

LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Spring Chinook Salmon Evaluation Studies
2000 Annual Progress Report

Oregon Department of Fish and Wildlife
Fish Research and Development, NE Region



Fred R. Monzyk
Gary R. Vonderohe
Timothy L. Hoffnagle
Richard W. Carmichael
Debra L. Eddy
Patrick J. Keniry

March 2006



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COMPENSATION PLAN

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ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Lower Snake River Compensation Plan: Oregon Spring Chinook
Salmon Evaluation Studies

CONTRACT NUMBER: 14110-3-J050

PROJECT PERIOD: January 1, 2000 through December 31, 2000

Prepared By: Fred R. Monzyk
Gary R. Vonderohe
Timothy L. Hoffnagle
Richard W. Carmichael
Debra L. Eddy
Patrick J. Keniry

March 2006

Oregon Department of Fish and Wildlife
3406 Cherry Avenue NE
Salem, OR 97303

This project was financed by the U.S. Fish and Wildlife Service under
the Lower Snake River Compensation Plan.

Preface

This progress report provides summary information for spring Chinook salmon Lower Snake River Compensation Plan (LSRCP) programs operated by Oregon Department of Fish and Wildlife (ODFW) in the Grande Ronde and Imnaha river basins during 2000. These ongoing monitoring and evaluation programs provide technical, logistical and biological information to managers charged with maintaining viable Chinook salmon populations and associated fisheries in northeast Oregon.

The data in this report serve as the basis for assessing the success of meeting management objectives and were derived from hatchery inventories and standard databases (e.g., PSMFC, coded-wire tag) or through standard measuring techniques. As such, specific protocols are usually not described. In cases where expansions of data or unique methodologies were used, protocols are described in more detail. Additional descriptions of protocols can be found in the 2000 work statement (Carmichael and Ruzycki 2000). Coded-wire tag (CWT) data collected from 2000 adult returns were used to evaluate smolt-to-adult survival rates in production and experimental rearing and release groups. In 2000, experimental treatments from which salmon returned included, size at release, rearing density, and presmolt exercise. Analysis of data for specific survival studies will be completed once all cohorts have returned and CWT data are complete for a given experiment. In addition, much of the data that we discuss in this report will be used in separate and specific evaluations of ongoing supplementation programs for Chinook salmon in the Imnaha River Basin. We began fish culture evaluations in 1983 and have dramatically improved many practices. Progress for work completed in previous years is presented in annual progress reports (Carmichael and Wagner 1983; Carmichael and Messmer 1985; Carmichael et al. 1986a 1987, 1988, 1999 and 2004; Hoffnagle et al. 2005; Messmer et al. 1989, 1990, 1991, 1992 and 1993; Monzyk et al. 2006) and United States v. Oregon production report (Carmichael et al. 1986b).

Within each section of this report, data are organized into salmon culture monitoring for juveniles, adults, CWT recoveries, compensation goals and estimates for total escapement. During the period covered in this report, Chinook salmon from the 1998 cohort were released as smolts, Chinook salmon from the 1995-1997 cohorts returned to spawn, and adult Chinook salmon that returned to spawn were used to create the 2000 cohort.

Acknowledgments

Mike Gribble, Bob Lund and many other hatchery personnel exhibited great dedication and provided essential assistance. Numerous personnel from the U.S. Fish and Wildlife Service, U.S. Forest Service, the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation were enthusiastically supportive during spawning ground surveys and spawning at Lookingglass Fish Hatchery. This project was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, contract numbers 14-48-0001-95560 and 96540, a cooperative agreement with the Oregon Department of Fish and Wildlife.

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EXECUTIVE SUMMARY

In 2000 we released 179,987 smolts from the 1998 cohort into the Imnaha River. We estimated 99.8% of the released smolts were recognizably marked with adipose fin clips. In the Grande Ronde Basin we released 24,201 Rapid River stock parr (1999 cohort) into Lookingglass Creek. We estimated 99.4% of Rapid River stock parr were recognizably marked with ad clips. In addition, smolts produced from the Grande Ronde Basin Captive Broodstock Program were released in the Grande Ronde Basin for the first time. We released 35,105 smolts into the Lostine River in 2000, 99.9% of which were recognizably marked with ad clips. We released 38,149 smolts into Catherine Creek with 99.3% of these fish recognizably marked with ad clips. We released 1,508 smolts into the upper Grande Ronde River and estimated that 100% of these smolts had recognizable ad clip marks.

In 2000, we trapped 777 hatchery- and 332 naturally-produced Chinook salmon on the Imnaha River. In 1995 we began trapping Rapid River stock adults destined for Lookingglass Fish Hatchery at Lower Granite Dam to reduce the number of these hatchery salmon straying on the spawning grounds in the Grande Ronde Basin. In 2000, we trapped 822 Rapid River stock Chinook salmon at Lower Granite Dam and 186 at Lookingglass Fish Hatchery. In addition, we captured 27 hatchery- and 64 naturally-produced Chinook salmon on the Lostine River, 24 naturally-produced Chinook salmon on Catherine Creek, and 17 naturally-produced Chinook salmon on the upper Grande Ronde River.

We estimated that 1,685 Imnaha River stock and 1,010 Rapid River stock hatchery Chinook salmon returned to the LSRCP compensation area in 2000 as a result of hatchery releases in the Imnaha and Grande Ronde basins. These returns achieved only 52.5% and 17.4% of the adult compensation goals in the Imnaha and Grande Ronde basins, respectively. In 2000, we recovered 388 carcasses and found 261 redds during spawning ground surveys in the Imnaha River Basin. In the Grande Ronde Basin, we recovered 319 carcasses and found 502 redds. There were six strays recovered in 2000. Two strays were Rapid River stock Chinook salmon released into Lookingglass Creek from Lookingglass Fish Hatchery and recovered in the Imnaha and Minam rivers. Also in the Imnaha River, one stray from Youngs River (near Astoria, Oregon) and one stray from Rapid River Fish Hatchery were recovered. In the Minam River, one stray from the Imnaha River was recovered and in the Wenaha River, a salmon released from Dworshak Fish Hatchery, Idaho, was recovered.

INTRODUCTION

This report summarizes spring Chinook salmon monitoring data for the Lower Snake River Compensation Plan (LSRCP) facilities in 2000. The main objective of this report is to document and evaluate salmon culture performance and achievement of management objectives for spring Chinook salmon hatchery programs in the Imnaha and Grande Ronde river basins. These data are used to design culture practices to optimize egg-to-smolt survival rate, smolt quality and smolt-to-adult survival rate. This report provides information on rearing and release operations for the 1998 and 1999 cohorts of juvenile Chinook salmon, the collection, spawning and adult characteristics for the 2000 return of adult Chinook salmon, and the collection of eggs for the 2000 cohort.

Program Objectives

1. Document spring Chinook salmon rearing and release activities at all LSRCP facilities.
2. Determine optimum rearing and release strategies that will produce maximum survival to adulthood for hatchery-produced spring Chinook salmon smolts.
3. Document Chinook salmon adult returns by stock to each LSRCP broodstock collection facility.
4. Determine if the total production of spring Chinook salmon adults meet mitigation goals and index annual smolt survival and adult returns to Lower Granite Dam for production groups.
5. Coordinate spring Chinook salmon broodstock marking programs for Lookingglass Fish Hatchery.
6. Participate in planning activities associated with anadromous salmon production and management in the Grande Ronde and Imnaha river basins and participate in ESA permitting, consultation and rearing activities.
7. Conduct index, extensive and supplemental spring Chinook salmon spawning ground surveys in selected streams in northeast Oregon.
8. Identify hatchery and wild origin for carcasses collected on spawning ground surveys in the Grande Ronde Basin.

RESULTS AND DISCUSSION

During 2000, Chinook salmon from the 1998 cohort were released as smolts into the Imnaha River. In the Grande Ronde River Basin, smolts from the 1998 cohort produced from the Captive Broodstock Program were released into the Lostine River, Grande Ronde River, and Catherine Creek. In addition, parr from the 1999 cohort of Rapid River stock were released into Lookingglass Creek. This was the final release of Rapid River stock Chinook salmon into the Grande Ronde Basin, as the supplementation program shift to endemic salmon. Adult Chinook salmon from the 1995-1997 cohorts returned to spawn and were used as broodstock to create the 2000 cohort to be reared at Lookingglass Fish Hatchery (LFH). Experimental treatments from which adult salmon returned included size-at-release and rearing density for Imnaha River stock and pre-smolt exercise for Rapid River stock. Analysis of data for specific survival studies will be completed once all cohorts have returned and coded-wire tag (CWT) data are complete for a

given experiment and will be presented in separate and specific reports for these experiments. In addition, much of the data discussed in this report will be used in separate and specific evaluations of ongoing supplementation programs for Chinook salmon in the Grande Ronde and Imnaha river basins.

Juveniles

Eyed egg-to-smolt survival rates for the 1998 cohort of Chinook salmon released in 2000 were 58.3% for the Imnaha River conventional broodstock offspring, and 53.3% for Lostine River, 36.3% for Grande Ronde River, and 40.1% for Catherine Creek Captive Broodstock offspring. Eyed egg-to-parr survival rate for the 1999 cohort of Rapid River stock released into Lookingglass Creek was 87.8% (Table 1). The release of 179,987 smolts from the 1998 Imnaha River cohort was far below the mitigation goal of 490,000. This was the result of a poor 1998 return, as well as broodstock collection strategies that placed a large proportion of trapped hatchery and natural salmon above the weir to spawn naturally. The production goal for the 1999 cohort of Rapid River Chinook salmon was set at 30,000 parr. The release of 24,201 parr from the 1999 cohort was below this modified production goal. We attempted to mark all smolts from each stock of the 1998 cohort and all parr from the 1999 cohort of River Rapid River stock with Ad clips+CWT. We had good mark rates for each stock (Table 2): Imnaha (95.7%); Lostine (98.6%); Grande Ronde (100%); Catherine Creek (97.7%); and Rapid River stock (98.4%).

The 1998 cohort of Imnaha River Chinook salmon was reared in ten raceways at Lookingglass Fish Hatchery. We marked all ten raceways with unique CWT codes. All Imnaha River Chinook salmon smolts were acclimated at the Imnaha Acclimation Facility. Volitional releases began on 1 April 2000 and remaining smolts were forced out on 18 April 2000 (Table 3). Lostine River Chinook salmon smolts were reared in three raceways at the hatchery and transported to the Lostine acclimation ponds 29 February 2000, volitional release began on 1 April 2000 and remaining smolts were forced out on 18 April 2000. Grande Ronde River Chinook salmon smolts were reared in one raceway, transported to Grande Ronde acclimation ponds on 28 February and force released on 14 March 2000. Catherine Creek Chinook salmon smolts were reared in three raceways and transported to Catherine Creek acclimation ponds on 28 February 2000. Smolts were volitionally released beginning 1 April 2000 and forced out on 18 April 2000. Rapid River Chinook salmon parr from the 1999 cohort were reared in one raceway and released from LFH directly into Lookingglass Creek on 29 June 2000. Smolt migration success was monitored based on PIT-tag observations at mainstem dams. Mean first-time detection rates for each raceway were 48.6% for Imnaha River smolts, 41.5% for Lostine River smolts, 30.8% for Catherine Creek smolts, and 29.8% for Grande Ronde River smolts.

Adults

The Imnaha River weir was installed on 28 June 2000, well after the target date of 15 June, and operated until 12 September 2000 (Table 4). We trapped 777 hatchery- and 332 naturally-produced salmon and retained 32% (301 hatchery; 56 natural) for broodstock (Table 5). The remaining salmon were either outplanted to Big Sheep and Lick creeks (296 hatchery jacks) or released above the weir to spawn naturally (180 hatchery, 456 natural). Age structure of salmon used for broodstock was determined from CWT age, scale age and length-at-age

relationships (Figure 1). Age 3 hatchery males were the dominant age group trapped at the weir, comprising 66.4% of hatchery- and 48.2% of naturally-produced returns. Pre-spawn mortality of combined hatchery and natural Imnaha River Chinook salmon held at LFH was 6%. We spawned 59 hatchery and 8 natural females with 223 hatchery and 41 natural males (Table 5). We collected 333,824 eggs, which was below our goal of 576,500 green eggs. All eggs were incubated at Lookingglass Fish Hatchery (Table 6). Mortality to shocking was moderate (6.7%) compared to previous years.

In 2000, we trapped Rapid River stock Chinook salmon at Lower Granite Dam and at Lookingglass Fish Hatchery. A total of 822 Ad-RV+CWT marked hatchery Chinook salmon were collected at Lower Granite Dam and transported to Lyons Ferry Fish Hatchery, Washington (Table 4). An additional 186 hatchery Chinook salmon were trapped at Lookingglass Fish Hatchery along with 52 naturally-produced Chinook salmon. The majority of the hatchery- and naturally-produced fish were returned below the weir for a tribal fishery. No Rapid River adults were kept for broodstock at Lookingglass Fish Hatchery.

The Lostine River weir captured 27 hatchery- and 64 naturally-produced adult Chinook salmon and we retained 36% (11 hatchery, 22 natural) for broodstock (Table 5). The remaining adults (16 hatchery, 42 natural) were passed upstream to spawn naturally. Pre-spawning mortality of the fish held at Lookingglass Hatchery was 3.0%. We spawned 10 hatchery males (all jacks) and 13 natural males with 8 natural females. We collected 34,630 eggs, which was well below the goal of 192,850 green eggs. Egg mortality to shocking was low (3.1%).

At the Catherine Creek weir, we captured 24 naturally-produced Chinook salmon. Sixteen were released above the weir to spawn naturally. Seven salmon were initially kept for broodstock but, because of insufficient numbers, all were eventually returned and released above the weir to spawn naturally (Table 5). There was one pre-spawning mortality at the weir.

At the upper Grande Ronde River weir, we captured 17 naturally-produced Chinook salmon. Nine were released above the weir to spawn naturally and six were initially kept for broodstock, but because of insufficient numbers, all were eventually returned to the river and released above the weir to spawn naturally (Table 5). There were two mortalities at the weir.

Coded-Wire Tag Recoveries

Coded-wire tag recoveries from adult returns, strays, and fisheries collections from experimental groups of each stock of Chinook salmon are used to evaluate hatchery treatments and assess the success of achieving mitigation goals and management objectives. Fish from all experimental and most production groups were marked with a coded-wire tag (CWT) to provide basic information on survival, harvest, escapement and straying and specific information on experimental results. We summarized the number of recoveries of each CWT code from the Regional Mark Information system (RMIS) CWT recovery database maintained by the Pacific States Marine Fisheries Commission.

To account for the total number of coded-wire tagged hatchery adults returning to the Imnaha River, we develop expansion factors for CWT recoveries based on estimated escapement and average tag retention for each hatchery cohort (see Monzyk et al. 2006).

Nearly all CWT recoveries for hatchery Chinook salmon released in the Grande Ronde and Imnaha basins occurred in the Snake River Basin (Tables 7 and 8). In 2000, we recovered 411 hatchery-reared Imnaha River Chinook salmon with a CWT from the 1995-1997 cohorts. These recoveries were expanded to an estimated 1,613 CWT returns to the Imnaha River with

the following age distribution: 22 from the 1995 cohort; 516 from the 1996 cohort; and 1,075 from the 1997 cohort (Table 7). We also estimated 10 CWT marked Imnaha River salmon (all 1997 cohort) were recovered in Columbia River sport fishery. Four CWT salmon were recovered in ocean fisheries (1997 cohort). One was recovered in ceremonial fisheries near Bonneville Dam (1996 cohort), and one 1997 cohort salmon was recovered at Lower Granite Dam (Table 9). In addition, two salmon strayed within the Snake River Basin (collected in the Minam River and at Rapid River Hatchery, both 1997 cohort). Seventeen strayed outside the Snake River Basin and were recovered in the Deschutes River: one from the 1995 cohort; four from the 1996 cohort; and twelve from the 1997 cohort.

In 2000, we recovered 687 CWT marked Rapid River Chinook salmon from the 1995-1997 cohorts released from Lookingglass Fish Hatchery (Table 8). Of those, 542 were captured at Lower Granite Dam with the following age distribution: 21 from the 1995 cohort; 464 from the 1996 cohort; and 57 from the 1997 cohort. An additional 108 CWT fish were recovered at the LFH weir or during spawning ground surveys on Lookingglass Creek and 19 were recovered from Columbia River fisheries (Table 9). There were three strays recovered in the Snake River Basin: one 1996 cohort in the Lostine River; one 1996 cohort in the Minam River; and one 1997 cohort in the Imnaha River. Thirteen Rapid River Chinook salmon were recovered as strays outside of the Snake River Basin: four in the Deschutes River; two in the John Day Basin; one in the Umatilla River; one in the White Salmon River; four in the Wind River, Washington; and one recovered at Ringold Fish Hatchery, Washington.

Compensation Goals

The total number of hatchery-produced salmon for each stock that are recovered in fisheries, escape to the stream of release, or stray within or outside the Snake River Basin can be estimated based on CWT recoveries, weir counts, redd counts, and mark-recapture estimates during spawning ground surveys. To calculate the return to the LSRCP Compensation Area, defined as the Snake River basin above Ice Harbor Dam, we summed all estimated escapement for the 2000 return year that occurred above Ice Harbor Dam.

We did not reach the compensation goal in 2000 for either the Imnaha or Grande Ronde basins (Table 9). We estimated that 1,685 Imnaha River adults returned to the compensation area, 52.5% of the goal for the Imnaha Basin. We estimated that 1,010 Rapid River adults returned to the compensation area, 17.4% of the Grande Ronde Basin goal. Similar to 1999, the two primary factors causing low returns were poor smolt-to-adult survival and smolt releases that were below the goal.

The progeny-to-parent ratio for natural and hatchery origin Imnaha River salmon that spawned naturally in 1995 was 0.64, slightly higher than the mean value since the 1982, but well below replacement (Figure 2). This represented the twelfth year in a row that productivity has been well below replacement. The progeny-to-parent ratio for the hatchery component was 11.3, better than naturally spawning salmon and well above replacement. The number of natural salmon that returned to the basin (707) was much higher than the 1999 return of 291 adults and greater than the average return since 1990 (Figure 3).

Natural Escapement Monitoring

Stream surveys to enumerate Chinook salmon redds and to sample salmon carcasses were conducted as the previous year (Monzyk et al. 2006). We surveyed three streams in the Imnaha River Basin and nine in the Grande Ronde Basin.

In 2000, we counted 261 redds and recovered 388 carcasses in the Imnaha Basin (Table 11). Almost all marked hatchery salmon recovered were Imnaha stock, but three were out-of-basin strays (Table 10): one each from Youngs River and Bay near Astoria, Oregon (1996 cohort), Rapid River Hatchery (1996 cohort), and Lookingglass Fish Hatchery (1997 cohort). Marked salmon comprised 65.5% of the recovered carcasses. Strays accounted for 0.8% of the total carcasses recovered.

In the Grande Ronde Basin, we observed 502 redds and recovered 364 carcasses on the spawning grounds. We recovered three marked hatchery strays in the Grande Ronde Basin (Table 10). In the Minam River, one stray originated from releases at Lookingglass Fish Hatchery (1996 cohort) and another from the Imnaha acclimation pond (1997 cohort). In the Wenaha River, a stray from Dworshak National Fish Hatchery (1996 cohort) was recovered. Marked salmon comprised 25.8% of the carcasses recovered. Hatchery strays comprised 0.8% of the total carcasses recovered in the Grande Ronde Basin.

The majority of the recovered carcasses (91.1% in the Grande Ronde Basin and 75.8% in the Imnaha Basin) were age-4 salmon, similar to the 1999 return year (Table 12). Males outnumbered females in the Imnaha River Basin with female recoveries accounting for only 39.2% of all recoveries while in the Grande Ronde River Basin females accounted for 58.8% of the recoveries. In the Imnaha River Basin, age-3 males comprised 18.6% of the carcasses recovered but only 6.6% in the Grande Ronde Basin. Age-5 salmon comprised 4% of the carcasses in the Imnaha River Basin and 2.2% in the Grande Ronde Basin.

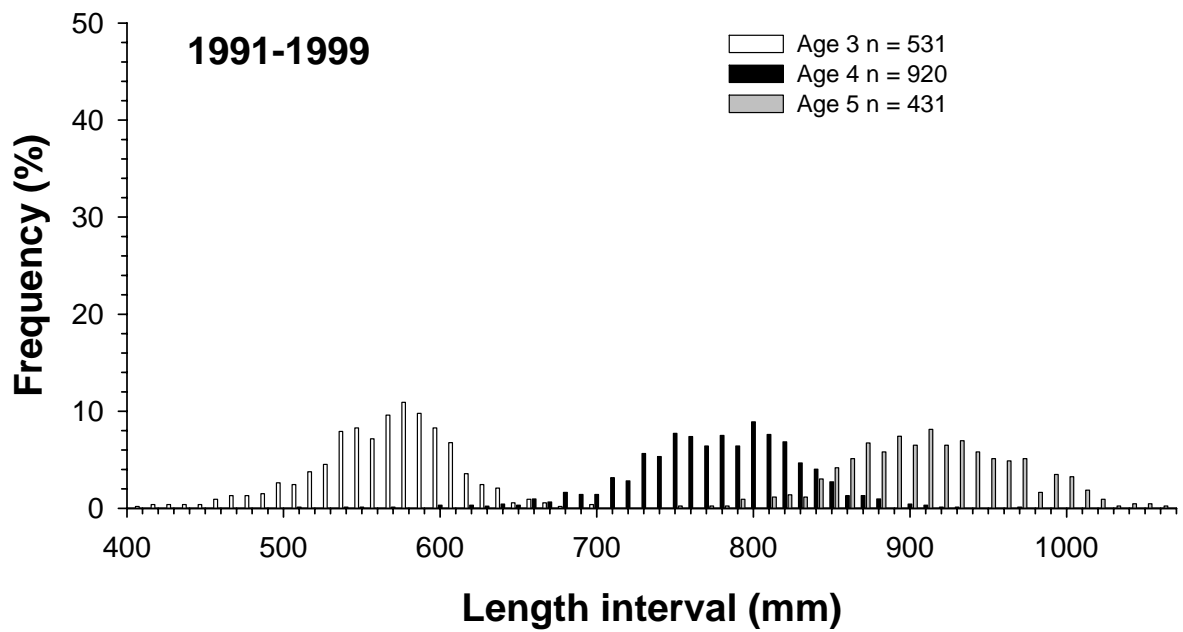
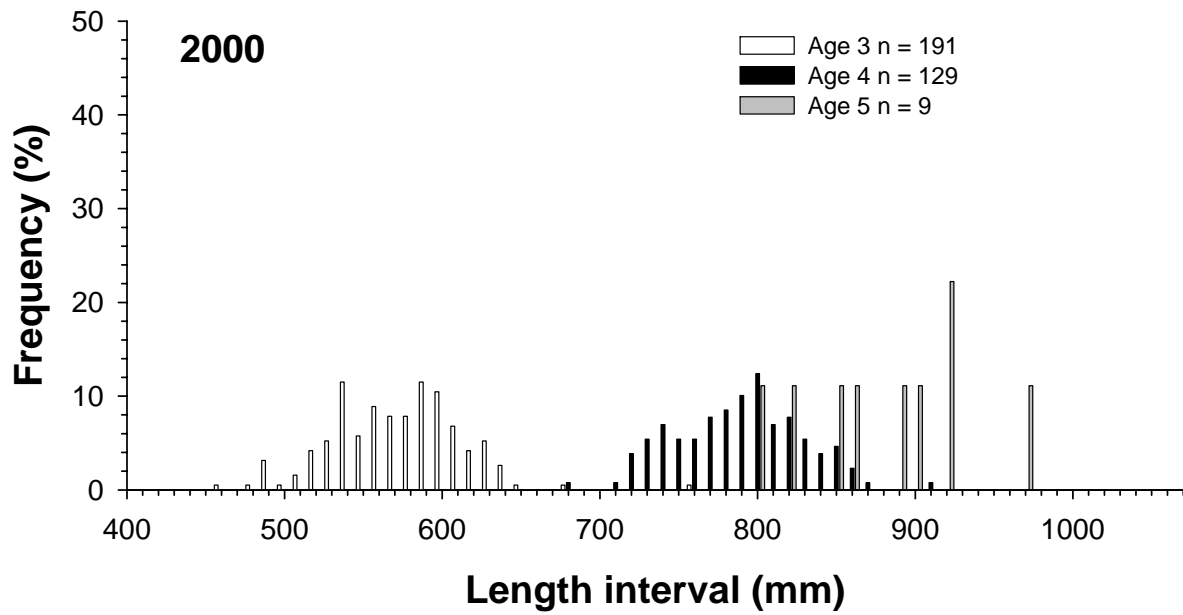


Figure 1. Length frequency-at-age relationship for Imnaha River Chinook salmon adults used as hatchery broodstock in 2000 (top) and from 1991-1999 (bottom).

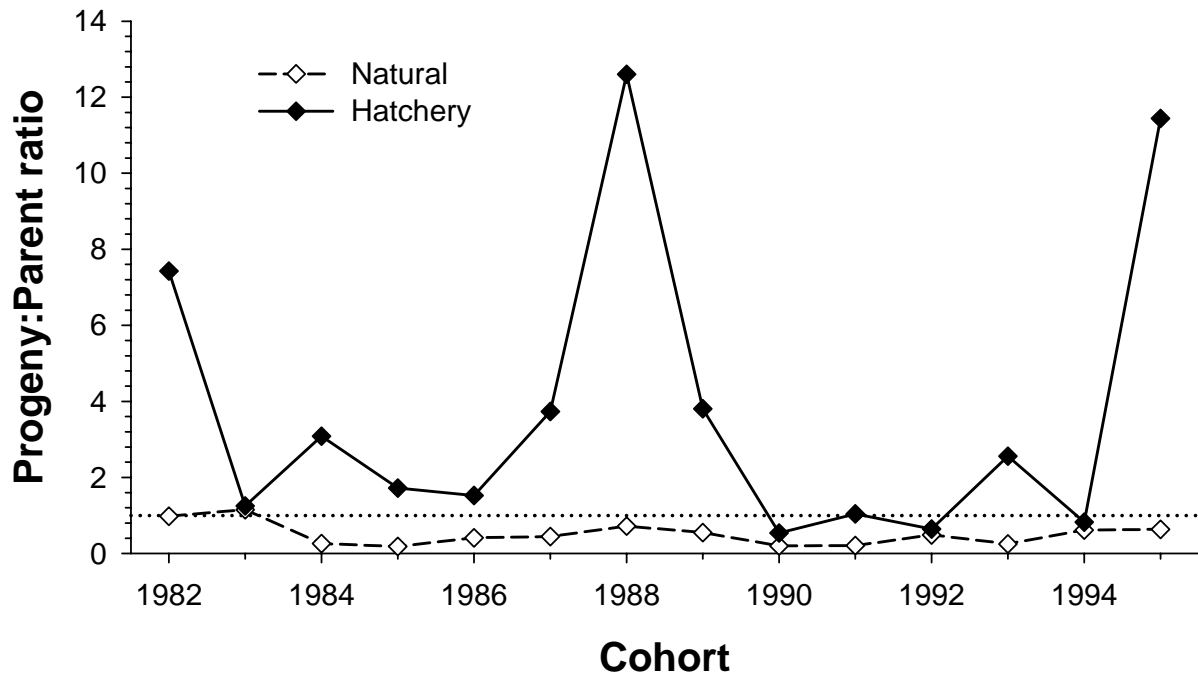


Figure 2. Progeny-to-parent ratios for completed cohorts (1982-1995) of Imnaha River Chinook salmon. Note: dotted line indicates P:P ratio = 1.

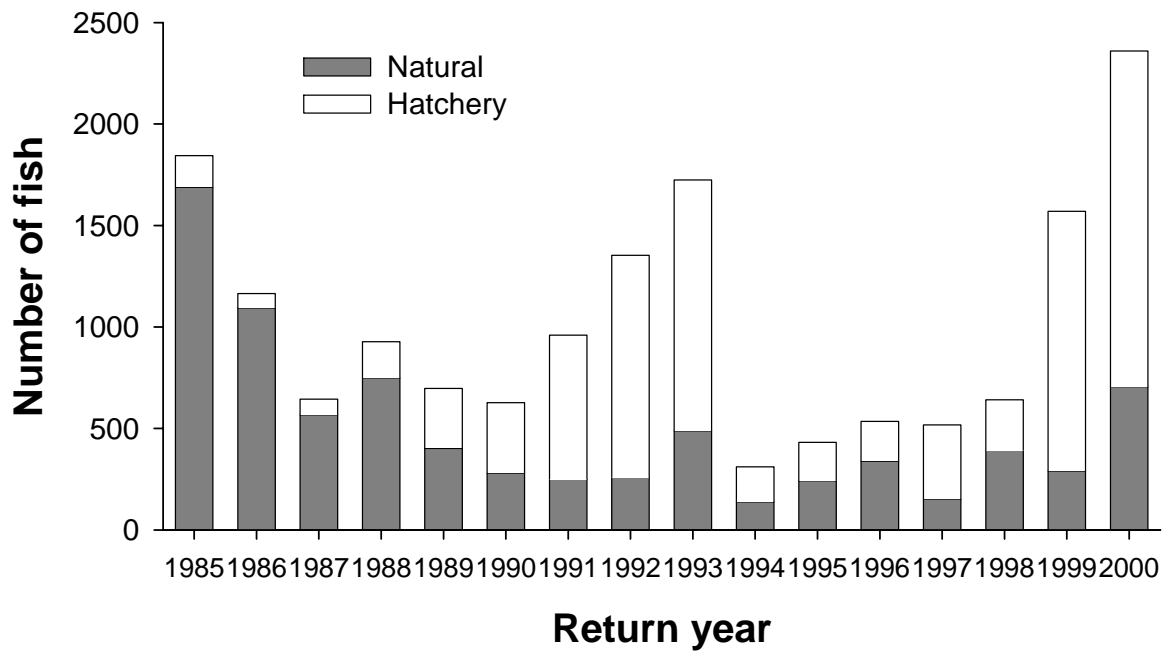


Figure 3. Estimated numbers of natural- and hatchery-origin Chinook salmon that spawned naturally in the Imnaha River, 1985-2000.

Table 1. Rearing summaries for the 1998 and 1999 cohorts of juvenile spring Chinook salmon released into the Grande Ronde and Imnaha river basins in 2000.

Cohort, stock	Broodstock	Number of eggs taken	Eyed embryos	Percent Survival		Total parr/ smolts released
				Egg-to- embryo	Embryo- to-smolt	
<u>1998 cohort</u>						
Imnaha River	Conventional	308,572	185,095	60.0	97.2	179,987
	Captive	65,892	44,614	67.7	78.7	
Lostine River	Captive	4,145	1,855	44.7	81.3	35,105
	Captive	95,178	47,194	49.6	80.8	
Grande Ronde River	Captive					1,508
Catherine Creek						38,149
<u>1999 Cohort</u>						
Rapid River	Conventional	27,542	25,040	90.9	96.6	24,201

Table 2. Estimates of percent of adipose fin clip (Ad) and coded-wire tag application success for Imnaha River, Lostine River, Grande Ronde River, and Catherine Creek 1998 cohort and Rapid River 1999 cohort spring Chinook salmon reared at Lookingglass Fish Hatchery and released in 2000. Targets were 100% Ad with CWT. Rapid River stock target was 100% ADRV with CWT.

Stock, raceway	CWT code	Number checked	Ad clip, with CWT	Ad clip, no CWT	No Ad clip, with CWT	No Ad clip, no CWT
<u>Imnaha River</u>						
2	92826	501	97.6	2.4	0	0
3	92825	506	98.0	1.6	0.4	0
4	92824	501	97.6	2.2	0.2	0
5	92823	505	94.9	4.8	0.4	0
6	62822	500	97.8	2.2	0	0
7	92830	498	95.8	3.8	0.4	0
8	82829	500	96.4	3.4	0.2	0
9	92828	500	91.6	8.2	0.2	0
10	92827	500	90.8	9.2	0	0
16	92821	<u>501</u>	<u>96.6</u>	<u>2.8</u>	<u>0.6</u>	<u>0</u>
Total / mean		5,012	95.7	4.1	0.2	0
<u>Lostine River</u>						
11	92831	299	99.0	0.7	0.3	0
12	92832	381	99.2	0.5	0.3	0
11	92834	198	99.5	0.5	0	0
15	92835	426	97.2	2.8	0	0
12	92836	119	100.0	0	0	0
15	92841	<u>75</u>	<u>97.3</u>	<u>2.7</u>	<u>0</u>	<u>0</u>
Total / mean		1,498	98.6	1.3	0.1	0
<u>Grande Ronde River</u>						
13	92840	267	100	0	0	0
<u>Catherine Creek</u>						
14	92820	499	97.0	2.2	0.8	0
17	92833	441	98.4	1.4	0.2	0
17	92837	42	97.6	2.4	0.0	0
18	92838	340	97.9	1.2	0.9	0
17	92839	21	100.0	0	0	0
18	92842	<u>160</u>	<u>97.5</u>	<u>1.3</u>	<u>1.3</u>	<u>0</u>
Total / mean		1,503	97.7	1.6	0.7	0
<u>Rapid River</u>						
2	93114	507	98.4	1.0	0.4	0.2

Table 3. Mean size of Imnaha River, Lostine River, Grande Ronde, and Catherine Creek 1998 cohort and Rapid River 1999 cohort spring Chinook salmon, total number released into the Imnaha and Grande Ronde river basins, number PIT-tagged and percent detected at Snake and Columbia river dams in 2000.

Stock, raceway	Release date (1999)	Cohort	Life stage at release	CWT codes	Fork Length (mm)		Weight (g)		Condition factor (K)		Total released ^a	Number PIT- tagged	Percent PIT tags detected ^b
					Mean	SD	Mean	SD	Mean	SD			
<u>Imnaha River</u> - released at Imnaha acclimation site													
2	1-18 APR	1998	Smolt	092826	120.1	6.3	23.0	4.4	1.3	0.06	15,245	1,762	49.3
3	1-18 APR	1998	Smolt	092825	120.4	6.8	22.2	3.5	1.2	0.07	18,600	2,153	49.2
4	1-18 APR	1998	Smolt	092824	120.0	6.7	21.3	3.4	1.2	0.06	18,624	2,149	48.8
5	1-18 APR	1998	Smolt	092823	120.5	6.4	21.1	4.4	1.2	0.08	18,618	2,164	50.6
6	1-18 APR	1998	Smolt	092822	120.4	7.0	22.2	3.5	1.2	0.05	18,617	2,167	48.8
7	1-18 APR	1998	Smolt	092830	128.8	8.2	27.0	6.9	1.3	0.11	18,894	2,182	50.5
8	1-18 APR	1998	Smolt	092829	125.6	7.4	24.7	4.6	1.3	0.07	17,581	2,041	51.0
9	1-18 APR	1998	Smolt	092828	124.8	6.9	25.0	5.2	1.3	0.07	17,585	2,044	49.2
10	1-18 APR	1998	Smolt	092827	130.4	8.7	28.9	6.5	1.3	0.09	17,590	2,042	49.7
16	1-18 APR	1998	Smolt	092821	119.5	7.1	21.9	3.8	1.2	0.09	<u>18,633</u>	<u>2,117</u>	<u>44.2</u>
Total/mean											179,987	21,034	48.6
<u>Lostine River</u> - released at Lostine acclimation site													
11	1-18 APR	1998	Smolt	092831 092834	119.0	10.1	20.7	5.9	1.2	0.08	19,092	4,291	42.1
12	1-18 APR	1998	Smolt	092832 092836	122.4	12.5	22.6	6.6	1.2	0.10	12,753	2,905	40.9
15	1-18 APR	1998	Smolt	092835 092841	121.9	12.7	21.7	7.0	1.3	0.02	<u>3,260</u>	<u>725</u>	<u>40.6</u>
Total/mean											35,105	7,921	41.5
<u>Grande Ronde River</u> - released at Grande Ronde acclimation site													
13	14 MAR	1998	Smolt	092840	127.1	12.4	23.3	6.1	1.2	0.09	1,508	985	29.8

Table 3. continued.

Stock, raceway	Release date (1999)	Cohort	Life stage at release	CWT codes	Fork Length (mm)		Weight (g)		Condition factor (K)		Total released ^a	Number PIT- tagged	Percent PIT tags detected ^b
					Mean	SD	Mean	SD	Mean	SD			
<u>Catherine Creek</u> - released at Catherine Creek acclimation site													
14	1-18 APR	1998	Smolt	092820	118.0	10.3	19.3	5.6	1.2	0.07	23,698	2,469	29.1
17	1-18 APR	1998	Smolt	092833	123.3	11.0	21.3	4.1	1.2	0.06	12,885	1,345	33.1
				092837									
				092839									
18	1-18 APR	1998	Smolt	092838	129.1	14.7	25.0	8.6	1.2	0.01	<u>1,566</u>	<u>166</u>	<u>38.6</u>
				092842									
Total/mean											38,149	3,980	30.8
<u>Rapid River</u> - released at Lookingglass Hatchery													
2	29 JUN	1999	Parr	093114	83.4	6.2	6.5	1.4	1.13	0.06	24,201	0	-

^a Equals total number released in Table 1 by stock. Total released includes all fish with adipose clip and CWT (target 100%).

^b Percent PIT tag detections are unique detections at all dams in the Snake and Columbia Rivers.

Table 4. Recoveries of adult spring Chinook salmon at northeast Oregon LSRCF facilities and Lower Granite Dam in 2000. No salmon were captured in any trap before 9 April or after 23 September.

Period	Week of year	Imnaha River		Lostine River		Grande Ronde River		Catherine Creek		Lookingglass Creek ^a		Lower Granite Dam ^b
		Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked
Dates of trap operation		28 JUN – 12 SEP		19 MAY – 22 SEP		24 MAR – 4 AUG		30 MAR – 4 AUG		19 MAY – 2 OCT		
9-15 APR	15	-	-	-	-	0	0	0	0	-	-	1
16-22 APR	16	-	-	-	-	0	0	0	0	-	-	28
23-29 APR	17	-	-	-	-	0	0	0	0	-	-	120
30 APR – 6 MAY	18	-	-	-	-	0	0	0	0	-	-	304
7-13 MAY	19	-	-	-	-	0	0	0	0	-	-	172
14-20 MAY	20	-	-	0	0	0	0	0	0	0	0	98
21-27 MAY	21	-	-	0	0	0	0	0	3	93	27	71
28 MAY - 3 JUN	22	-	-	0	0	0	0	0	6	18	6	12
4-10 JUN	23	-	-	0	0	0	1	0	7	27	5	8
11-17 JUN	24	-	-	0	0	0	5	0	1	23	8	5
18-24 JUN	25	-	-	0	4	0	3	0	0	6	3	3
25 JUN – 1 JUL	26	0	0	0	4	0	4	0	4	2	1	0
2-8 JUL	27	39	19	0	0	0	2	0	2	0	0	0
9-15 JUL	28	190	87	0	6	0	1	0	1	10	0	0
16-22 JUL	29	159	75	3	4	0	0	0	0	0	0	0
23-29 JUL	30	202	85	2	1	0	1	0	0	1	0	0
30 JUL - 5 AUG	31	82	28	1	2	0	0	0	0	0	0	0
6-12 AUG	32	9	4	0	0	-	-	-	-	0	0	0
13-19 AUG	33	12	5	0	0	-	-	-	-	0	1	0
20-26 AUG	34	17	8	1	6	-	-	-	-	2	0	0
27 AUG - 2 SEP	35	62	20	7	16	-	-	-	-	4	1	0

Table 4. continued.

Period	Week of year	Imnaha River		Lostine River		Grande Ronde River		Catherine Creek		Lookingglass Creek ^a		Lower Granite Dam ^b
		Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked
3-9 SEP	36	3	0	12	13	-	-	-	-	0	0	0
10-16 SEP	37	5	1	1	7	-	-	-	-	0	0	0
17-23 SEP	38	-	-	0	1	=	=	=	=	-	-	0
Total		780	332	27	64	0	17	0	24	186	52	822

^a All fish were passed below the weir or killed for tribal fishery.

^b All fish were trucked to Lyons Ferry Fish Hatchery, Washington.

Table 5. Number and disposition of adult spring Chinook salmon that returned to northeast Oregon LSRCF facilities in 2000 by origin, age, and sex.

Stock, disposition	Hatchery							Natural							Grand total
	3		4		5		Total	3		4		5		Total	
	F	M	F	M	F	M		F	M	F	M	F	M		
<u>Imnaha River</u>															
Trapped ^a	0	516	127	123	6	5	777	0	160	51	99	14	8	332	1,109
Passed	0	36	71	68	2	3	180	0	131	43	84	11	7	276	456
Outplanted	0	296	0	0	0	0	296	0	0	0	0	0	0	0	294
Kept	0	184	56	55	4	2	301	0	29	8	15	3	1	56	357
Actual spawned	0	167	55	55	4	1	282	0	25	5	15	3	1	49	331
Killed, not spawned	0	3	0	0	0	0	3	0	0	0	0	0	0	0	3
Pre-spawn mortality	0	14	1	0	0	1	16	0	4	3 ^b	0	0	0	7	23
Mean fork length (mm) ^c	-	550	791	751	881	887		-	557	787	762	919	889		
Standard deviation (mm)	-	34.4	30.5	47.2	20.6	38.9		-	33.7	32.7	49.0	39.1	28.6		
Age composition (%)	0	66.4	16.3	15.8	0.7	0.6	100	0	48.2	15.4	29.8	4.2	2.4	100	
<u>Lostine River</u>															
Trapped	0	27	0	0	0	0	27	1	10	19	23	1	10	64	91
Passed	0	16	0	0	0	0	16	1	8	12	15	0	6	42	58
Kept	0	11	0	0	0	0	11	0	2	7	8	1	4	22	33
Actual spawned	0	10	0	0	0	0	10	0	2	7	8	1	3	21	31
Killed, not spawned	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
Pre-spawn mortality	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Mean fork length (mm) ^c	-	561	-	-	-	-		537	524	746	768	850	850		
Standard deviation (mm)	-	25.9	-	-	-	-		NA	37.5	35.6	27.6	NA	58.5		
Age composition (%)	-	100	-	-	-	-	100	1.6	15.6	29.7	35.9	1.6	15.6	100	

Table 5. continued.

Stock, disposition	Hatchery							Natural							Grand total
	3		4		5			3		4		5			
	F	M	F	M	F	M	Total	F	M	F	M	F	M	Total	
<u>Grande Ronde River^d</u>															
Trapped	0	0	0	0	0	0	0	0	0	9	7	0	0	17	17
Passed	0	0	0	0	0	0	0	0	0	5	3	0	0	9	9
Kept (returned)	0	0	0	0	0	0	0	0	0	4	2	0	0	6	6
Mortality	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
Mean fork length (mm) ^c	-	-	-	-	-	-	-	-	-	701	744	-	-	-	-
Standard Deviation (mm)	-	-	-	-	-	-	-	-	-	32.9	40.6	-	-	-	-
Age composition (%)	-	-	-	-	-	-	-	-	-	52.9	41.2	-	-	100	-
<u>Catherine Creek^e</u>															
Trapped	-	-	-	-	-	-	-	0	2	4	5	1	2	24	24
Passed	-	-	-	-	-	-	-	0	2	2	5	1	1	16	16
Kept (returned)	-	-	-	-	-	-	-	0	0	2	0	0	1	7	7
Mortality	-	-	-	-	-	-	-	0	0	0	0	0	0	1	1
Mean fork length (mm) ^c	-	-	-	-	-	-	-	-	510	727	718	800	820	-	-
Standard Deviation (mm)	-	-	-	-	-	-	-	-	35.4	20	32.3	NA	28.3	-	-
Age composition (%)	-	-	-	-	-	-	-	-	8.3	16.7	20.8	4.2	8.3	100	-

Table 5. continued.

Stock, disposition	Hatchery							Natural							Grand total
	3		4		5		Total	3		4		5		Total	
	F	M	F	M	F	M		F	M	F	M	F	M		
<u>Lookingglass Creek (Rapid River stock)</u>															
Trapped		117	481	361	17	22	1,008	0	2	24	15	0	1	52	1,060
Trapped at LG Dam ^f	0	101	410	275	15	21	822	0	0	0	0	0	0	0	822
Trapped at LFH	0	16	71	86	2	1	186	0	2	24	15	0	1	52	238
Returned ^g	0	13	69	82	2	1	177	0	2	24	15	0	1	52	229
Killed	0	3	2	4	0	0	9	0	0	0	0	0	0	0	9
Mean fork length (mm) ^c		504	729	729	837	847		-	511	731	733	-	870		
Standard deviation (mm)		31.3	28.7	36.8	31.9	59.2		-	8.5	29.1	28.3	-	NA		
Age composition (%)		11.6	47.7	35.8	1.7	2.2	100	0	4.8	57.1	35.7	0	2.3	100	

^a Two more hatchery males were passed, both age 2 and one age 2 male was outplanted to Lick Creek.

^b Discrepancy in weir and spawning data. Assuming two kept fish at weir that were unaccounted for during spawning were age-4 females pre-spawn mortalities.

^c Mean length per age class determined from length at age estimates or known age fish based on either CWT or scale data.

^d There was one age 4 fish of unknown sex passed. All kept fish were eventually returned and passed above weir.

^e There were 10 more fish trapped all age 4 of unknown sex (5 were passed, 4 were kept, and 1 mort). All kept fish were eventually returned and passed above weir.

^f All fish were taken to Lyons Ferry to be spawned.

^g All returned to creek below weir. There were 20 more fish trapped and passed downstream of unknown sex and age (10 were hatchery fish and 10 fish were wild).

Table 6. Timing of spawning and spawning summaries for spring Chinook salmon at Lookingglass Fish Hatchery in 2000.

Stock, spawn date	Origin of parents	Number of parents		Number of eggs collected	Number of eyed eggs	Percent mortality to shocking
		F	M ^a			
<u>Imnaha River</u>						
9 AUG	Mixed	1	3	5,069	2,184	56.9
16 AUG	Mixed	3	6	15,180	6,902	27.8
23 AUG	Mixed	8	70	40,228	38,100	5.3
30 AUG	Mixed	28	89	136,626	131,750	3.6
6 SEP	Mixed	23	69	115,517	112,250	2.8
13 SEP	Mixed	<u>4</u>	<u>39</u>	<u>21,204</u>	<u>20,244</u>	<u>4.5</u>
Total		67	276	333,824	311,430	6.7
<u>Lostine River</u>						
7 SEP	Wild	7	17	30,371	29,375	3.3
14 SEP	Mixed	<u>1</u>	<u>7</u>	<u>4,259</u>	<u>4,171</u>	<u>2.1</u>
Total		8	24	34,630	33,546	3.1

^a The number of males in table are greater than the number kept because some males were recycled.

Table 7. Expanded recoveries of coded-wire tagged Imnaha River spring Chinook salmon for the 2000 return year. Mainstem river recoveries were collected in Columbia/Snake rivers en route to the Imnaha River (includes ocean recoveries). In-basin strays were recovered in other streams within the Snake River basin. Out-of-basin strays were recovered from streams outside the Snake River Basin (not in the migration route) or in the upper Columbia River. Numbers in parentheses are unexpanded recoveries.

Cohort	Experimental group (rearing density and target size at release)	CWT code	Recovery location				Total
			Imnaha River ^a	Mainstem rivers ^b	In-basin strays ^b	Out-of- basin strays ^b	
1995	30 g, 1/8 Density	091720	3 (1)	0	0	0	3
	30 g, 1/4 Density	091721	6 (2)	0	0	1	7
	18 g, 1/8 Density	091722	10 (3)	0	0	0	10
	18 g, 1/4 Density	091723	<u>3 (1)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>3</u>
	Total		22 (7)	0	0	1	23
1996	30 g, 1/4 Density	092124	8 (3)	0	0	0	8
	30 g, 1/8 Density	092163	45 (17)	0	0	1	46
	18 g, 1/8 Density	092201	45 (17)	0	0	1	46
	18 g, 1/8 Density	092202	40 (15)	1	0	0	41
	30 g, 1/4 Density	092203	66 (25)	0	0	1	67
	30 g, 1/4 Density	092204	61 (23)	0	0	1	62
	18 g, 1/8 Density	092205	96 (36)	0	0	0	96
	30 g, 1/4 Density	092206	<u>154 (58)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>154</u>
Total		516 (194)	1	0	4	521	
1997	30 g, 1/2 Density	071248	113 (22)	0	0	1	114
	30 g, 1/4 Density	092558	15 (3)	0	0	0	15
	30 g, 1/4 Density	092559	36 (7)	1	0	0	37
	High BKD, not accl.	092609	46 (9)	0	0	0	46
	30 g, 1/4 Density	092612	133 (26)	0	0	0	133
	30 g, 1/4 Density	092613	41 (8)	0	0	1	42
	30 g, 1/4 Density	092614	77 (15)	4	1	2	84
	18 g, 1/4 Density	092615	210 (41)	5	0	3	218
	18 g, 1/4 Density	092616	148 (29)	0	0	2	150
	18 g, 1/2 Density	092619	<u>256 (50)</u>	<u>5</u>	<u>1</u>	<u>3</u>	<u>265</u>
	Total		1,075 (210)	15	2	12	1,104
Grand Total			1,613 (411)	16	2	17	1,648

^a Expansion factor is based on estimated total return to Imnaha River of hatchery cohort and estimated tag retention rates for tag group. Includes weir and spawning ground recoveries.

^b Estimated number of total CWT fish recovered from PSMFC and ODFW databases.

Table 8. Expanded adult recoveries for the 2000 return year of coded-wire tagged Rapid River spring Chinook salmon, released as smolts from Lookingglass Fish Hatchery. Mainstem river recoveries were collected in Columbia/Snake/Grande Ronde rivers (other than Lower Granite Dam) en route to Lookingglass Creek (includes ocean recoveries). In-basin strays were fish collected in streams within the Snake River basin other than Lookingglass Creek. Out-of-basin strays were fish collected in streams outside the Snake River Basin (not in the migration route) or in the upper Columbia River.

Cohort	Experimental group ^a	CWT code	Recovery location					Total
			LFH weir ^b	Lower Granite Dam	Mainstem rivers	In-basin strays	Out-of-basin strays	
1995	Control	091724	0	8	0	0	0	8
	Control	091725	0	3	1	0	0	4
	Exercise	091726	1	7	0	0	0	8
	Exercise	091727	<u>0</u>	<u>3</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>3</u>
	Total		1	21	1	0	0	23
1996	Production	075309	7	45	1	0	4	57
	Production	075310	1	41	1	0	0	43
	Production	075311	5	44	1	0	0	50
	Production	075850	2	48	2	0	1	53
	Unmarked ^c	092207	43	0	3	1	1	48
	Unmarked ^c	092208	38	1	4	1	2	46
	Production	092209	1	42	1	0	1	45
	Production	092210	0	76	1	0	3	80
	Production	092211	3	89	2	0	0	94
	Production	092212	<u>2</u>	<u>78</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>81</u>
Total			102	464	16	2	13	597
1997	Production	070148	1	7	0	0	0	8
	Production	070749	2	4	1	1	0	8
	Production	092620	1	19	0	0	0	20
	Production	092621	3	13	1	0	0	17
	Production	092622	<u>0</u>	<u>14</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>14</u>
	Total			7	57	2	1	0
Grand Total			110	542	19	3	13	687

^a All groups reared at target size of 22.8 g except CWT group 092207(reared at 10.8 g).

^b Includes observed fish killed at weir and downstream passed fish collected during spawning ground surveys. Weir counts were not expanded to be consistent with previous years.

^c Progeny were from unmarked parents.

Table 9. Catch and escapement distribution of hatchery adult spring Chinook salmon by recovery location in 2000. Data summarized through May 2005 from the PSMFC and ODFW CWT recovery databases. Recruitment to Imnaha River is based on weir count, redd counts, and mark-recapture estimate above weir.

Location, recovery type	Imnaha River stock			Rapid River stock		
	Actual recoveries	Expanded adults	Percent of total	Actual recoveries	Expanded adults	Percent of total
Ocean catch	1	4	0.2	0	0	0
Columbia River						
Treaty net	1	1	0.1	17	17	1.6
Non-treaty net	0	0	0	1	1	0.1
Sport	2	10	0.7	1	1	0.1
Deschutes River						
Trap	14	14	1.0	3	3	0.3
Sport	3	3	0.2	1	1	0.1
Ceremonial and subsistence	0	0	0			
Strays						
Outside Snake River Basin	0	0	0	6	9	0.9
Within Snake River Basin ^a	2	2	0.1	3	3	0.3
Terminal fishery ^a	0	0	0	2	2	0.2
Lower Granite Dam ^a	1	1	0.1	539	822	78.7
Recruitment to river ^a	411	1,650	97.5	108	186	17.8
Total estimated return		1,653			1,045	
Return to compensation area ^a		1,685	98.1		1,010	96.7
Percent of compensation goal ^b		52.5			17.4	

^a Indicates areas defining the compensation area.

^b The compensation goal for Imnaha River stock is 3,210 adults and the goal for Rapid River stock is 5,820 adults.

Table 10. Summary of adipose-clipped Chinook salmon carcass recoveries in 2000 during spawning ground surveys in the Imnaha and Grande Ronde river basins.

Recovery basin, stream	CWT code	Number Recovered ^a	Release site and cohort
<u>Imnaha River Basin</u>			
Imnaha River	092204	8	Imnaha Acclimation Pond, 1996 cohort
	092205	16	Imnaha Acclimation Pond, 1996 cohort
	092206	26	Imnaha Acclimation Pond, 1996 cohort
	092214	1	Youngs River and Bay, 1996 cohort
	092558	2	Imnaha Acclimation Pond, 1997 cohort
	092609	1	Imnaha Acclimation Pond, 1997 cohort
	092612	4	Imnaha Acclimation Pond, 1997 cohort
	071248	3	Imnaha Acclimation Pond, 1997 cohort
	091721	1	Imnaha Acclimation Pond, 1995 cohort
	092124	2	Imnaha Acclimation Pond, 1996 cohort
	092163	9	Imnaha Acclimation Pond, 1996 cohort
	092201	8	Imnaha Acclimation Pond, 1996 cohort
	092202	4	Imnaha Acclimation Pond, 1996 cohort
	092614	3	Imnaha Acclimation Pond, 1997 cohort
	092615	8	Imnaha Acclimation Pond, 1997 cohort
	092616	4	Imnaha Acclimation Pond, 1997 cohort
	092619	8	Imnaha Acclimation Pond, 1997 cohort
	092822	1	Imnaha Acclimation Pond, 1998 cohort
	092827	1	Imnaha Acclimation Pond, 1998 cohort
	092828	1	Imnaha Acclimation Pond, 1998 cohort
092829	1	Imnaha Acclimation Pond, 1998 cohort	
104905	1	Rapid River Hatchery, 1996 cohort	
092203	13	Imnaha Acclimation Pond, 1996 cohort	
070749	1	Lookingglass Fish Hatchery, 1997 cohort	
<u>Grande Ronde River Basin</u>			
Wenaha River	053517	1	Dworshak National Hatchery, 1996 cohort
Lostine River	092610	1	Lostine Acclimation Facility, 1997 cohort
Minam River	092208	1	Lookingglass Fish Hatchery, 1996 cohort
	092614	1	Imnaha Acclimation Pond, 1997 cohort

^a There were an additional six adipose clipped fish collected on the Imnaha River (one with no snout collected, one with a lost tag, and four with no data).

Table 11. Summary of hatchery- and naturally produced spring Chinook salmon carcass recoveries and number of redds observed in each stream during spawning ground surveys in 2000. Hatchery salmon were determined by the presence of a coded-wire tag.

Basin, stream	Hatchery	Natural	Unknown origin	Percent hatchery (%)	Number of redds
<u>Imnaha River Basin</u>					
Big Sheep Creek	0	1	1	0	0
Imnaha River	132	234	20	36.1	261
Lick Creek	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	132	255	1	34.0	261
<u>Grande Ronde River Basin</u>					
Bear Creek	0	0	0	0	0
Hurricane Creek	1	11	0	8.3	22
Lostine River	4	59	4	6.3	64
Wallowa River	0	0	0	0	0
Grande Ronde River	0	14	1	0	20
Catherine Creek	0	6	4	0	34
Lookingglass Creek	83	34	0	70.9	85
Minam River	2	77	0	2.5	139
Wenaha River	<u>2</u>	<u>68</u>	<u>1</u>	<u>2.9</u>	<u>138</u>
Total	92	261	7	25.6	502

Table 12. Age composition of spring Chinook salmon carcasses recovered in 2000 during spawning ground surveys in the Imnaha and Grande Ronde river basins.

Basin, parameter	Age 2		Age 3		Age 4		Age 5	
	M	F	M	F	M	F	M	
<u>Grande Ronde River Basin</u>								
Number ^a	-	-	15	130	76	3	2	
Percent of total	-	-	6.6	57.5	33.6	1.3	0.9	
Mean fork length (mm)	-	-	567	731	768	880	998	
Standard deviation	-	-	92.0	34.0	54.1	50.0	31.8	
<u>Imnaha River Basin</u>								
Number ^b	5	-	65	129	134	7	7	
Percent of total	1.4	-	18.7	37.2	38.6	2.0	2.0	
Mean fork length (mm)	323	-	551	783	773	895	991	
Standard deviation	86.9	-	60.5	42.8	69.7	69.0	86.6	

^a Seventeen more fish were found, two unknown sex that were aged at 4 years old, also 12 males and 3 females of unknown age.

^b An additional 40 fish were collected (three fish of unknown sex all aged at 3 years old, three age 4 fish of unknown sex, one age 5 fish of unknown sex, one age 6 female, eight females of unknown age, 22 males of unknown age, and two fish of unknown sex and age).

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