# LOWER SNAKE RIVER COMPENSATION PLAN:
# Oregon Spring Chinook Salmon Evaluation Studies
# 2004 Annual Progress Report

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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 2004. Also included in this report are summaries of data collected at adult broodstock collection facilities operated by the Nez Perce Tribe (Lostine River) and the Confederated Tribes of the Umatilla Indian Reservation (Catherine Creek and upper Grande Ronde River) and funded by the Bonneville Power Administration. 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), through standard sampling techniques, or provided by other agencies. 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, we describe protocols in more detail. Additional descriptions of protocols can be found in the 2004 work statement (Carmichael et al. 2003).

We used coded-wire tag (CWT) data collected from 2004 adult returns to evaluate smolt-to-adult survival rates, harvest, straying, escapement, and specific information on experimental results. 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, 2006e) 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 2002 brood year were released, Chinook salmon from the 1999-2001 brood years returned to spawn, and some of the adult Chinook salmon that returned were spawned to create the 2004 brood year.

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## EXECUTIVE SUMMARY

In 2004, we released 398,185 Chinook salmon smolts into the Imnaha River produced from conventional broodstock during the 2002 brood year. We estimated that 98.8% of these smolts were recognizably marked with adipose fin clips (ad clip). In addition, smolts produced during the 2002 brood year from the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program and Conventional Broodstock Program were released into the Grande Ronde Basin. We released 133,729 Captive Broodstock smolts and 116,370 Conventional Broodstock smolts into the Lostine River with an estimated 99.0% recognizably marked with ad clips. We released 91,797 Captive Broodstock smolts and 70,071 Conventional Broodstock smolts into Catherine Creek with an estimated 96.9% recognizably marked with ad clips. We also released 53,195 Catherine Creek Captive Broodstock smolts into Lookingglass Creek with an estimated 99.2% recognizably marked with ad clips. We released 75,063 Captive Broodstock smolts and 69,856 Conventional Broodstock smolts into the upper Grande Ronde River and estimated 99.6% of these smolts had recognizable ad clip marks.

We trapped 1,003 hatchery- and 246 naturally-produced Chinook salmon at the Imnaha River weir. At the Lookingglass Creek weir, 49 hatchery-produced Chinook salmon were trapped along with 73 naturally-produced Chinook salmon. Totals of 793 hatchery- and 298 naturally-produced Chinook salmon were captured on the Lostine River, 635 hatchery- and 89 naturally-produced Chinook salmon were captured on Catherine Creek, and 433 hatchery- and 33 naturally-produced Chinook salmon were captured on the upper Grande Ronde River.

We estimated that 2,017 Imnaha River hatchery Chinook salmon returned to the Lower Snake River Compensation Plan compensation area in 2004, achieving 63% of the hatchery adult compensation goal in the Imnaha River Basin. In the Grande Ronde River Basin, we estimated 1,073 Lostine River, 656 Catherine Creek, and 659 Grande Ronde River hatchery adults returned to the basin. In addition, three Rapid River stock and 50 Catherine Creek stock hatchery spring Chinook salmon that were originally released into Lookingglass Creek returned to the compensation area. Combined, these returns achieved 41.9% of the compensation goal for the Grande Ronde Basin.

The recruits per spawner ratio for natural-origin (spawned in nature from natural or hatchery parents) Imnaha River salmon in 1999 was 0.817. After three consecutive years of natural productivity levels above replacement, natural productivity for the 1999 brood year was below replacement. The recruits per spawner ratio for the hatchery component was 6.1, better than naturally spawning salmon and well above replacement, but also less than the previous three years.

In 2004, we observed 520 carcasses and found 569 redds during spawning ground surveys in the Imnaha River Basin. Only two strays were recovered in the basin: one from the Lostine River and one from the Rapid River Hatchery in Idaho. In the Grande Ronde Basin, we observed 637 carcasses and found 1,006 redds. There were 10 known hatchery strays recovered in 2004 within the Grande Ronde Basin. All were strays from within the Grande Ronde Basin except for three Imnaha River hatchery Chinook salmon recovered one each in the Lostine River, Catherine Creek, and Wenaha River.

# INTRODUCTION

This report summarizes spring Chinook salmon monitoring data for the Lower Snake River Compensation Plan (LSRCP) facilities in 2004. Also summarized are adult broodstock monitoring data collected in the Grande Ronde Basin by the Nez Perce Tribe (NPT) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The main objectives of this report are to document and evaluate spring Chinook salmon culture performance for 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 2002 brood year of juvenile Chinook salmon smolts, the collection, spawning, and adult characteristics for the 2004 return of adult Chinook salmon, and the collection of eggs for the 2004 brood year.

## 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 to broodstock collection facilities in the Imnaha River, Lostine River, Catherine Creek, upper Grande Ronde River, and Lookingglass Creek.
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 2004, spring Chinook salmon from the 2002 brood year produced from Conventional Broodstock were released as smolts into the Imnaha River. In the Grande Ronde River Basin, smolts from the 2002 brood year 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 2002 brood year produced from the Conventional Broodstock Program. Adult Chinook salmon from the 1999-2001 brood years returned to spawn and were used as broodstock to create the 2004 brood year to be reared at Lookingglass Fish Hatchery (LFH). Coded-wire-tag recoveries from adult hatchery returns were used to assess the success of achieving mitigation goals and management objectives. 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 rate for the 2002 brood year of Imnaha River Chinook salmon released in 2004 was 87.4% (green egg-to-eyed egg survival rate, 88.1%; eyed-to-smolt survival rate, 99.2%). For the Lostine River, green egg-to-smolt survival rates were 50.5% for Captive Broodstock offspring and 88.9% for Conventional Broodstock offspring. Green egg-to-smolt survival rates for Catherine Creek salmon were 61.9% for Captive Broodstock offspring and 85.6% for Conventional Broodstock offspring. For the Grande Ronde River, green egg-to-smolt survival rates were 71.6% for Captive Broodstock offspring and 78.3% for Conventional Broodstock offspring (Table 1).

The release of 398,185 smolts from the 2002 Imnaha River brood year was below the long-term mitigation goal of 490,000 but above the specific annual production goal of 360,000

for this brood year. The recently modified long-term mitigation goal for the Grande Ronde River Basin was set at 250,000 smolts per year for each of the Lostine, Catherine Creek, and upper Grande Ronde populations and 150,000 smolts for Lookingglass Creek. In the Lostine River, the 2004 release of 133,729 smolts produced from Captive Broodstock and 116,370 smolts produced from Conventional Broodstock (250,099 total) was at the mitigation goal (Table 1). In Catherine Creek, we released 91,797 smolts produced from Captive Broodstock and 70,071 smolts produced from Conventional Broodstock (161,868 total). We also released 53,195 smolts produced from the Catherine Creek Captive Broodstock Program into Lookingglass Creek. In the Grande Ronde River, we released 75,063 smolts produced from Captive Broodstock and 69,856 smolts produced from Conventional Broodstock (144,919 total).

We marked only a portion of the Imnaha River 2002 brood year smolts released in 2004 with ad clip+CWT. The remainder of the 2002 Imnaha River brood year smolts received only ad clips. We attempted to mark all 2002 brood year smolts destined for release in the Grande Ronde Basin with ad clip+CWT with the exception of Grande Ronde River smolts produced from Conventional Broodstock that received CWT but no ad clips. We did not have enough CWTs to tag 100% of the Lostine River smolts so some received ad clips only (Table 2). We had good ad clip+CWT mark retention rates for each stock (Table 2): Imnaha River (97.3%); Lostine River (98.8%); Catherine Creek (95.4%); Grande Ronde River (96.3%), and Lookingglass Creek (98.8%). We also had good retention rates (99.6%) for the Grande Ronde River Conventional Broodstock produced smolts that received only CWTs.

The 2002 brood year of Imnaha River Chinook salmon was reared in six raceways at LFH. All Imnaha River Chinook salmon smolts were acclimated at the Imnaha Acclimation Facility starting as early as 8 March 2004. Smolts were volitionally released beginning on 26 March 2004 and the remaining smolts were forced out on 15 April 2004.

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 1 March 2004. Volitional release of smolts began on 12 March 2004 and remaining smolts were forced out on 21 March 2004. Smolts from the late acclimation period were transported to acclimation ponds on 22 March 2004, were volitionally released beginning on 29 March 2004, and remaining smolts were forced out on 14 April 2004.

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. Smolts produced from Captive Broodstock parents were transported to Catherine Creek acclimation ponds on 8 March 2004. These smolts were volitionally released beginning 15 March 2004 and remaining smolts were forced out on 22 March 2004. Smolts produced from Conventional Broodstock parents were transported to the acclimation ponds on 23 March 2004, volitionally released beginning 1 April 2004, and forced out on 12 April 2004.

Grande Ronde River Chinook salmon smolts produced from Captive Broodstock parents were reared in two raceways and smolts produced from Conventional Broodstock were reared in one raceway. Smolts produced from Captive Broodstock parents were transported to the Grande Ronde River acclimation ponds on 9 March 2004. Smolts were volitionally released beginning 15 March 2004 and remaining smolts were forced out on 22 March 2004. In the late acclimation period, smolts produced from Conventional Broodstock parents were transported to the

acclimation ponds on 24 March 2004, volitionally released beginning 1 April 2004, and forced out on 12 April 2004.

Lookingglass Creek Chinook salmon smolts produced from Catherine Creek Captive Broodstock parents were reared in one raceway at LFH. Smolts were volitionally released from the raceway beginning 19 March 2004 and the remaining smolts were forced out on 8 April 2004.

Smolt migration success was monitored based on first-time PIT-tag detections at mainstem dams. Mean detection rates for smolts released in 2004 were: 56.6% for Imnaha River stock; 45.8% for Lostine River stock; 23.7% for Catherine Creek stock; and 30.2% for Grande Ronde River stock. In general, smolts released during early acclimation periods were detected at lower rates than smolts released during late acclimation periods. In the Lostine River, detection rates were similar for Captive Broodstock and Conventional Broodstock produced smolts within an acclimation period (Table 3).

## Adults

The Imnaha River weir was installed on the target date of 15 June 2004 and operated until 17 September 2004 (Table 4). We trapped 1,007 hatchery- and 242 naturally-produced salmon and 44.5% (484 hatchery; 72 natural) were retained (Table 5). Most were retained for broodstock or to limit the number of hatchery jacks (age 3 males) on the spawning grounds, but 24 (18 hatchery and six natural) were weir mortalities. The remaining salmon collected at the weir were either outplanted to Big Sheep and Lick creeks (332 hatchery), returned below the weir (25 hatchery), or released above the weir (166 hatchery, 169 natural) to spawn naturally. Age structure of salmon captured at the weir was determined from CWT or scale analysis, when available, or from length-at-age relationships. The majority of adults (75.5%) used as broodstock were age 4 (Figure 1). Age structure of hatchery-produced adults collected at the weir was: 35.2% age 3; 60.9% age 4; and 4.0% age 5. This differed from the age structure of naturally-produced adults collected at the weir: 6.2% age 3; 77.2% age 4; and 16.6% age 5 (Table 5). Pre-spawn mortality of combined hatchery and natural Imnaha River Chinook salmon retained at LFH was 9.0%. We spawned 78 hatchery and 23 natural females with 74 hatchery and 32 natural males (Table 5). We collected 488,475 eggs, which was below our goal of 576,500 green eggs (Table 6), they were incubated at LFH and mortality to shocking was 7.2%.

The Lostine River weir was installed by personnel from the Nez Perce Tribe on 10 May 2004 and operated until 30 September 2004 (Table 4). A total of 793 hatchery- and 298 naturally-produced adult Chinook salmon were captured, with 9.8% (62 hatchery, 45 natural) retained for broodstock (Table 5). The remaining salmon trapped at the weir were either outplanted to Bear Creek (447 hatchery), returned below the weir (17 hatchery, two natural), or released above the weir ( 267 hatchery, 251 natural) to spawn naturally. Age 4 adults were the dominant age group returning to the Lostine River weir, comprising 72.6% of the hatchery-produced salmon and 87.2% of the naturally produced salmon collected (Table 5). Age 3 adults comprised 24.7% of hatchery-produced adults and only 5.7% of naturally-produced adults returning to the weir. Age 5 adults comprised 2.6% of hatchery-produced salmon and 7.1% of naturally-produced salmon collected. The age 3 and age 4 hatchery returns were Captive Broodstock and Conventional Broodstock progeny. Age 5 hatchery returns were Captive Broodstock progeny from the 1999 brood year. Adults used as broodstock in the 2004 brood year were both natural origin and Conventional Broodstock progeny. Age structure of adults

kept for conventional broodstock was as follows: 2.8% age 3; 91.6% age 4; and 5.6% age 5. Pre-spawning mortality of broodstock caught at the weir and held at Lookingglass Hatchery was 9.3%. We spawned 30 hatchery and 22 natural females with 24 hatchery and 18 natural males and collected 221,888 eggs, which was above the goal of 188,400 green eggs (Table 6). Egg mortality to shocking was low (5.0%).

The Catherine Creek weir was operated by personnel from the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) from 1 March to 18 August 2004. Totals of 635 hatchery- and 89 naturally-produced adult Chinook salmon were captured with 34.5% (231 hatchery and 19 natural) retained (Table 5). Most were retained for broodstock or to limit the number of hatchery jacks (age 3 males) on the spawning grounds, but five (three hatchery, two natural) were weir mortalities. The remaining salmon collected at the weir were either outplanted to Lookingglass Creek (226 hatchery) and Indian Creek (48 hatchery) or released above the weir (130 hatchery, 70 natural) to spawn naturally. Age structure of hatchery-produced adults collected at the weir was: 9.4% age 3; 87.5% age 4; and 3.0% age 5. Age structure of naturally-produced adults collected at the weir was: 5.6% age 3; 84.2% age 4; and 10.1% age 5 (Table 5). All age 4 and age 5 hatchery returns were progeny of the Captive Broodstock Program. Age 3 hatchery returns were both Captive Broodstock and Conventional Broodstock progeny. Broodstock used to create the Catherine Creek 2004 brood year were all natural-origin adults. The hatchery-origin adults retained for broodstock were used to create the Lookingglass Creek 2004 brood year. Pre-spawning mortality of broodstock caught at the weir and held at Lookingglass Hatchery was 2.0%. We spawned nine natural females with seven natural males and collected 26,204 eggs (Table 6). Egg mortality to shocking was low (6.5%).

The upper Grande Ronde River weir was operated by CTUIR personnel from 1 March to 1 August 2004. A total of 433 hatchery- and 33 naturally-produced adult Chinook salmon were captured with 10.5% (33 hatchery and 16 natural) retained (Table 5). Hatchery-produced adults were retained to limit the number of hatchery jacks on the spawning grounds (29) or because of weir mortalities (4). One of the hatchery jacks was used as broodstock. All naturally-produced adults retained were used as broodstock. The remaining salmon caught at the weir were released above the weir to spawn naturally (400 hatchery, 17 natural). All age 4 and age 5 hatchery returns were progeny of the Captive Broodstock Program while age 3 hatchery returns were both Captive Broodstock and Conventional Broodstock progeny. Overall age structure of hatchery returns to the weir was 13.6% age 3; 85.5% age 4; and 0.9% age 5. Age structure of naturally produced adults returning to the weir was as follows: 12.1% age 3; 87.9% age 4; and 0% age 5. The weak age 5 adult return was the result of poor escapement to spawning grounds in 1999 that produced this brood year. Pre-spawning mortality of the fish collected at the weir and held at Lookingglass Hatchery was 12.2%. We spawned 7 natural females with 7 natural males and collected 20,858 eggs (Table 6). Egg mortality to shocking was 8.5%.

The Lookingglass Creek weir was operated by CTUIR personnel from 2 March to 8 October 2004. A total of 73 naturally-produced Chinook salmon (likely offspring of Rapid River adults that spawned naturally) were collected at the weir and retained for tribal ceremonial/subsistence purposes 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. A total of 49 hatchery adults from parr and smolt releases in Lookingglass Creek were captured and retained for broodstock. In addition, numerous Catherine Creek hatchery-produced adults outplanted below the weir were captured and returned below the weir to spawn, with the exception of 18 retained for broodstock. In all, 112 hatchery adults produced from the Captive

Broodstock Program were used as broodstock for the 2004 brood year and originated from either Catherine or Lookingglass creek smolt releases. In addition, 140 hatchery adults initially held for broodstock were eventually released back into Lookingglass Creek to spawn naturally (100 above and 40 below the weir).

## Coded-Wire Tag Recoveries

We used coded-wire tag recoveries from adult returns, strays, and fisheries collections from each stock of Chinook salmon to evaluate hatchery treatments and assess the success of achieving mitigation goals and management objectives. Hatchery fish from 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 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 from the RMIS database. Expanded numbers in the RMIS database provided 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. Therefore, we expanded observed CWT recoveries from each brood year of returning hatchery adults (from weir collections and spawning ground recoveries) 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 brood year (see Monzyk et al. 2006a). For each stream and brood year, the estimated total number of coded-wire tagged returns was determined by multiplying the hatchery escapement estimate by the proportion of the brood year tagged at release and the weighted average tag retention rate for each brood year. The estimated total number of CWT returns was partitioned into each CWT code group by multiplying the total number of CWT returns by the relative proportion of each CWT code within a brood year to give the expanded number of CWT returns for each tag group. The exception to this method was when we did not have any CWT recoveries for a particular brood year but weir data indicated that adults from that brood year returned. In these cases, we estimated total number of coded-wire tagged returns as described above. If the returning adults from the brood year were potentially comprised of more than one tag group, we partitioned the estimated CWT returns into individual code groups based on the relative proportion of tag group recoveries from the previous year's return.

In 2004, a total of 451 hatchery-reared Imnaha River Chinook salmon with a CWT from the 1999-2001 brood years were recovered. Nearly all of these CWT recoveries occurred in the Snake River Basin. Recoveries were expanded to an estimated 1,994 CWT returns to the Imnaha River with the following age distribution: 75 from the 1999 brood year (3.8% age 5); 1,179 from the 2000 brood year (59.1% age 4); and 740 from the 2001 brood year (37.1% age 3) (Table 7). In addition, an estimated 10 CWT Imnaha River salmon were recovered in ocean fisheries, 169 were recovered in the Columbia River, 11 were recovered as strays outside the Snake River Basin, and four were recovered as in-basin strays. Of the Columbia River recoveries, an estimated 101 were recovered in treaty net fisheries and 63 were recovered in sport fisheries (Table 8). Of the out-of-basin strays, an estimated five were recovered in the Deschutes River, one was recovered at the Bonneville Hatchery, one was recovered in the John Day River, and an

estimated 4 were recovered in the Twisp River, WA. Of the in-basin strays, two were recovered in Catherine Creek, one in the Lostine River, and one in the Wenaha River.

Returning to Lookingglass Creek in 2004 were Rapid River hatchery Chinook salmon from 1999 brood year and Catherine Creek hatchery Chinook salmon from the 2000 and 2001 brood years that were originally released in Lookingglass Creek. An estimated three CWT marked Rapid River Chinook salmon from the 1999 brood year returned to Lookingglass Creek (Table 9). An estimated 35 CWT marked Catherine Creek Chinook salmon from the 2000 brood year and seven CWT marked Catherine Creek Chinook salmon from the 2001 brood year returned to Lookingglass Creek (Table 9). In addition, an estimated two Catherine Creek Chinook salmon released in Lookingglass Creek were recovered in the Columbia River and four strayed into Catherine Creek. (Table 10). We also had one 1998 Rapid River brood year recovery in the Salmon River, OR.

We recovered 176 hatchery-reared Lostine River Chinook salmon from the 1999-2001 brood years with a CWT in 2004. Recoveries were expanded to an estimated 1,019 CWT returns to the Lostine River with the following age distribution: 29 from the 1999 brood year (2.8% age 5); 727 from the 2000 brood year (71.3% age 4); and 263 from the 2001 brood year (25.8% age 3) (Table 11). An estimated seven Lostine River Chinook salmon were recovered in ocean fisheries and 90 in the Columbia River migration corridor (Table 10). One stray was recovered out of the Snake River basin, in the John Day River. A total of 17 CWT salmon were recovered as in-basin strays, although 12 of these recovered in the Wallowa River may have been the result of outplanting from the Lostine River weir. The remaining five in-basin strays were recovered in Catherine Creek, Lookingglass Creek, Imnaha River, Minam River, and South Fork Salmon River.

We recovered 272 hatchery-reared Catherine Creek Chinook salmon with a CWT from the 1999-2001 brood years. Recoveries were expanded to an estimated 593 CWT returns to Catherine Creek with the following age distribution: 19 from the 1999 brood year (3.2% age 5); 514 from the 2000 brood year (86.7% age 4); and 60 from the 2001 brood year (10.1% age 3) (Table 12). An estimated 158 CWT marked Catherine Creek salmon were also recovered in the Columbia and Snake rivers, mostly from sport fisheries (Table 10). Four were recovered out of the Snake River Basin: two in the Deschutes River; one at the Clackamas Hatchery; and one in Desolation Creek (John Day Basin). There were two in-basin strays recovered in the Imnaha River.

We recovered 229 hatchery-reared Grande Ronde Chinook salmon with a CWT from the 1999-2001 brood years in 2004. Recoveries were expanded to an estimated 580 CWT returns to the Grande Ronde River with the following age distribution: six from the 1999 brood year (1.0% age 5); 488 from the 2000 brood year (84.1% age 4); and 86 from the 2001 brood year (14.8% age 3) (Table 13). An estimated five CWT marked Grande Ronde River salmon were recovered in ocean fisheries and 161 were recovered in the Columbia/Snake river migration corridor, mostly from sport fisheries (Table 10). There were 14 out-of-basin strays recovered: seven in the Deschutes River and seven in the John Day River Basin. Nine in-basin strays were recovered: four in Catherine Creek and five in Lookingglass Creek.

## 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 expanded 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 2004 return year above Ice Harbor Dam.

The compensation goal for the Imnaha Basin is 3,210 hatchery adults. We estimated that 2,025 Imnaha River hatchery adults returned to the compensation area, 63.1% of the goal for the Imnaha River stock (Table 8). Of these, an estimated 2,021 returned to the Imnaha River.

In the Grande Ronde Basin, the compensation goal for all stocks combined was set at 5,820 hatchery adults. We estimated that 1,073 Lostine River, 656 Catherine Creek, 659 Grande Ronde River, and 53 Lookingglass Creek adults returned to the basin. The combined return to the compensation area was 881 hatchery adults, or 41.9% 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 (1999 brood year) 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 1999 was 0.817, much lower than the previous three years and below the mean value since 1982 (Figure 2). After three consecutive years of natural productivity levels above replacement, this year productivity is once again below replacement. The progeny-to-parent ratio for the hatchery component was 6.1, better than naturally spawning salmon and well above replacement, but also less than the previous three years. The progeny-to-parent ratios reported here include jacks. The number of natural salmon that returned to the basin to spawn (380) was down considerably from the previous four years (Figure 3).

## Natural Escapement Monitoring

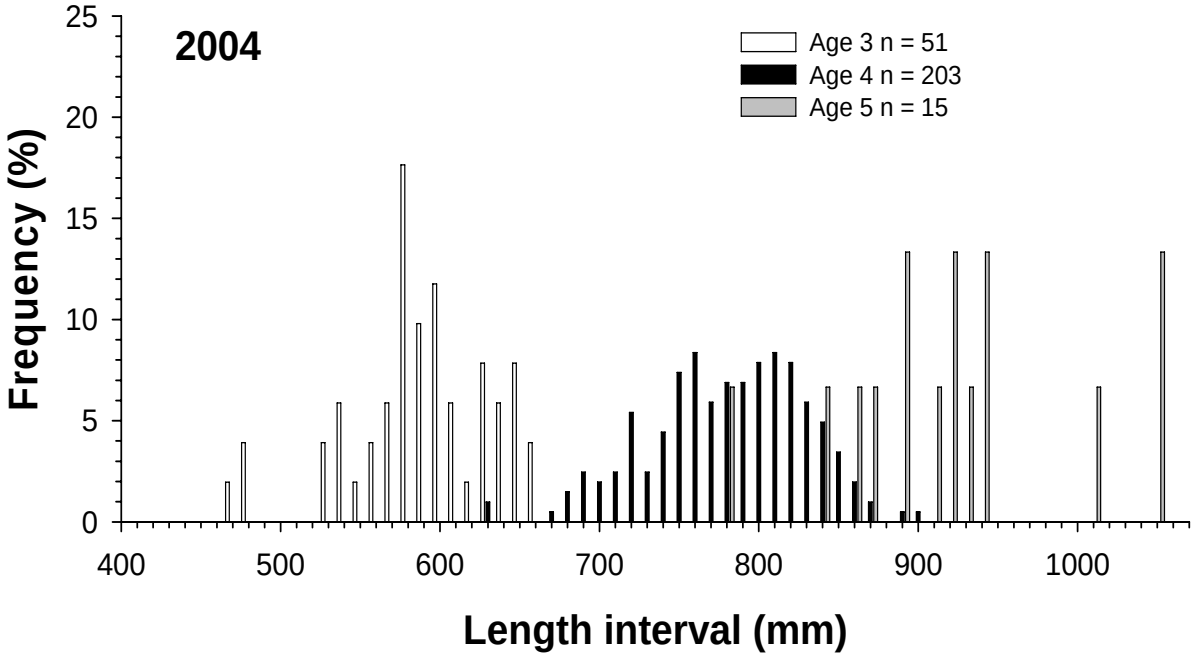
Stream surveys to enumerate Chinook salmon redds and to sample salmon carcasses were conducted as in previous years (see Monzyk et al. 2006a). We surveyed three streams in the Imnaha River Basin and nine in the Grande Ronde Basin. In 2004, we counted 569 redds and observed 520 carcasses in the Imnaha 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 adult and one adult originally released from Rapid River Hatchery, ID (Table 15). Marked salmon comprised 60.7% 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 0.3% age 3, 77.3% age 4, and 18.6% age 5. Age composition of natural adults was 3.3% age 3, 62.3% age 4, and 34.5% age 5 (Table 16).

In the Grande Ronde Basin, we observed 1,006 redds and recovered 637 carcasses on the spawning grounds (Table 14). We recovered 10 marked hatchery strays in the Grande Ronde Basin (Table 15). All were strays within the Grande Ronde Basin except for three Imnaha River hatchery Chinook salmon recovered one each in the Lostine River, Catherine Creek, and the

Wenaha River. Marked salmon comprised 64.4% of the observed carcasses of known origin. Age composition of hatchery adults recovered on spawning grounds in the Grande Ronde Basin was 9.2% age 3, 86.9% age 4, and 3.9% age 5 and age composition of natural adults was 3.3% age 3, 82.0% age 4, and 14.7% age 5 (Table 16).

## Acknowledgments

Bob Lund, Lookingglass Hatchery Manager, and many other hatchery personnel exhibited great dedication and provided essential assistance. Numerous personnel from ODFW, 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-J051, a cooperative agreement with the Oregon Department of Fish and Wildlife.



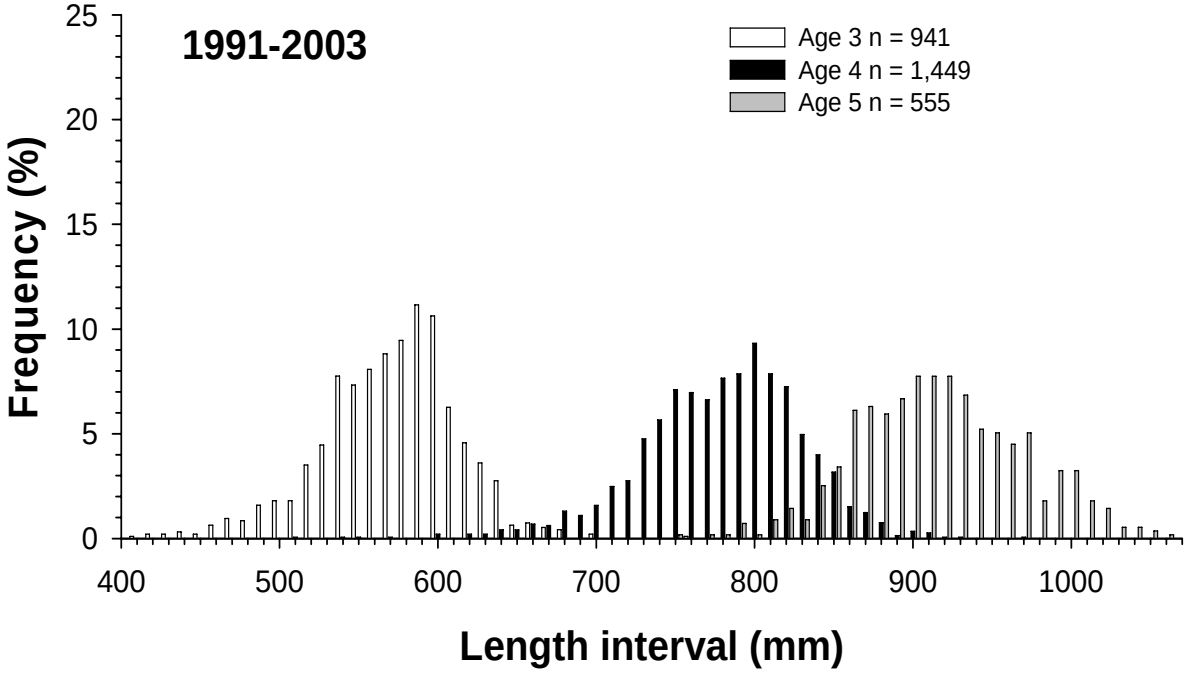




Figure 1. Length frequency-at-age relationship for Imnaha River Chinook salmon adults used as hatchery broodstock in 2004 (top) and from 1991-2003 (below).

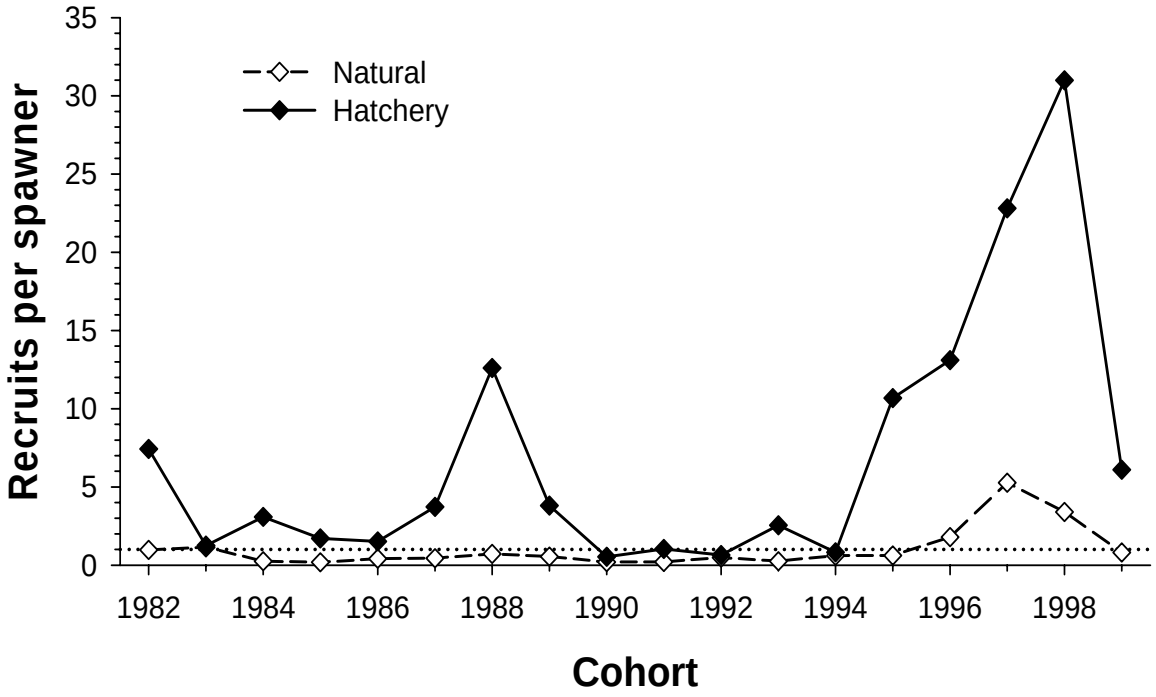



Figure 2. Recruits per spawner ratios for completed brood years (1982-1999) of Imnaha River Chinook salmon. Note: dotted line indicates recruits:spawner ratio=1.

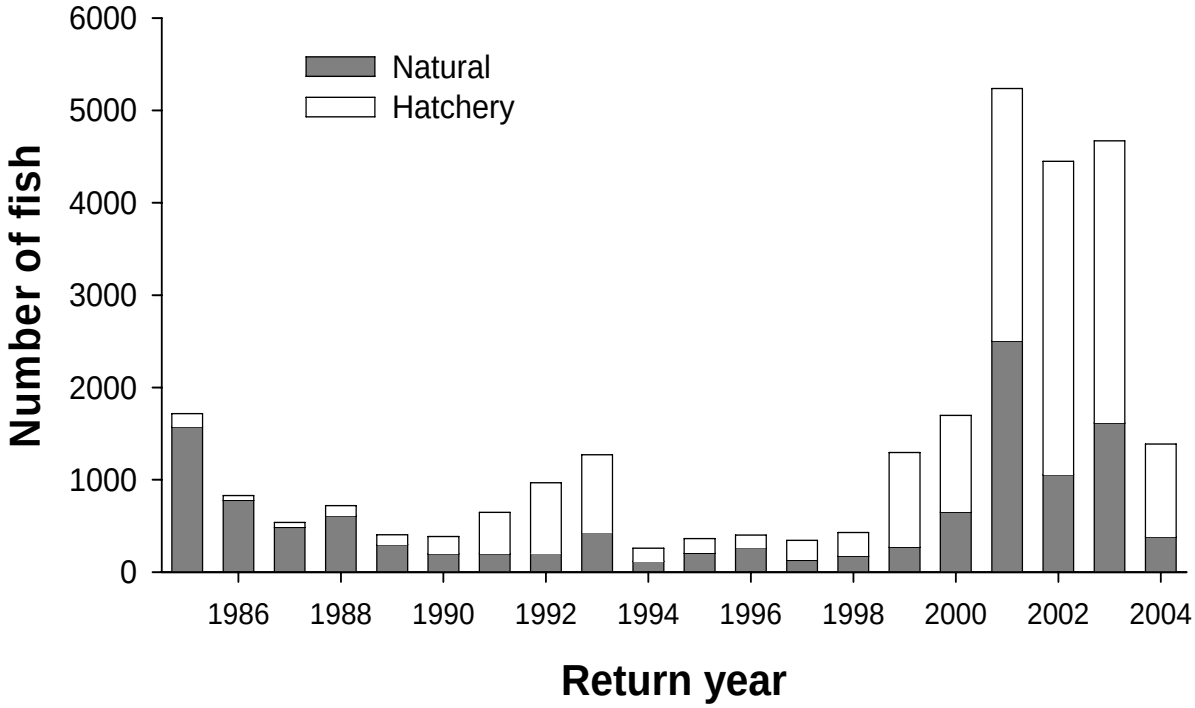



Figure 3. Estimated numbers of natural- and hatchery-origin Chinook salmon that spawned naturally in the Imnaha River, 1984-2004. These estimates include age 3 males.

Table 1. Rearing summaries for the brood year 2002 juvenile spring Chinook salmon released into the Imnaha and Grande Ronde river basins in 2004.

| Stock | Broodstock | Number of green eggs taken | Eyed eggs | Percent Survival | | | Total smolts released |
|---|---|---|---|---|---|---|---|
| | | | | Green egg -to- eyed egg | Eyed egg -to- smolt | Green egg -to- smolt | |
| Imnaha River | Conventional | 455,372 | 401,265 | 88.1 | 99.2 | 87.4 | 398,185 |
| Lostine River | Captive | 264,473 | 228,794 | 86.5 | 58.4 | 50.5 | 133,729 |
| Lostine River | Conventional | 131,023 | 119,039 | 90.9 | 97.8 | 88.9 | 116,370 |
| Catherine Creek | Captive | 234,388 | 204,848 | 87.4 | 70.8 | 61.9 | 144,992[a] |
| Catherine Creek | Conventional | 81,926 | 71,750 | 87.6 | 97.7 | 85.6 | 70,071 |
| Grande Ronde River | Captive | 104,782 | 97,983 | 93.5 | 76.6 | 71.6 | 75,063 |
| Grande Ronde River | Conventional | 89,156 | 73,051 | 81.9 | 95.6 | 78.3 | 69,856 |

[a] *Of total, 53,195 were released into Lookingglass Creek.*

Table 2. Estimates of percent adipose fin clip (Ad) and coded-wire tag application success for 2002 brood year spring Chinook salmon stocks reared at Lookingglass Fish Hatchery and released as smolts in 2004.

| CWT code | Raceway | Broodstock | Number checked | Ad clip, with CWT | Ad clip, no CWT | No Ad clip, with CWT | No Ad clip, no CWT | Total released |
|---|---|---|---|---|---|---|---|---|
| Imnaha River | | | | | | | | |
| 093822 | 12 | Conventional | 524 | 97.1 | 0.6 | 2.3 | 0.0 | 57,053 |
| 093823 | 13 | Conventional | 524 | 97.5 | 1.5 | 0.8 | 0.2 | 56,992 |
| Total/mean | | | 1,048 | 97.3 | 1.0 | 1.5 | 0.1 | 114,045 |
| Ad-only | 14 | Conventional | 519 | n/a | 98.3 | n/a | 1.7 | 70,810 |
| Ad-only | 15 | Conventional | 550 | n/a | 99.3 | n/a | 0.7 | 71,060 |
| Ad-only | 16 | Conventional | 501 | n/a | 98.2 | n/a | 1.8 | 71,114 |
| Ad-only | 17 | Conventional | 505 | n/a | 99.4 | n/a | 0.6 | 71,156 |
| Total/mean | | | 2,075 | n/a | 98.8 | n/a | 1.2 | 284,140 |
| Lostine River | | | | | | | | |
| 093830 | 7 | Conventional | 494 | 98.4 | 0.0 | 1.4 | 0.2 | 58,004 |
| 093831 | 8 | Conventional | 497 | 97.2 | 0.0 | 2.4 | 0.4 | 58,366 |
| 093829 | 9 | Captive | 502 | 98.8 | 0.6 | 0.6 | 0.0 | 27,773 |
| 093827 | | | 498 | 99.2 | 0.6 | 0.2 | 0.0 | 12,830 |
| 093821 | 10 | Captive | 500 | 99.4 | 0.0 | 0.6 | 0.0 | 58,030 |
| 093839 | 11 | Captive | 502 | 99.6 | 0.2 | 0.2 | 0.0 | 26,727 |
| Total/mean | | | 2,993 | 98.8 | 0.2 | 0.9 | 0.1 | 250,099 |
| Ad-only | 11 | Captive | 499 | n/a | 8,335 | n/a | 34 | 8,369 |
| Catherine Creek | | | | | | | | |
| 093840 | 1 | Conventional | 496 | 97.6 | 2.0 | 0.4 | 0.0 | 70,071 |
| 093835 | 2 | Captive | 510 | 96.9 | 1.4 | 1.2 | 0.6 | 45,413 |
| 093836 | 3 | Captive | 504 | 91.7 | 1.2 | 6.5 | 0.6 | 46,384 |
| Total/mean | | | 1,510 | 95.4 | 1.5 | 2.7 | 0.4 | 161,868 |

Table 2 continued.

| CWT code | Raceway | Broodstock | Number checked | Ad clip, with CWT | Ad clip, no CWT | No Ad clip, with CWT | No Ad clip, no CWT | Total released |
|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | | | | | | | | |
| 093833 | 5 | Conventional | 501 | n/a | n/a | 99.6 | 0.4 | 69,856 |
| 093834 | 6 | Captive | 500 | 99.0 | 0.4 | 0.6 | 0.0 | 59,387 |
| 093832 | 18 | Captive | 502 | 93.6 | 6.2 | 0.0 | 0.2 | 15,676 |
| Total/mean | | | 1,002 | 96.3 | 3.3 | 0.3 | 0.1 | 75,063 |
| Lookingglass Creek | | | | | | | | |
| 093837 | 4 | Captive | 613 | 98.9 | 0.0 | 1.1 | 0.0 | 15,843 |
| 093838 | | | 557 | 98.7 | 0.7 | 0.5 | 0.0 | 37,352 |
| Total/mean | | | 1,170 | 98.8 | 0.4 | 0.8 | 0.0 | 53,195 |

Table 3. Mean size of 2002 brood year 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, 2004. Length, weight, and condition factor data collected 9-12 February 2004. Asterisk denotes Captive Broodstock Program progeny.

| CWT code | Raceway | Release date (2004) | 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 | | | | | | | | | | | |
| 093822 | 12 | 26 MAR-15 APR | 110.6 | 11.6 | 17.1 | 6.1 | 1.3 | 0.3 | 57,053 | 3,501 | 55.9 |
| 093823 | 13 | 26 MAR-15 APR | 109.2 | 7.6 | 18.3 | 4.2 | 1.3 | 0.2 | 56,992 | 3,486 | 56.2 |
| Ad-only | 14 | 26 MAR-15 APR | 104.8 | 7.5 | 14.5 | 3.4 | 1.3 | 0.1 | 70,810 | 3,499 | 57.2 |
| Ad-only | 15 | 26 MAR-15 APR | 103.2 | 6.6 | 14.4 | 3.8 | 1.4 | 0.2 | 71,060 | 3,493 | 55.5 |
| Ad-only | 16 | 26 MAR-15 APR | 107.4 | 7.5 | 16.9 | 4.2 | 1.3 | 0.3 | 71,114 | 3,477 | 58.0 |
| Ad-only | 17 | 26 MAR-15 APR | 105.7 | 7.9 | 17.8 | 6.6 | 1.4 | 0.2 | 71,156 | 3,454 | 56.7 |
| Total | | | | | | | | | 398,185 | 20,910 | 56.6 |
| Lostine River | | | | | | | | | | | |
| 093830 | 7 | 29 MAR-14 APR | 109.9 | 10.2 | 17.1 | 4.2 | 1.3 | 0.1 | 58,004 | 3,981 | 51.1 |
| 093831 | 8 | 12-21 MAR | 108.8 | 9.9 | 16.4 | 2.5 | 1.3 | 0.2 | 58,366 | 3,970 | 40.5 |
| 093829*<br>093827* | 9 | 29 MAR-14 APR | 114.9 | 11.1 | 21.4 | 6.0 | 1.3 | 0.2 | 40,603 | 2,621 | 50.4 |
| 093821* | 10 | 12-21 MAR | 113.7 | 11.4 | 20.4 | 5.8 | 1.4 | 0.2 | 58,030 | 2,663 | 37.7 |
| 093839*<br>Ad-only* | 11 | 29 MAR-14 APR | 118.4 | 13.5 | 20.7 | 7.7 | 1.3 | 0.2 | 35,096 | 2,665 | 49.4 |
| Total | | | | | | | | | 250,099 | 15,900 | 45.8 |
| Catherine Creek | | | | | | | | | | | |
| 093840 | 1 | 1-12 APR | 110.6 | 6.1 | 19.0 | 7.3 | 1.4 | 0.2 | 70,071 | 5,235 | 27.1 |
| 093835* | 2 | 15-22 MAR | 114.5 | 11.2 | 21.9 | 7.3 | 1.3 | 0.2 | 45,413 | 7,869 | 23.0 |
| 093836* | 3 | 15-22 MAR | 114.7 | 13.9 | 20.8 | 9.9 | 1.2 | 0.2 | 46,384 | 7,890 | 22.0 |
| Total | | | | | | | | | 161,868 | 20,994 | 23.7 |

Table 3 continued.

| 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 | | | |
| Grande Ronde River | | | | | | | | | | | |
| 093833 | 5 | 1-12 APR | 110.9 | 7.8 | 16.4 | 3.7 | 1.2 | 0.1 | 69,856 | 509 | 47.0 |
| 093834* | 6 | 15-22 MAR | 118.2 | 13.0 | 22.9 | 9.7 | 1.3 | 0.2 | 59,387 | 498 | 23.7 |
| 093832* | 18 | 15-22 MAR | 119.0 | 15.7 | 21.3 | 5.5 | 1.4 | 0.2 | 15,676 | 484 | 19.2 |
| Total | | | | | | | | | 144,919 | 1,491 | 30.2 |
| Lookingglass Creek | | | | | | | | | | | |
| 093837*<br>093838* | 4 | 19 MAR-8 APR | 114.6 | 14.2 | 20.4 | 10.7 | 1.3 | 0.2 | 53,195 | 5,193 | 50.6 |

[a] *Equals total number released in Table 1 by stock.*

[b] *Percent PIT tag detections are unique first-time detections at dams in the Snake and Columbia rivers.*

Table 4. Recoveries of adult spring Chinook salmon at northeast Oregon LSRCP facilities, 2004.

| 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 | | 15 JUN – 17 SEP | | 10 MAY –30 SEP | | 1 MAR – 18 AUG | | 1 MAR – 1 AUG | | 2 MAR – 8 OCT | |
| 7-13 MAY | 19 | - | - | - | - | 0 | 0 | 0 | 0 | 0 | 0 |
| 14-20 MAY | 20 | - | - | 0 | 2 | 18 | 4 | 0 | 0 | 0 | 0 |
| 21-27 MAY | 21 | - | - | 1 | 0 | 32 | 12 | 0 | 1 | 0 | 3 |
| 28 MAY - 3 JUN | 22 | - | - | 1 | 0 | 132 | 21 | 1 | 1 | 1 | 1 |
| 4-10 JUN | 23 | - | - | 0 | 0 | 107 | 14 | 7 | 0 | 11 | 33 |
| 11-17 JUN | 24 | - | - | 10 | 6 | 164 | 13 | 68 | 2 | 2 | 1 |
| 18-24 JUN | 25 | - | - | 25 | 25 | 118 | 11 | 271 | 20 | 8 | 7 |
| 25 JUN – 1 JUL | 26 | 148 | 61 | 16 | 26 | 36 | 8 | 50 | 3 | 7 | 6 |
| 2-8 JUL | 27 | 262 | 84 | 150 | 59 | 12 | 1 | 32 | 3 | 0 | 0 |
| 9-15 JUL | 28 | 24 | 9 | 242 | 91 | 9 | 2 | 0 | 0 | 10 | 2 |
| 16-22 JUL | 29 | 278 | 31 | 211 | 39 | 2 | 1 | 1 | 3 | 2 | 2 |
| 23-29 JUL | 30 | 57 | 9 | 68 | 14 | 3 | 1 | 2 | 0 | 5 | 0 |
| 30 JUL - 5 AUG | 31 | 41 | 6 | 9 | 3 | 1 | 0 | 1 | 0 | 2 | 0 |
| 6-12 AUG | 32 | 32 | 8 | 1 | 0 | 1 | 1 | - | - | 1 | 1 |
| 13-19 AUG | 33 | 8 | 4 | 3 | 0 | 0 | 0 | - | - | 0 | 1 |
| 20-26 AUG | 34 | 30 | 16 | 9 | 5 | - | - | - | - | 0 | 8 |
| 27 AUG - 2 SEP | 35 | 98 | 18 | 34 | 22 | - | - | - | - | 0 | 4 |
| 3-9 SEP | 36 | 25 | - | 7 | 5 | - | - | - | - | 0 | 1 |
| 10-16 SEP | 37 | - | - | 4 | 1 | - | - | - | - | 0 | 3 |
| 17-23 SEP | 38 | - | - | - | - | - | - | - | - | 0 | 0 |
| Total | | 1,003 | 246 | 793 | 298 | 635 | 89 | 433 | 33 | 49 | 73 |

Table 5. Number and disposition of adult spring Chinook salmon returning to northeast Oregon LSRCP facilities in 2004 by origin, age, and sex.

| | Hatchery | | | | | | | Natural | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | | 4 | | 5 | | | 3 | | 4 | | 5 | | | Grand |
| Disposition | M | F | M | F | M | F | Total | M | F | M | F | M | F | Total | total |
| Imnaha River | | | | | | | | | | | | | | | |
| Trapped | 354 | 0 | 204 | 409 | 7 | 33 | 1,007 | 15 | 0 | 94 | 93 | 20 | 20 | 242 | 1,249 |
| Passed | 0 | 0 | 64 | 93 | 2 | 7 | 166 | 13 | 0 | 59 | 68 | 14 | 15 | 169 | 335 |
| Returned below weir | 7 | 0 | 3 | 11 | 1 | 3 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Outplanted | 37 | 0 | 63 | 212 | 4 | 16 | 332 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 333 |
| Kept | 310 | 0 | 74 | 93 | 0 | 5 | 484 | 2 | 0 | 34 | 25 | 6 | 5 | 72 | 556 |
| Actual spawned | 15 | 0 | 59 | 77 | 0 | 1 | 156 | 1 | 0 | 26 | 19 | 5 | 4 | 55 | 211 |
| Killed, not spawned | 282 | 0 | 6 | 5 | 0 | 1 | 294 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 295 |
| Pre-spawn mortality | 13 | 0 | 9 | 11 | 0 | 2 | 34 | 1 | 0 | 7 | 6 | 1 | 1 | 16 | 50 |
| Mean length (mm)[a] | 586 | - | 798 | 770 | n/a | 856 | | 625 | - | 784 | 737 | 912 | 953 | | |
| Standard deviation (mm) | 43.8 | - | 36.1 | 53.8 | n/a | 77.5 | | - | - | 32.9 | 42.0 | 8.9 | 94.2 | | |
| Age composition (%) | 35.2 | 0.0 | 20.3 | 40.6 | 0.7 | 3.3 | 100 | 6.2 | 0.0 | 38.8 | 38.4 | 8.3 | 8.3 | 100.0 | |
| Lostine River | | | | | | | | | | | | | | | |
| Trapped | 195 | 1 | 239 | 337 | 13 | 8 | 793 | 17 | 0 | 122 | 138 | 16 | 5 | 298 | 1,091 |
| Passed | 8 | 1 | 99 | 145 | 11 | 3 | 267 | 16 | 0 | 106 | 114 | 11 | 4 | 251 | 518 |
| Returned below weir | 0 | 0 | 3 | 14 | 0 | 0 | 17 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 19 |
| Outplanted | 185 | 0 | 108 | 147 | 2 | 5 | 447 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 447 |
| Kept | 2 | 0 | 29 | 31 | 0 | 0 | 62 | 1 | 0 | 16 | 22 | 5 | 1 | 45 | 107 |
| Actual spawned | 0 | 0 | 24 | 30 | 0 | 0 | 54 | 1 | 0 | 13 | 21 | 4 | 1 | 40 | 94 |
| Killed, not spawned | 2 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Pre-spawn mortality | 0 | 0 | 4 | 1 | 0 | 0 | 5 | 0 | 0 | 3 | 1 | 1 | 0 | 5 | 10 |
| Mean length (mm)[a] | 556 | - | 756 | 762 | n/a | n/a | | 535 | - | 779 | 755 | 905 | 864 | | |
| Standard deviation (mm) | 42.1 | - | 46.7 | 33.3 | n/a | n/a | | n/a | - | 57.7 | 40.2 | 27.5 | 22.6 | | |
| Age composition (%) | 24.6 | 0.1 | 30.1 | 42.5 | 1.6 | 1.0 | 100.0 | 5.7 | 0.0 | 40.9 | 46.3 | 5.4 | 1.7 | 100.0 | |

[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 | M | F | M | F | M | F | Total | M | F | M | F | M | F | Total | total |
| Catherine Creek | | | | | | | | | | | | | | | |
| Trapped | 60 | 0 | 282 | 274 | 18 | 1 | 635 | 5 | 0 | 40 | 35 | 3 | 6 | 89 | 724 |
| Passed | 5 | 0 | 59 | 60 | 6 | 0 | 130 | 5 | 0 | 33 | 26 | 0 | 6 | 70 | 200 |
| Returned below weir | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Outplanted | 28 | 0 | 110 | 130 | 5 | 1 | 274 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 274 |
| Kept | 27 | 0 | 113 | 84 | 7 | 0 | 231 | 0 | 0 | 7 | 9 | 3 | 0 | 19 | 250 |
| Spawned[b] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 9 | 1 | 0 | 16 | 16 |
| Killed not spawned | 24 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 25 |
| Pre-spawn mortality | 0 | 0 | 2 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 5 |
| Mean length (mm)[a] | 498 | - | 650 | 730 | 767 | 873 | | n/a | - | 673 | 709 | 940 | n/a | | |
| Standard Deviation (mm) | 40.7 | - | 77.8 | 56.7 | n/a | n/a | | n/a | - | 29.1 | 34.6 | n/a | n/a | | |
| Age composition (%) | 9.4 | 0.0 | 44.4 | 43.1 | 2.8 | 0.2 | 100.0 | 5.6 | 0.0 | 44.9 | 39.3 | 3.4 | 6.7 | 100.0 | |
| Grande Ronde River | | | | | | | | | | | | | | | |
| Trapped | 58 | 1 | 166 | 204 | 4 | 0 | 433 | 4 | 0 | 17 | 12 | 0 | 0 | 33 | 466 |
| Passed | 29 | 1 | 164 | 202 | 4 | 0 | 400 | 3 | 0 | 10 | 4 | 0 | 0 | 17 | 417 |
| Returned below weir | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kept | 29 | 0 | 2 | 2 | 0 | 0 | 33 | 1 | 0 | 7 | 8 | 0 | 0 | 16 | 49 |
| Spawned | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 6 | 7 | 0 | 0 | 14 | 15 |
| Killed not spawned | 28 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| Pre-spawn mortality | 0 | 0 | 2 | 2 | 0 | 0 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 6 |
| Mean length (mm)[a] | 510 | n/a | n/a | n/a | n/a | - | | 549 | - | 707 | 691 | - | - | | |
| Standard Deviation (mm) | 44.8 | n/a | n/a | n/a | n/a | - | | n/a | - | 64.5 | 35.6 | - | - | | |
| Age composition (%) | 13.4 | 0.2 | 38.3 | 47.1 | 0.9 | 0.0 | 100.0 | 12.1 | 0.0 | 51.5 | 36.4 | 0.0 | 0.0 | 100.0 | |

[b] *Only natural Chinook salmon were used for the Catherine Creek Conventional Broodstock Program. Most kept hatchery adults (204) were used as broodstock for Lookingglass Creek or eventually outplanted into Lookingglass Creek.*

Table 5 continued.

| | Hatchery | | | | | | | Natural | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | | 4 | | 5 | | | 3 | | 4 | | 5 | | | Grand |
| Disposition | M | F | M | F | M | F | Total | M | F | M | F | M | F | Total | total |
| Lookingglass Creek | | | | | | | | | | | | | | | |
| Trapped[c] | 10 | 0 | 18 | 16 | 1 | 2 | 49[g] | 3 | 0 | 33 | 35 | 1 | 0 | 73[h] | 122 |
| Passed[d] | 0 | 0 | 16 | 7 | 1 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| Returned below weir[e] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| Kept | 10 | 0 | 4 | 8 | 0 | 2 | 25[g] | 3 | 0 | 33 | 35 | 1 | 0 | 74 | 96 |
| Spawned[f] | 6 | 0 | 51 | 51 | 2 | 2 | 112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 112 |
| Killed not spawned | 4 | 0 | 4 | 1 | 0 | 0 | 9 | 3 | 0 | 33 | 35 | 1 | 0 | 74 | 83 |
| Pre-spawn mortality | 0 | 0 | 6 | 6 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| Mean length (mm)[a] | 508 | - | 708 | 705 | 860 | 847 | | 553 | - | 720 | 716 | 838 | - | | |
| Standard Deviation (mm) | 46.0 | - | 42.0 | 30.9 | n/a | 26.2 | | 45.3 | - | 38.6 | 32.9 | n/a | - | | |
| Age composition (%) | 21.3 | 0 | 38.3 | 34.0 | 2.1 | 4.3 | | 4.2 | 0 | 45.8 | 48.6 | 1.4 | 0 | | |

[c] *Does not include Catherine Creek outplants recaptured at weir and returned downstream.*

[d] *In addition, 76 Catherine Creek adults not needed for broodstock were released above the weir to spawn naturally. Also, one Catherine Creek outplant recaptured at the weir was passed above on 8/30/04.*

[e] *In addition, 36 adults and four jacks not needed for broodstock were released below the weir to spawn naturally.*

[f] *Includes Catherine Creek broodstock brought from Catherine Creek weir and outplants recaptured at Lookingglass weir.*

[g] *Includes two hatchery returns of unknown age and sex.*

[h] *Includes one age-4 natural return of unknown sex.*

Table 6. Timing of spawning and spawning summaries for the Conventional Broodstock of spring Chinook salmon at Lookingglass Fish Hatchery, 2004.

| Stock, spawn date | Origin of parents | Number of parents F | Number of parents M[a] | Number of eggs collected | Average fecundity | Number of eyed eggs | Percent mortality to shocking |
|---|---|---|---|---|---|---|---|
| Imnaha River | | | | | | | |
| 17 AUG | Mixed | 2 | 2 | 10,440 | 5,220 | 6,938 | 33.4 |
| 24 AUG | Mixed | 5 | 4 | 25,764 | 5,153 | 22,524 | 12.4 |
| 31 AUG | Mixed | 74 | 74 | 343,063 | 4,636 | 322,137 | 5.9 |
| 8 SEP | Mixed | 17 | 18 | 78,855 | 4,639 | 72,471 | 7.3 |
| 14 SEP | Mixed | 7 | 7 | 30,353 | 4,336 | 27,831 | 8.2 |
| Total | | 105 | 105 | 488,475 | 4,523 | 451,901 | 7.2 |
| Lostine River | | | | | | | |
| 18 AUG | Mixed | 2 | 2 | 7,331 | 3,666 | 7,044 | 3.9 |
| 25 AUG | Mixed | 11 | 11 | 48,046 | 4,368 | 42,991 | 10.4 |
| 1 SEP | Mixed | 15 | 15 | 65,838 | 4,389 | 64,619 | 1.7 |
| 8 SEP | Mixed | 16 | 16 | 66,531 | 4,158 | 62,255 | 6.3 |
| 14 SEP | Mixed | 6 | 6 | 26,117 | 4,353 | 25,888 | 0.9 |
| 17 SEP | Mixed | 2 | 2 | 8,025 | 4,013 | 7,864 | 1.9 |
| Total | | 52 | 52 | 221,888 | 4,267 | 210,661 | 5.0 |
| Catherine Creek | | | | | | | |
| 2 SEP | Natural | 3 | 2 | 9,301 | 3,100 | 9,184 | 1.2 |
| 9 SEP | Natural | 1 | 2 | 1,886 | 1,886 | 1,718 | 8.9 |
| 13 SEP | Natural | 1 | 2 | 2,888 | 2,888 | 2,872 | 0.0 |
| 17 SEP | Natural | 1 | 2 | 3,538 | 3,538 | 3,410 | 3.5 |
| 20 SEP | Natural | 1 | 2 | 2,155 | 2,155 | 1,247 | 41.5 |
| 23 SEP | Natural | 1 | 2 | 3,177 | 3,177 | 2,942 | 7.4 |
| 30 SEP | Natural | 1 | 2 | 3,259 | 3,259 | 3,092 | 5.1 |
| Total | | 9 | 14 | 26,204 | 2,912 | 24,465 | 6.5 |
| Grande Ronde River | | | | | | | |
| 19 AUG | Natural | 1 | 2 | 3,058 | 3,058 | 2,503 | 18.1 |
| 2 SEP | Natural | 2 | 2 | 6,623 | 3,312 | 6,231 | 5.7 |
| 9 SEP | Natural | 3 | 2 | 7,595 | 2,532 | 6,787 | 10.5 |
| 13 SEP | Natural | 1 | 2 | 3,582 | 3,582 | 3,536 | 1.3 |
| Total | | 7 | 8 | 20,858 | 2,980 | 19,057 | 8.5 |
| Lookingglass Creek | | | | | | | |
| 26 AUG | Hatchery | 2 | 2 | 8,731 | 4,366 | 2,623 | 67.7 |
| 2 SEP | Hatchery | 16 | 16 | 53,871 | 3,367 | 51,968 | 3.3 |
| 9 SEP | Hatchery | 20 | 23 | 62,641 | 3,132 | 55,698 | 10.6 |
| 13 SEP | Hatchery | 15 | 16 | 47,233 | 3,149 | 44,356 | 6.0 |
| Total | | 53 | 57 | 172,476 | 3,254 | 154,645 | 9.9 |

[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 2004 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 | | | | | |
|---|---|---|---|---|---|---|---|---|
| Brood year | CWT code | Number released | Imnaha River[a] | Ocean catch[b] | Mainstem rivers[b] | In-basin strays[b] | Out-of-basin strays[b] | Total |
| 1999 | 093056 | 18,033 | 8 (1) | 0 | 0 | 0 | 0 | 8 |
| | 093057 | 35,863 | 33 (4) | 0 | 0 | 0 | 0 | 33 |
| | 093058 | 35,880 | 17 (2) | 0 | 0 | 0 | 0 | 17 |
| | 093059 | 33,238 | 17 (2) | 0 | 0 | 0 | 0 | 17 |
| | Total | 123,014 | 75 (9) | 0 | 0 | 0 | 0 | 75 |
| 2000 | 075851 | 27,730 | 129 (32) | 0 | 9 (3) | 0 | 0 | 138 |
| | 093413 | 61,615 | 230 (57) | 3 (2) | 47 (7) | 1 (1) | 0 | 281 |
| | 093414 | 61,578 | 315 (78) | 4 (2) | 31 (6) | 1 (1) | 8 (3) | 359 |
| | 093415 | 61,511 | 246 (61) | 0 | 16 (3) | 0 | 0 | 262 |
| | 093417 | 61,497 | 170 (42) | 3 (1) | 26 (7) | 1 (1) | 1 (1) | 201 |
| | 093443 | 29,806 | 89 (22) | 0 | 9 (3) | 1 (1) | 0 | 99 |
| | Total | 303,737 | 1,179 (292) | 10 (5) | 138 (29) | 4 (4) | 9 (4) | 1,340 |
| 2001 | 093642 | 54,853 | 161 (22) | 0 | 0 | 0 | 1 (1) | 162 |
| | 093643 | 54,836 | 95 (13) | 0 | 0 | 0 | 1 (1) | 96 |
| | 093644 | 49,056 | 154 (21) | 0 | 15 (1) | 0 | 0 | 169 |
| | 093659 | 54,842 | 154 (21) | 0 | 7 (2) | 0 | 0 | 161 |
| | 093660 | 54,839 | 176 (24) | 0 | 9 (2) | 0 | 0 | 185 |
| | Total | 268,426 | 740 (101) | 0 | 31 (5) | 0 | 2 (2) | 773 |
| Grand Total | | 695,177 | 1,994 (402) | 10 (5) | 169 (34) | 4 (4) | 11 (6) | 2,188 |

[a] *Expansion based on estimated number of CWT fish returning (brood year escapement x proportion with CWT x tag retention rate).*
[b] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*

Table 8. Catch and escapement distribution of Imnaha River hatchery adult spring Chinook salmon by recovery location in 2004 (CWT recovery data summarized through December 2006 from the PSMFC and ODFW recovery databases).

| Location, recovery type | Actual recoveries | Expanded adults | Percent of total |
|---|---|---|---|
| Ocean catch | 5 | 10 | 0.5 |
| Columbia River | | | |
| Ceremonial and subsistence | 0 | 0 | 0.0 |
| Treaty net | 25 | 101 | 4.6 |
| Non-treaty net | 2 | 5 | 0.2 |
| Sport | 7 | 63 | 2.8 |
| 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 | 2 | 4 | 0.2 |
| Sport | 1 | 1 | >0.1 |
| Ceremonial and subsistence | 0 | 0 | 0.0 |
| Other Strays | | | |
| Outside Snake River Basin | 3 | 6 | 0.3 |
| Within Snake River Basin[a] | 4 | 4 | 0.2 |
| Recruitment to river[a] | 1,191[b] | 2,021[c] | 91.2 |
| Total catch/escapement | | 2,215 | |
| Return to compensation area | | 2,025 | |
| Percent of compensation goal[d] | | 63.1 | |

[a] *Indicates areas defining the compensation area.*
[b] *Number of hatchery spring Chinook salmon observed at weir and on spawning ground surveys.*
[c] *Expansion factor based on estimated total return to Imnaha River of hatchery brood years.*
[d] *The compensation goal for Imnaha stock is 3,210 hatchery adults.*

Table 9. Expanded adult recoveries by coded-wire tag group for the 2004 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 | | | | | |
|---|---|---|---|---|---|---|---|---|
| Brood year | CWT code | Number released | Lookingglass Creek[a] | Ocean catch[b] | Mainstem rivers[b] | In-basin strays[b] | Out-of-basin strays[b] | Total |
| 1998 | 092819 | 57,290 | 0 | 0 | 0 | 0 | 1 (1) | 1 |
| 1999 | 093114 | 24,201 | 3 (0) | 0 | 0 | 0 | 0 | 3 |
| 2000[b] | 093434 | 24,176 | 21 (6) | 0 | 0 | 4 (4) | 0 | 25 |
| | 093437 | 23,756 | 14 (4) | 0 | 2 (1) | 0 | 0 | 16 |
| | Total | 47,932 | 35 (10) | 0 | 2 (1) | 4 (4) | 0 | 41 |
| 2001[c] | 093506 | 17,880 | 7 (0) | 0 | 0 | 0 | 0 | 7 |
| Grand Total | | 147,303 | 45 (10) | 0 | 2 (1) | 4 (4) | 1 (1) | 52 |

[a] *Expanded number is total hatchery return to Lookingglass Creek of each brood year (first-time captures at weir and on spawning grounds) x proportion with CWT x tag retention rate. Does not include known strays.*

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

[c] *Catherine Creek stock released as parr into Lookingglass Creek.*

Table 10. Catch and escapement distribution of Grande Ronde Basin hatchery adult spring Chinook salmon by stock and recovery location in 2004 (CWT recovery data summarized through December 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 | 4 | 7 | 0.6 | 0 | 0 | 0.0 | 2 | 5 | 0.6 | 0 | 0 | 0.0 |
| Columbia River | | | | | | | | | | | | |
| Ceremonial/subsistence | 0 | 0 | 0.0 | 0 | 0 | 0.0 | 1 | 1 | >0.1 | 0 | 0 | 0.0 |
| Treaty net | 8 | 43 | 3.6 | 15 | 31 | 3.8 | 12 | 18 | 2.2 | 0 | 0 | 0.0 |
| Non-treaty net | 0 | 0 | 0.0 | 18 | 33 | 4.1 | 12 | 22 | 2.7 | 1 | 2 | 3.4 |
| Sport | 5 | 47 | 4.0 | 15 | 90 | 11.1 | 19 | 108 | 13.1 | 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] | 0 | 0 | 0.0 | 1 | 4 | 0.5 | 3 | 12 | 1.5 | 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 | 1 | 1 | 0.1 | 3 | 7 | 0.8 | 0 | 0 | 0.0 |
| Sport | 0 | 0 | 0.0 | 1 | 1 | 0.1 | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| Ceremonial/subsistence | 0 | 0 | 0.0 | 0 | 0 | | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| Other Strays | | | | | | | | | | | | |
| Outside Snake R. Basin | 1 | 1 | >0.1 | 2 | 2 | 0.2 | 7 | 7 | 0.8 | 1 | 1 | 1.7 |
| Within Snake R. Basin[a] | 17[b] | 17 | 1.5 | 2 | 2 | 0.2 | 9 | 9 | 1.1 | 4 | 4 | 6.9 |
| Recruitment to stream[a] | 824[c] | 1,056[d] | 90.2 | 638[c] | 650[d] | 79.9 | 465[c] | 638[d] | 77.1 | 49[c] | 49 | 87.9 |
| Total estimated return | | 1,171 | | | 814 | | | 827 | | | 56[e] | |
| Compensation area return | | 1,073 | | | 656 | | | 659 | | | 53 | |

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

[b] *Twelve of these were recovered in Wallowa River and most likely the result of outplanting.*

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

[d] *Expansion factor based on estimated total return to natal stream of hatchery adults. Does not include adjustment for CWT loss.*

[e] *Of total, four were Rapid River stock (three 1999 brood year returns to Lookingglass Creek and one 1998 brood year stray to Salmon River, OR).*

Table 11. Expanded adult recoveries by coded-wire tag group of Lostine River spring Chinook salmon for the 2004 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. Numbers in parenthesis are unexpanded CWT recoveries.

| | | | | Recovery location | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Brood year | Broodstock | CWT code | Number released | Lostine River[a] | Ocean catch[b] | Mainstem rivers[b] | In-basin strays[b] | Out-of-basin strays[b] | Total |
| 1999 | Captive | 093060 | 3,581 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093061 | 11,260 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093062 | 12,932 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093063 | 16,307 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093101 | 15,279 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093102 | 14,360 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093103 | 22,565 | 10 (1) | 0 | 0 | 0 | 0 | 10 |
| | Captive | 093104 | 34,124 | 19 (2) | 0 | 0 | 0 | 0 | 19 |
| | Captive | 093105 | 3,475 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 133,883 | 29 (3) | 0 | 0 | 0 | 0 | 29 |
| 2000 | Conventional | 075852 | 31,464 | 485 (80) | 3 (2) | 8 (2) | 2 (2) | 0 | 498 |
| | Captive | 093419 | 2,363 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093421 | 7,800 | 30 (5) | 0 | 8 (1) | 2 (2) | 1 (1) | 41 |
| | Captive | 093422 | 10,514 | 36 (6) | 0 | 21 (3) | 0 | 0 | 57 |
| | Captive | 093423 | 13,178 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093425 | 16,537 | 91 (17) | 4 (2) | 9 (2) | 5 (5) | 0 | 109 |
| | Captive | 093426 | 20,265 | 85 (14) | 0 | 6 (1) | 3 (3) | 0 | 94 |
| | Captive | 093428 | 3,815 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 105,936 | 727 (120) | 7 (4) | 52 (9) | 12 (12) | 1 (1) | 799 |

[a] *Expansion based on estimated number of CWT fish returning (brood year escapement x proportion with CWT x tag retention rate).*
[b] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*

Table 11 continued.

| Brood year | 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 |
|---|---|---|---|---|---|---|---|---|---|
| 2001 | Captive | 093507 | 29,158 | 29 (2) | 0 | 15 (1) | 0 | 0 | 44 |
| | Captive | 093535 | 50,559 | 15 (1) | 0 | 0 | 1 (1) | 0 | 16 |
| | Captive | 093536 | 46,752 | 15 (1) | 0 | 15 (1) | 1 (1) | 0 | 31 |
| | Captive | 093537 | 7,971 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093538 | 7,427 | 15 (1) | 0 | 0 | 0 | 0 | 15 |
| | Conventional | 093539 | 51,795 | 101 (7) | 0 | 3 (1) | 2 (2) | 0 | 106 |
| | Conventional | 093540 | 49,087 | 88 (6) | 0 | 5 (1) | 1 (1) | 0 | 94 |
| | Total | | 242,749 | 263 (18) | 0 | 38 (4) | 5 (5) | 0 | 306 |
| Grand Total | | | 482,568 | 1,019 (141) | 7 (4) | 90 (13) | 17 (17) | 1 (1) | 1,116 |

Table 12. Expanded adult recoveries by coded-wire tag group of Catherine Creek spring Chinook salmon for the 2004 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. Numbers in parenthesis are unexpanded recoveries.

| | | | | Recovery location | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Brood year | Broodstock | CWT code | Number released | Catherine Creek[a] | Ocean catch[b] | Mainstem rivers[b] | In-basin strays[b] | Out-of-basin strays[b] | Total |
| 1999 | Captive | 093106 | 6,068 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093107 | 4,711 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093108 | 6,916 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093109 | 11,471 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093110 | 13,062 | 0 | 0 | 2 (1) | 0 | 0 | 2 |
| | Captive | 093111 | 18,985 | 19 (3) | 0 | 0 | 0 | 1 (1) | 20 |
| | Captive | 093112 | 25,498 | 0 | 0 | 2 (1) | 0 | 0 | 2 |
| | Captive | 093113 | 25,534 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093226 | 7,936 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093227 | 16,652 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 136,833 | 19 (3) | 0 | 4 (2) | 0 | 1 (1) | 24 |
| 2000 | Captive | 093420 | 5,553 | 14 (5) | 0 | 9 (3) | 0 | 0 | 23 |
| | Captive | 093429 | 3,260 | 8 (3) | 0 | 0 | 0 | 0 | 8 |
| | Captive | 093430 | 6,560 | 14 (5) | 0 | 12 (2) | 0 | 0 | 26 |
| | Captive | 093431 | 9,404 | 16 (6) | 0 | 2 (1) | 0 | 0 | 18 |
| | Captive | 093432 | 10,524 | 25 (9) | 0 | 6 (1) | 0 | 0 | 31 |
| | Captive | 093433 | 14,490 | 33 (12) | 0 | 12 (3) | 0 | 0 | 45 |
| | Captive | 093435 | 46,365 | 239 (87) | 0 | 55 (17) | 1 (1) | 0 | 295 |
| | Captive | 093436 | 43,986 | 129 (47) | 0 | 31 (12) | 0 | 2 (2) | 162 |
| | Captive | 093438 | 23,348 | 36 (13) | 0 | 21 (7) | 0 | 1 (1) | 58 |
| | Total | | 163,490 | 514 (187) | 0 | 148 (46) | 1 (1) | 3 (1) | 666 |

[a] *Expansion based on predicted number of CWT fish returning (brood year escapement x proportion with CWT x tag retention rate). Recoveries from Lookingglass Creek were assumed to be the result of outplanting and not counted as strays.*

Table 12 continued.

| Brood year | Broodstock | CWT code | Number released | Recovery location: Catherine Creek[a] | Ocean catch[b] | Mainstem rivers[b] | In-basin strays[b] | Out-of-basin strays[b] | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2001 | Captive | 093541 | 52,989 | 27 (12) | 0 | 6 (1) | 1 (1) | 0 | 34 |
| | Captive | 093542[c] | 52,303 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Conventional | 093543 | 24,392 | 33 (15) | 0 | 0 | 0 | 0 | 33 |
| | Total | | 129,684 | 60 (27) | 0 | 6 (1) | 1 (1) | 0 | 69 |
| Grand Total | | | 430,007 | 593 (217) | 0 | 158 (49) | 2 (2) | 4 (4) | 757 |

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

[c] At *time of release, CWT code group 093542 had high ELISA levels for Bacterial Kidney Disease*.

Table 13. Expanded adult recoveries by coded-wire tag group of Grande Ronde River spring Chinook salmon for the 2004 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. Numbers in parenthesis are unexpanded recoveries.

| | | | | Recovery location | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Brood year | 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 |
| 1999 | Captive | 093115 | 2,560 | 6 (0) | 0 | 0 | 0 | 0 | 6 |
| 2000 | Captive | 070149 | 42,152 | 169 (46) | 5 (2) | 33 (12) | 4 (4) | 3 (3) | 214 |
| | Captive | 092611 | 2,029 | 18 (5) | 0 | 3 (2) | 0 | 0 | 21 |
| | Captive | 093416 | 24,669 | 51 (14) | 0 | 17 (5) | 0 | 2 (2) | 70 |
| | Captive | 093424 | 13,214 | 15 (4) | 0 | 3 (2) | 0 | 5 (3) | 23 |
| | Captive | 093439 | 30,376 | 29 (8) | 0 | 11 (4) | 0 | 0 | 40 |
| | Captive | 093440 | 31,824 | 103 (28) | 0 | 64 (15) | 1 (1) | 1 (1) | 169 |
| | Captive | 093442 | 20,394 | 29 (8) | 0 | 13 (3) | 0 | 0 | 42 |
| | Captive | 093441 | 4,544 | 37 (10) | 0 | 11 (2) | 0 | 0 | 48 |
| | Captive | 093444 | 42,200 | 37 (10) | 0 | 6 (2) | 1 (1) | 3 (1) | 47 |
| | Total | | 211,402 | 488 (133) | 5 (2) | 161 (47) | 6 (6) | 14 (10) | 674 |
| 2001 | Captive | 092607 | 480 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093544 | 57,750 | 28 (9) | 0 | 0 | 0 | 0 | 28 |
| | Captive | 093545 | 57,797 | 19 (6) | 0 | 0 | 0 | 0 | 19 |
| | Captive | 093546 | 4,821 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Captive | 093547 | 31,881 | 15 (5) | 0 | 0 | 0 | 0 | 15 |
| | Captive | 093548 | 52,252 | 9 (3) | 0 | 0 | 2 (2) | 0 | 11 |
| | Captive | 093549 | 26,443 | 15 (5) | 0 | 0 | 1 (1) | 0 | 16 |
| | Captive | 093649 | 5,612 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 237,036 | 86 (28) | 0 | 0 | 3 (3) | 0 | 89 |
| Grand Total | | | 450,998 | 580 (161) | 5 (2) | 161 (47) | 9 (9) | 14 (10) | 769 |

[a] *Expansion based on predicted number of CWT fish returning (brood year escapement x proportion with CWT x tag retention rate).*
[b] *Estimated number of total CWT fish recovered from PSMFC and ODFW databases.*

Table 14. Summary of marked and unmarked spring Chinook salmon carcass recoveries and number of redds observed by stream during spawning ground surveys, 2004.

| Basin, stream | Marked | Unmarked | Unknown Mark | Percent marked | Number of redds |
|---|---|---|---|---|---|
| Imnaha River Basin | | | | | |
| Big Sheep Creek | 9 | 1 | 2 | 90.0 | 40 |
| Imnaha River | 265 | 197 | 13 | 57.4 | 495 |
| Lick Creek | 31 | 0 | 2 | 100.0 | 34 |
| Totals | 305 | 198 | 17 | 60.6 | 569 |
| Grande Ronde River Basin | | | | | |
| Bear Creek | 15 | 0 | 2 | 100.0 | 21 |
| Hurricane Creek | 2 | 6 | 3 | 25.0 | 30 |
| Lostine River | 95 | 29 | 3 | 76.6 | 189 |
| Wallowa River | 16 | 9 | 8 | 64.0 | 32 |
| Catherine Creek | 47 | 9 | 1 | 83.9 | 96 |
| Grande Ronde River[a] | 146 | 10 | 17 | 93.6 | 186 |
| Lookingglass Creek | 60 | 18 | 0 | 76.9 | 103 |
| Minam River | 1 | 68 | 2 | 1.4 | 151 |
| Wenaha River | 1 | 63 | 6 | 1.6 | 198 |
| Totals | 383 | 212 | 42 | 64.4 | 1,006 |

[a] *Includes one redd in Sheep Creek.*

Table 15. Summary of adipose-clipped Chinook salmon carcass with coded-wire tags recovered during spawning ground surveys, 2004.

| Recovery location | CWT code | Number recovered | Release site | Brood year |
|---|---|---|---|---|
| Imnaha River Basin | | | | |
| Big Sheep Creek[a] | 093059 | 1 | Imnaha River Acclimation Site | 1999 |
| | 093414 | 3 | Imnaha River Acclimation Site | 2000 |
| | 093415 | 1 | Imnaha River Acclimation Site | 2000 |
| | 093417 | 1 | Imnaha River Acclimation Site | 2000 |
| | 093443 | 1 | Imnaha River Acclimation Site | 2000 |
| Imnaha River | 075851 | 15 | Imnaha River Acclimation Site | 2000 |
| | 093056 | 1 | Imnaha River Acclimation Site | 1999 |
| | 093057 | 2 | Imnaha River Acclimation Site | 1999 |
| | 093058 | 1 | Imnaha River Acclimation Site | 1999 |
| | 093413 | 24 | Imnaha River Acclimation Site | 2000 |
| | 093414 | 37 | Imnaha River Acclimation Site | 2000 |
| | 093415 | 31 | Imnaha River Acclimation Site | 2000 |
| | 093417 | 18 | Imnaha River Acclimation Site | 2000 |
| | 093425 | 1 | Lostine River Acclimation Site | 2000 |
| | 093443 | 12 | Imnaha River Acclimation Site | 2000 |
| | 093642 | 7 | Imnaha River Acclimation Site | 2001 |
| | 093643 | 6 | Imnaha River Acclimation Site | 2001 |
| | 093644 | 12 | Imnaha River Acclimation Site | 2001 |
| | 093659 | 13 | Imnaha River Acclimation Site | 2001 |
| | 093660 | 14 | Imnaha River Acclimation Site | 2001 |
| | 103609 | 1 | Rapid River Hatchery | 2000 |
| Lick Creek[a] | 075851 | 2 | Imnaha River Acclimation Site | 2000 |
| | 093057 | 1 | Imnaha River Acclimation Site | 1999 |
| | 093059 | 1 | Imnaha River Acclimation Site | 1999 |
| | 093413 | 3 | Imnaha River Acclimation Site | 2000 |
| | 093414 | 9 | Imnaha River Acclimation Site | 2000 |
| | 093415 | 4 | Imnaha River Acclimation Site | 2000 |
| | 093417 | 3 | Imnaha River Acclimation Site | 2000 |
| | 093643 | 1 | Imnaha River Acclimation Site | 2001 |
| | 093659 | 1 | Imnaha River Acclimation Site | 2001 |

Table 15 continued.

| Recovery location | CWT code | Number recovered | Release site | Brood year |
|---|---|---|---|---|
| Grande Ronde River Basin | | | | |
| Bear Creek[a] | 075852 | 1 | Lostine River Acclimation Site | 2000 |
| | 093104 | 1 | Lostine River Acclimation Site | 1999 |
| | 093425 | 3 | Lostine River Acclimation Site | 2000 |
| | 093426 | 3 | Lostine River Acclimation Site | 2000 |
| | 093540 | 1 | Lostine River Acclimation Site | 2001 |
| Hurricane Creek[a] | 075852 | 1 | Lostine River Acclimation Site | 2000 |
| Lostine River | 075852 | 26 | Lostine River Acclimation Site | 2000 |
| | 093103 | 1 | Lostine River Acclimation Site | 1999 |
| | 093104 | 1 | Lostine River Acclimation Site | 1999 |
| | 093414 | 1 | Imnaha River Acclimation Site | 2000 |
| | 093421 | 5 | Lostine River Acclimation Site | 2000 |
| | 093422 | 5 | Lostine River Acclimation Site | 2000 |
| | 093425 | 14 | Lostine River Acclimation Site | 2000 |
| | 093426 | 12 | Lostine River Acclimation Site | 2000 |
| | 093507 | 2 | Lostine River Acclimation Site | 2001 |
| | 093535 | 1 | Lostine River Acclimation Site | 2001 |
| | 093536 | 1 | Lostine River Acclimation Site | 2001 |
| | 093538 | 1 | Lostine River Acclimation Site | 2001 |
| | 093539 | 6 | Lostine River Acclimation Site | 2001 |
| | 093540 | 4 | Lostine River Acclimation Site | 2001 |
| Wallowa River[a] | 075852 | 2 | Lostine River Acclimation Site | 2000 |
| | 093421 | 1 | Lostine River Acclimation Site | 2000 |
| | 093425 | 4 | Lostine River Acclimation Site | 2000 |
| | 093426 | 1 | Lostine River Acclimation Site | 2000 |
| | 093535 | 1 | Lostine River Acclimation Site | 2001 |
| | 093536 | 1 | Lostine River Acclimation Site | 2001 |
| | 093539 | 2 | Lostine River Acclimation Site | 2001 |

[a] *Recoveries of Lostine River adults in Bear and Hurricane creeks and the Wallowa River were most likely the result of outplanting.*

Table 15 continued.

| Recovery location | CWT code | Number recovered | Release site | Brood year |
|---|---|---|---|---|
| Catherine Creek | 093413 | 1 | Imnaha River Acclimation Site | 2000 |
| | 093420 | 2 | Catherine Creek Acclimation Site | 2000 |
| | 093430 | 1 | Catherine Creek Acclimation Site | 2000 |
| | 093431 | 2 | Catherine Creek Acclimation Site | 2000 |
| | 093432 | 2 | Catherine Creek Acclimation Site | 2000 |
| | 093433 | 1 | Catherine Creek Acclimation Site | 2000 |
| | 093435 | 12 | Catherine Creek Acclimation Site | 2000 |
| | 093436 | 11 | Catherine Creek Acclimation Site | 2000 |
| | 093438 | 2 | Catherine Creek Acclimation Site | 2000 |
| Grande Ronde River | 070149 | 43 | Grande Ronde Acclimation Site | 2000 |
| | 092611 | 5 | Grande Ronde Acclimation Site | 2000 |
| | 093416 | 14 | Grande Ronde Acclimation Site | 2000 |
| | 093424 | 4 | Grande Ronde Acclimation Site | 2000 |
| | 093439 | 8 | Grande Ronde Acclimation Site | 2000 |
| | 093440 | 28 | Grande Ronde Acclimation Site | 2000 |
| | 093441 | 8 | Grande Ronde Acclimation Site | 2000 |
| | 093442 | 9 | Grande Ronde Acclimation Site | 2000 |
| | 093444 | 10 | Grande Ronde Acclimation Site | 2000 |
| | 093549 | 3 | Grande Ronde Acclimation Site | 2001 |
| Lookingglass Creek[b] | 070149 | 3 | Grande Ronde Acclimation Site | 2000 |
| | 093420 | 1 | Catherine Creek Acclimation Site | 2000 |
| | 093421 | 1 | Lostine River Acclimation Site | 2000 |
| | 093429 | 1 | Catherine Creek Acclimation Site | 2000 |
| | 093430 | 2 | Catherine Creek Acclimation Site | 2000 |
| | 093431 | 1 | Catherine Creek Acclimation Site | 2000 |
| | 093432 | 2 | Catherine Creek Acclimation Site | 2000 |
| | 093433 | 5 | Catherine Creek Acclimation Site | 2000 |
| | 093434 | 5 | Lookingglass Creek | 2000 |
| | 093435 | 27 | Catherine Creek Acclimation Site | 2000 |
| | 093436 | 12 | Catherine Creek Acclimation Site | 2000 |
| | 093437 | 4 | Lookingglass Creek | 2000 |
| | 093438 | 6 | Catherine Creek Acclimation Site | 2000 |
| | 093541 | 2 | Catherine Creek Acclimation Site | 2001 |
| | 093543 | 2 | Lookingglass Creek | 2001 |
| | 093548 | 1 | Grande Ronde Acclimation Site | 2001 |
| | 093549 | 1 | Grande Ronde Acclimation Site | 2001 |

[b] *Recoveries of Catherine Creek adults were most likely the result of outplanting.*

Table 15 continued.

| Recovery location | CWT code | Number recovered | Release site | Brood year |
|---|---|---|---|---|
| Minam River | 093540 | 1 | Lostine River Acclimation Site | 2001 |
| Wenaha River | 93443 | 1 | Imnaha River Acclimation Site | 2000 |

Table 16. Age composition and length characteristics of hatchery- and naturally-produced spring Chinook salmon carcasses with known age, sex, and origin recovered during 2004 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 by age-length key when CWT or scale data were not available.

| | 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 | 1 | 55 | 169 | 49 | 5 | 11 | 290 | 2 | 4 | 55 | 57 | 32 | 30 | 180 |
| Age composition (%) | 0.3 | 19.0 | 58.3 | 16.9 | 1.7 | 3.8 | 100.0 | 1.1 | 2.2 | 30.6 | 31.7 | 17.8 | 16.7 | 100.0 |
| Mean fork length (mm) | 510 | 546 | 775 | 747 | 898 | 918 | | 580 | 556 | 762 | 761 | 903 | 967 | |
| Standard deviation | - | 40.3 | 46.7 | 46.4 | 53.6 | 95.3 | | 14.1 | 24.3 | 45.1 | 50.3 | 48.1 | 100.7 | |
| Grande Ronde River Basin | | | | | | | | | | | | | | |
| Number | 0 | 37 | 232 | 119 | 1 | 15 | 404 | 1 | 6 | 105 | 68 | 8 | 23 | 211 |
| Age composition (%) | 0.0 | 9.2 | 57.4 | 29.5 | 0.2 | 3.7 | 100.0 | 0.5 | 2.8 | 49.8 | 32.2 | 3.8 | 10.9 | 100.0 |
| Mean fork length (mm) | - | 539 | 707 | 746 | 880 | 846 | | 585 | 545 | 717 | 730 | 877 | 850 | |
| Standard deviation | - | 55.0 | 44.4 | 57.9 | 49.0 | 79.5 | | - | 35.4 | 39.4 | 48.5 | 24.6 | 59.2 | |

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