**	**49**
	LF00SBCA	630271	13	1	**14**	2		**2**	**16**
	LF00SPA	630272	4	1	**5**	2		**2**	**7**
	LF00YBCA	630677	17	2	**19**	11	4	**15**	**34**
	LF00YCJA	630183	13	14	**27**	6	5	**11**	**38**
	LF00YO	631273	67	52	**119**	432	252	**684**	**803**
	LF00YPA	630678	17	11	**28**	7		**7**	**35**
	LF01SBCA	612639		20	**20**		9	**9**	**29**
	LF01SCJA	610105		45	**45**	1	6	**7**	**52**
		610106		14	**14**		2	**2**	**16**
	LF01SO	630890		7	**7**	1	30	**31**	**38**
	LF01SPA	612501		11	**11**		3	**3**	**14**
	LF01YBCA	610119		7	**7**		8	**8**	**15**
	LF01YCJA	610118		31	**31**		8	**8**	**39**
	LF01YO	631585	1	76	**77**	1	557	**558**	**635**
	LF01YPA	610120		10	**10**				**10**
	LF97YCJA	630453	1		**1**				**1**
	LF97YO	630860	1		**1**	1		**1**	**2**
	LF98SBCA	631025	6		**6**				**6**
	LF98SO	631026	2		**2**	16		**16**	**18**
	LF98YBCA	631012	4		**4**	2		**2**	**6**
	LF98YCJA	631013	10		**10**	4		**4**	**14**
	LF98YO	631213	36	1	**37**	116		**116**	**153**
	LF98YPA	631212	2		**2**	1		**1**	**3**

Appendix I; (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
	LF99SCJA	630168	19		**19**	1		**1**	**20**
		630169	37		**37**	4		**4**	**41**
	LF99SO	630167	9		**9**	50		**50**	**59**
	LF99YBCA	630477	3		**3**	8		**8**	**11**
	LF99YCJA	630478	12		**12**	4		**4**	**16**
	LF99YO	630476	32	1	**33**	434	1	**435**	**468**
	LF99YPA	630479	4		**4**				**4**
LF/Snake River Hatchery origin (VI elastomer):									
		ADLR	1		**1**	14	3	**17**	**18**
		NOT READ (ADLR)	2	4	**6**	539	314	**853**	**859**
		NO TAG (ADLR)		1	**1**				**1**
		LOST TAG (ADLR)	2	1	**3**	13	12	**25**	**28**
		NOT READ (ADLG)					1	**1**	**1**
		LOST TAG (LB)		1	**1**				**1**
		LOST TAG (ADRG)	2		**2**				**2**
		LOST TAG (ADLG)		1	**1**				**1**
		LOST TAG (ADLB)	1		**1**				**1**
LF/Snake River Hatchery origin (unm/untag subs):									
	Hatchery unm/untag sub age 2	NONE					7	**7**	**7**
	Hatchery unm/untag sub age 3	NONE				5		**5**	**5**
	Hatchery unm/untag sub age 4	NONE				22		**22**	**22**
	Hatchery unm/untag sub age 5	NONE				4		**4**	**4**
	Hatchery unm/untag sub res rear age 2	NONE		1	**1**		7	**7**	**8**
	Hatchery unm/untag sub res rear age 3	NONE				13	1	**14**	**14**
	Hatchery unm/untag sub res rear age 4	NONE				24		**24**	**24**

Appendix I; (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
	Hatchery unm/untag sub res rear age 5	NONE				2		**2**	**2**
LF/Snake River Natural origin (wild):									
	Wild sub age 3	NONE				1		**1**	**1**
	Wild sub age 4	NONE				2		**2**	**2**
	Wild sub res rear age 4	NONE				1		**1**	**1**
Out-of-basin (strays):									
Umatilla (CWT or BLANK wire):									
		092702				1		**1**	**1**
		092703	1		**1**				**1**
		092705				1		**1**	**1**
		092925	1		**1**	12		**12**	**13**
		092926	1		**1**	4		**4**	**5**
		093004	1		**1**	1		**1**	**2**
		093033	1		**1**	2		**2**	**3**
		093037				1		**1**	**1**
		093206				5		**5**	**5**
		093255	1		**1**				**1**
		093256				1		**1**	**1**
		093346		1	**1**	4		**4**	**5**
		093501		1	**1**				**1**
		09BLANK	1	6	**7**	1	4	**5**	**12**
	Blank wire stray (AD) unk age	BLANK	1		**1**	16		**16**	**17**
	Blank wire stray (no clip) unk age	BLANK	79	4	**83**	238	4	**242**	**325**
	BLANK wire stray sub age 4	BLANK	1		**1**				**1**
	BLANK wire stray yearling age 4	BLANK	1		**1**				**1**
Klickitat (CWT or BLANK wire):		093228				2		**2**	**2**

Appendix I; (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
		63BLANK		1	**1**				**1**
Bonneville (CWT):		092740				1		**1**	**1**
		093030	2		**2**	2		**2**	**4**
Little White Salmon NFH (CWT):		0501021004	1		**1**				**1**
Ringold Springs (CWT):		630165	1		**1**				**1**
Priest Rapids (CWT):		631030				1		**1**	**1**
		631382		1	**1**				**1**
Stray (AD clipped):	Ad only hatchery stray sub age 4	AD ONLY				1		**1**	**1**
Stray (unm/untag):	Stray unm/untag sub age 4	NONE				8		**8**	**8**
	Hatchery stray unm/untag yrl age 4	NONE				2		**2**	**2**
	Hatchery stray unm/untag yrl age 5	NONE				12		**12**	**12**
Unassigned hatchery origin:									
		AD ONLY				32	6	**38**	**38**
		NO TAG (AD)	2		**2**				**2**
		LOST TAG (AD)	2	2	**4**	11	16	**27**	**31**
		LOST TAG (No clip)	4	3	**7**	4	1	**5**	**12**
		NO TAG (No clip)					1	**1**	**1**
Unknown origin (natural or hatchery):									
	unmarked/untagged	No scale data taken				8	2	**10**	**10**
Spring/Summer Chinook (CWT):									
		105508				1		**1**	**1**
		093056				1		**1**	**1**
		093154				1		**1**	**1**

Appendix I; (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
		104370				1		**1**	**1**
		104770	1		**1**				**1**
		108471				1		**1**	**1**
		108571				1		**1**	**1**
		109071				1		**1**	**1**
		631151				1		**1**	**1**
Grand Total			420	332	**752**	2172	1264	**3436**	**4188**

Appendix J: Salmon Processed at LFH in 2004

(LFH=voluntary return to Lyons Ferry Hatchery, LGR=fish trapped at Lower Granite Dam. Origin states origin, brood year, age at release, and release site (LF00SO is a LFH hatchery origin fish from the 2000 brood year, released as a subyearling, Onstation at LFH).

Appendix J; Table 1. Origin, CWT, and number of fish removed from the Snake River and retained at LFH for spawning/run composition purposes in 2004.

			Trapping Location						
			LGR			LFH			
Origin	Age/rearing	CWT/marks	Adults	Jacks<53	LGR Total	Adults	Jacks<53	LFH Total	Grand Total
LF/Snake River Hatchery origin:									
LF/Snake River Hatchery origin (CWT):									
	LF00SB	630270	1		**1**	19		**19**	**20**
	LF00SBCA	630271	7		**7**	2		**2**	**9**
	LF00SPA	630272	1		**1**	1		**1**	**2**
	LF00YBCA	630677	16		**16**	7		**7**	**23**
	LF00YCJA	630183	20		**20**	7		**7**	**27**
	LF00YO	631273	123		**123**	566	1	**567**	**690**
	LF00YPA	630678	29		**29**	5		**5**	**34**
	LF01SBCA	612639	29	3	**32**	1		**1**	**33**
	LF01SCJA1	610106	11	2	**13**	4		**4**	**17**
	LF01SCJA2	610105	45	4	**49**	4		**4**	**53**
	LF01SO	630890	19		**19**	66	1	**67**	**86**
	LF01SPA	612501	13	1	**14**				**14**
	LF01YBCA	610119	11		**11**	15	1	**16**	**27**
	LF01YCJA	610118	40	3	**43**	6		**6**	**49**
	LF01YO	631585	206	33	**239**	1244	116	**1360**	**1599**
	LF01YPA	610120	20		**20**	2		**2**	**22**
	LF02SBCA	610122	1	7	**8**		2	**2**	**10**
	LF02SCCD	631391	1	2	**3**		1	**1**	**4**
	LF02SCJA1	610121	1	3	**4**				**4**
	LF02SCJA2	612654	2	2	**4**		2	**2**	**6**
	LF02SO	631545	3	7	**10**	11	26	**37**	**47**
	LF02SPA	610123		1	**1**		1	**1**	**2**
	LF02YBCA	612659		10	**10**		17	**17**	**27**

Appendix J; Table 1 (continued).

			Trapping Location						
			LGR			LFH			
Origin	Age/rearing	CWT/marks	Adults	Jacks<53	LGR Total	Adults	Jacks<53	LFH Total	Grand Total
	LF02YCJA	612503		35	**35**		29	**29**	**64**
	LF02YO	632167		16	**16**		206	**206**	**222**
	LF02YPA	612502		13	**13**		3	**3**	**16**
	LF98YCJA	631013	1		**1**				**1**
	LF98YO	631213	1		**1**	5		**5**	**6**
	LF99SCJA1	630168	1		**1**				**1**
	LF99SCJA2	630169	1		**1**	1		**1**	**2**
	LF99SO	630167	2		**2**	5		**5**	**7**
	LF99YBCA	630477				2		**2**	**2**
	LF99YCJA	630478				1		**1**	**1**
	LF99YO	630476	15		**15**	107		**107**	**122**
	NPT02SNLVA	610109		2	**2**				**2**
		612648		1	**1**				**1**
	NPTH02SO1	610107	1	2	**3**				**3**
	NPTH02SO2	610110	3	6	**9**		3	**3**	**12**
LF/Snake River Hatchery origin (VI elastomer):									
	LF AGE 2	ADLB		3	**3**				**3**
		ADLR					8	**8**	**8**
		LB ONLY		1	**1**				**1**
	LF AGE 3	ADLR	3	1	**4**	14	1	**15**	**19**
		NOT READ (ADLR)				5		**5**	**5**
		NOT READ (LR only)				1		**1**	**1**
	LF AGE 4	ADLR	4		**4**	9		**9**	**13**
		NOT READ (ADLR)				3		**3**	**3**

Appendix J; Table 1 (continued).

			Trapping Location						
			LGR			LFH			
Origin	**Age/rearing**	**CWT/marks**	**Adults**	**Jacks<53**	**LGR Total**	**Adults**	**Jacks<53**	**LFH Total**	**Grand Total**
	LF AGE 5	ADLR				4		**4**	**4**
		LR ONLY				1		**1**	**1**
		NOT READ (ADLR)				3		**3**	**3**
	LFH	ADLR	1		**1**	4	1	**5**	**6**
		LOST TAG (ADLG)	1		**1**		1	**1**	**2**
		LOST TAG (ADLR)	1		**1**	20	6	**26**	**27**
		LOST TAG (ADRG)	1		**1**				**1**
		NO TAG (ADLR)				1	1	**2**	**2**
		NOT READ (ADLR)				476	67	**543**	**543**
LF/Snake River Hatchery origin (Ad only):									
	Ad only hatchery sub age 2	AD ONLY		5	**5**				**5**
	Ad only hatchery sub age 3	AD ONLY	5		**5**				**5**
	Ad only hatchery sub age 5	AD ONLY	2		**2**				**2**
	Ad only hatchery sub res rear age 2	AD ONLY	2	1	**3**				**3**
	Ad only hatchery sub res rear age 3	AD ONLY	1		**1**	1		**1**	**2**
	Ad only hatchery sub res rear age 4	AD ONLY	1		**1**	2		**2**	**3**
LF/Snake River Hatchery origin (unm/untag subs):									
	Hatchery unm/untag sub age 2	NONE	3	7	**10**		1	**1**	**11**
	Hatchery unm/untag sub age 3	NONE	36	1	**37**	14		**14**	**51**
	Hatchery unm/untag sub age 4	NONE	23		**23**	9		**9**	**32**
	Hatchery unm/untag sub age 5	NONE	23		**23**	2		**2**	**25**
	Hatchery unm/untag sub res rear age 2	NONE		8	**8**		1	**1**	**9**
	Hatchery unm/untag sub res rear age 3	NONE	30	1	**31**	6		**6**	**37**

Appendix J; Table 1 (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
	Hatchery unm/untag sub res rear age 4	NONE	49		**49**	17		**17**	**66**
	Hatchery unm/untag sub res rear age 5	NONE	25		**25**	3		**3**	**28**
	Hatchery unm/untag sub res rear age 6	NONE				1		**1**	**1**
LF/Snake River Natural origin (wild)									
LF/Snake River Natural origin (wild)									
	Wild sub age 2	NONE		3	**3**				**3**
	Wild sub age 3	NONE	5		**5**				**5**
	Wild sub age 4	NONE	12		**12**	4		**4**	**16**
	Wild sub age 5	NONE	39		**39**	3		**3**	**42**
	Wild sub age 6	NONE	1		**1**				**1**
	Wild sub res rear age 2	NONE		5	**5**				**5**
	Wild sub res rear age 3	NONE	3	2	**5**				**5**
	Wild sub res rear age 4	NONE	51		**51**	2		**2**	**53**
	Wild sub res rear age 5	NONE	35		**35**	1		**1**	**36**
	Wild sub res rear age 6	NONE	2		**2**				**2**
Out-of-basin (strays):									
Umatilla (CWT or BLANK wire):									
	UMA00SA	093256				1		**1**	**1**
	UMA00SD	093254				1		**1**	**1**
	UMA01SA	093501	1		**1**	1		**1**	**2**
		093503	1		**1**				**1**
	UMA01SD	093502	2		**2**	1		**1**	**3**
	UMA02SD	093760		1	**1**				**1**

Appendix J; Table 1 (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
	UMA99SA	093004				1		**1**	**1**
	09BLANK	09BLANK	10		**10**	10		**10**	**20**
	Blank wire stray (no clip) unk age	BLANK	31	1	**32**	73	2	**75**	**107**
	Blank wire stray sub age 5	BLANK	1		**1**				**1**
	Blank wire stray yrl age 3	09BLANK	1		**1**				**1**
	Blank wire stray yrl age 4	BLANK	1		**1**	1		**1**	**2**
Klickitat (CWT or BLANK wire)									
	KLICK99SO	630170	2		**2**				**2**
	63BLANK	63BLANK	4		**4**				**4**
Bonneville (CWT):									
	BONN00YUMA	093346	10		**10**	14		**14**	**24**
	BONN02YUMA	093910		1	**1**				**1**
	BONN98YUMA	092926				1		**1**	**1**
	BONN99YUMA	093206	1		**1**	2		**2**	**3**
		093207	1		**1**	1		**1**	**2**
CALFEATHERRIVER00SNETPEN		062665	1		**1**				**1**
Hatchery Stray (Ad clipped):									
	Ad only hatchery stray sub age 2	AD ONLY	1	4	**5**				**5**
	Ad only hatchery stray sub age 3	AD ONLY	5		**5**	1		**1**	**6**
	Ad only hatchery stray sub age 5	AD ONLY	2		**2**	1		**1**	**3**
	Ad only hatchery stray yrl age 2	AD ONLY		1	**1**		1	**1**	**2**
	Ad only hatchery stray yrl age 3	AD ONLY				3		**3**	**3**
	Ad only hatchery stray yrl age 4	AD ONLY	2		**2**	13		**13**	**15**
	Ad only hatchery stray yrl age 6	AD ONLY				2		**2**	**2**

Appendix J; Table 1 (continued).

Origin	Age/rearing	CWT/marks	Trapping Location: LGR Adults	LGR Jacks<53	LGR Total	LFH Adults	LFH Jacks<53	LFH Total	Grand Total
Hatchery Stray (unm/untag):									
	Hatchery stray unm/untag sub age 3	NONE	1		**1**				**1**
	Hatchery stray unm/untag sub age 4	NONE	2		**2**	3		**3**	**5**
	Hatchery stray unm/untag sub age 5	NONE	15		**15**	7		**7**	**22**
	Hatchery stray unm/untag yrl age 3	NONE				2		**2**	**2**
	Hatchery stray unm/untag yrl age 4	NONE	6		**6**	3		**3**	**9**
	Hatchery stray unm/untag yrl age 5	NONE	1		**1**	4		**4**	**5**
	Hatchery stray unm/untag yrl age 6	NONE				1		**1**	**1**
Unassigned hatchery origin									
Unassigned hatchery origin		AD ONLY	2		**2**	1		**1**	**3**
		LOST TAG (Ad clip)	1	1	**2**	7	6	**13**	**15**
		LOST TAG (no clip)		1	**1**	2		**2**	**3**
		NO TAG (Ad clip)		1	**1**				**1**
		NO TAG (no clip)	1		**1**				**1**
Unassigned hatchery yrl age 3		LOST TAG (Ad clip)				1		**1**	**1**
Unknown origin (natural or hatchery)									
Unm/untag unknown origin		(no scale data)	26	2	**28**	12	1	**13**	**41**
Spring/Summer Chinook (CWT or scales +VI elastomer)									
Spring/Summer Chinook (CWT)		100372				1		**1**	**1**
		630996	1		**1**	4		**4**	**5**
Spring/Summer Chinook (scales +VI elastomer)		ADRR				1		**1**	**1**
			1116	204	**1320**	2863	506	**3369**	**4689**

Appendix K: Run Composition of Fall Chinook to LGR Dam in 2003

(Data includes tagged and untagged fish to LGR Dam).

Appendix K; Table 1. Total run of fall Chinook to LGR Dam and Past LGR Dam based on CWT and scale readings from fish trapped at LGR Dam in 2003.

Origin	Run assoc with CWT	TOTAL RUN TO LGR Adults	TOTAL RUN TO LGR Jacks	TOTAL RUN PAST LGR Adults	TOTAL RUN PAST LGR Jacks
LF/Snake River Hatchery origin					
LF/Snake River Hatchery origin					
LF97YCJA	630453	10	0	9	0
LF97YO	630860	10	0	9	0
LF98SBCA1	631025	107	0	101	0
LF98SCJA1U	UNASSOC	305	0	305	0
LF98SO	631026	20	0	18	0
LF98YBCA	631012	50	0	45	0
LF98YCJA	631013	102	0	92	0
LF98YO	631213	414	10	369	9
LF98YPA	631212	33	0	30	0
LF99SBCA1U	UNASSOC	1155	11	1155	11
LF99SBCA2U	UNASSOC	1710	16	1710	16
LF99SCJA1	630168	531	0	508	0
LF99SCJA2	630169	765	0	725	0
LF99SO	630167	109	0	98	0
LF99SPA1U	UNASSOC	112	1	112	1
LF99YBCA	630477	39	0	35	0
LF99YCJA	630478	122	0	110	0
LF99YO	630476	324	9	291	8
LF99YPA	630479	51	0	46	0
LF00SBCA1	630271	382	26	367	25
LF00SBCA2U	UNASSOC	681	134	681	134
LF00SCJA1U	UNASSOC	397	78	397	78
LF00SPA1	630272	76	19	72	18
LF00YBCA	630677	169	21	151	19
LF00YCJA	630183	141	134	126	120
LF00YO	631273	686	501	613	447
LF00YPA	630678	192	103	171	92
LF01SBCA1	612639	0	507	0	485
LF01SBCA2U	UNASSOC	70	1143	70	1143
LF01SCJA1	610106	0	382	0	366
LF01SCJA2	610105	0	1250	0	1201
LF01SO	630890	0	67	0	60
LF01SPA1	612501	0	224	0	212
LF01YBCA	610119	0	74	0	66
LF01YCJA	610118	0	280	0	250
LF01YO	631585	10	742	9	662
LF01YPA	610120	0	95	0	85
LF01SNOAA	PIT tag research	0	86	0	86
IPC	AD ONLY	143	352	143	352
LF/Snake River natural origin					
WILD	WILD	3856	477	3856	477

Appendix K; Table 1 (continued).

Origin	Run assoc with CWT	TOTAL RUN TO LGR Adults	TOTAL RUN TO LGR Jacks	TOTAL RUN PAST LGR Adults	TOTAL RUN PAST LGR Jacks
Out-of-basin (strays):					
Bonneville Hatchery					
BONN98S_Umatilla_R	092925	10	0	9	0
BONN99S_Tanner_CK	093030	20	0	18	0
BONN99UM	092926	21	0	19	0
BONN00Y_Umatilla_R	093346	0	9	0	8
Umatilla Hatchery					
UMHS98_Umatilla_R	092703	10	0	9	0
UMH99S_Umatilla_R	093004	10	0	9	0
UMH99S_Umatilla_R	093033	10	0	9	0
UMH00S_Umatilla_R	093255	10	0	9	0
UMH01S_Umatilla_R	093501	0	9	0	8
BLANK	BLANK	914	37	817	33
09BLANK	09BLANK	10	65	9	58
Klickitat Hatchery					
KLICK	63BLANK	0	9	0	8
Little White Salmon Hatchery					
LWS99S_Yakima_R	0501021004	28	0	27	0
Priest Rapids Hatchery					
PRIEST01S_COL_R	631382	0	212	0	209
Ringold Hatchery					
RNGLDH99S_COL_R	630165	143	0	142	0
Tucannon River natural origin					
TUC wild	PIT tag Tuc wild	0	1	0	1
Summer Chinook (incidental catch)					
MCCALLh99SUMR	104770	10	0	9	0
Grand total		**13,963**	**7,084**	**13,505**	**6,748**

Appendix L: Final Location of Wire Tagged LFH/Snake River Hatchery Origin Fall Chinook in Return Years 2003 and 2004

(SN=Snake River, COL=Columbia River, AK=Alaska, BC=British Columbia, CA=California, OR=Oregon, WA=Washington, HS=High Seas. Data for untagged fish associated with the wire tagged fish are not included. This summary is solely for wire tagged fish).

Appendix L; Table 1. Estimated final locations of wire tagged LFH/Snake River hatchery origin fish in return years 2003 and 2004. Based upon RMIS downloaded on 4/22/05 as well as run reconstruction estimates of fish returning above LGR Dam to spawn. Snake River recoveries for 2004 are not included.

			Subyearling Brood Year						Yearling Brood Year							
Return Year	**Area**	**Locale**	**1998**	**1999**	**2000**	**2001**	**2002**	**Total**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**Total**	**Grand Total**
2003	freshwater	SN	97	759	264	1,033		2,153	21	804	1,269	3,036	1,991		7,121	9,274
		COL	51	45	295	2		393	2	570	1,648	2,896	137		5,253	5,646
	freshwater Total		**148**	**804**	**559**	**1,035**		**2,546**	**23**	**1,374**	**2,917**	**5,932**	**2,128**		**12,374**	**14,920**
	ocean	AK	22	19	4			45		66	15				81	126
		BC	12	127	15			154	13	212	729	157			1,111	1,265
		CA								9	8				17	17
		OR		21	12			33		71	360	110			541	574
		WA	13	69	17			99	2	162	508	120			792	891
	ocean Total		**47**	**236**	**48**			**331**	**15**	**520**	**1,620**	**387**			**2,542**	**2,873**
2003 Total			195	1,040	607	1,035		2,877	38	1,894	4,537	6,319	2,128		14,916	17,793
2004	freshwater	COL		8	34	19	1	62		11	189	560	541	17	1,318	1,380
	freshwater Total			**8**	**34**	**19**	**1**	**62**		**11**	**189**	**560**	**541**	**17**	**1,318**	**1,380**
	ocean	AK		16	18			34		8	21	38			67	101
		BC		11	66	25		102		14	150	672	212		1,048	1,150
		CA			13			13			15	64	12		91	104
		OR			7	9	2	18			87	692	268		1,047	1,065
		WA		4	47	67		118			142	662	300		1,104	1,222
	ocean Total			**31**	**151**	**101**	**2**	**285**		**22**	**415**	**2,128**	**792**		**3,357**	**3,642**
2004 Total				39	185	120	3	347		33	604	2,688	1,333	17	4,675	5,022

Appendix M: Smolt-to-Adult Return Estimates for BY1990-BY2001 Fall Chinook Released as Subyearlings as Part of LFH Production

(SAR=smolt-to-adult returns, SN=Snake River, COL=Columbia River, AK=Alaska, BC=British Columbia, CA=California, OR=Oregon, WA=Washington, HS=High Seas. Estimated SARS are complete (through age 5) for BY1990-BY1998 Chinook. Estimates are based upon RMIS downloads through 4/22/05, recoveries at LFH, estimated returns to the Tucannon River, and estimated returns to LGR Dam from the run reconstruction. All estimates are based on CWTs).

Appendix M; Table 1. Smolt-to-adult estimates of fall Chinook released as **subyearlings** from WDFW as part of LFH production, numbers of observed CWTs and numbers of estimated CWTs in returns estimated to freshwater and ocean locations.

				Freshwater			Ocean							
Release site	BY	CWT	Data	SN	COL	Total	AK	BC	CA	OR	WA	HS	Total	Grand Total
Barged to Below Bonneville Dam														
	2000	**630270**	**SAR (%)**	**0.03**	**0.17**	**0.20**	**0.01**	**0.03**	**0.01**	**0.01**	**0.01**		**0.07**	**0.27**
			Sum of OBS'D	58	32	90	6	16	3	6	10		41	131
			Sum of EST'D	59	340	399	22	55	13	19	26		135	534
			CWT release	198,442										
LF1 onstation (completed returns through age 5)														
	1990	**634143**	**SAR (%)**	**0.11**	**0.04**	**0.15**	**0.03**	**0.06**			**0.01**		**0.10**	**0.25**
			Sum of OBS'D	122	21	143	17	19			4		40	183
			Sum of EST'D	125	42	167	38	68			8		114	281
			CWT release	111,784										
		634160	**SAR (%)**	**0.09**	**0.04**	**0.12**	**0.02**	**0.04**	**0.00**		**0.01**	**0.00**	**0.08**	**0.20**
			Sum of OBS'D	92	17	109	8	14	1		3	1	27	136
			Sum of EST'D	95	43	138	17	47	3		13	4	84	222
			CWT release	110,748										
	1992	**635012**	**SAR (%)**	**0.30**	**0.10**	**0.40**	**0.01**	**0.03**		**0.04**	**0.01**	**0.00**	**0.09**	**0.48**
			Sum of OBS'D	605	72	677	12	20		30	5	2	69	746
			Sum of EST'D	608	196	804	26	59		74	15	6	180	984
			CWT release	203,177										
	1998	**631026**	**SAR (%)**	**0.66**	**0.27**	**0.94**	**0.05**	**0.04**	**0.00**	**0.07**	**0.10**	**0.00**	**0.26**	**1.20**
			Sum of OBS'D	1,263	152	1,415	41	29	1	50	89	3	213	1,628
			Sum of EST'D	1,342	555	1,897	102	75	3	147	204	3	534	2,431
			CWT release	202,893										
LF1 onstation (incomplete returns)														
	1999	**630167**	**SAR (%)**	**0.25**	**0.06**	**0.30**	**0.02**	**0.03**		**0.02**	**0.04**	**0.00**	**0.11**	**0.41**
			Sum of OBS'D	357	46	403	10	17		9	33	1	70	473
			Sum of EST'D	476	109	585	35	61		31	79	3	209	794
			CWT release	194,208										
	2001	**630890**	**SAR (%)**	**0.05**	**0.01**	**0.06**	**0.00**	**0.00**		**0.00**	**0.01**		**0.02**	**0.08**
			Sum of OBS'D	38	10	48	1	2		3	8		14	62
			Sum of EST'D	98	18	116		7		9	13		29	145
			CWT release	192,247										

Appendix N: Smolt-to-Adult Return Estimates for BY1990-BY2001 Fall Chinook Released as Yearlings as Part of LFH

(SAR=smolt-to-adult returns, SN=Snake River, COL=Columbia River, AK=Alaska, BC=British Columbia, CA=California, OR=Oregon, WA=Washington, HS=High Seas. Estimated SARS are complete (through age 5) for BY1990-BY1998 Chinook. Estimates are based upon RMIS downloads through 4/22/05, recoveries at LFH, estimated returns to the Tucannon River, and estimated returns to LGR Dam from the run reconstruction. All estimates are based on CWTs).

Appendix N; Table 1. Survivals to freshwater and ocean locations for fall chinook released by WDFW.

				Freshwater			Ocean							
Release site	BY	CWT	Data	SN	COL	Total	AK	BC	CA	OR	WA	HS	Total	Grand Total
LF1 onstation (completed returns)														
	1990	**634012**	**SAR (%)**	**0.06**	**0.03**	**0.08**		**0.02**					**0.02**	**0.10**
			Sum of OBS'D	14	3	17		1					1	18
			Sum of EST'D	14	6	20		5					5	25
			CWT release	23,954										
		634013	**SAR (%)**	**0.05**	**0.05**	**0.10**		**0.03**					**0.03**	**0.13**
			Sum of OBS'D	10	1	11		2					2	13
			Sum of EST'D	10	11	21		7					7	28
			CWT release	21,137										
		634118	**SAR (%)**	**0.06**	**0.01**	**0.07**		**0.01**					**0.01**	**0.08**
			Sum of OBS'D	128	10	138		9					9	147
			Sum of EST'D	130	19	149		32					32	181
			CWT release	218,110										
		634120	**SAR (%)**	**0.06**	**0.02**	**0.08**	**0.00**	**0.01**		**0.00**	**0.01**		**0.02**	**0.10**
			Sum of OBS'D	115	17	132	1	9		1	5		16	148
			Sum of EST'D	116	40	156	2	29		4	11		46	202
			CWT release	202,674										
		634209	**SAR (%)**	**0.06**	**0.02**	**0.08**		**0.01**					**0.01**	**0.09**
			Sum of OBS'D	68	12	80		4					4	84
			Sum of EST'D	68	18	86		9					9	95
			CWT release	104,820										
		634210	**SAR (%)**	**0.05**	**0.01**	**0.06**		**0.01**					**0.01**	**0.06**
			Sum of OBS'D	51	3	54		2					2	56
			Sum of EST'D	51	5	56		7					7	63
			CWT release	98,374										
		634320	**SAR (%)**	**0.02**		**0.02**								**0.02**
			Sum of OBS'D	1		1								1
			Sum of EST'D	1		1								1
			CWT release	4,386										
	1991	**633731**	**SAR (%)**	**0.15**	**0.10**	**0.25**		**0.03**		**0.02**			**0.05**	**0.30**
			Sum of OBS'D	14	4	18		1		1			2	20
			Sum of EST'D	14	9	23		3		2			5	28
			CWT release	9,196										
		634618	**SAR (%)**	**0.08**	**0.02**	**0.10**	**0.00**			**0.01**			**0.01**	**0.11**
			Sum of OBS'D	67	7	74	1			1			2	76
			Sum of EST'D	68	14	82	3			9			12	94
			CWT release	82,796										
		634631	**SAR (%)**	**0.13**	**0.07**	**0.20**		**0.01**		**0.04**			**0.04**	**0.24**
			Sum of OBS'D	69	9	78		1		2			3	81
			Sum of EST'D	69	34	103		3		18			21	124
			CWT release	51,408										
		634655	**SAR (%)**	**0.11**	**0.01**	**0.12**		**0.04**					**0.04**	**0.16**
			Sum of OBS'D	55	3	58		5					5	63
			Sum of EST'D	55	6	61		20					20	81

Appendix N; Table 1 (continued).

				Freshwater			Ocean							
Release site	BY	CWT	Data	SN	COL	Total	AK	BC	CA	OR	WA	HS	Total	Grand Total
			CWT release	52,093	52,093									
		634656	**SAR (%)**	**0.12**	**0.02**	**0.14**		**0.03**		**0.01**			**0.04**	**0.18**
			Sum of OBS'D	59	5	64		4		2			6	70
			Sum of EST'D	59	11	70		14		4			18	88
			CWT release	49,656										
		634657	**SAR (%)**	**0.10**	**0.02**	**0.13**		**0.05**					**0.05**	**0.18**
			Sum of OBS'D	56	7	63		6					6	69
			Sum of EST'D	56	12	68		28					28	96
			CWT release	53,595										
		634658	**SAR (%)**	**0.10**	**0.04**	**0.14**		**0.03**					**0.03**	**0.17**
			Sum of OBS'D	52	7	59		5					5	64
			Sum of EST'D	52	19	71		15					15	86
			CWT release	51,663										
		634659	**SAR (%)**	**0.12**	**0.01**	**0.13**	**0.01**	**0.02**	**0.00**	**0.01**			**0.04**	**0.16**
			Sum of OBS'D	62	1	63	1	2	1	3			7	70
			Sum of EST'D	62	4	66	3	8	2	5			18	84
			CWT release	51,371										
		634660	**SAR (%)**	**0.06**	**0.01**	**0.07**		**0.01**		**0.01**		**0.01**	**0.02**	**0.09**
			Sum of OBS'D	30	3	33		1		1		1	3	36
			Sum of EST'D	30	6	36		3		3		3	9	45
			CWT release	51,887										
		634661	**SAR (%)**	**0.11**	**0.01**	**0.12**	**0.01**	**0.01**		**0.01**	**0.00**	**0.01**	**0.04**	**0.16**
			Sum of OBS'D	49	5	54	1	1		2	1	1	6	60
			Sum of EST'D	56	7	63	3	4		7	1	4	19	82
			CWT release	51,370										
		634662	**SAR (%)**	**0.12**	**0.02**	**0.14**		**0.00**	**0.01**	**0.01**	**0.01**		**0.02**	**0.17**
			Sum of OBS'D	62	4	66		1	1	1	1		4	70
			Sum of EST'D	62	12	74		2	4	3	3		12	86
			CWT release	51,410										
		634663	**SAR (%)**	**0.08**	**0.01**	**0.09**		**0.01**			**0.01**		**0.01**	**0.10**
			Sum of OBS'D	40	4	44		1			1		2	46
			Sum of EST'D	40	7	47		3			3		6	53
			CWT release	50,892										
		634703	**SAR (%)**	**0.11**	**0.01**	**0.12**		**0.08**		**0.01**	**0.01**		**0.10**	**0.22**
			Sum of OBS'D	42	2	44		6		1	1		8	52
			Sum of EST'D	42	5	47		31		3	4		38	85
			CWT release	38,460										
		634705	**SAR (%)**	**0.13**	**0.03**	**0.17**		**0.06**		**0.02**			**0.08**	**0.24**
			Sum of OBS'D	50	5	55		6		2			8	63
			Sum of EST'D	51	12	63		23		7			30	93
			CWT release	38,170										
		634706	**SAR (%)**	**0.09**	**0.01**	**0.10**		**0.06**		**0.01**			**0.07**	**0.17**
			Sum of OBS'D	31	1	32		4		1			5	37
			Sum of EST'D	31	2	33		22		3			25	58
			CWT release	33,994										

Appendix N; Table 1 (continued).

				Freshwater			Ocean							
Release site	BY	CWT	Data	SN	COL	Total	AK	BC	CA	OR	WA	HS	Total	Grand Total
		634709	**SAR (%)**	**0.08**		**0.08**		**0.02**					**0.02**	**0.09**
			Sum of OBS'D	25		25		2					2	27
			Sum of EST'D	25		25		5					5	30
			CWT release	31,901										
	1992	**634758**	**SAR (%)**	**0.19**	**0.13**	**0.33**		**0.03**		**0.05**	**0.01**		**0.09**	**0.42**
			Sum of OBS'D	98	25	123		5		7	2		14	137
			Sum of EST'D	100	68	168		14		27	4		45	213
			CWT release	51,316										
		634760	**SAR (%)**	**0.22**	**0.23**	**0.46**	**0.01**	**0.04**		**0.08**	**0.01**		**0.13**	**0.59**
			Sum of OBS'D	108	41	149	2	6		14	4		26	175
			Sum of EST'D	113	120	233	5	18		39	7		69	302
			CWT release	51,160										
		634763	**SAR (%)**	**0.20**	**0.18**	**0.37**	**0.01**	**0.02**		**0.02**	**0.04**		**0.09**	**0.46**
			Sum of OBS'D	98	33	131	2	3		4	5		14	145
			Sum of EST'D	99	89	188	4	12		10	20		46	234
			CWT release	50,481										
		634912	**SAR (%)**	**0.24**	**0.16**	**0.40**		**0.03**	**0.03**	**0.05**	**0.01**	**0.01**	**0.13**	**0.53**
			Sum of OBS'D	119	31	150		5	2	10	3	1	21	171
			Sum of EST'D	121	84	205		17	16	26	5	4	68	273
			CWT release	51,168										
		634915	**SAR (%)**	**0.22**	**0.14**	**0.36**		**0.03**		**0.05**	**0.02**		**0.10**	**0.45**
			Sum of OBS'D	107	20	127		5		12	4		21	148
			Sum of EST'D	112	71	183		13		28	9		50	233
			CWT release	51,258										
		634917	**SAR (%)**	**0.22**	**0.25**	**0.48**	**0.00**	**0.03**		**0.03**	**0.01**		**0.08**	**0.55**
			Sum of OBS'D	113	43	156	1	6		7	1		15	171
			Sum of EST'D	116	130	246	2	18		16	3		39	285
			CWT release	51,702										
		634918	**SAR (%)**	**0.18**	**0.13**	**0.31**	**0.01**	**0.03**		**0.04**	**0.02**		**0.09**	**0.40**
			Sum of OBS'D	91	25	116	1	4		7	3		15	131
			Sum of EST'D	92	67	159	3	13		20	10		46	205
			CWT release	51,702										
		634920	**SAR (%)**	**0.17**	**0.20**	**0.37**	**0.00**	**0.03**		**0.05**	**0.01**		**0.11**	**0.48**
			Sum of OBS'D	83	30	113	1	6		11	2		20	133
			Sum of EST'D	83	100	183	1	17		27	7		52	235
			CWT release	49,248										
		635224	**SAR (%)**	**0.24**	**0.23**	**0.47**	**0.02**	**0.03**	**0.01**	**0.05**	**0.02**		**0.13**	**0.60**
			Sum of OBS'D	128	38	166	2	6	1	13	4		26	192
			Sum of EST'D	129	120	249	11	17	4	27	11		70	319
			CWT release	53,276										
		635227	**SAR (%)**	**0.23**	**0.07**	**0.30**	**0.01**	**0.04**		**0.03**	**0.01**		**0.09**	**0.39**
			Sum of OBS'D	118	18	136	2	5		6	4		17	153
			Sum of EST'D	119	34	153	6	18		16	7		47	200
			CWT release	51,260										

Appendix N; Table 1 (continued).

Release site	BY	CWT	Data	Freshwater SN	Freshwater COL	Freshwater Total	Ocean AK	Ocean BC	Ocean CA	Ocean OR	Ocean WA	Ocean HS	Ocean Total	Grand Total
		635229	**SAR (%)**	**0.26**	**0.10**	**0.36**	**0.01**	**0.03**		**0.03**	**0.02**		**0.10**	**0.46**
			Sum of OBS'D	123	22	145	1	6		6	5		18	163
			Sum of EST'D	131	53	184	3	17		17	12		49	233
			CWT release	51,091										
		635263	**SAR (%)**	**0.28**	**0.22**	**0.50**	**0.01**	**0.02**		**0.06**	**0.02**	**0.01**	**0.12**	**0.61**
			Sum of OBS'D	93	28	121	1	4		7	3	1	16	137
			Sum of EST'D	94	74	168	2	7		21	6	3	39	207
			CWT release	33,736										
	1993	**635162**	**SAR (%)**	**1.16**	**0.28**	**1.44**	**0.05**	**0.08**		**0.04**	**0.04**	**0.00**	**0.21**	**1.66**
			Sum of OBS'D	1,027	8	1,035	20	26			15	1	62	1,097
			Sum of EST'D	1,046	253	1,299	41	76		39	32	3	191	1,490
			CWT release	89,900										
		635163	**SAR (%)**	**0.94**	**0.21**	**1.15**	**0.02**	**0.08**		**0.07**	**0.03**	**0.01**	**0.22**	**1.37**
			Sum of OBS'D	921	6	927	11	26			14	5	56	983
			Sum of EST'D	951	210	1,161	23	78		72	33	15	221	1,382
			CWT release	101,165										
		635639	**SAR (%)**	**1.09**	**0.26**	**1.35**	**0.04**	**0.10**	**0.00**	**0.06**	**0.04**	**0.00**	**0.24**	**1.59**
			Sum of OBS'D	871	7	878	10	25	1		17	1	54	932
			Sum of EST'D	902	212	1,114	29	82	3	51	33	3	201	1,315
			CWT release	82,624										
		635640	**SAR (%)**	**0.78**	**0.26**	**1.04**	**0.03**	**0.11**		**0.07**	**0.07**	**0.00**	**0.28**	**1.32**
			Sum of OBS'D	547	5	552	10	20			21	1	52	604
			Sum of EST'D	575	194	769	23	80		50	50	3	206	975
			CWT release	73,986										
	1994	**635844**	**SAR (%)**	**0.43**	**0.13**	**0.56**	**0.02**	**0.02**		**0.01**	**0.01**	**0.00**	**0.07**	**0.63**
			Sum of OBS'D	786	129	915	16	19		9	15	1	60	975
			Sum of EST'D	858	259	1,117	41	40		22	29	4	136	1,253
			CWT release	198,219										
		635845	**SAR (%)**	**0.38**	**0.09**	**0.47**	**0.02**	**0.02**		**0.03**	**0.01**		**0.08**	**0.55**
			Sum of OBS'D	731	88	819	17	17		14	12		60	879
			Sum of EST'D	797	186	983	46	49		54	24		173	1,156
			CWT release	208,475										
	1995	**636320**	**SAR (%)**	**1.12**	**0.28**	**1.39**	**0.02**	**0.11**	**0.02**	**0.09**	**0.13**	**0.02**	**0.39**	**1.78**
			Sum of OBS'D	1,932	196	2,128	19	96	11	59	115	12	312	2,440
			Sum of EST'D	2,430	607	3,037	41	244	43	205	274	36	843	3,880
			CWT release	217,794										
		636321	**SAR (%)**	**1.18**	**0.28**	**1.46**	**0.02**	**0.13**	**0.02**	**0.08**	**0.15**	**0.01**	**0.42**	**1.88**
			Sum of OBS'D	2,068	216	2,284	21	113	14	55	134	7	344	2,628
			Sum of EST'D	2,570	604	3,174	50	283	53	176	334	27	923	4,097
			CWT release	217,810										
	1996	**630163**	**SAR (%)**	**0.50**	**0.13**	**0.63**	**0.02**	**0.08**	**0.00**	**0.05**	**0.05**		**0.20**	**0.83**
			Sum of OBS'D	750	100	850	14	46	1	29	46		136	986
			Sum of EST'D	1,010	257	1,267	34	164	3	94	96		391	1,658
			CWT release	200,215										

Appendix N; Table 1 (continued).

				Freshwater			Ocean							
Release site	**BY**	**CWT**	**Data**	**SN**	**COL**	**Total**	**AK**	**BC**	**CA**	**OR**	**WA**	**HS**	**Total**	**Grand Total**
		636318	**SAR (%)**	**0.42**	**0.12**	**0.54**	**0.01**	**0.07**	**0.00**	**0.03**	**0.04**	**0.00**	**0.15**	**0.70**
			Sum of OBS'D	657	90	747	14	39	1	22	39	1	116	863
			Sum of EST'D	885	247	1,132	28	141	4	62	79	4	318	1,450
			CWT release	208,388										
	1997	**630860**	**SAR (%)**	**1.01**	**0.46**	**1.48**	**0.02**	**0.21**	**0.02**	**0.36**	**0.20**	**0.02**	**0.83**	**2.30**
			Sum of OBS'D	3,181	700	3,881	39	314	25	502	444	20	1,344	5,225
			Sum of EST'D	4,356	1,992	6,348	76	905	87	1,542	876	69	3,555	9,903
			CWT release	430,140										
	1998	**631213**	**SAR (%)**	**1.10**	**0.41**	**1.51**	**0.02**	**0.18**	**0.01**	**0.18**	**0.28**	**0.01**	**0.69**	**2.20**
			Sum of OBS'D	3,603	566	4,169	40	268	14	286	558	11	1,177	5,346
			Sum of EST'D	4,987	1,853	6,840	101	823	49	834	1,277	32	3,116	9,956
			CWT release	453,430										
LF1 onstation (incomplete returns)														
	1999	**630476**	**SAR (%)**	**0.66**	**0.55**	**1.22**	**0.01**	**0.26**	**0.01**	**0.13**	**0.18**	**0.00**	**0.59**	**1.81**
			Sum of OBS'D	1,387	356	1,743	13	177	5	151	230	3	579	2,322
			Sum of EST'D	2,238	1,867	4,105	42	889	23	424	614	3	1,995	6,100
			CWT release	337,109										
	2000	**631273**	**SAR (%)**	**0.63**	**0.46**	**1.09**	**0.00**	**0.13**	**0.01**	**0.13**	**0.12**		**0.41**	**1.50**
			Sum of OBS'D	1,183	276	1,459	7	179	9	185	237		617	2,076
			Sum of EST'D	2,717	1,968	4,685	19	569	46	577	528		1,739	6,424
			CWT release	428,002										
	2001	**631585**	**SAR (%)**	**0.30**	**0.11**	**0.41**	**0.00**	**0.03**	**0.00**	**0.04**	**0.05**		**0.12**	**0.53**
			Sum of OBS'D	635	212	847	1	48	1	73	110		233	1,080
			Sum of EST'D	1,530	575	2,105		171	4	210	243		628	2,733
			CWT release	513,890										

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