

LOWER SNAKE RIVER COMPENSATION PLAN:  
Oregon Spring Chinook Salmon Evaluation Studies  
2002 Annual Progress Report

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LOWER SNAKE RIVER  
COMPENSATION PLAN

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## **Preface**

This progress report provides summary information for Lower Snake River Compensation Plan (LSRCP) spring Chinook salmon programs operated by Oregon Department of Fish and Wildlife (ODFW) in the Imnaha and Grande Ronde river basins during 2002. 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 sampling techniques. As such, specific protocols are usually not described. When possible, data obtained from different sources were cross-referenced and verified. 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 2002 work statement (Carmichael et al. 2002). Coded-wire tag (CWT) data collected from 2002 adult returns were used to evaluate smolt-to-adult survival rates in production and experimental rearing and release groups. In 2002, experimental treatments from which salmon returned included, size at release and rearing density for Imnaha stock. 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 Grande Ronde and Imnaha river basins. 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. 2006a, 2006b, 2006c) 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 smolts from the 2000 cohort and parr from the 2001 cohort were released, Chinook salmon from the 1997-1999 cohorts returned to spawn, and adult Chinook salmon that returned to spawn were used to create the 2002 cohort.

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## CONTENTS

	<u>Page</u>
Preface .....	i
Acknowledgements .....	i
Contents .....	ii
List of Figures.....	ii
List of Tables .....	ii
Executive Summary.....	iv
Introduction .....	1
Program Objectives .....	1
Research Objectives .....	1
Results and Discussion .....	2
Juveniles .....	2
Adults .....	3
Coded-Wire Tag Recoveries .....	5
Compensation Goals.....	6
Natural Escapement Monitoring.....	7
References .....	31

### LIST OF FIGURES

<u>Number</u>	<u>Page</u>
1. Length frequency-at-age relationship for Imnaha River Chinook salmon adults used as hatchery broodstock in 2002 and from 1991-2001 .....	9
2. Progeny-to parent ratios for completed cohorts (1982-1997) of Imnaha River Chinook salmon .....	10
3. Estimated numbers of natural- and hatchery-origin Chinook salmon returning to the Imnaha River, 1985-2002 .....	10

### LIST OF TABLES

<u>Number</u>	<u>Page</u>
1. Rearing summaries for the 2000 and 2001 cohorts of juvenile spring Chinook salmon released into the Grande Ronde and Imnaha river basins in 2002 .....	11
2. Estimates of percent adipose fin clip (Ad) and coded-wire tag application success for Imnaha River, Lostine River, Grande Ronde River, and Catherine Creek 2000 cohort and Lostine River, Grande Ronde River, and Catherine Creek 2001 cohort spring Chinook salmon reared at Lookingglass Fish Hatchery and released in 2002 .....	12

3.	Mean size of Imnaha River, Lostine River, Grande Ronde River, and Catherine Creek 2000 cohort and Lostine River, Grande Ronde River, and Catherine Creek 2001 cohort spring Chinook salmon, total number released into the Imnaha River and Grande Ronde river basins, number PIT-tagged and percent detected at Snake and Columbia river dams, 2002 ....	14
4.	Recoveries of adult spring Chinook salmon at northeast Oregon LSRCF facilities and Lower Granite Dam, 2002 .....	16
5.	Number and disposition of adult spring Chinook salmon returning to northeast Oregon LSRCF facilities in 2002 by origin, age, and sex .....	17
6.	Timing of spawning and spawning summaries for spring Chinook salmon at Lookingglass Fish Hatchery, 2002 .....	19
7.	Expanded adult recoveries by coded-wire tag group of Imnaha River spring Chinook salmon for the 2002 return year .....	20
8.	Catch and escapement distribution of Imnaha River hatchery adult spring Chinook salmon by recovery location in 2002 .....	22
9.	Expanded adult recoveries by coded-wire tag group of Rapid River spring Chinook salmon for the 2002 return year .....	23
10.	Expanded adult recoveries by coded-wire tag group of Lostine River spring Chinook salmon for the 2002 return year .....	24
11.	Catch and escapement distribution of Grande Ronde Basin hatchery adult spring Chinook salmon by stock and recovery location in 2002.....	25
12.	Expanded adult recoveries by coded-wire tag group of Catherine Creek spring Chinook salmon for the 2002 return year .....	26
13.	Summary of adipose-clipped Chinook salmon carcass recoveries during spawning ground surveys, 2002 .....	27
14.	Summary of hatchery- and naturally-produced spring Chinook salmon carcass observed and number of redds discovered by stream during spawning ground surveys, 2002 .....	29
15.	Age composition and length characteristics of hatchery- and naturally-produced spring Chinook salmon carcasses with known age, sex, and origin recovered during 2002 spawning ground surveys in the Imnaha and Grande Ronde river basins .....	30

## EXECUTIVE SUMMARY

In 2002, we released into the Imnaha River 303,737 Chinook salmon smolts from the 2000 cohort produced from conventional broodstock. We estimated 94.8% of the released smolts were recognizably marked with adipose fin clips (ad clips). In addition, smolts produced from the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program and Conventional Broodstock Program were released into the Grande Ronde Basin. We released 77,314 Captive Broodstock smolts and 31,464 Conventional Broodstock smolts from the 2000 cohort into the Lostine River with an estimated 97.2% and 96.3% recognizably marked with ad clips, respectively. We released 151,444 Captive Broodstock smolts into the upper Grande Ronde River and estimated 92.2% of these smolts had recognizable ad clip marks. We released 180,343 Captive Broodstock smolts into Catherine Creek with 95.5% of these fish recognizably marked with ad clips. We also had direct stream releases of 2001 cohort parr produced from Captive Broodstock parents. We released 4,660 parr from Lostine River Captive Broodstock into Bear Creek, 32,800 parr from Grande Ronde River Captive Broodstock into Sheep Creek, and 17,880 parr from Catherine Creek Captive Broodstock into Lookingglass Creek.

We trapped 937 hatchery- and 267 naturally-produced Chinook salmon on the Imnaha River. We trapped 40 Rapid River stock Chinook salmon on Lookingglass Creek along with 22 naturally-produced Chinook salmon. In addition, we captured 269 hatchery- and 274 naturally-produced Chinook salmon on the Lostine River, 142 hatchery- and 170 naturally-produced Chinook salmon on Catherine Creek, and three hatchery- and 102 naturally-produced Chinook salmon on the upper Grande Ronde River.

We estimated that 3,889 Imnaha River hatchery Chinook salmon returned to the LSRCP compensation area in 2002, achieving 121% of the adult compensation goals for the Imnaha River Program. In the Grande Ronde River Basin, we estimated 71 Rapid River stock, 409 Lostine River, 223 Catherine Creek, and three Grande Ronde River hatchery Chinook salmon returned to the compensation area, achieving 12.1% of the compensation goal for the Grande Ronde Basin. In 2002, we observed 1,716 carcasses and found 1,189 redds during spawning ground surveys in the Imnaha River Basin. One carcass was a hatchery stray from the Lostine River recovered in the Imnaha River. In the Grande Ronde Basin, we observed 642 carcasses and found 895 redds. There were six strays recovered in 2002 within the Grande Ronde Basin. Two Rapid River stock strays released into Lookingglass Creek were recovered in the Lostine River. One Lostine River and one Imnaha River hatchery adult Chinook salmon were recovered in the Wenaha River. One Catherine Creek hatchery adult was recovered in the Minam River and one was recovered in Lookingglass Creek.

## **INTRODUCTION**

This report summarizes spring Chinook salmon monitoring data for the Lower Snake River Compensation Plan (LSRCP) facilities in 2002. The main objectives of this report are to document and evaluate salmon culture performance for spring Chinook salmon hatchery programs and achievement of management objectives 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, smolt-to-adult survival rate, and to provide information to adapt the programs to most effectively meet management objectives. This report provides information on rearing and release operations for the 2000 and 2001 cohorts of juvenile Chinook salmon, the collection, spawning and adult characteristics for the 2002 return of adult Chinook salmon, and the collection of eggs for the 2002 cohort.

### **LSRCP Chinook Salmon Program Objectives**

1. Prevent extinction of Imnaha River, Lostine River, Catherine Creek, and upper Grande Ronde River Chinook salmon populations and ensure a high probability of population persistence well into the future, once causes of basin-wide declines have been addressed.
2. Establish adequate broodstock to meet annual production goals.
3. Establish a consistent total return of Chinook salmon that meets the LSRCP mitigation goal of 3,210 hatchery adults in the Imnaha Basin and 5,820 hatchery adults in the Grande Ronde Basin.
4. Re-establish historic tribal and recreational fisheries.
5. Minimize impacts of hatchery programs on resident stocks of game fish.
6. Operate the hatchery program so that the genetic and life history characteristics of hatchery fish mimic those of wild fish, while achieving mitigation goals.
7. Maintain genetic and life-history characteristics of natural Chinook salmon populations in the Imnaha River, Lostine River, Catherine Creek, and upper Grande Ronde River.
8. Maintain the genetic and life-history characteristics of the endemic wild populations of Chinook salmon in the Minam and Wenaha rivers.
9. Provide a future basis to reverse the decline in abundance of endemic Chinook salmon populations in the Imnaha and Grande Ronde river basins.

### **Research Monitoring and Evaluation Objectives**

1. Document 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 Chinook salmon smolts.
3. Document Chinook salmon adult returns by stock to each LSRCP broodstock collection facility.
4. Estimate annual hatchery returns to compensation areas and determine success in meeting mitigation goals.
5. Estimate annual smolt survival to Lower Granite Dam for production and experimental groups.



6. Conduct index, extensive, and supplemental Chinook salmon spawning ground surveys for all populations in northeast Oregon to assess spawn timing and spawning distribution, and estimate natural spawner escapement.
7. Determine the proportion of naturally spawning spring Chinook salmon that are of hatchery origin in all Imnaha and Grande Ronde Chinook salmon populations.
8. Determine annual escapement and spawner numbers to estimate and compare productivity (recruits per spawner) for natural- and hatchery-produced fish in the Imnaha and Grande Ronde basin Chinook salmon populations.
9. Compare life history characteristics (age structure, run timing, sex ratio, egg size, and fecundity) of hatchery and natural origin salmon.
10. Coordinate Chinook salmon broodstock marking programs for Lookingglass Fish Hatchery.
11. Participate in planning activities associated with anadromous salmon production and management in the Imnaha and Grande Ronde river basins and participate in ESA permitting, consultation, and recovery planning.

## **RESULTS AND DISCUSSION**

During 2002, spring Chinook salmon from the 2000 cohort produced from the Conventional Broodstock Program were released as smolts into the Imnaha River. In the Grande Ronde River Basin, smolts from the 2000 cohort produced from the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program were released into the Lostine River, Catherine Creek, and the Grande Ronde River. Also released into the Lostine River were smolts from the 2000 cohort produced from Conventional Broodstock. In addition, we released parr from the 2001 cohort produced from the Captive Broodstock Program into the Bear Creek (Lostine River stock), Lookingglass Creek (Catherine Creek stock), and Sheep Creek (Grande Ronde River stock). Adult Chinook salmon from the 1997-1999 cohorts returned to spawn and were used as broodstock to create the 2002 cohort to be reared at Lookingglass Fish Hatchery (LFH). In 2002, experimental treatments from which salmon returned included, size at release and rearing density for Imnaha 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 Imnaha and Grande Ronde river basins.

### **Juveniles**

Green egg-to-smolt survival rates for the 2000 cohort of Imnaha River Chinook salmon produced from conventional broodstock and released in 2002 was 91.0% (green egg-to-eyed egg survival rate, 94.5%; eyed egg-to-smolt survival rate, 96.3%). For the Lostine River, green egg-to-smolt survival rate was 90.9% for conventional broodstock offspring and 50.9% for Captive Broodstock offspring. Green egg-to-smolt survival rates for Captive Broodstock offspring were 60.8% for Catherine Creek stock and 50.7% for Grande Ronde River stock (Table 1). The release of 303,737 smolts from the 2000 Imnaha River cohort was below the long-term mitigation goal of 490,000 and the production goal of 360,000 for this cohort. This was the

result of a poor 2000 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 recently modified long-term mitigation goal for the Grande Ronde River Basin was set at 250,000 smolts per year for the Lostine, Catherine Creek, and upper Grande Ronde populations. The release in 2002 of 31,464 Lostine River smolts produced from Conventional Broodstock and 77,314 Lostine River, 180,343 Catherine Creek, and 151,444 Grande Ronde River smolts produced from Captive Broodstock was below the production goal.

We attempted to mark all smolts from the 2000 cohort and all parr from the 2001 cohort released in 2002 with ad clips+CWT. However, we underestimated the number of CWT needed and, therefore, some smolts from the Lostine River and Catherine Creek stocks received only Ad clips (Table 2). We had fair ad clip+CWT mark retention rates for each stock from the 2000 cohort: Imnaha River (93.6%); Lostine River (94.8%); Catherine Creek (94.1%); and Grande Ronde River (89.9%). We had good mark rates for each stock from the 2001 cohort: Lostine River (99.6%); Catherine Creek (98.1%); and Grande Ronde River (98.0%).

The 2000 cohort of Imnaha River Chinook salmon was reared in five raceways at Lookingglass Fish Hatchery. All Imnaha River Chinook salmon smolts were acclimated at the Imnaha Acclimation Facility starting 1 March 2002. Smolts were volitionally released beginning on 22 March 2002 and the remaining smolts were forced out on 15 April 2002. Lostine River Chinook salmon smolts produced from Captive Broodstock parents were reared in three raceways and smolts from Conventional Broodstock were reared in one raceway at LHF. All smolts were transported to the Lostine acclimation ponds from 26-28 February 2002 and volitionally released beginning on 1 April and remaining smolts were forced out on 15 April 2002. Catherine Creek Chinook salmon smolts produced from Captive Broodstock parents were reared in three raceways and transported to Catherine Creek acclimation ponds on from 26-28 February 2002. Smolts were volitionally released beginning 1 April 2002 and remaining smolts were forced out on 15 April 2002. Grande Ronde River Chinook salmon smolts produced from Captive Broodstock parents were reared in three raceways and transported to Grande Ronde acclimation ponds from 26-28 February 2002. Smolts were volitionally released starting 1 April 2002 and forced out on 15 April 2002. Smolt migration success was monitored based on first-time PIT-tag detections at mainstem dams. Mean detection rates for smolts released in 2002 were: 52.1% for Imnaha River stock; 48.2% for Lostine River stock; 32.2% for Catherine Creek stock; and 33.9% for Grande Ronde River stock. The detection rate for the Lostine River smolts produced from Conventional Broodstock was within the range observed for the Captive Broodstock produced smolts (Table 3).

The 2001 cohort of Lostine River Chinook parr were released into Bear Creek on 28 May 2002. The 2001 cohort of Grande Ronde River parr were released into Sheep Creek on 29 May 2002 and the 2001 cohort of Catherine Creek Chinook salmon parr were released into Lookingglass Creek on 28 May 2002. This was the second year Catherine Creek salmon parr were released into Lookingglass Creek in an effort to establish a stock endemic to the Grande Ronde Basin.

## **Adults**

The Imnaha River weir was installed on 14 June 2002, close to the target date of 15 June, and operated until 13 September 2002 (Table 4). We trapped 937 hatchery- and 267 naturally-produced salmon and 26.7% (274 hatchery; 47 natural) were retained (Table 5). Most were

retained for broodstock but there were 14 weir mortalities (11 hatchery and 3 natural). The remaining salmon trapped at the weir were either outplanted to Big Sheep and Lick creeks (205 hatchery Chinook salmon) or released above the weir to spawn naturally (458 hatchery, 220 natural). Age structure of salmon captured at the weir was determined from CWT or scale analysis, when available, or from length-at-age relationships. Most adults (69.7%) used as broodstock were age 4 (Figure 1). Age 4 adults were also the dominant age group returning to the Imnaha River weir, comprising 79.9% of the hatchery-produced salmon and 57.3% of the naturally-produced salmon collected (Table 5). Age 5 adults comprised 8.5% of hatchery-produced salmon and 32.6% of naturally-produced salmon collected at the weir. Pre-spawn mortality of combined hatchery and natural Imnaha River Chinook salmon held at LFH (including weir mortalities) was 26.2%, much higher than previous years. We spawned 83 hatchery and 14 natural females with 117 hatchery and 14 natural males (Table 5). We collected 455,372 eggs, which was below our goal of 576,500 green eggs, and they were incubated at Lookingglass Fish Hatchery (Table 6). Mortality to shocking was 11.9%.

The Lostine River weir was installed on 24 April 2002 and operated until 10 November 2002. A total of 269 hatchery- and 274 naturally-produced adult Chinook salmon were captured with 10.9% (six hatchery, 53 natural) retained (Table 5). All were retained for broodstock except for one age-3 hatchery male weir mortality. The remaining salmon trapped at the weir were either outplanted (27 hatchery Chinook salmon) or released above the weir to spawn naturally (236 hatchery, 220 natural). Age 4 adults were the dominant age group returning to the Lostine River weir, comprising 89.6% of the hatchery-produced salmon and 79.9% of the naturally produced salmon collected (Table 5). Age 5 adults comprised 4.0% of hatchery-produced salmon and 16.4% of naturally-produced salmon collected. The age 4 hatchery returns were from the 1998 cohort release in 2000 of Captive Broodstock progeny. The age 5 hatchery returns were from the 1997 cohort release in 1999 of conventional broodstock progeny. Age structure of adults used as conventional broodstock was as follows: 2.0% age 3; 74.5% age 4; and 23.5% age 5. Pre-spawning mortality of fish trapped at the weir and held at Lookingglass Hatchery was 13.6%. We spawned one hatchery and 27 natural females with two hatchery and 21 natural males. We collected 131,023 eggs, which was below the goal of 176,600 green eggs. Egg mortality to shocking was low (9.1%).

The Catherine Creek weir was operated from 12 March to 13 August 2002. A total of 142 hatchery- and 170 naturally-produced adult Chinook salmon were captured with 12.5% (39 natural) retained for broodstock (Table 5). There was one hatchery female weir mortality. The remaining salmon trapped at the weir were released above the weir to spawn naturally. Age 4 adults were the dominant age group returning to the Catherine Creek weir, comprising 90.9% of the hatchery-produced salmon and 69.9% of the naturally-produced salmon collected (Table 5). The age 4 hatchery returns were from the 1998 cohort release in 2000 of Captive Broodstock progeny. Age 5 adults comprised 1.4% of hatchery produced salmon returning to the weir and 22.9% of natural produced salmon. However, because age of hatchery fish passed above the weir was determined from length-at-age relationships and there was no 1997 cohort release to produce age 5 adults, these fish were either hatchery strays, large age 4 hatchery adults, or misidentified natural adults. Pre-spawning mortality of fish held at Lookingglass Hatchery was 10.0%. We spawned 20 natural females with 15 natural males. We collected 81,926 eggs, which was below the goal of 176,600 green eggs. Egg mortality to shocking was low (12.4%).

The upper Grande Ronde River weir was operated from 22 April to 24 July 2002. A total of three hatchery- and 102 naturally-produced adult Chinook salmon were captured with 48.6%

(51 natural) retained (Table 5). A total of 49 were retained for broodstock and two were weir mortalities. The remaining salmon trapped at the weir were released above the weir to spawn naturally. All hatchery returns were age 4 salmon from the 1998 cohort release in 2000 of Captive Broodstock progeny. Age structure of naturally produced adults returning to the weir was as follows: 1.0% age 3; 72.5% age 4; and 26.4% age 5. Pre-spawning mortality of fish held at Lookingglass Hatchery was 17.6%. We spawned 25 natural females with 17 natural males. We collected 89,156 eggs, which was below the goal of 176,600 green eggs. Egg mortality to shocking was 18.1%.

In 2002, a total of 40 Rapid River hatchery- and 22 naturally-produced Chinook salmon were collected at the weir on Lookingglass Creek (Table 4). The majority of the hatchery- and naturally-produced fish were returned below the weir for a recreational fishery in an effort to phase out non-endemic Rapid River stock salmon in the Grande Ronde Basin. No fish were passed above the weir or kept for broodstock at Lookingglass Fish Hatchery.

### **Coded-Wire Tag Recoveries**

We used coded-wire tag recoveries from adult returns, strays, and fisheries collections from experimental and production groups of each stock of Chinook salmon to evaluate hatchery treatments and assess the success of achieving mitigation goals and management objectives. Hatchery fish from all experimental and most production groups were marked with a coded-wire tag (CWT) to provide basic information on survival, harvest, escapement, straying, and specific information on experimental results. Coded-wire tag recovery information for each CWT code group was obtained from the Regional Mark Information System (RMIS) CWT recovery database maintained by the Pacific States Marine Fisheries Commission. We summarized from the RMIS database the observed and expanded number of CWTs recovered in ocean and mainstem river fisheries as well as strays collected in and out of the Snake River Basin. Expanded numbers in the RMIS database were the estimated number of CWT fish caught based on sampling efficiencies at each recovery location. The RMIS database does not expand for recoveries observed in the Imnaha and Grande Ronde River basins. We expanded observed recoveries from returning hatchery adults (from weir collections and spawning ground recoveries) from each cohort to the Imnaha, Lostine, and Grande Ronde rivers and Catherine Creek. Observed recoveries were expanded for unrecovered CWT adults by first estimating hatchery escapement to each stream for each cohort (see Monzyk et al. 2006a). For each stream, the total number of coded-wire tagged returns was estimated by multiplying the hatchery escapement estimate by the proportion of the cohort tagged at release and the weighted average tag retention rate for each cohort. The expanded number of recoveries for each CWT code group was estimated by multiplying the total number of CWT returns by the relative proportion of each CWT code within a cohort.

Nearly all CWT recoveries for hatchery Chinook salmon released in the Imnaha Basin occurred in the Snake River Basin. In 2002, we recovered 505 hatchery-reared Imnaha River Chinook salmon with a CWT from the 1997-1999 cohorts. These recoveries were expanded to an estimated 3,744 CWT returns to the Imnaha River with the following age distribution: 324 from the 1997 cohort; 2,970 from the 1998 cohort; and 450 from the 1999 cohort (Table 7). In addition, an estimated 12 CWT Imnaha River salmon were recovered in ocean fisheries, 134 were recovered in Columbia/Snake rivers, and 20 were recovered as strays outside the Snake River basin. Of the Columbia/Snake rivers recoveries, 10 were recovered in ceremonial fisheries

and 109 were recovered in sport fisheries (Table 8). Of the out-of-basin strays, an estimated 14 were recovered in the Deschutes River, two were recovered at Spring Creek National Fish Hatchery, Washington and four were recovered in the Wind River, Washington.

In 2002, we recovered 27 CWT marked Rapid River Chinook salmon from the 1997-1998 cohorts released from Lookingglass Fish Hatchery (Table 9). Of those, six CWT fish were recovered at the LFH weir or during spawning ground surveys on Lookingglass Creek. Because so few CWT returns were recovered in Lookingglass Creek, the proportion returning from each tag group is suspect. However, we estimated that a total of 64 Rapid River Chinook hatchery salmon returned to the Lookingglass Creek. An estimated 64 CWT Rapid River Chinook salmon were also recovered from the Columbia/Snake rivers (Table 9). There were three strays recovered within the Snake River basin, all in the Lostine River.

In the Lostine River, we recovered 101 hatchery-reared Lostine River Chinook salmon from the 1997-1999 cohorts with a CWT. These recoveries were expanded to an estimated 397 CWT returns to the Lostine River with the following age distribution: 17 from the 1997 cohort; 356 from the 1998 cohort; and 24 from the 1999 cohort (Table 10). An estimated 22 Lostine River Chinook salmon were recovered in the Columbia/Snake river sport fisheries (Table 11). One stray was recovered out of the Snake River basin at the Coles River Fish Hatchery, Washington. Three were recovered as in-basin strays from the Imnaha River. One CWT Lostine River fish recovered in the Wallowa River may have been the result of outplanting from the Lostine River weir.

In Catherine Creek, we recovered 59 hatchery-reared Catherine Creek Chinook salmon with a CWT from the 1998 and 1999 cohorts. These recoveries were expanded to an estimated 216 CWT returns to Catherine Creek with the following age distribution: 200 from the 1998 cohort; and 16 from the 1999 cohort (Table 12). An estimated 77 CWT marked Catherine Creek salmon were also recovered in the Columbia/Snake river fisheries (Table 12). Of these, 36 were recovered in sport fisheries and 37 were recovered in ceremonial/subsistence fisheries (Table 11). In addition, two CWT Catherine Creek Chinook salmon were recovered as strays in Lookingglass Creek.

Only one CWT-marked Grande Ronde River Chinook salmon was recovered in 2002. This 1998 cohort salmon was recovered in the North Fork John Day River. Only three hatchery salmon were collected and passed upstream of the Grande Ronde River weir and CWT were not recovered.

### **Compensation Goals**

To assess the success of achieving mitigation goals and management objectives, we determined the total number of hatchery-produced salmon for each stock that were recovered in fisheries, escaped to stream of release, or strayed within or outside the Snake River basin. The number of hatchery-produced salmon that were recovered in fisheries or strayed within or outside the Snake River basin was estimated based on CWT recoveries. The number of hatchery-produced salmon that escape to the stream of release was determined using the method described above to estimate total return of hatchery adults to natal streams. To determine the return to the LSRCP Compensation Area, defined as the Snake River basin above Ice Harbor Dam, we summed all estimated escapement for the 2002 return year that occurred above Ice Harbor Dam.

The compensation goal for the Imnaha Basin is 3,210 hatchery adults. We estimated that 3,889 Imnaha River hatchery adults returned to the compensation area, 121% of the goal for the Imnaha River stock (Table 8). Of these, an estimated 3,876 returned to the Imnaha River, one was recovered at Lower Granite Dam, and 12 were recovered in a Snake River sport fishery.

In the Grande Ronde Basin, the compensation goal for all stocks combined was set at 5,820 hatchery adults. We estimated 409 Lostine River, 223 Catherine Creek, three Grande Ronde River, and 71 Rapid River adults returned to the compensation area for a combined return of 706 hatchery adults, or 12.1% of the compensation goal. Although well below the compensation goal, we did not have a complete cohort return from the initial release of the 1998 cohort.

The progeny-to-parent ratio for combined hatchery and natural origin Imnaha River salmon that spawned naturally in 1997 was 5.3, much higher than the mean value since 1982 and well above replacement (Figure 2). This is the second year that productivity has been above replacement after a twelve year period of being below replacement. The progeny-to-parent ratio for the hatchery component was 22.8, better than naturally spawning salmon and well above replacement. The number of natural salmon that returned to the basin to spawn (1,056) was down from the 2001 return but was still 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 in previous years (see Monzyk et al. 2006a). We surveyed three streams in the Imnaha River Basin and nine in the Grande Ronde Basin. An exception to normal carcass sampling was on the Imnaha and Lostine rivers, where we encountered large numbers of carcasses that made complete sampling of every carcass prohibitive. For this reason, we completely sampled every other carcass observed for scale samples and snouts (CWT). All carcasses were observed for fin and opercle marks, sex, and degree of spawning.

In 2002, we counted 1,189 redds and observed 1,716 carcasses in the Imnaha Basin (Table 13). Based on recovered CWTs from marked hatchery salmon on spawning grounds, all were Imnaha stock with the exception of one Lostine River salmon (Table 12). Marked salmon comprised 55.9% of the observed carcasses of known origin. Age composition of hatchery adults recovered on spawning grounds in the Imnaha River Basin was 2.9% age 3, 86.0% age 4, and 11.1% age 5. Age composition of natural adults was 1.4% age 3, 48.6% age 4, 49.7% age 5, 0.3% age 6 (Table 15).

In the Grande Ronde Basin, we observed 895 redds and recovered 642 carcasses on the spawning grounds. We recovered six marked hatchery strays in the Grande Ronde Basin (Table 12). In Lookingglass Creek, two strays from the 1998 Catherine Creek cohort were recovered. In the Lostine River, three strays that were released from Lookingglass Fish Hatchery (1997 and 1998 cohorts) were recovered. In the Wenaha River, two hatchery strays from the 2000 cohort (precocious males) were recovered; one from Lostine River and one from the Imnaha River. Similarly, in the Minam River, one stray from the 2000 Catherine Creek cohort was recovered. Marked salmon comprised 41.0% of the observed carcasses of known origin. Hatchery strays comprised 1.3% of the total carcasses recovered in the Grande Ronde River Basin. Age composition of hatchery adults recovered on spawning grounds in the Grande Ronde Basin was 5.5% age 3, 89.5% age 4, and 4.0% age 5. In addition three age 2 males of hatchery origin were

recovered. Age composition of natural adults was 3.0% age 3, 71.8% age 4, and 25.2% age 5 (Table 15).

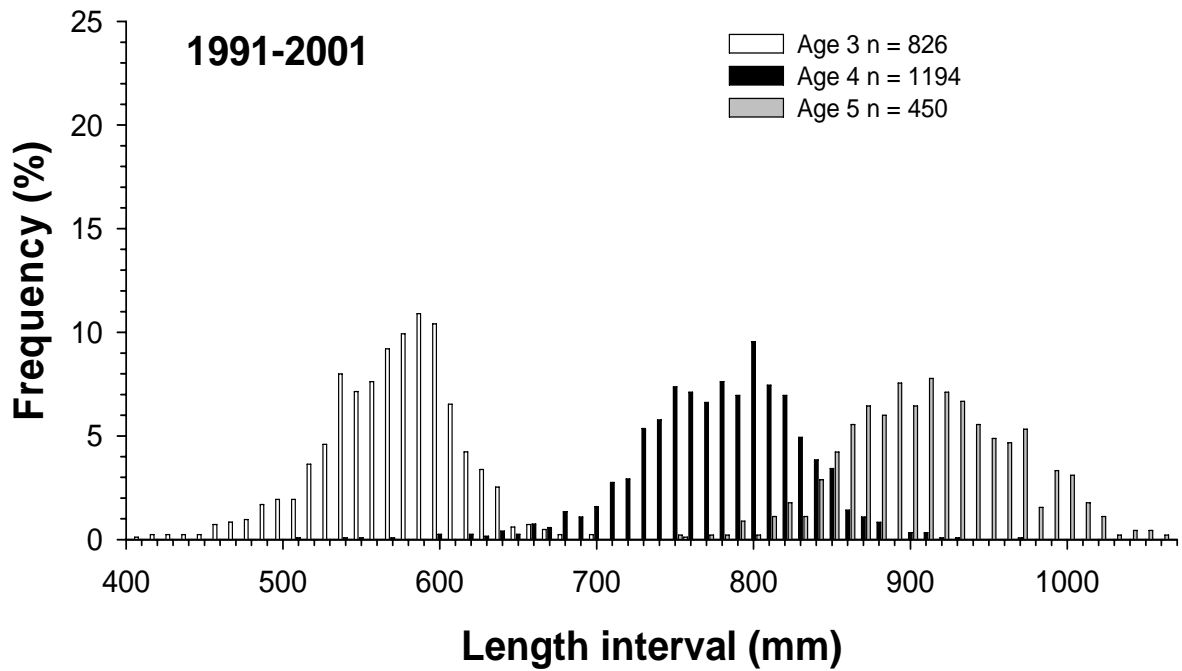
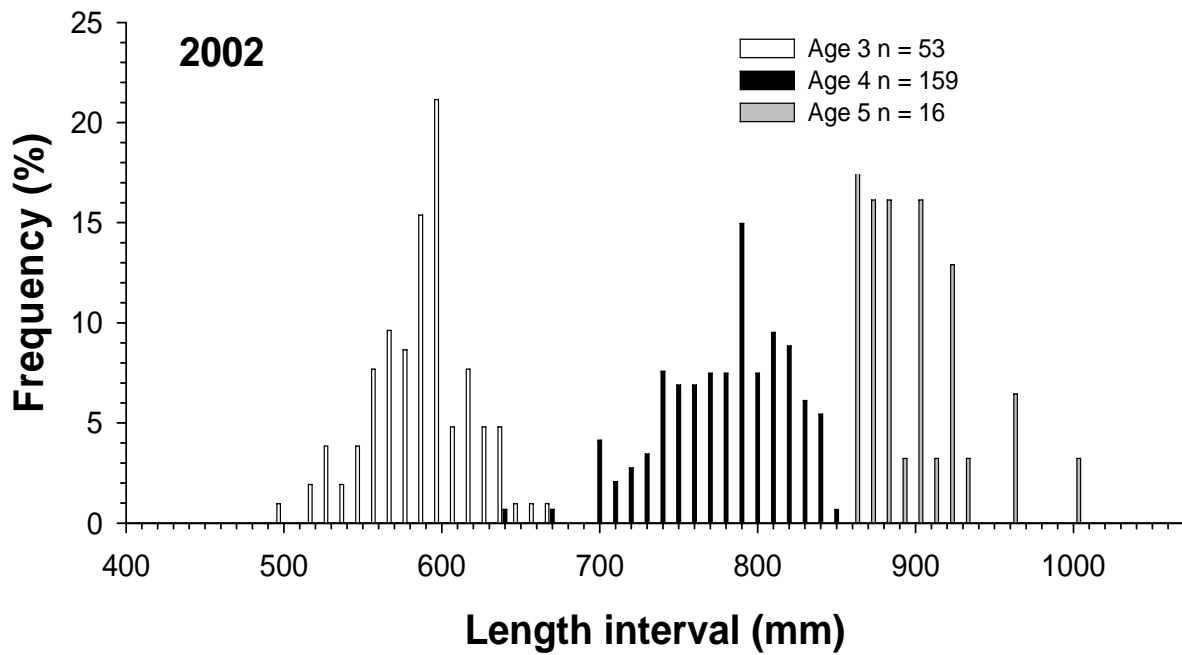


Figure 1. Length frequency-at-age relationship for Imnaha River Chinook salmon adults used as hatchery broodstock in 2002 (top) and from 1991-2001 (below).



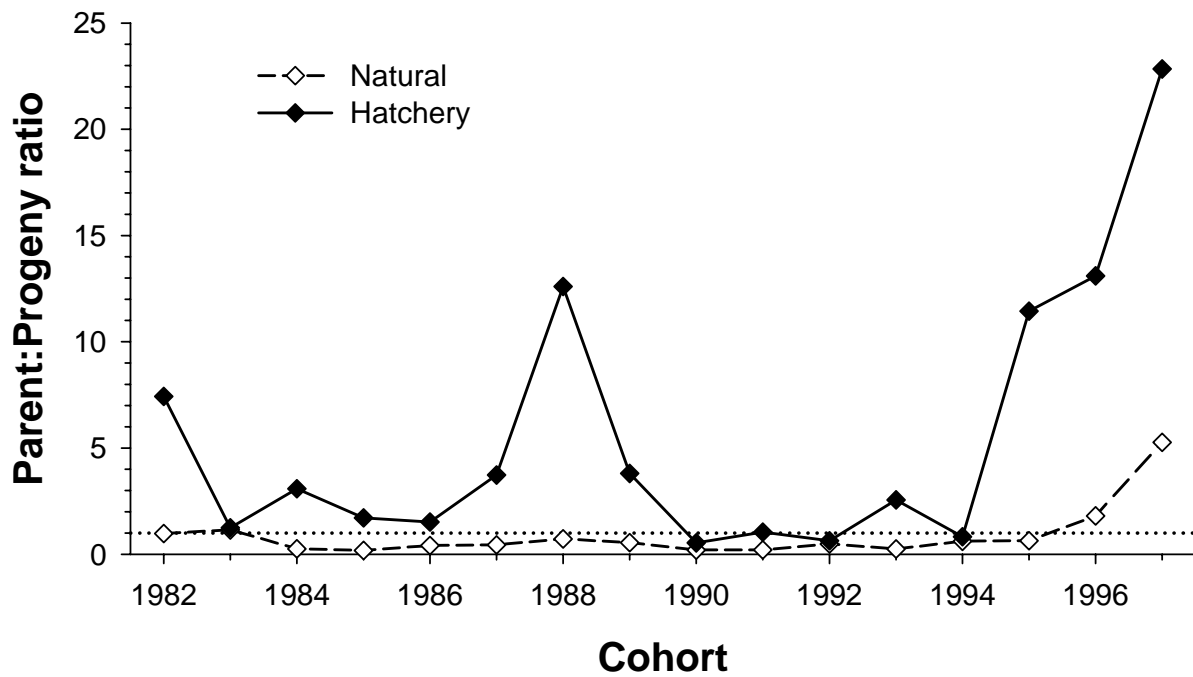


Figure 2. Progeny-to-parent ratios for completed cohorts (1982-1997) of Imnaha River Chinook salmon. Note: dotted line indicates P:P ratio=1.

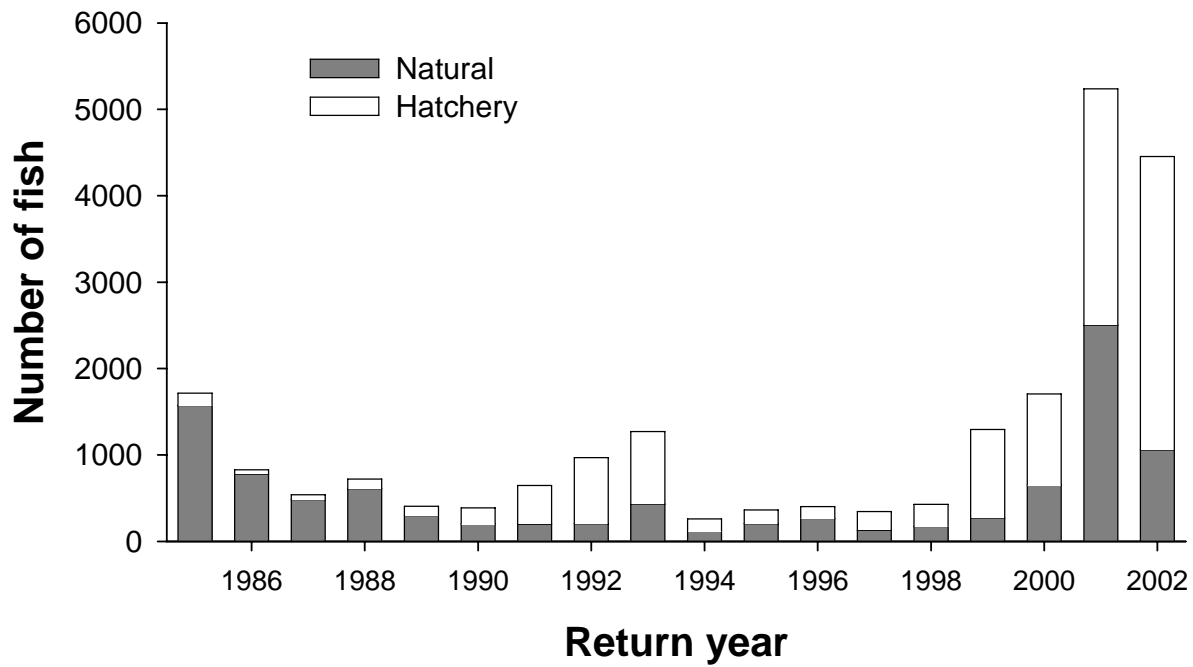


Figure 3. Estimated numbers of natural- and hatchery-origin Chinook salmon that spawned naturally in the Imnaha River, 1985-2002.

Table 1. Rearing summaries for the 2000 and 2001 cohorts of juvenile spring Chinook salmon released into the Grande Ronde and Imnaha river basins in 2002.

Cohort / stock	Broodstock	Number of green eggs taken	Eyed eggs	Percent Survival		Total released <sup>a</sup>
				Green -to- eyed	Eyed -to- smolt	
<u>2000 cohort</u>						
Imnaha River	Conventional	333,824	315,486	94.5	96.3	303,737
Lostine River	Captive	152,270	114,530	75.2	67.7	77,314
Lostine River	Conventional	34,630	33,546	96.9	93.8	31,464
Catherine Creek	Captive	296,764	229,636	77.3	78.5	180,343
Grande Ronde River	Captive	298,878	256,004	85.7	59.2	151,444
<u>2001 cohort</u>						
Lostine River <sup>b</sup>	Captive	216,471	196,192	90.6	n/a	4,660
Catherine Creek <sup>c</sup>	Captive	30,155	26,732	88.6	n/a	17,880
Grande Ronde River <sup>d</sup>	Captive	46,165	42,279	91.6	n/a	32,800

<sup>a</sup> Includes all fish released (adipose clipped and coded-wire tagged plus unrecognizable marks, target 100%).

<sup>b</sup> Lostine River stock released in Bear Creek as parr. Number of green eggs taken and eyed eggs were not separated out from rest of cohort released in 2003.

<sup>c</sup> Catherine Creek stock released in Lookingglass Creek as parr.

<sup>d</sup> Grande Ronde stock released in Sheep Creek as parr.

Table 2. Estimates of percent adipose fin clip (Ad) and coded-wire tag application success for Imnaha River, Lostine River, Grande Ronde River, and Catherine Creek 2000 cohort and Lostine River, Grande Ronde River, and Catherine Creek 2001 cohort spring Chinook salmon reared at Lookingglass Fish Hatchery and released in 2002. Targets were 100% Ad + 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	Number Released
<u>Imnaha River (2000)</u>							
12	093413	}	505	93.3	2.0	4.6	12,768
	093443						6,134
	093414						12,553
	093415						12,506
	075851						5,402
	093417						11,335
13	093413	515	93.2	1.7	4.7	0.4	48,847
13,14	093443	512	93.9	1.0	4.9	0.2	23,672
14	093414	510	94.5	0.4	5.1	0.0	49,025
15	093415	506	94.3	1.0	4.7	0.0	49,005
15,18	075851	507	93.5	1.0	5.5	0.0	22,328
18	093417	<u>508</u>	<u>92.7</u>	<u>1.0</u>	<u>6.3</u>	<u>0.0</u>	<u>50,162</u>
Total / mean		3,563	93.6	1.2	5.1	0.1	303,737
<u>Lostine River (2000)</u>							
1	093422	}	503	97.0	0.2	2.8	10,514
	093421						7,800
	093425						16,537
2	093426	}	n/a <sup>b</sup>	94.8	2.0	3.2	20,265
	093419						2,363
3	093428	}	n/a <sup>b</sup>	94.8	2.0	3.2	3,815
	093423						13,178
9 <sup>a</sup>	075852		<u>512</u>	<u>92.6</u>	<u>3.7</u>	<u>3.5</u>	<u>31,464</u>
Total / mean		2,038	94.8	2.0	3.2	0.1	105,936
2	none	n/a <sup>b</sup>	n/a	96.8	n/a	3.3	1,444
3	none	n/a <sup>b</sup>	n/a	96.8	n/a	3.3	<u>1,398</u>
Total / mean							2,842

<sup>a</sup> Conventional broodstock progeny were reared in raceway 9.

<sup>b</sup> Raceways 2 and 3 contained Ad-only fish along with Ad + CWT fish so we used averages from raceways 1 and 9 to estimate tag application success.

Table 2 continued.

Stock, raceway	CWT code	Number checked	Ad clip, with CWT	Ad clip, no CWT	No Ad clip, with CWT	No Ad clip, no CWT	Number released
<u>Catherine Creek (2000)</u>							
4	093429	n/a <sup>c</sup>	94.9	0.6	4.4	0.1	3,260
	093430						6,560
	093432						10,524
	093433						14,490
	093438						23,348
5	093420	501	94.0	1.0	5.0	0.0	5,553
	093436						43,986
6	093431	<u>508</u>	<u>95.9</u>	<u>0.2</u>	<u>3.7</u>	<u>0.2</u>	9,404
	093435						<u>46,365</u>
Total / mean		1,009	94.9	0.6	4.4	0.1	163,490
4	none	n/a <sup>c</sup>	n/a	95.5	n/a	4.5	16,853
<u>Grande Ronde River (2000)</u>							
7	093440	506	87.2	4.0	7.3	1.6	31,824
	092611						2,029
	093416						24,669
8	070149	49	79.6	2.0	18.4	0.0	42,152
11	093439	<u>521</u>	<u>93.7</u>	<u>0.8</u>	<u>5.6</u>	<u>0.0</u>	30,376
	093441						<u>20,394</u>
Total / mean		1,076	89.9	2.3	7.1	0.7	151,444
<u>Lostine River (2001)</u>							
T40	092640	<u>234</u>	<u>99.6</u>	<u>0.4</u>	<u>0.0</u>	<u>0.0</u>	<u>4,660</u>
Total / mean		234	99.6	0.4	0.0	0.0	4,660
<u>Catherine Creek (2001)</u>							
16	093506	<u>576</u>	<u>98.1</u>	<u>1.0</u>	<u>0.7</u>	<u>0.2</u>	<u>17,880</u>
Total / mean		576	98.1	1.0	0.7	0.2	17,880
<u>Grande Ronde River (2001)</u>							
14	093508	<u>511</u>	<u>98.0</u>	<u>1.2</u>	<u>0.8</u>	<u>0.0</u>	<u>32,800</u>
Total / mean		511	98.0	1.2	0.8	0.0	32,800

<sup>c</sup> Raceway 4 contained Ad-only fish along with Ad+CWT fish so we used averages from raceways 5 and 6 to estimate tag application success.

Table 3. Mean size of Imnaha River, Lostine River, Grande Ronde River, and Catherine Creek 2000 cohort and Lostine River, Grande Ronde River, and Catherine Creek 2001 cohort spring Chinook salmon, total number released into the Imnaha River and Grande Ronde river basins, number PIT-tagged and percent detected at Snake and Columbia river dams, 2002.

Stock, raceway	Release date (2002)	Cohort	CWT code	Fork Length (mm)		Weight (g)		Condition factor (K)		Total released <sup>a</sup>	Number PIT- tagged	Percent PIT tags detected <sup>b</sup>
				Mean	SD	Mean	SD	Mean	SD			
<u>Imnaha River</u> – smolts released at Imnaha acclimation site												
12	22 MAR-15 APR	2000		134.5	16.2	30.3	12.3	1.22	0.13	60,698	4,191	49.6
13	22 MAR -15 APR	2000		135.9	17.0	33.0	13.0	1.26	0.17	60,683	4,200	52.5
14	22 MAR -15 APR	2000		134.0	15.6	32.1	11.5	1.34	0.23	60,861	4,194	52.5
15	22 MAR -15 APR	2000		130.6	14.2	32.2	11.1	1.43	0.24	60,169	4,199	53.9
18	22 MAR -15 APR	2000		129.8	14.3	29.1	9.4	1.34	0.24	<u>61,326</u>	<u>4,199</u>	<u>51.8</u>
Total										303,737	20,983	52.1
<u>Lostine River</u> - smolts released at Lostine acclimation site												
1	1-15 APR	2000		122.8	7.7	25.3	5.7	1.37	0.14	34,851	2,666	51.2
2	1-15 APR	2000		121.9	8.2	25.0	5.6	1.43	0.19	24,072	2,667	50.5
3	1-15 APR	2000		123.0	9.4	26.1	7.1	1.40	0.24	18,628	2,660	37.2
9 <sup>c</sup>	1-15 APR	2000		125.8	7.0	27.3	5.2	1.38	0.21	<u>31,464</u>	<u>8,002</u>	<u>50.1</u>
Total										109,015	15,995	48.2
<u>Catherine Creek</u> - smolts released at Catherine Creek acclimation site												
4	1-15 APR	2000		118.3	8.8	24.2	8.1	1.33	0.13	75,035	6,978	30.2
5	1-15 APR	2000		125.7	10.4	25.1	4.8	1.29	0.13	49,539	6,964	33.1
6	1-15 APR	2000		121.7	8.8	23.1	4.7	1.45	0.38	<u>55,769</u>	<u>6,944</u>	<u>33.3</u>
Total										180,343	20,886	32.2

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

<sup>b</sup> Percent PIT tag detections are unique detections at all dams in the Snake and Columbia Rivers.

<sup>c</sup> Conventional broodstock progeny.

Table 3 continued.

Stock, raceway	Release date (2002)	Cohort	CWT code	Fork Length (mm)		Weight (g)		Condition factor (K)		Total released <sup>a</sup>	Number PIT- tagged	Percent PIT tags detected <sup>b</sup>
				Mean	SD	Mean	SD	Mean	SD			
<u>Grande Ronde River-</u> smolts released at Grande Ronde acclimation site												
7	1-15 APR	2000		119.1	6.3	21.7	3.9	1.33	0.18	58,522	499	33.9
8	1-15 APR	2000		121.0	9.6	24.3	5.4	1.44	0.50	42,152	500	33.2
11	1-15 APR	2000		126.2	11.2	27.7	8.2	1.34	0.26	<u>50,770</u>	<u>497</u>	<u>34.6</u>
Total										151,444 <sup>d</sup>	1,048	33.9
<u>Lostine River-</u> parr released at Bear Creek												
T40	28 MAY	2001	092640	n/a	n/a	n/a	n/a	n/a	n/a	4,660	0	n/a
<u>Grande Ronde River-</u> parr released at Sheep Creek												
14	29 MAY	2001	093508	n/a	n/a	n/a	n/a	n/a	n/a	32,800	0	n/a
<u>Catherine Creek-</u> parr released at Lookingglass Creek												
16	28 MAY	2001	093506	n/a	n/a	n/a	n/a	n/a	n/a	17,880	0	n/a

<sup>d</sup> An additional 49,216 smolts were lost at acclimation site due to freezing conditions that interrupted flow in the raceways.

Table 4. Recoveries of adult spring Chinook salmon at northeast Oregon LSRCF facilities and Lower Granite Dam, 2002.

Period	Week of year	Imnaha River		Lostine River		Catherine Creek		Grande Ronde River		Lookingglass Creek	
		Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked	Un- marked	Marked	Un- marked
Dates of trap operation <sup>a</sup>		14 JUN – 13 SEP		24 APR – 10 NOV		12 MAR – 13 AUG		22 APR – 24 JUL		24 MAY – 21 SEP	
7-13 MAY	19	-	-	0	0	0	0	0	0	-	-
14-20 MAY	20	-	-	0	0	1	0	0	0	-	-
21-27 MAY	21	-	-	0	0	4	13	0	0	0	0
28 MAY - 3 JUN	22	-	-	0	0	9	25	0	6	0	0
4-10 JUN	23	-	-	1	0	5	6	1	27	5	1
11-17 JUN	24	-	-	6	4	70	80	2	28	2	6
18-24 JUN	25	-	-	0	7	29	24	0	19	2	4
25 JUN – 1 JUL	26	-	-	0	2	19	10	0	9	17	4
2-8 JUL	27	-	-	76	65	2	5	0	1	1	0
9-15 JUL	28	157	48	32	41	2	5	0	12	3	2
16-22 JUL	29	386	89	49	49	1	1	0	0	0	0
23-29 JUL	30	220	60	53	27	0	0	0	0	0	0
30 JUL - 5 AUG	31	42	13	2	2	0	1	-	-	0	0
6-12 AUG	32	10	9	3	11	0	0	-	-	1	0
13-19 AUG	33	72	23	1	2	0	0	-	-	3	1
20-26 AUG	34	48	22	26	27	0	0	-	-	2	2
27 AUG - 2 SEP	35	0	0	16	15	0	0	-	-	2	2
3-9 SEP	36	2	3	2	8	-	-	-	-	1	0
10-16 SEP	37	0	0	2	14	-	-	-	-	0	0
17-23 SEP	38	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>0</u>
Total		937	267	269	274	142	170	3	102	40	22

<sup>a</sup> No salmon were captured in any trap before 14 May or after 23 September.

Table 5. Number and disposition of adult spring Chinook salmon returning to northeast Oregon LSRCF facilities in 2002 by origin, age, and sex.

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	0	109	457	291	34	46	937	0	27	66	87	55	32	267	1,204
Passed	0	41	232	132	23	30	458	0	22	53	72	45	28	220	678
Outplanted	0	8	119	61	5	12	205	0	0	0	0	0	0	0	205
Kept	0	60	106	98	6	4	274	0	5	13	15	10	4	47	321
Actual spawned	0	51	78	65	5	1	200	0	2	7	9	7	3	28	228
Killed, not spawned	0	3	4	0	0	1	8	0	1	0	0	0	0	1	9
Pre-spawn mortality	0	6	24	33	1	2	66	0	2	6	6	3	1	18	84
Mean length (mm) <sup>a</sup>	-	563	800	777	838	928		-	562	801	779	900	956		
Standard deviation (mm)	-	45.0	36.0	60.1	54.3	4.9		-	40.1	47.0	62.6	38.6	42.6		
Age composition (%)	-	11.6	48.8	31.1	3.6	4.9	100	-	10.1	24.7	32.6	20.6	12.0	100	
<u>Lostine River</u>															
Trapped	0	17	128	113	2	9	269	1	9	106	113	17	28	274	543
Passed <sup>b</sup>	0	14	114	98	1	9	236	1	8	82	97	11	21	220	456
Outplanted	0	2	12	13	0	0	27	0	0	0	1	0	0	1	28
Kept	0	1	2	2	1	0	6	0	1	24	15	6	7	53	59
Actual spawned	0	0	1	2	0	0	3	0	1	22	13	5	7	48	51
Killed, not spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-spawn mortality	0	1	1	0	1	0	3	0	0	2	2	1	0	5	8
Mean length (mm)	-	550	751	754	950	860		-	554	757	752	896	927		
Standard deviation (mm)	-	63.6	31.8	46.1	21.2	7.0		-	50.2	41.9	48.4	35.1	65.7		
Age composition (%)	-	6.3	47.6	42.0	0.7	3.3	100	0.4	3.3	38.7	41.2	6.2	10.2	100	

<sup>a</sup> Mean length based on CWT of scale information of spawned fish.

<sup>b</sup> Total passed includes 14 natural fish that were initially kept and then returned back to Lostine River.



Table 5 continued.

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	0	4	11	12	6	7	40	1	2	8	7	2	2	22	62
Passed below weir	0	4	11	12	4	6	37	1	2	8	7	2	2	22	59
Killed not spawned	0	0	0	0	2	1	3	0	0	0	0	0	0	0	3
Mean length (mm)	-	581	744	764	789	830		545	457	757	722	867	913		
Standard deviation (mm)	-	65.8	55.1	51.5	48.9	55.5		NA	NA	51.7	40.3	0.0	4.2		
Age composition (%)	-	10.0	27.5	30.0	15.0	17.5	100	4.5	9.1	36.4	31.8	9.1	9.1	100	
<u>Catherine Creek</u>															
Trapped	0	11	67	62	1	1	142	0	12	62	57	17	22	170	312
Passed	0	11	66	62	1	1	141	0	7	46	48	12	18	131	272
Kept	0	0	1	0	0	0	1	0	5	16	9	5	4	39	40
Actual spawned	0	0	0	0	0	0	0	0	4	15	7	5	4	35	35
Killed not spawned	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Pre-spawn mortality	0	0	1	0	0	0	1	0	1	1	1	0	0	3	4
Mean length (mm)	-	494	695	714	870	815		-	568	710	713	845	861		
Standard Deviation (mm)	-	63.2	34.1	37.7	NA	10.0		-	66.3	39.3	44.2	31.5	42.5		
Age composition (%)	0	7.7	47.2	43.7	0.7	0.7	100	0	7.1	36.4	33.5	10.0	12.9	100	
<u>Grande Ronde River</u>															
Trapped	0	0	3	0	0	0	3	0	1	40	34	14	13	102	105
Passed	0	0	3	0	0	0	3	0	0	17	20	8	6	51	54
Kept	0	0	0	0	0	0	0	0	1	23	14	6	7	51	51
Actual spawned	0	0	0	0	0	0	0	0	1	20	11	5	5	42	42
Pre-spawn mortality	0	0	0	0	0	0	0	0	0	3	3	1	2	9	9
Mean length (mm)	-	-	718	-	-	-		-	503	708	726	845	870		
Standard Deviation (mm)	-	-	26.2	-	-	-		-	NA	36.3	37.0	30.2	36.0		
Age composition (%)	-	-	100	-	-	-	100	-	1.0	39.2	33.3	13.7	12.7	100	

Table 6. Timing of spawning and spawning summaries for spring Chinook salmon at Lookingglass Fish Hatchery, 2002.

Stock, spawn date	Origin of parents	Number of parents		Number of eggs collected	Number of eyed eggs	Percent mortality to shocking
		F	M <sup>a</sup>			
<u>Imnaha River</u>						
21 AUG	Mixed	13	11	62,885	51,864	17.5
28 AUG	Mixed	38	40	180,608	171,069	5.3
05 SEP	Mixed	38	49	171,972	139,553	18.9
11 SEP	Mixed	<u>8</u>	<u>30</u>	<u>39,907</u>	<u>38,779</u>	<u>2.8</u>
Total		97	130	455,372	401,265	11.9
<u>Lostine River</u>						
21 AUG	Natural	1	1	4,311	4,257	1.3
28 AUG	Mixed	6	8	28,100	20,133	28.4
04 SEP	Mixed	17	2	80,474	77,719	3.4
11 SEP	Natural	<u>4</u>	<u>3</u>	<u>18,138</u>	<u>16,930</u>	<u>6.7</u>
Total		28	14	131,023	119,039	9.1
<u>Catherine Creek</u>						
16 AUG	Natural	7	7	31,438	27,500	12.5
23 AUG	Natural	4	3	12,000	9,750	18.8
30 AUG	Natural	7	3	33,438	29,500	11.8
06 SEP	Natural	<u>2</u>	<u>2</u>	<u>5,050</u>	<u>5,000</u>	<u>1.0</u>
Total		20	15	81,926	71,750	12.4
<u>Grande Ronde River</u>						
16 AUG	Natural	8	8	32,804	30,677	6.5
23 AUG	Natural	3	2	7,550	6,752	10.6
30 AUG	Natural	10	6	37,152	24,952	32.8
6 SEP	Natural	<u>4</u>	<u>4</u>	<u>11,650</u>	<u>10,670</u>	<u>8.4</u>
Total		25	20	89,156	73,051	18.1

<sup>a</sup> The number of males in table are greater than the number kept because some males were recycled.

Table 7. Expanded adult recoveries by coded-wire tag group of Imnaha River spring Chinook salmon for the 2002 return year. Mainstem river recoveries were collected in Columbia/Snake river fisheries en route to the Imnaha River. In-basin strays were recovered in other Snake River Basin streams (not in the migration route). Out-of-basin strays were recovered from streams outside the Snake River Basin or in the upper Columbia River. Numbers in parenthesis are unexpanded recoveries.

Cohort	Experimental group (target size at release and/or rearing density )	CWT code	Number released	Recovery location					Total
				Imnaha River <sup>a</sup>	Ocean catch <sup>b</sup>	Mainstem rivers <sup>b</sup>	In-basin strays <sup>b</sup>	Out-of-basin strays <sup>b</sup>	
1997	30 g, 1/2 Density	071248	26,796	36 (2)	0	0	0	0	36
	30 g, 1/2 Density	092558	13,308	0	0	0	0	0	0
	30 g, 1/2 Density	092559	14,872	0	0	0	0	0	0
	30 g, 1/2 Density <sup>c</sup>	092609	10,278	0	0	0	0	0	0
	30 g, 1/4 Density	092612	13,395	36 (2)	0	0	0	0	36
	30 g, 1/4 Density	092613	13,363	18 (1)	0	0	0	0	18
	30 g, 1/4 Density	092614	13,997	0	0	0	0	0	0
	18 g, 1/4 Density	092615	22,385	54 (3)	0	0	0	0	54
	18 g, 1/4 Density	092616	21,787	54 (3)	0	0	0	0	54
	18 g, 1/2 Density	092619	<u>44,712</u>	<u>126 (7)</u>	<u>0</u>	<u>4 (2)</u>	<u>0</u>	<u>0</u>	<u>130</u>
	Total		194,893	324 (18)	0	4 (2)	0	0	328

<sup>a</sup> Expansion based on predicted number of CWT fish returning (cohort escapement x proportion with CWT x tag retention rate).

<sup>b</sup> Estimated number of total CWT fish recovered from PSMFC and ODFW databases.

<sup>c</sup> This group had high BKD levels and were direct stream released.

Table 7 continued.

Cohort	Experimental group (target size at release and/or rearing density )	CWT code	Number released	Recovery location					Total
				Imnaha River <sup>a</sup>	Ocean catch <sup>b</sup>	Mainstem rivers <sup>b</sup>	In-basin strays <sup>b</sup>	Out-of-basin strays <sup>b</sup>	
1998	18 g	092821	18,633	183 (26)	0	0	0	0	183
	18 g	092822	18,617	310 (44)	3 (1)	24 (5)	0	3 (2)	340
	18 g	092823	18,618	352 (50)	0	5 (2)	0	0	357
	18 g	092824	18,624	338 (48)	3 (1)	14 (3)	0	4 (3)	359
	18 g	092825	18,600	352 (50)	0	10 (2)	0	4 (1)	366
	18 g	092826	15,245	232 (33)	0	28 (5)	0	1 (1)	261
	30 g	092827	17,590	281 (40)	0	7 (2)	0	1 (1)	289
	30 g	092828	17,585	310 (44)	0	20 (5)	0	3 (2)	333
	30 g	092829	17,581	253(36)	3 (1)	0	0	3 (2)	259
	30 g	092830	18,894	359 (51)	0	6 (1)	0	1 (1)	366
	Total		179,987	2,970 (422)	9 (3)	114 (25)	0	20 (13)	3,113
1999	Production	093056	18,033	76 (11)	0	0	0	0	76
	Production	093057	35,863	83 (12)	0	6 (1)	0	0	89
	Production	093058	35,880	166 (24)	3 (1)	10 (2)	0	0	179
	Production	093059	33,238	125 (18)	0	0	0	0	125
	Total		123,014	450 (65)	3 (1)	16 (3)	0	0	469
Grand Total			497,894	3,744 (505)	12 (4)	134 (30)	0	20 (13)	3,910

Table 8. Catch and escapement distribution of Imnaha River hatchery adult spring Chinook salmon by recovery location in 2002 (CWT recovery data summarized through May 2005 from the PSMFC and ODFW recovery databases).

Location, recovery type	Imnaha River		
	Observed recoveries	Expanded adults	Percent of total
Ocean catch	4	12	0.3
Columbia River			
Ceremonial and subsistence	3	10	0.2
Treaty net	1	3	0.1
Non-treaty net	5	11	0.3
Sport	17	97	2.4
Test fishery	0	0	0.0
Snake River			
Sport <sup>a</sup>	3	12	0.3
Lower Granite Dam <sup>a</sup>	1	1	>0.1
Deschutes River			
Trap	8	8	0.2
Sport	3	6	0.1
Ceremonial and subsistence	0	0	0.0
Other Strays			
Outside Snake River Basin	2	6	0.1
Within Snake River Basin <sup>a</sup>	0	0	0.0
Recruitment to river <sup>a</sup>	1,218 <sup>b</sup>	3,876 <sup>c</sup>	95.9
Total catch/escapement		4,042	
Return to compensation area		3,889	
Percent of compensation goal <sup>d</sup>		121	

<sup>a</sup> Indicates areas defining the compensation area.

<sup>b</sup> Number of hatchery Chinook salmon observed at weir and on spawning ground surveys.

<sup>c</sup> Expansion factor based on estimated total return to Imnaha River of hatchery cohorts.

<sup>d</sup> The compensation goal for Imnaha stock is 3,210 hatchery adults.

Table 9. Expanded adult recoveries by coded-wire tag group of Rapid River spring Chinook salmon for the 2002 return year. Mainstem river recoveries were collected in Columbia/Snake river fisheries en route to Lookingglass Creek. In-basin strays were recovered in other Snake River Basin streams. 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 parenthesis are unexpanded recoveries.

Cohort	Experimental group	CWT code	Number released	Recovery location					Total
				Lookingglass Creek	Ocean catch <sup>a</sup>	Mainstem rivers <sup>a</sup>	In-basin strays <sup>a</sup>	Out-of-basin strays <sup>a</sup>	
1997	Production	070148	56,638	11 (1)	0	2 (1)	1 (1)	0	14
	Production	070749	64,166	0	0	1 (1)	0	0	1
	Production	092620	66,301	0	0	18 (5)	0	0	18
	Production	092621	58,896	10 (1)	0	21 (2)	0	0	31
	Production	092622	66,142	<u>0</u>	<u>0</u>	<u>19 (7)</u>	<u>0</u>	<u>0</u>	<u>19</u>
	Total			21 (2)	0	61 (16)	1 (1)	0	83
1998	Parr release	092819	57,290	43 (4)	0	3 (2)	2 (2)	0	48
1999 <sup>b</sup>	Parr release	093114	24,201	0	0	0	0	0	0
Grand Total			393,634	64 (6)	0	64 (18)	3 (3)	0	131

<sup>a</sup> Estimated number of total CWT fish recovered from PSMFC and ODFW databases.

<sup>b</sup> Four 1999 cohort salmon returned to the weir but no CWT from this cohort were recovered, therefore, expansion of CWT groups biased towards 1997 and 1998 cohorts.

Table 10. Expanded adult recoveries by coded-wire tag group of Lostine River spring Chinook salmon for the 2002 return year. Mainstem river recoveries were collected in Columbia/Snake river fisheries en route to the Lostine River. In-basin strays were recovered in other Snake River Basin streams (not in the migration route). Out-of-basin strays were recovered from streams outside the Snake River Basin or in the upper Columbia River. Numbers in parenthesis are unexpanded recoveries.

Cohort	Experimental group	CWT code	Number released	Recovery location					Total
				Lostine River <sup>a</sup>	Ocean catch <sup>b</sup>	Mainstem rivers <sup>b</sup>	In-basin strays <sup>b</sup>	Out-of-basin strays <sup>b</sup>	
1997	Production	092610	11,871	17 (1)	0	0	1 (1)	0	18
1998	Production	092831	11,438	148 (37)	0	10 (2)	0	0	158
	Production	092832	9,743	96 (24)	0	0	3 (3)	0	99
	Production	092834	7,654	60 (15)	0	6 (1)	0	0	66
	Production	092835	2,783	12 (3)	0	0	0	0	12
	Production	092836	3,010	28 (7)	0	0	0	0	28
	Production	092841	477	12 (3)	0	0	0	0	12
	Total		35,105	356 (89)	0	16 (3)	3 (3)	0	375
1999	Production	093060	3,581	0	0	0	0	0	0
	Production	093061	11,260	0	0	0	0	0	0
	Production	093062	12,932	4 (2)	0	0	0	0	4
	Production	093063	16,307	0	0	0	0	0	0
	Production	093101	15,279	2 (1)	0	0	0	1 (1)	3
	Production	093102	14,360	7 (3)	0	0	0	0	7
	Production	093103	22,565	7 (3)	0	6 (1)	0	0	13
	Production	093104	34,124	4 (2)	0	0	0	0	4
	Production	093105	3,475	0	0	0	0	0	0
	Total		133,883	24 (11)	0	6 (1)	0	1 (1)	31
Grand Total			180,859	397 (101)	0	22 (4)	4 (4)	1 (1)	424

<sup>a</sup> Expansion based on predicted number of CWT fish returning (cohort escapement x proportion with CWT x tag retention rate).

<sup>b</sup> Estimated number of total CWT fish recovered from PSMFC and ODFW databases.

Table 11. Catch and escapement distribution of Grande Ronde Basin hatchery adult spring Chinook salmon by stock and recovery location in 2002 (CWT recovery data summarized through May 2005 from the PSMFC and ODFW databases).

Location, recovery type	Lostine River			Catherine Creek			Grande Ronde River			Rapid River		
	Ob-served	Expanded adults	Percent of total	Ob-served	Expanded adults	Percent of total	Ob-served	Expanded adults	Percent of total	Ob-served	Expanded adults	Percent of total
Ocean catch	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Columbia River												
Ceremonial/subsistence	0	0	0.0	8	37	12.2	0	0	0.0	14	43	32.8
Treaty net	0	0	0.0	0	0	0.0	0	0	0.0	1	5	3.8
Non-treaty net	0	0	0.0	1	3	1.0	0	0	0.0	0	0	0.0
Sport	3	18	4.2	7	36	11.9	0	0	0.0	2	12	9.2
Test fishery	0	0	0.0	1	1	0.3	0	0	0.0	0	0	0.0
Snake River												
Sport <sup>a</sup>	1	4	1.0	0	0	0.0	0	0	0.0	1	4	3.1
Lower Granite Dam <sup>a</sup>	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Deschutes River												
Trap	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Sport	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Ceremonial/subsistence	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Other Strays												
Outside Snake R. Basin	1	1	0.2	0	0	0.0	1	1	25.0	0	0	0.0
Within Snake R. Basin <sup>a</sup>	4	4	0.9	2	2	0.7	0	0	0.0	3	3	2.3
Recruitment to stream <sup>a</sup>	312 <sup>b</sup>	401 <sup>c</sup>	93.7	171 <sup>b</sup>	221 <sup>c</sup>	74.4	3 <sup>b</sup>	3 <sup>c</sup>	75.0	45 <sup>b</sup>	64 <sup>d</sup>	48.9
Total estimated return		428			297			4			131	
Compensation area return		409			223			3			71	

<sup>a</sup> Indicates areas within LRSCP compensation area.

<sup>b</sup> Number of hatchery Chinook salmon observed at weir and on spawning ground surveys.

<sup>c</sup> Expansion factor based on estimated total return to natal stream of hatchery adults. Does not include adjustment for CWT loss.

<sup>d</sup> Expanded return based on mark recapture estimate of hatchery fish in Lookingglass Creek and hatchery fish kept at weir.



Table 12. Expanded adult recoveries by coded-wire tag group of Catherine Creek spring Chinook salmon for the 2002 return year. Mainstem river recoveries were collected in Columbia/Snake river fisheries en route to Catherine Creek. In-basin strays were recovered in other Snake River Basin streams (not in the migration route). Out-of-basin strays were recovered from streams outside the Snake River Basin or in the upper Columbia River. Numbers in parenthesis are unexpanded recoveries.

Cohort	Experimental group	CWT code	Number released	Recovery location					Total
				Catherine Creek <sup>a</sup>	Ocean catch <sup>b</sup>	Mainstem rivers <sup>b</sup>	In-basin strays <sup>b</sup>	Out-of-basin strays <sup>b</sup>	
1998	Production	092820	23,698	91 (26)	0	25 (7)	2 (2)	0	118
	Production	092833	11,261	81 (23)	0	42 (8)	0	0	123
	Production	092837	1,061	10 (3)	0	4 (1)	0	0	14
	Production	092838	1,064	14 (4)	0	0	0	0	14
	Production	092839	563	0	0	6 (1)	0	0	6
	Production	092842	<u>502</u>	<u>4 (1)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>4</u>
	Total		38,149	200 (57)	0	77 (17)	2 (2)	0	279
1999	Production	093110	13,062	8 (1)	0	0	0	0	8
	Production	093113	<u>25,534</u>	<u>8 (1)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>8</u>
	Total		38,596	16 (2)	0	0	0	0	16
Grand Total			76,745	216 (59)	0	77 (17)	2 (2)	0	295

<sup>a</sup> Expansion based on predicted number of CWT fish returning (cohort escapement x proportion with CWT x tag retention rate).

<sup>b</sup> Estimated number of total CWT fish recovered from PSMFC and ODFW databases.

Table 13. Summary of adipose-clipped Chinook salmon carcass recoveries during spawning ground surveys, 2002.

Recovery location	CWT code	Number Recovered	Release site and cohort
<u>Innaha River Basin</u>			
Innaha River	92612	1	Innaha Acclimation Pond (1997 Cohort)
	92615	2	Innaha Acclimation Pond (1997 Cohort)
	92616	3	Innaha Acclimation Pond (1997 Cohort)
	92619	6	Innaha Acclimation Pond (1997 Cohort)
	92821	14	Innaha Acclimation Pond (1998 Cohort)
	92822	24	Innaha Acclimation Pond (1998 Cohort)
	92823	24	Innaha Acclimation Pond (1998 Cohort)
	92824	17	Innaha Acclimation Pond (1998 Cohort)
	92825	26	Innaha Acclimation Pond (1998 Cohort)
	92826	19	Innaha Acclimation Pond (1998 Cohort)
	92827	20	Innaha Acclimation Pond (1998 Cohort)
	92828	27	Innaha Acclimation Pond (1998 Cohort)
	92829	19	Innaha Acclimation Pond (1998 Cohort)
	92830	23	Innaha Acclimation Pond (1998 Cohort)
	92832	1	Lostine River (1998 Cohort)
	93056	3	Innaha Acclimation Pond (1999 Cohort)
	93058	1	Innaha Acclimation Pond (1999 Cohort)
	93059	4	Innaha Acclimation Pond (1999 Cohort)
	93415	1	Innaha Acclimation Pond (2000 Cohort)
	93417	1	Innaha Acclimation Pond (2000 Cohort)
93443	1	Innaha Acclimation Pond (2000 Cohort)	
Lick Creek	92821	1	Innaha Acclimation Pond (1998 Cohort)
	92823	1	Innaha Acclimation Pond (1998 Cohort)
	92824	3	Innaha Acclimation Pond (1998 Cohort)
	92830	1	Innaha Acclimation Pond (1998 Cohort)
<u>Grande Ronde River Basin</u>			
Lookingglass Cr.	70148	1	Lookingglass Fish Hatchery (1997 Cohort)
	92621	1	Lookingglass Fish Hatchery (1997 Cohort)
	92820	2	Catherine Acclimation Pond (1998 Cohort)
	92819	4	Lookingglass Fish Hatchery (1998 Cohort)

Table 13 continued.

Recovery location	CWT code	Number Recovered	Release site and cohort
Lostine River	70749	1	Lookingglass Fish Hatchery (1997 Cohort)
	92819	2	Lookingglass Fish Hatchery (1998 Cohort)
	92831	38	Lostine River (1998 Cohort)
	92832	24	Lostine River (1998 Cohort)
	92834	13	Lostine River (1998 Cohort)
	92835	3	Lostine River (1998 Cohort)
	92836	7	Lostine River (1998 Cohort)
	92841	3	Lostine River (1998 Cohort)
	93062	2	Lostine River (1999 Cohort)
	93101	1	Lostine River (1999 Cohort)
	93102	3	Lostine River (1999 Cohort)
	93103	3	Lostine River (1999 Cohort)
	93104	2	Lostine River (1999 Cohort)
	Catherine Cr.	92820	26
92833		23	Catherine Acclimation Pond (1998 Cohort)
92837		2	Catherine Acclimation Pond (1998 Cohort)
92838		4	Catherine Acclimation Pond (1998 Cohort)
92842		1	Catherine Acclimation Pond (1998 Cohort)
93110		1	Catherine Acclimation Pond (1999 Cohort)
93113		1	Catherine Acclimation Pond (1999 Cohort)
Wallowa River	92832	1	Lostine River (1998 Cohort)
Wenaha River	93415	1	Imnaha Acclimation Pond (2000 Cohort)
	93422	1	Lostine River (2000 Cohort)
Minam River	93438	1	Catherine Acclimation Pond(2000 Cohort)

Table 14. Summary of hatchery- and naturally-produced spring Chinook salmon carcass observed and number of redds discovered by stream during spawning ground surveys, 2002.

Basin, stream	Marked	Unmarked	Unknown Mark	Percent marked	Number of redds
<u>Imnaha River Basin</u>					
Big Sheep Creek	8	9	4	47.1	45
Imnaha River	916	726	37	55.8	1,111
Lick Creek	<u>13</u>	<u>3</u>	<u>0</u>	<u>81.3</u>	<u>33</u>
Totals	937	738	41	55.9	1,189
<u>Grande Ronde River Basin</u>					
Bear Creek	2	5	1	28.6	10
Hurricane Creek	0	4	0	0.0	11
Lostine River	136	93	13	59.4	209
Wallowa River	1	16	1	5.9	71
Grande Ronde River	0	9	0	0.0	14
Catherine Creek	91	52	17	63.6	158
Lookingglass Creek	10	7	3	58.8	18
Minam River	3	109	4	2.7	193
Wenaha River	<u>1</u>	<u>56</u>	<u>8</u>	<u>1.8</u>	<u>211</u>
Totals	244	351	47	41.0	895

Table 15. Age composition and length characteristics of hatchery- and naturally-produced spring Chinook salmon carcasses with known age, sex, and origin recovered during 2002 spawning ground surveys in the Imnaha and Grande Ronde river basins. Only a sub-sample of carcasses observed on the Imnaha River was recovered. Hatchery origin was determined by the presence of CWT. Age was determined by CWT or scale analysis when available, else by age-length key.

Basin, parameter	Hatchery							Natural							
	3		4		5		Total	3		4		5		6	Total
	F	M	F	M	F	M		F	M	F	M	F	M	M	
<b>Imnaha River Basin<sup>b</sup></b>															
Number	2	8	189	105	22	16	342	0	5	78	92	110	64	1	350
Age composition (%)	0.6	2.3	55.3	30.7	6.4	4.7	100	0.0	1.4	22.3	26.3	31.4	18.3	0.3	100
Mean fork length (mm)	625	563	788	785	883	911		-	559	793	777	905	997	1001	
Standard deviation	7.1	39.2	42.5	59.8	46.3	76.5		-	34.7	40.8	52.4	47.2	70.5	-	
<b>Grande Ronde River Basin<sup>a</sup></b>															
Number	0	11	117	62	6	2	198 <sup>c</sup>	2	6	137	54	27	40	-	266
Age composition (%)	0.0	5.5	58.5	31.0	3.0	1.0	100	0.7	2.3	51.5	20.3	10.2	15.0	-	100
Mean fork length (mm)	-	535	726	767	851	830		623	533	741	732	853	869	-	
Standard deviation	-	69.6	42.3	45.3	19.3	28.3		9.9	56.0	39.1	58.5	44.2	56.2	-	

<sup>a</sup> There were an additional two fish collected of unknown sex (one hatchery and one natural).

<sup>b</sup> There were an additional 8 hatchery and three natural fish collected of unknown sex.

<sup>c</sup> An additional two age 2 males were collected.

<sup>d</sup> There was an additional age 6 male collected on the Imnaha River survey.

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