LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Spring Chinook Salmon Evaluation Studies
2003 Annual Progress Report

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

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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 2003. 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 our 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 2003 work statement (Carmichael et al. 2003). We used coded-wire tag (CWT) data collected from 2003 adult returns to evaluate smolt-to-adult survival rates in production and experimental rearing release groups. In 2003, salmon returned from the experimental size at release treatments for Imnaha River 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 and research programs for Chinook salmon in the Imnaha and Grande Ronde 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, 2006d) 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 2001 cohort were released, Chinook salmon from the 1998-2000 cohorts returned to spawn, and adult Chinook salmon that returned to spawn were used to create the 2003 cohort.

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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. In addition, personnel from the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation provided much of the weir data summarized in this report. This project was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, contract number 14-11-03-J050, a cooperative agreement with the Oregon Department of Fish and Wildlife.

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EXECUTIVE SUMMARY

In 2003, we released 268,426 Chinook salmon smolts into the Imnaha River from the 2001 cohort produced from conventional broodstock. We estimated that 96.5% of these smolts were recognizably marked with adipose fin clips (ad clip). 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 141,867 Captive Broodstock smolts and 100,882 Conventional Broodstock smolts from the 2001 cohort into the Lostine River with an estimated 96.7% recognizably marked with ad clips. We released 105,292 Captive Broodstock smolts and 24,392 Conventional Broodstock smolts from the 2001 cohort into Catherine Creek with an estimated 95.3% recognizably marked with ad clips. We released 210,113 Captive Broodstock smolts and 26,923 Conventional Broodstock smolts into the upper Grande Ronde River and estimated 97.2% of these smolts had recognizable ad clip marks.

We trapped 899 hatchery- and 406 naturally-produced Chinook salmon at the Imnaha River weir. We trapped 45 hatchery-produced Chinook salmon at the Lookingglass Creek weir along with 32 naturally-produced Chinook salmon. We captured 225 hatchery- and 238 naturally-produced Chinook salmon on the Lostine River, 305 hatchery- and 254 naturally-produced Chinook salmon on Catherine Creek, and 41 hatchery- and 121 naturally-produced Chinook salmon on the upper Grande Ronde River.

We estimated that 3,856 Imnaha River hatchery Chinook salmon returned to the Lower Snake River Compensation Plan compensation area in 2003, achieving 120% of the adult compensation goal in the Imnaha River Basin. In the Grande Ronde River Basin, we estimated 465 Lostine River, 334 Catherine Creek, and 77 Grande Ronde River hatchery adults returned to the basin. In addition, 31 Rapid River stock and six Catherine Creek stock hatchery spring Chinook salmon that were originally released into Lookingglass Creek returned to the compensation area. Combined, these returns achieved 15.1% of the compensation goal for the Grande Ronde Basin.

In 2003, we observed 838 carcasses and found 754 redds during spawning ground surveys in the Imnaha River Basin. One carcass recovered in the Imnaha River was a hatchery stray from the Lostine River and two were hatchery strays from Catherine Creek. In the Grande Ronde Basin, we observed 548 carcasses and found 794 redds. There were four known hatchery strays recovered in 2003 within the Grande Ronde Basin. We recovered two marked hatchery strays that came from the Lostine River: one stray recovered in the Minam River and one in Lookingglass Creek. We recovered one hatchery stray that came from Catherine Creek in the Lostine River. In addition, one stray that came from the Imnaha River was recovered in Lookingglass Creek.

INTRODUCTION

This report summarizes spring Chinook salmon monitoring data for the Lower Snake River Compensation Plan (LSRCP) facilities in 2003. 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, and smolt-to-adult survival rate, as well as to provide information to adapt the programs to most effectively meet management objectives. This report provides information on rearing and release operations for the 2001 cohort of juvenile Chinook salmon smolts, the collection, spawning, and adult characteristics for the 2003 return of adult Chinook salmon, and the collection of eggs for the 2003 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 2003, spring Chinook salmon from the 2001 cohort produced from Conventional Broodstock were released as smolts into the Imnaha River. In the Grande Ronde River Basin, smolts from the 2001 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, Catherine Creek, and the Grande Ronde River were smolts from the 2001 cohort produced from the Conventional Broodstock Program. Adult Chinook salmon from the 1998-2000 cohorts returned to spawn and were used as broodstock to create the 2003 cohort to be reared at Lookingglass Fish Hatchery (LFH). In 2003, the only experimental group from which salmon returned were size at release treatments from the Imnaha 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 Imnaha and Grande Ronde river basins.

Juveniles

Eyed egg-to-smolt survival rate for the 2001 cohort of Imnaha River Chinook salmon released in 2003 was 58.0% (green egg-to-eyed egg survival rate, 61.0%; eyed egg-to-smolt survival rate, 95.0%). For the Lostine River, green egg-to-smolt survival rates were 67.9% for Captive Broodstock offspring and 72.2% for Conventional Broodstock offspring. Green egg-to-smolt survival rates for Catherine Creek salmon were 54.0% for Captive Broodstock offspring and 58.3% for Conventional Broodstock offspring. For the Grande Ronde River, green egg-to-smolt survival rates were 54.5% for Captive Broodstock offspring and 91.0% for Conventional Broodstock offspring (Table 1).

The release of 268,426 smolts from the 2001 Imnaha River cohort (Table 1) was below the long-term mitigation goal of 490,000 and the specific annual production goal of 360,000 for this cohort. This was the result of broodstock collection strategies that placed a large proportion of trapped hatchery and natural salmon above the weir to spawn naturally, along with and a relatively high number of pre-spawn mortalities at Lookingglass Fish Hatchery compared to previous years.

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. In the Lostine River, the release in 2003 of 141,867 smolts produced from Captive Broodstock and 100,882 smolts produced from Conventional Broodstock (242,749 total) was close to the mitigation goal (Table 1). In Catherine Creek, we released 105,292 smolts produced from Captive Broodstock and 24,392 smolts produced from Conventional Broodstock (129,684 total). In the Grande Ronde River, we released 210,113 smolts produced from Captive Broodstock and 26,923 smolts produced from Conventional Broodstock (237,036 total). In addition, we released 2001 cohort parr from the Captive Broodstock Program in 2002 into Bear Creek (4,660 Lostine River stock), Lookingglass Creek (17,880 Catherine Creek stock), and Sheep Creek (32,800 Grande Ronde River stock).

We attempted to mark 100% of the 2001 cohort smolts released in 2003 with ad clip+CWT. We had good ad clip+CWT mark rates for each stock (Table 2): Imnaha River (95.5%); Lostine River (95.8%); Catherine Creek (94.5%); and Grande Ronde River (96.6%).

The 2001 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 as early as 10 March 2003. Smolts were volitionally released beginning on 1 April 2003 and the remaining smolts were forced out on 15 April 2003.

Lostine River Chinook salmon smolts produced from Captive Broodstock parents were reared in three raceways and smolts produced from Conventional Broodstock were reared in two raceways at LFH. Smolts from both production groups were transported to and released from the Lostine acclimation ponds in two stages: early and late acclimation periods (Table 3). Smolts from the early acclimation were transported to the acclimation ponds on 3 March 2003. Volitional release of smolts began on 17 March 2003 and remaining smolts were forced out on 24 March 2003. Smolts from the late acclimation period were transported to acclimation ponds on 25 March 2003, were volitionally released beginning on 31 March 2003, and the remaining smolts were forced out on 14 April 2003.

Catherine Creek Chinook salmon smolts produced from Captive Broodstock parents were reared in two raceways and smolts produced from Conventional Broodstock were reared in one raceway at LFH. Smolts produced from Captive Broodstock parents were transported to Catherine Creek acclimation ponds on 10 March 2003. These smolts were volitionally released beginning 17 March 2003 and remaining smolts were forced out on 24 March 2003. Smolts produced from Conventional Broodstock parents were transported to the acclimation ponds on 25 March 2003, volitionally released beginning 31 March 2003, and forced out on 14 April 2003.

Grande Ronde River Chinook salmon smolts produced from Captive Broodstock parents were reared in four raceways and smolts produced from Conventional Broodstock were reared in one raceway at LFH. Smolts produced from Captive Broodstock parents were transported to the Grande Ronde River acclimation ponds on 10 March 2003. Smolts were volitionally released beginning 17 March 2003 and remaining smolts were forced out on 24 March 2003. In the late acclimation period, smolts produced from Captive Broodstock and Conventional Broodstock

parents were transported to the acclimation ponds on 25 March 2003, volitionally released beginning 31 March 2003, and forced out on 14 April 2003.

Smolt migration success was monitored based on first-time PIT-tag detections at mainstem dams. Mean detection rates for smolts released in 2003 were: 50.0% for Imnaha River stock; 37.1% for Lostine River stock; 25.2% for Catherine Creek stock; and 33.1% for Grande Ronde River stock. Detection rates for the smolts produced from Captive Broodstock parents were similar to detection rates of Conventional Broodstock produced smolts (Table 3).

Adults

The Imnaha River weir was installed on 7 July 2003, well after the target date of 15 June, due to high river flows. The weir was operated until 10 September 2003 (Table 4). We trapped 899 hatchery- and 406 naturally-produced salmon and 28.6% (304 hatchery; 69 natural) were retained (Table 5). Most were retained for broodstock, but seven (three hatchery and four natural) were weir mortalities. The remaining salmon collected at the weir were either outplanted to Big Sheep and Lick creeks (371 hatchery, one natural) or released above the weir to spawn naturally (224 hatchery, 336 natural). Age structure of salmon captured at the weir was determined from CWT or scale analysis, when available, or from length-at-age relationships. The largest proportion of adults (43.7%) used as broodstock were age 4 (Figure 1). Age structure of hatchery-produced adults collected at the weir was: 41.9% age 3; 30.2% age 4; and 27.9% age 5. This differed from the age structure of naturally-produced adults collected at the weir: 6.7% age 3; 51.2% age 4; and 42.1% age 5 (Table 5). Pre-spawn mortality of combined hatchery and natural Imnaha River Chinook salmon that died at the weir or were held at LFH was 32.7%. Much of the mortality occurred late in the spawning season and was comprised mainly age 3 males (jacks). We spawned 71 hatchery and 26 natural females with 125 hatchery and 24 natural males (Table 5). We collected 497,969 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 12.0%.

The Lostine River weir was installed on 16 May 2003 and operated until 18 September 2003. A total of 225 hatchery- and 238 naturally-produced adult Chinook salmon were captured, with 11.0% (six hatchery, 45 natural) retained (Table 5). Most were retained for broodstock, but two hatchery-origin salmon were weir mortalities. The remaining salmon trapped at the weir were either outplanted (39 hatchery Chinook salmon to Bear Creek) or released above the weir to spawn naturally (180 hatchery, 193 natural). Age 4 adults were the dominant age group returning to the Lostine River weir, comprising 45.8% of the hatchery-produced salmon and 56.7% of the naturally produced salmon collected (Table 5). Age 3 adults comprised 32.4% of hatchery-produced adults and only 4.6% of naturally-produced adults returning to the weir. Age 5 adults comprised 21.8% of hatchery-produced salmon and 38.6% of naturally-produced salmon collected. The age 4 and age 5 hatchery returns were Captive Broodstock progeny from the 1999 and 1998 cohorts, respectively. Age 3 hatchery returns were from both Captive Broodstock and Conventional Broodstock progeny. All adults used as broodstock to create the 2003 cohort were natural origin salmon. Age structure of adults used as conventional broodstock was as follows: 5.1% age 3; 56.4% age 4; and 38.5% age 5. Pre-spawning mortality of broodstock caught at the weir and held at Lookingglass Hatchery was 23.5%. We spawned 21 natural females with 18 natural males and collected 106,646 eggs, which was below the goal of 176,600 green eggs. Egg mortality to shocking was low (4.5%).

The Catherine Creek weir was operated from 5 March to 1 August 2003. Totals of 305 hatchery- and 254 naturally-produced adult Chinook salmon were captured (Table 5). Fifty-three (9.5% of total) naturally-produced adults were retained (51 for broodstock and two weir mortalities). In order to limit the number of hatchery jacks on the spawning grounds, 51 hatchery-origin jacks were kept and provided to the Confederated Tribe of the Umatilla Indian Reservation (CTUIR) for ceremonial/subsistence purposes. Two small age-4 hatchery adults were mistaken for jacks and also provided to CTUIR. The remaining salmon were released above the weir to spawn naturally (252 hatchery, 201 natural). Age structure of hatchery-produced adults collected at the weir was: 22.6% age 3; 59.7% age 4; and 17.7% age 5. This differed from the age structure of naturally-produced adults collected at the weir: 2.4% age 3; 26.4% age 4; and 71.3% age 5 (Table 5). All hatchery returns were progeny of the Captive Broodstock Program. Pre-spawning mortality of broodstock caught at the weir and held at Lookingglass Hatchery was 11.3%. We spawned 28 natural females with 19 natural males and collected 103,916 eggs, which was below the goal of 176,600 green eggs. Egg mortality to shocking was low (12.5%).

The upper Grande Ronde River weir was operated from 19 March to 1 August 2003. A total of 41 hatchery- and 121 naturally-produced adult Chinook salmon were captured with 36.4% (59 natural) retained for broodstock (Table 5). In addition, there were two hatchery-origin salmon weir mortalities. In order to limit the number of hatchery jacks on the spawning grounds, 32 hatchery-origin jacks were kept and provided to the Confederated Tribe of the Umatilla Indian Reservation for ceremonial/subsistence purposes. The remaining salmon were released above the weir to spawn naturally (nine hatchery, 60 natural). All hatchery returns were from Captive Broodstock progeny releases. Age 3 adults comprised the majority of hatchery returns (86.0%) mainly because the size of the 2000 cohort release was two orders of magnitude larger than previous releases. Age structure of naturally produced adults returning to the weir was as follows: 1.7% age 3; 3.4% age 4; and 95.0% age 5. The weak age 4 adult return was the result of poor escapement to spawning grounds in 1999 that produced this cohort. In addition to adults collected at the weir, two hatchery-origin adults of unknown age were collected with seines below the weir and released upstream. Twenty-five naturally produced salmon were also collected below the weir. Thirteen (seven age-5 females and six age-5 males) were released above the weir to spawn naturally and 12 were kept for broodstock (six age-5 females, six age-5 males). Pre-spawning mortality of the fish held at Lookingglass Hatchery was 27.9%. We spawned 23 natural females with 20 natural males and collected 120,703 eggs, which was below the goal of 176,600 green eggs. Egg mortality to shocking was 12.7%.

The Lookingglass Creek weir was operated from 5 March to 2 October 2003. A total of 45 hatchery- and 32 naturally-produced Chinook salmon were collected. As part of the management objective to phase out Rapid River stock in Lookingglass Creek and re-establish stock endemic to the Grande Ronde Basin, all adults collected at the weir were retained for tribal ceremonial/subsistence purposes. No adults 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 2003, we recovered 517 hatchery-reared Imnaha River Chinook salmon with a CWT from the 1998-2000 cohorts. These recoveries were expanded to an estimated 3,781 CWT returns to the Imnaha River with the following age distribution: 1,034 from the 1998 cohort; 1,160 from the 1999 cohort; and 1,587 from the 2000 cohort (Table 7). In addition, an estimated three CWT Imnaha River salmon were recovered in ocean fisheries, 152 were recovered in the Columbia River, and five were recovered as strays outside the Snake River basin. Of the Columbia River recoveries, and estimated 25 were recovered in ceremonial fisheries and 82 were recovered in sport fisheries (Table 8). Of the out-of-basin strays, an estimated three were recovered in the Deschutes River, one was recovered at Sandy Fish Hatchery, Oregon, and one was recovered at Lyons Ferry Fish Hatchery, Washington. A within-basin stray was recovered in Lookingglass Creek.

In 2003, we recovered 28 CWT marked Rapid River Chinook salmon from the 1998-1999 cohorts and two CWT marked Catherine Creek Chinook salmon from the 2000 cohort that had been released into Lookingglass Creek (Table 9). Of the Rapid River Chinook salmon, 27 CWT fish were recovered at the LFH weir or during spawning ground surveys on Lookingglass Creek and one was also recovered from the Deschutes River. The two Catherine Creek hatchery salmon were recovered at the weir. We estimated that a total of 31 Rapid River Chinook salmon and six Catherine Creek Chinook salmon returned to Lookingglass Creek (Table 9)

We recovered 98 hatchery-reared Lostine River Chinook salmon from the 1998-2000 cohorts with a CWT in 2003. These recoveries were expanded to an estimated 441 CWT returns to the Lostine River with the following age distribution: 98 from the 1998 cohort; 205 from the 1999 cohort; and 138 from the 2000 cohort (Table 11). An estimated 65 Lostine River Chinook salmon were recovered in the Columbia/Snake river migration corridor, mostly from sport fisheries (Table 10). One stray was recovered out of the Snake River basin, in the Deschutes River. Thirteen CWT salmon were recovered as in-basin strays, although three recovered in the

Wallowa River Basin may have been the result of outplanting from the Lostine River weir. Two in-basin strays were recovered in Lookingglass Creek.

We recovered 176 hatchery-reared Catherine Creek Chinook salmon with a CWT from the 1998-2000 cohorts. These recoveries were expanded to an estimated 310 CWT returns to Catherine Creek with the following age distribution: 56 from the 1998 cohort; 189 from the 1999 cohort; and 65 from the 2000 cohort (Table 12). An estimated 45 CWT marked Catherine Creek salmon were also recovered in the Columbia River, mostly from sport fisheries (Table 10). Two were recovered out of the Snake River Basin at the Little White Salmon National Fish Hatchery. In addition, 13 CWT Catherine Creek Chinook salmon were recovered as within-basin strays, most (10) from Lookingglass Creek.

We recovered 54 hatchery-reared Grande Ronde Chinook salmon with a CWT from the 1998-2000 cohorts in 2003. These recoveries were expanded to an estimated 66 CWT returns to the Grande Ronde River with the following age distribution: one from the 1998 cohort; six from the 1999 cohort; and 59 from the 2000 cohort (Table 13). An estimated 10 CWT marked Grande Ronde River salmon were also recovered in the Columbia/Snake river migration corridor, all from sport fisheries (Table 10). In addition, three CWT Grande Ronde Chinook salmon were recovered at the Lookingglass Creek weir.

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 escaped to the stream of release was determined using the method described in Monzyk et al. (2006a). 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 2003 return year above Ice Harbor Dam.

The compensation goal for the Imnaha Basin is 3,210 hatchery adults. We estimated that 3,856 Imnaha River hatchery adults returned to the compensation area, 120% of the goal for the Imnaha River stock (Table 8). Of these, an estimated 3,855 returned to the Imnaha River and one was recovered in Lookingglass Creek.

In the Grande Ronde Basin, the compensation goal for all stocks combined was set at 5,820 hatchery adults. We estimated 451 Lostine River, 321 Catherine Creek, and 72 Grande Ronde River adults returned to the basin. In addition, 31 Rapid River and six Catherine Creek hatchery adults that were released from LFH returned to Lookingglass Creek. The combined return to the compensation area was 881 hatchery adults, or 15.1% of the compensation goal. The primary factors causing low hatchery returns in the basin were management strategies that reduced the number of Rapid River salmon released in the basin (1998 and 1999 cohorts) and newly initiated Conventional Broodstock Programs that are yet to reach production goals.

The progeny-to-parent ratio for hatchery- and natural-origin Imnaha River salmon that spawned naturally in 1998 was 3.4, much higher than the mean value since 1982 and well above replacement (Figure 2). This is the third consecutive year that natural productivity has been above replacement, after a twelve year period of being below replacement. The progeny-to-parent ratio for the hatchery component was 30.8, better than naturally spawning salmon and

well above replacement. The progeny-to-parent ratios reported here include jacks. The number of natural salmon that returned to the basin to spawn (1,615) was up slightly from the 2002 return and was 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 2003, we counted 754 redds and observed 838 carcasses in the Imnaha Basin (Table 14). Based on recovered CWTs from marked hatchery salmon on spawning grounds, all were Imnaha stock with the exception of one Lostine River and two Catherine Creek adults (Table 15). Marked salmon comprised 37.4% of the observed carcasses of known origin on the spawning grounds. Age composition of hatchery adults recovered on spawning grounds in the Imnaha River Basin was 16.8% age 3, 14.3% age 4, and 68.9% age 5. Age composition of natural adults was 3.6% age 3, 36.0% age 4, and 60.3% age 5 (Table 16).

In the Grande Ronde Basin, we observed 794 redds and recovered 548 carcasses on the spawning grounds (Table 14). We recovered four marked hatchery strays in the Grande Ronde Basin (Table 15). In Lookingglass Creek, one stray from the 1998 Lostine River cohort and one stray from the 2000 Imnaha River cohort were recovered on spawning grounds. In the Lostine River, one stray from the 1999 Catherine Creek cohort was recovered. No strays were recovered in the Wenaha River, but a stray from the 1999 Lostine River cohort was recovered in the Minam River. Hatchery strays comprised 0.8% 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 9.6% age 3, 65.1% age 4, and 25.3% age 5 and age composition of natural adults was 1.9% age 3, 24.4% age 4, and 73.7% age 5 (Table 16).

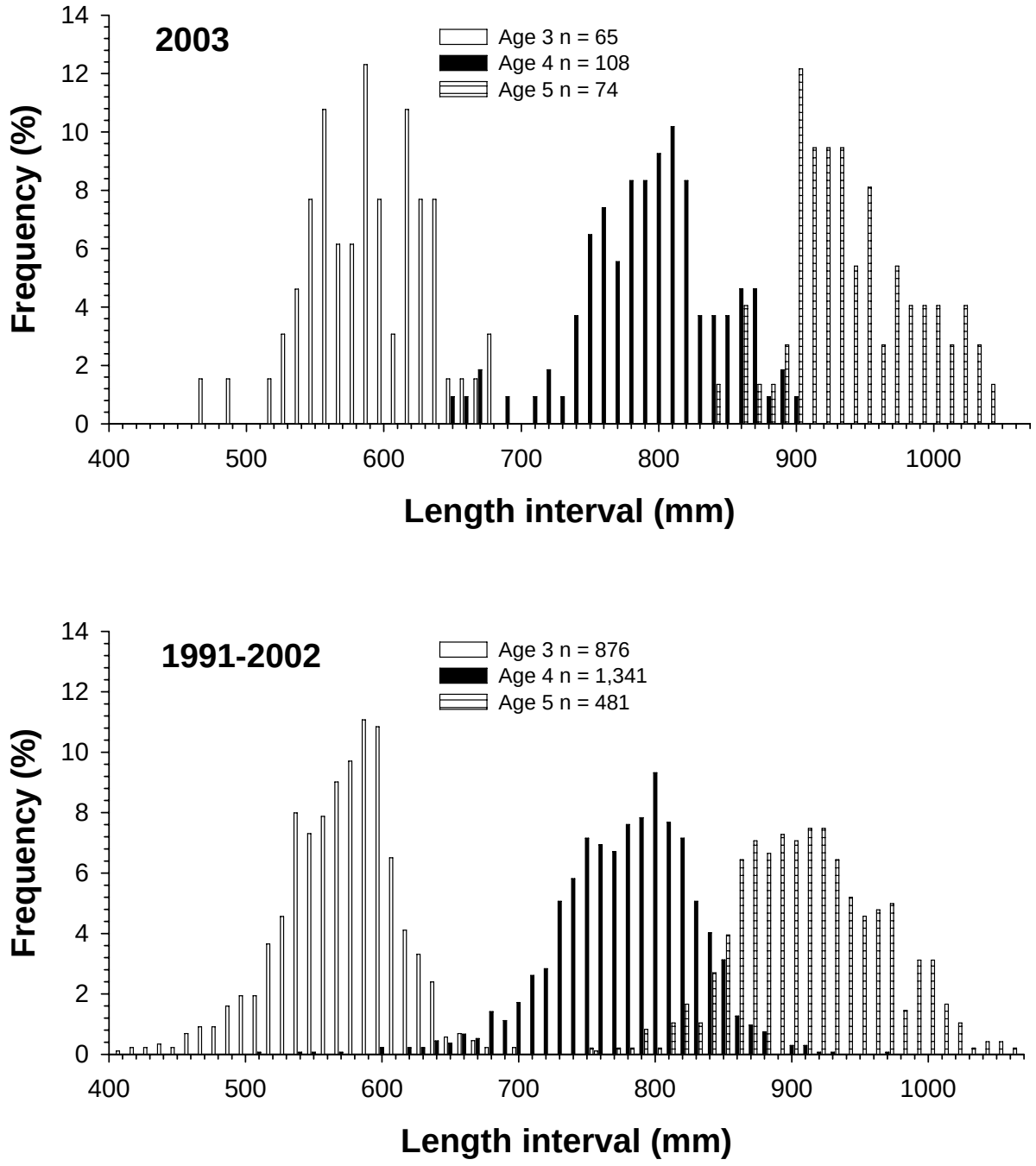

Figure 1. Length frequency-at-age relationship for Imnaha River Chinook salmon adults used as hatchery broodstock in 2003 (top) and from 1991-2002 (below).

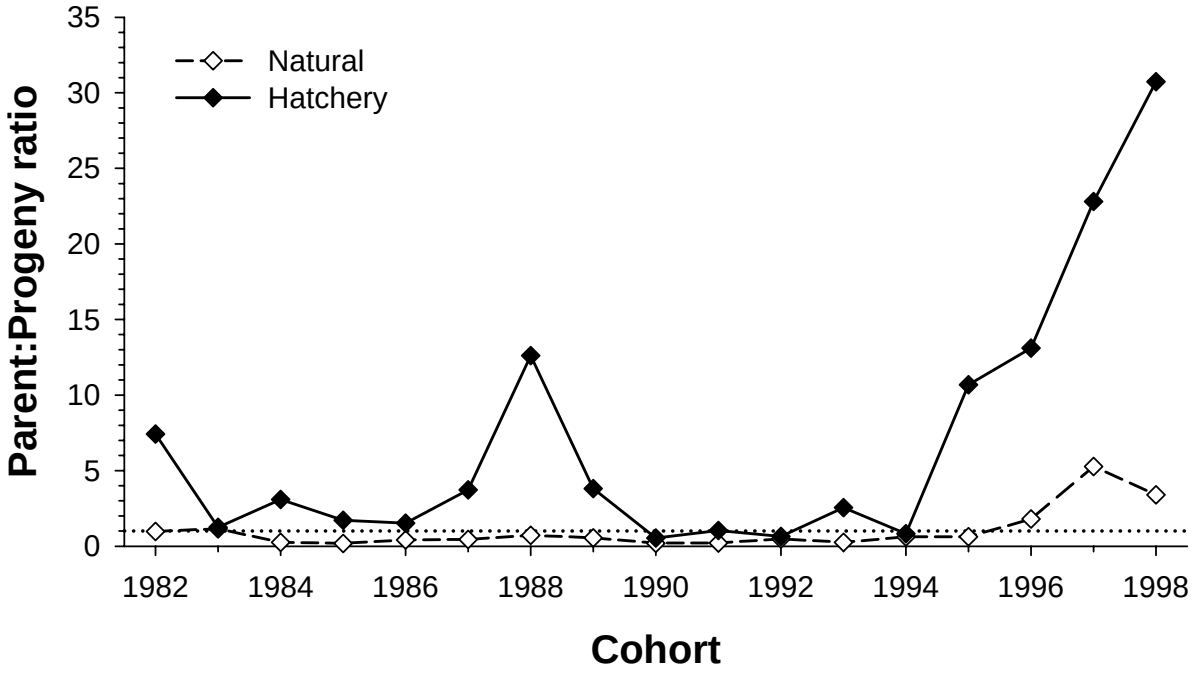

Figure 2. Progeny-to-parent ratios for completed cohorts (1982-1998) of Imnaha River Chinook salmon. Note: dotted line indicates P:P ratio=1.

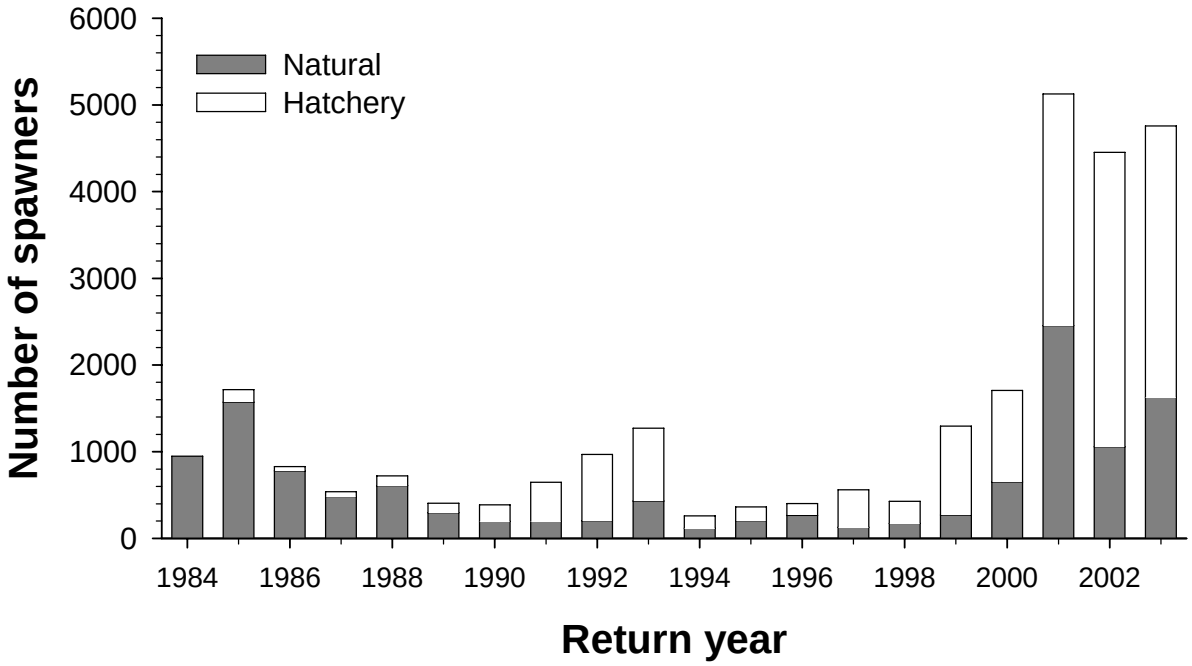

Figure 3. Estimated numbers of natural- and hatchery-origin Chinook salmon that spawned naturally in the Imnaha River, 1984-2003. These estimates include age-3 males.

Table 1. Rearing summaries for the 2001 cohort of juvenile spring Chinook salmon released into the Imnaha and Grande Ronde river basins in 2003.

Cohort, stock	Broodstock	Number of green eggs taken	Eyed eggs [a]	Percent Survival		Total smolts released[b]
				Green -to- eyed	Eyed -to- smolt	
2001 cohort						
Imnaha River	Conventional	462,968	282,541	61.0	95.0	268,426
Lostine River	Captive	266,739	242,360	90.9	74.7	141,867
Lostine River	Conventional	139,768	97,493	69.8	100.0	100,882
Catherine Creek	Captive	227,782	199,990	88.8	60.8	105,292
Catherine Creek	Conventional	41,826	26,426	63.2	92.3	24,392
Grande Ronde River	Captive	434,670	375,347	86.4	63.1	210,113
Grande Ronde River	Conventional	29,580	25,339	85.7	100.0	26,923

[a] *Underestimated number of eyed eggss for Lostine and Grande Ronde River Conventional Program so estimated survival biased.*

[b] *Includes all smolts released (adipose clipped and coded-wire tagged plus unrecognizable marks) but does not include captive broodstock produced parr released in 2002.*

Table 2. Estimates of percent adipose fin clip (Ad) and coded-wire tag retention for 2001 cohort spring Chinook salmon stocks reared at Lookingglass Fish Hatchery and released as smolts in 2003. Targets were 100% AD with CWT.

Stock, CWT code	Raceway	Broodstock	Number checked	Ad clip, with CWT	Ad clip, no CWT	No Ad clip, with CWT	No Ad clip, no CWT
Imnaha River							
093659	14	Conventional	522	94.6	2.7	2.7	0
093660	15	Conventional	511	97.7	0.8	1.6	0
093642	16	Conventional	510	95.1	0.4	4.5	0
093643	17	Conventional	503	94.4	0.8	4.8	0
093644	18	Conventional	513	95.7	0.2	4.1	0
Total/mean			2,559	95.5	1.0	3.5	0
Lostine River							
093536	4	Captive	527	96.4	0.2	3.4	0
093537							
093535	5	Captive	519	93.6	2.1	4.2	0
093538							
093507	6	Captive	505	95.4	1.4	3.2	0
093539	11	Conventional	498	98.2	0.0	1.8	0
093540	12	Conventional	504	95.6	0.4	4.0	0
Total/mean			2,553	95.8	0.9	3.3	0
Catherine Creek							
093541	1	Captive	496	91.9	1.2	6.9	0
093542	2	Captive	501	95.8	0.4	3.6	0.2
093543	3	Conventional	325	96.3	0.6	3.1	0
Total/mean			1,322	94.5	0.8	4.6	0.1
Grande Ronde River							
093544	7	Captive	511	95.9	1.6	2.5	0
093546	8	Captive	502	96.8	0.4	2.8	0
093547							
093649							
093548	9	Captive	528	95.5	0.8	3.8	0
093545	10	Captive	509	97.8	0.2	2.0	0
093549	13	Conventional	510	97.1	0.2	2.7	0
092607							
Total/mean			2,560	96.6	0.6	2.8	0

Table 3. Mean size of 2001 cohort spring Chinook salmon smolts, total number released into the Imnaha River and Grande Ronde River basins, number PIT-tagged and percent detected at Snake and Columbia river dams, 2003. Asterisk denotes Captive Broodstock Program progeny.

Stock, CWT code	Raceway	Release date (2003)	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			
Imnaha River											
093659	14	1-15 APR	127.8	10.6	27.4	8.5	1.34	0.29	54,842	4,192	47.9
093660	15	1-15 APR	129.0	12.4	27.5	8.5	1.30	0.16	54,839	4,156	50.3
093642	16	1-15 APR	128.2	11.5	26.3	8.4	1.35	0.63	54,853	4,186	49.9
093643	17	1-15 APR	134.1	14.1	31.4	6.7	1.28	0.18	54,836	4,188	50.0
093644	18	1-15 APR	132.7	15.2	26.0	11.5	1.11	0.33	49,056	4,182	51.7
Total									268,426	20,904	50.0
Lostine River											
093536*	4	31 MAR-14 APR	121.0	10.6	25.5	7.4	1.53	0.20	54,723	2,664	38.5
093537*											
093535*	5	17-24 MAR	127.4	15.6	28.1	7.4	1.51	0.63	57,986	2,665	34.6
093538*											
093507*	6	31 MAR-14 APR	133.1	16.5	34.1	18.7	1.34	0.18	29,158	2,614	37.8
093539	11	17-24 MAR	126.2	13.6	26.8	8.6	1.31	0.18	51,795	3,985	34.8
093540	12	31 MAR-14 APR	120.4	12.2	21.6	7.6	1.28	0.25	49,087	3,890	39.7
Total									242,749	15,858	37.1

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

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

Table 3 continued.

Stock, CWT code	Raceway	Release date (2003)	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			
Catherine Creek											
093541*	1	17-24 MAR	132.7	19.6	34.9	14.3	1.31	0.16	52,989	6,933	24.8
093542*	2	17-24 MAR	135.8	18.2	36.4	12.9	1.37	0.19	52,303	6,774	26.2
093543	3	31MAR-14 APR	138.6	16.3	36.1	12.5	1.37	0.13	24,392	6,921	24.7
Total									129,684	20,628	25.2
Grande Ronde River											
093544*	7	31 MAR-14 APR	141.1	17.8	35.4	11.1	1.26	0.16	57,750	496	35.7
093546* 093547* 093649*	8	31 MAR-14 APR	131.9	15.4	35.1	10.4	1.37	0.23	42,314	496	36.7
093548*	9	17-24 MAR	138.1	18.4	35.1	10.4	1.29	0.12	52,252	501	27.5
093545*	10	17-24 MAR	133.2	15.9	29.2	9.2	1.30	0.13	57,797	489	28.6
093549 092607	13	31 MAR-14 APR	133.7	13.5	33.0	12.7	1.30	0.15	26,923	498	36.7
Total									237,036	2,480	33.1

Table 4. Recoveries of adult spring Chinook salmon at northeast Oregon LSRCP facilities and Lower Granite Dam, 2003. No salmon were captured in any trap before 7 May or after 23 September.

		Imnaha River		Lostine River		Catherine Creek		Grande Ronde River[a]		Lookingglass Creek	
Period	Week of year	Marked	Un-marked	Marked	Un-marked	Marked	Un-marked	Marked	Un-marked	Marked	Un-marked
Dates of trap operation		7 JUL – 10 SEP		16 MAY –18 SEP		5 MAR – 1 AUG		19 MAR – 1 AUG		5 MAR – 2 OCT	
7-13 MAY	19	-	-	-	-	1	8	0	0	0	0
14-20 MAY	20	-	-	1	1	8	32	0	0	0	0
21-27 MAY	21	-	-	0	0	47	72	0	14	3	1
28 MAY - 3 JUN	22	-	-	0	0	17	10	0	12	11	8
4-10 JUN	23	-	-	0	0	115	77	2	56	5	2
11-17 JUN	24	-	-	0	0	53	28	1	13	1	1
18-24 JUN	25	-	-	0	3	30	13	22	12	7	10
25 JUN – 1 JUL	26	-	-	12	27	14	10	9	5	2	0
2-8 JUL	27	-	-	65	73	7	2	1	0	3	1
9-15 JUL	28	145	69	101	78	12	1	0	6	1	1
16-22 JUL	29	347	197	20	31	0	0	5	1	1	0
23-29 JUL	30	129	40	6	2	1	1	1	2	1	0
30 JUL - 5 AUG	31	50	8	2	0	0	0	0	0	0	0
6-12 AUG	32	0	0	1	0	-	-	-	-	0	0
13-19 AUG	33	50	6	0	0	-	-	-	-	3	0
20-26 AUG	34	93	45	2	0	-	-	-	-	3	2
27 AUG - 2 SEP	35	35	27	10	21	-	-	-	-	4	5
3-9 SEP	36	43	21	0	1	-	-	-	-	0	1
10-16 SEP	37	-	-	4	1	-	-	-	-	0	0
17-23 SEP	38	-	-	1	0	-	-	-	-	0	0
Total		892[b]	413[b]	225	238	305	254	41	121	45	32

[a] *In addition, two marked and 25 unmarked adults were seined below the weir on 25 July 2003.*

[b] *Totals do not agree with Table 5 totals because of erroneous origin designations of kept fish taken at weir .*

Table 5. Number and disposition of adult spring Chinook salmon that returned to northeast Oregon LSRCP facilities in 2003 by origin, age, and sex.

	Hatchery							Natural							
	3		4		5			3		4		5			Grand
Disposition	F	M	F	M	F	M	Total	F	M	F	M	F	M	Total	total
Imnaha River															
Trapped	2	375	114	157	154	97	899	0	27	85	123	97	74	406	1,305
Passed	0	23	37	59	64	41	224	0	27	71	106	78	54	336	560
Outplanted	1	201	33	44	55	37	371	0	0	0	0	0	1	1	372
Kept	1	151	44	54	35	19	304	0	0	14	17	19	19	69	373
Actual spawned	1	65	37	48	33	12	196	0	0	12	11	14	13	50	246
Killed, not spawned	0	3	0	0	0	1	4	0	0	0	0	0	1	1	5
Pre-spawn mortality	0	83	7	6	2	6	104	0	0	2	6	5	5	18	122
Mean length (mm)[a]	680	577	803	782	925	987		-	-	807	773	911	974		
Standard deviation (mm)	-	43.2	38.3	56.7	37.5	56.2		-	-	36.5	59.5	33.0	62.0		
Age composition (%)	0.2	41.7	12.7	17.5	17.1	10.8	100	0.0	6.7	20.9	30.3	23.9	18.2	100	41.7
Lostine River															
Trapped	0	73	50	53	22	27	225	0	11	76	59	46	46	238	463
Passed	0	30	49	53	22	26	180	0	9	61	51	36	36	193	373
Outplanted	0	39	0	0	0	0	39	0	0	0	0	0	0	0	39
Kept	0	4	1	0	0	1	6	0	2	15	8	10	10	45	51
Actual spawned	0	0	0	0	0	0	0	0	2	14	8	7	8	39	39
Killed, not spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-spawn mortality	0	4	1	0	0	1	6	0	0	1	0	3	2	6	12
Mean length (mm)[a]	-	553	-	-	-	-	-		565	804	791	892	990		
Standard deviation (mm)	-	43.4	-	-	-	-	-		33.9	28.8	38.0	27.8	59.1		
Age composition (%)	0.0	32.4	22.2	23.6	9.8	12.0	100	0.0	4.6	31.9	24.8	19.3	19.3	100	32.4

[a] *Mean length per age class determined from known age fish based on either CWT, scale data, or unique VIE mark.*

Table 5 continued.

	Hatchery							Natural							
	3		4		5			3		4		5			Grand
Disposition	F	M	F	M	F	M	Total	F	M	F	M	F	M	Total	total
Lookingglass Creek															
Trapped / Killed	0	13	6	4	12	10	45	0	9	9	6	7	1	32	77
Mean length (mm)[a]	0	502.0	730.0	677.8	885.3	902.6		0	514.3	719.6	744.0	875.0	900.0		
Standard deviation (mm)	0	52.6	24.8	26.7	33.0	56.6		0	46.6	32.2	40.0	38.2	NA		
Age composition (%)	0.0	28.9	13.3	8.9	26.7	22.2	100	0.0	28.1	28.1	18.8	21.9	3.1	100	
Catherine Creek															
Trapped	0	69	111	71	20	34	305	0	6	32	35	97	84	254	559
Passed	0	18	110	70	20	34	252	0	4	27	32	72	66	201	453
Kept	0	51	1	1	0	0	53	0	2	5	3	25	18	53	106
Spawned	0	0	0	0	0	0	0	0	1	4	3	24	15	47	47
Killed not spawned	0	51	1	1	0	0	53	0	0	0	0	0	0	0	53
Pre-spawn mortality	0	0	0	0	0	0	0	0	1	1	0	1	3	6	6
Mean length (mm)[a]	-	481	770	-	843	-		-	598	711	696	863	924		
Standard Deviation (mm)	-	41.6	-	-	-	-		-	-	17.2	46.3	35.8	51.4		
Age composition (%)	0.0	22.6	36.4	23.3	6.6	11.1	100	0.0	2.4	12.6	13.8	38.2	33.1	100	

Table 5 continued.

	Hatchery							Natural							
	3		4		5			3		4		5			Grand
Disposition	F	M	F	M	F	M	Total	F	M	F	M	F	M	Total	total
Grande Ronde River[b]															
Trapped	0	37	2	2	0	0	41	0	2	2	2	61	54	121	162
Passed	0	5	2	2	0	0	9	0	1	1	0	28	30	60	69
Kept	0	32	0	0	0	0	32	0	1	1	2	33	24	61	93
Spawned	0	0	0	0	0	0	0	0	0	0	1	23	19	43	43
Killed not spawned	0	32	0	0	0	0	32	0	0	0	0	0	1	1	33
Pre-spawn mortality	0	0	0	0	0	0	0	0	1	1	1	10	4	17	17
Mean length (mm)[a]	-	500	-	-	-	-		-	605	660	795	856	883		
Standard Deviation (mm)	-	32.6	-	-	-	-		-	-	-	-	28.8	64.1		
Age composition (%)	0.0	86.0	7.0	7.0	0.0	0.0	100	0.0	1.7	1.7	1.7	50.4	44.6	100	

[b] *In addition, two hatchery adults of unknown age (1 F, 1 M) were captured below the weir and passed upstream and 25 natural adults were captured below the weir (13 passed-7 F, 6 M; 12 kept –6 F, 6 M, all age-5). Only one kept adult (male) survived to spawn.*

Table 6. Timing of spawning and spawning summaries for spring Chinook salmon at Lookingglass Fish Hatchery, 2003. Mix=crosses of natural and hatchery parents.

Stock, spawn date	Origin of parents	Number of parents F	Number of parents M[a]	Number of eggs collected	Number of eyed eggs	Percent mortality to shocking
Imnaha River						
12 AUG	Hatchery	1	1	5,486	213	95.1
19 AUG	Mixed	6	7	37,383	28,678	23.2
26 AUG	Mixed	19	37	93,608	88,008	5.8
2 SEP	Mixed	33	51	181,113	165,862	8.2
9 SEP	Mixed	35	53	166,646	141,862	14.7
16 SEP	Mixed	4	4	13,733	13,427	2.1
Total		98	153	497,969	438,050	12.0
Lostine River						
20 AUG	Natural	3	3	15,212	13,602	10.6
27 AUG	Natural	4	4	19,515	18,643	4.4
3 SEP	Natural	7	7	36,229	34,729	3.7
10 SEP	Natural	6	6	29,270	28,466	2.5
16 SEP	Natural	1	2	6,420	6,371	0.7
Total		21	22	106,646	101,811	4.5
Catherine Creek						
14 AUG	Natural	3	3	11,703	3,534	69.6
21 AUG	Natural	12	12	44,995	41,749	6.9
28 AUG	Natural	10	8	35,420	34,177	3.3
4 SEP	Natural	3	3	11,798	11,431	1.9
Total		28	26	103,916	90,891	12.5
Grande Ronde River						
14 AUG	Natural	4	4	21,515	12,284	42.9
21 AUG	Natural	6	6	36,140	32,730	9.3
28 AUG	Natural	7	7	33,201	32,608	1.7
4 SEP	Natural	4	3	21,160	19,312	8.2
11 SEP	Natural	1	2	4,512	4,493	0.4
15 SEP	Natural	1	1	4,175	3,947	5.4
Total		23	23	120,703	105,374	12.7

[a] *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 2003 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 CWT recoveries.

				Recovery location					
Cohort	Experimental group (target size at release)	CWT code	Number released	Imnaha River[a]	Ocean catch[b]	Mainstem rivers[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
1998	18 g	092821	18,633	91 (17)	0	9 (2)	0	1 (1)	101
	18 g	092822	18,617	134 (25)	0	1 (1)	0	0	135
	18 g	092823	18,618	112 (21)	0	8 (2)	0	0	120
	18 g	092824	18,624	161 (30)	0	7 (2)	0	0	168
	18 g	092825	18,600	107 (20)	0	7 (3)	0	0	114
	18 g	092826	15,245	145 (27)	0	10 (3)	0	1 (1)	156
	30 g	092827	17,590	64 (12)	0	3 (1)	0	0	67
	30 g	092828	17,585	75 (14)	0	4 (1)	0	0	79
	30 g	092829	17,581	75 (14)	0	7 (2)	0	0	82
	30 g	092830	18,894	70 (13)	0	5 (2)	0	0	75
	Total		179,987	1,034 (193)	0	61 (19)	0	2 (2)	1,097
1999	Production	093056	18,033	170 (17)	0	7 (2)	0	3 (3)	180
	Production	093057	35,863	310 (31)	0	22 (6)	0	0	332
	Production	093058	35,880	350 (35)	3 (1)	12 (2)	0	0	365
	Production	093059	33,238	330 (33)	0	2 (1)	0	0	332
	Total		123,014	1,160 (116)	3 (1)	43 (11)	0	3 (3)	1,209

[a] *Expansion based on predicted number of CWT fish returning (cohort escapement x proportion with CWT x weighted average tag retention rate).*

[b] *Expanded number of total CWT fish recovered from PSMFC and ODFW databases.*

Table 7 continued.

Cohort	Experimental group (target size at release)	CWT code	Number released	Recovery location: Imnaha River[a]	Ocean catch[b]	Mainstem rivers[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000									
	Production	075851	27,730	171 (18)	0	0	0	0	171
	Production	093413	61,615	304 (32)	0	1 (1)	0	0	305
	Production	093414	61,578	390 (41)	0	20 (1)	0	0	410
	Production	093415	61,511	247 (26)	0	7 (1)	1 (1)	0	255
	Production	093417	61,497	285 (30)	0	20 (1)	0	0	305
	Production	093443	29,806	190 (20)	0	0	0	0	190
	Total		303,737	1,587 (167)	0	48 (4)	1 (1)	0	1,636
	Grand Total		606,738	3,781 (476)	3 (1)	152 (34)	1 (1)	5 (5)	3,942

Table 8. Catch and escapement distribution of Imnaha River hatchery adult spring Chinook salmon by recovery location in 2003 (CWT recovery data summarized through April 2006 from the PSMFC and ODFW recovery databases).

Location, recovery type	Observed recoveries	Expanded adults	Percent of total
Ocean catch	1	3	>0.1
Columbia River			
Ceremonial and subsistence	10	25	0.6
Treaty net	8	36	0.9
Non-treaty net	4	9	0.2
Sport	12	82	2.1
Test fishery	0	0	0.0
Snake River			
Sport[a]	0	0	0.0
Lower Granite Dam[a]	0	0	0.0
Deschutes River			
Trap	3	3	>0.1
Sport	0	0	0.0
Ceremonial and subsistence	0	0	0.0
Other Strays			
Outside Snake River Basin	2	2	>0.1
Within Snake River Basin[a]	1	1	>0.1
Escapement to river[a]	1,095[b]	3,855[c]	96.0
Total catch/escapement		4,016	
Return to compensation area		3,856	
Percent of compensation goal[d]		120	

[a] *Indicates areas defining the compensation area.*
[b] *Number of unique hatchery spring Chinook salmon observations at weir and on spawning ground surveys. Hatchery origin determined by presence of ad clip.*
[c] *Expansion factor is estimated total escapement to Imnaha River of hatchery cohorts.*
[d] *The compensation goal for Imnaha stock is 3,210 hatchery adults.*

Table 9. Expanded adult recoveries by coded-wire tag group for the 2003 return year of Rapid River and Catherine Creek spring Chinook salmon released into Lookingglass Creek. 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 CWT recoveries.

			Recovery location					
Cohort	CWT code	Number released	Lookingglass Creek	Ocean catch[a]	Mainstem rivers[a]	In-basin strays[a]	Out-of-basin strays[a]	Total
1998	092819	57,290	26 (23)	0	0	0	1 (1)	42
1999[b]	093114	24,201	5 (4)	0	0	0	0	7
2000[c]	093434	24,176	6 (2)	0	0	0	0	4
	093437	23,756	0	0	0	0	0	0
Grand Total		129,423	37[d] (29)	0	0	0	1 (1)	35

[a] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*
[b] *1999 cohort were released as parr.*
[c] *The 2000 cohort were Catherine Creek stock released as parr in 2001.*
[d] *Expanded return is sum of hatchery adults kept at weir and recovered during spawning ground surveys minus known hatchery strays.*

Table 10. Catch and escapement distribution of Grande Ronde Basin hatchery adult spring Chinook salmon by stock and recovery location in 2003 from CWT recovery data summarized through April 2006 from the PSMFC and ODFW databases.

	Lostine River			Catherine Creek			Grande Ronde River			Lookingglass Creek		
Location, recovery type	Actual	Expanded adults	Percent of total	Actual	Expanded adults	Percent of total	Actual	Expanded adults	Percent of total	Actual	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						0.0			0.0			0.0
Ceremonial/subsistence	4	13	2.5	3	7	1.8	0	0	0.0	0	0	0.0
Treaty net	2	12	2.3	0	0	0.0	0	0	0.0	0	0	0.0
Non-treaty net	2	4	0.8	0	0	0.0	0	0	0.0	0	0	0.0
Sport	3	34	6.4	8	38	10.0	2	8	9.4	0	0	0.0
Test fishery	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Snake River												
Sport [a]	1	2	0.4	0	0	0.0	1	2	2.4	0	0	0.0
Lower Granite Dam[a]	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	1	1	1.9
Sport	1	1	0.2	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	0	0	0.2	2	2	0.5	0	0	0.0	0	0	0.0
Within Snake R. Basin[a]	13	13	2.3	13	13	3.4	3	3	3.5	0	0	0.0
Escapement to stream[a]	301[b]	451[c]	85.1	310[b]	321[c]	84.3	43[b]	72[c]	84.7	37[b]	37[d]	98.1
Total estimated return		530			381			85			38	
Compensation area return		465			334			77			37	

[a] *Indicates areas within LRSCP compensation area.*

[b] *Number of hatchery spring Chinook salmon observed at weir and on spawning ground surveys.*

[c] *Expansion factor is estimated total escapement to natal stream of hatchery adults. Does not include adjustments for CWT loss or proportion intentionally not tagged.*

[d] *Six of the 37 observed Chinook salmon were age-3 jacks from Catherine Creek stock originally released into Lookingglass Creek.*

Table 11. Expanded adult recoveries by coded-wire tag group of Lostine River spring Chinook salmon for the 2003 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 CWT recoveries.

				Recovery location					
Cohort	Broodstock	CWT code	Number released	Lostine River[a]	Ocean catch[b]	Mainstem rivers[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
1998	Captive	092831	11,438	39 (8)	0	3 (1)	0	0	42
	Captive	092832	9,743	15 (3)	0	0	0	0	15
	Captive	092834	7,654	29 (6)	0	0	1 (1)	0	30
	Captive	092835	2,783	5 (1)	0	0	0	0	5
	Captive	092836	3,010	10 (2)	0	2 (1)	0	0	12
	Captive	092841	477	0	0	0	0	0	0
	Total		35,105	98 (20)	0	5 (2)	1 (1)	0	104
1999	Captive	093060	3,581	10 (2)	0	0	0	0	10
	Captive	093061	11,260	19 (4)	0	3 (1)	0	0	22
	Captive	093062	12,932	14 (3)	0	0	1 (1)	0	15
	Captive	093063	16,307	14 (3)	0	0	0	0	14
	Captive	093101	15,279	24 (5)	0	0	0	0	24
	Captive	093102	14,360	24 (5)	0	0	0	0	24
	Captive	093103	22,565	33 (7)	0	9 (2)	0	0	42
	Captive	093104	34,124	67 (14)	0	15 (4)	3 (3)	1 (1)	86
	Captive	093105	3,475	0	0	13 (2)	0	0	13
	Total		133,883	205 (43)	0	40 (9)	4 (4)	1 (1)	250

[a] *Expansion based on predicted number of CWT fish returning (cohort escapement x proportion with CWT x weighted average tag retention rate).*

[b] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*

Table 11 continued.

Cohort	Broodstock	CWT code	Number released	Recovery location: Lostine River[a]	Ocean catch[b]	Mainstem rivers[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000	Conventional	075852	31,464	108 (7)	0	0	0	0	108
	Captive	093419	2,363	0	0	0	2 (2)	0	2
	Captive	093421	7,800	0	0	0	1 (1)	0	1
	Captive	093422	10,514	0	0	0	1 (1)	0	1
	Captive	093423	13,178	15 (1)	0	20 (1)	0	0	35
	Captive	093425	16,537	15 (1)	0	0	0	0	15
	Captive	093426	20,265	0	0	0	4 (4)	0	4
	Captive	093428	3,815	0	0	0	0	0	0
	Total		105,936	138 (9)	0	20 (1)	8 (8)	0	164
	Grand Total		274,924	441 (72)	0	65 (12)	13 (13)	1 (1)	520

Table 12. Expanded adult recoveries by coded-wire tag group of Catherine Creek spring Chinook salmon for the 2003 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.

				Recovery location					
Cohort	Broodstock	CWT code	Number released	Catherine Creek[a]	Ocean catch[b]	Mainstem rivers[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
1998	Captive	092820	23,698	31 (6)	0	5 (1)	0	0	36
	Captive	092833	11,261	25 (5)	0	5 (1)	0	0	30
	Captive	092837	1,061	0	0	0	0	0	0
	Captive	092838	1,064	0	0	0	0	0	0
	Captive	092839	563	0	0	0	0	0	0
	Captive	092842	502	0	0	0	0	0	0
	Total		38,149	56 (11)	0	10 (2)	0	0	66
1999	Captive	093106	6,068	2 (1)	0	0	0	0	2
	Captive	093107	4,711	11 (5)	0	5 (1)	0	0	16
	Captive	093108	6,916	0	0	0	0	0	0
	Captive	093109	11,471	17 (8)	0	2 (1)	1 (1)	0	20
	Captive	093110	13,062	22 (10)	0	8 (2)	2 (2)	0	32
	Captive	093111	18,985	50 (23)	0	5 (1)	1 (1)	0	56
	Captive	093112	25,498	41 (19)	0	5 (1)	1 (1)	0	47
	Captive	093113	25,534	41 (19)	0	10 (3)	3 (3)	0	54
	Captive	093226	7,936	5 (2)	0	0	0	0	5
	Captive	093227	16,652	0	0	0	0	0	0
	Total		136,833	189 (87)	0	35 (9)	8 (8)	0	232

[a] *Expansion factor is based on estimated total return to Catherine Creek of hatchery cohort adjusted by tag retention rates for tag groups. Includes weir and spawning ground recoveries.*

[b] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*

Table 12 continued.

Cohort	Broodstock	CWT code	Number released	Recovery location: Catherine Creek[a]	Recovery location: Ocean catch[b]	Recovery location: Mainstem rivers[b]	Recovery location: In-basin strays[b]	Recovery location: Out-of-basin strays[b]	Total
2000	Captive	093420	5,553	4 (3)	0	0	0	1 (1)	5
	Captive	093429	3,260	1 (1)	0	0	0	0	1
	Captive	093430	6,560	1 (1)	0	0	0	0	1
	Captive	093431	9,404	6 (5)	0	0	0	0	6
	Captive	093432	10,524	4 (3)	0	0	1 (1)	0	5
	Captive	093433	14,490	4 (3)	0	0	0	0	4
	Captive	093435	46,365	25 (20)	0	0	1 (1)	0	26
	Captive	093436	43,986	14 (11)	0	0	1 (1)	1 (1)	16
	Captive	093438	23,348	6 (5)	0	0	2 (2)	0	8
	Total		163,490	65 (52)	0	0	5 (5)	2 (2)	72
	Grand Total		338,472	310 (150)	0	45 (11)	13 (13)	2 (2)	370

Table 13. Expanded adult recoveries by coded-wire tag group of Grande Ronde River spring Chinook salmon for the 2003 return year. Mainstem river recoveries were collected in Columbia/Snake river fisheries en route to the upper Grande Ronde 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.

				Recovery location					
Cohort	Broodstock	CWT code	Number released	Grande Ronde River[a]	Ocean catch[b]	Mainstem rivers[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
1998	Captive	092840	1,508	1 (1)	0	0	0	0	1
1999[c]	Captive	093115	2,560	6 (0)	0	0	0	0	6
2000	Captive	070149	42,152	22 (13)	0	1 (1)	2 (2)	0	25
	Captive	092611	2,029	2 (1)	0	0	0	0	2
	Captive	093416	24,669	7 (4)	0	0	0	0	7
	Captive	093424	13,214	0	0	0	0	0	0
	Captive	093439	30,376	7 (4)	0	2 (1)	0	0	9
	Captive	093440	31,824	9 (5)	0	7 (1)	1 (1)	0	17
	Captive	093442	20,394	0	0	0	0	0	0
	Captive	093441	4,544	7 (4)	0	0	0	0	7
	Captive	093444	42,200	5 (3)	0	0	0	0	5
	Total		211,402	59 (34)	0	10 (3)	3 (3)	0	72
	Grand Total		215,470	66 (54)	0	10 (3)	3 (3)	0	79

[a] *Expansion factor is based on estimated total return to the Grande Ronde River of hatchery cohort adjusted by tag retention rates for tag groups. Includes weir and spawning ground recoveries.*

[b] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*

[c] *No recoveries reported for CWT code 093115 but an estimated six adults from this cohort returned to the river.*

Table 14. Summary of marked and unmarked spring Chinook salmon carcass recoveries and number of redds discovered by stream during spawning ground surveys, 2003.

Basin, stream	Marked	Unmarked	Unknown Mark	Percent marked	Number of redds
Imnaha River Basin					
Big Sheep Creek	0	3	1	0	16
Imnaha River	286	483	59	37.2	727
Lick Creek	5	1	0	83.3	11
Total	291	487	60	37.4	754
Grande Ronde River Basin					
Bear Creek	0	2	0	0	2
Hurricane Creek	2	6	0	25.0	23
Lostine River	92	71	12	56.4	194
Wallowa River	3	29	3	9.3	59
Grande Ronde River	2	20	5	9.1	29
Catherine Creek	124	61	9	67.0	167
Lookingglass Creek	7	2	2	77.8	10
Minam River	5	67	2	6.9	153
Wenaha River	0	19	2	0	157
Total	235	278	35	45.8	794

Table 15. Summary of adipose-clipped Chinook salmon carcass recoveries during spawning ground surveys, 2003.

Recovery location	CWT code	Number Recovered	Release site and cohort
Imnaha River Basin			
Imnaha River	092821	8	Imnaha Acclimation Pond (1998 cohort)
	092822	13	Imnaha Acclimation Pond (1998 cohort)
	092823	13	Imnaha Acclimation Pond (1998 cohort)
	092824	23	Imnaha Acclimation Pond (1998 cohort)
	092825	15	Imnaha Acclimation Pond (1998 cohort)
	092826	15	Imnaha Acclimation Pond (1998 cohort)
	092827	9	Imnaha Acclimation Pond (1998 cohort)
	092828	9	Imnaha Acclimation Pond (1998 cohort)
	092829	11	Imnaha Acclimation Pond (1998 cohort)
	092830	7	Imnaha Acclimation Pond (1998 cohort)
	093056	5	Imnaha Acclimation Pond (1999 cohort)
	093057	8	Imnaha Acclimation Pond (1999 cohort)
	093058	7	Imnaha Acclimation Pond (1999 cohort)
	093059	4	Imnaha Acclimation Pond (1999 cohort)
	093104	1	Lostine River Acclimation Pond (1999 cohort)
	093110	1	Catherine Acclimation Pond (1999 cohort)
	093113	1	Catherine Acclimation Pond (1999 cohort)
	093413	7	Imnaha Acclimation Pond (2000 cohort)
	093414	7	Imnaha Acclimation Pond (2000 cohort)
	093415	8	Imnaha Acclimation Pond (2000 cohort)
	093417	7	Imnaha Acclimation Pond (2000 cohort)
	093443	2	Imnaha Acclimation Pond (2000 cohort)
Lick Creek	092822	1	Imnaha Acclimation Pond (1998 cohort)
	092824	1	Imnaha Acclimation Pond (1998 cohort)
	092826	1	Imnaha Acclimation Pond (1998 cohort)
	092828	1	Imnaha Acclimation Pond (1998 cohort)
	092830	1	Imnaha Acclimation Pond (1998 cohort)
Grande Ronde River Basin			
Lookingglass Creek	092819	4	Lookingglass Fish Hatchery (1998 cohort)
	092834	1	Lostine River Acclimation Pond (1998 cohort)
	093415	1	Imnaha Acclimation Pond (2000 cohort)

Table 15 continued.

Recovery location	CWT code	Number Recovered	Release site and cohort
Lostine River	075852	6	Lostine River Acclimation Pond (2000 cohort)
	092831	8	Lostine River Acclimation Pond (1998 cohort)
	092832	3	Lostine River Acclimation Pond (1998 cohort)
	092834	6	Lostine River Acclimation Pond (1998 cohort)
	092835	1	Lostine River Acclimation Pond (1998 cohort)
	092836	2	Lostine River Acclimation Pond (1998 cohort)
	093060	2	Lostine River Acclimation Pond (1999 cohort)
	093061	4	Lostine River Acclimation Pond (1999 cohort)
	093062	3	Lostine River Acclimation Pond (1999 cohort)
	093063	3	Lostine River Acclimation Pond (1999 cohort)
	093101	5	Lostine River Acclimation Pond (1999 cohort)
	093102	5	Lostine River Acclimation Pond (1999 cohort)
	093103	7	Lostine River Acclimation Pond (1999 cohort)
	093104	14	Lostine River Acclimation Pond (1999 cohort)
	093113	1	Catherine Acclimation Pond (1999 cohort)
	093423	1	Lostine River Acclimation Pond (2000 cohort)
	093425	1	Lostine River Acclimation Pond (2000 cohort)
Catherine Creek	092820	5	Catherine Acclimation Pond (1998 cohort)
	092833	5	Catherine Acclimation Pond (1998 cohort)
	093106	1	Catherine Acclimation Pond (1999 cohort)
	093107	5	Catherine Acclimation Pond (1999 cohort)
	093109	8	Catherine Acclimation Pond (1999 cohort)
	093110	10	Catherine Acclimation Pond (1999 cohort)
	093111	23	Catherine Acclimation Pond (1999 cohort)
	093112	18	Catherine Acclimation Pond (1999 cohort)
	093113	17	Catherine Acclimation Pond (1999 cohort)
	093226	2	Catherine Acclimation Pond (1999 cohort)
	093431	1	Catherine Acclimation Pond (2000 cohort)
	093435	2	Catherine Acclimation Pond (2000 cohort)
	093436	2	Catherine Acclimation Pond (2000 cohort)
Wallowa River	075852	1[a]	Lostine River Acclimation Pond (2000 cohort)
	093062	1[a]	Lostine River Acclimation Pond (1999 cohort)
Grande Ronde River	070149	1	Grande Ronde River (2000 cohort)
	092840	1	Grande Ronde River (1998 cohort)
Minam River	093104	1	Lostine River Acclimation Pond (1999 cohort)

[a] *Recoveries could be the result of outplants from Lostine River weir.*

Table 16. Age composition and length characteristics of hatchery- and naturally-produced spring Chinook salmon carcasses with known age, sex, and origin recovered during 2003 spawning ground surveys in the Imnaha and Grande Ronde river basins. Hatchery origin was determined by the presence of an adipose fin clip. Age was determined by CWT or scale analysis when available, or else by age-length key.

	Hatchery							Natural						
	3		4		5			3		4		5		
Basin, parameter	F	M	F	M	F	M	Total	F	M	F	M	F	M	Total
Imnaha River Basin														
Number	0	41	17	18	110	58	244	0	13	62	67	139	77	358
Age composition (%)	0.0	16.8	7.0	7.3	45.1	23.8	100.0	0.0	3.6	17.3	18.7	38.8	21.5	100.0
Mean fork length (mm)	-	561	805	797	926	1017		-	545	805	785	928	1008	
Standard deviation	-	49.2	75.2	65.2	42.2	82.1		-	50.7	43.0	54.3	48.5	79.6	
Grande Ronde River Basin														
Number	0	22	87	62	31	27	229	0	5	42	21	107	83	258
Age composition (%)	0.0	9.6	38.0	27.1	13.5	11.8	100.0	0.0	1.9	16.3	8.1	41.5	32.2	100.0
Mean fork length (mm)	-	533	736	789	852	928		-	552	745	741	872	933	
Standard deviation	-	55.0	44.4	57.9	49.0	79.5		-	31.7	42.8	41.6	41.1	63.5	

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