LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Spring Chinook Salmon Evaluation Studies
2005 Annual Progress Report

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LOWER SNAKE RIVER
COMPENSATION PLAN

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Preface

This annual progress report provides summary information for Lower Snake River Compensation Plan (LSRCP) spring Chinook salmon programs operated by the Oregon Department of Fish and Wildlife (ODFW) in the Imnaha and Grande Ronde river basins during 2005. 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 natural Chinook salmon populations, and managing hatchery programs and recreational and tribal 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 2005 work statement (Carmichael et al. 2005).

We used coded-wire tag (CWT) data collected from 2005 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; 2004; Messmer et al. 1989; 1990; 1991; 1992; 1993; Hoffnagle et al. 2005; Monzyk et al. 2006a; b; c; d; e; 2007) and United States v. Oregon production report (Carmichael et al. 1986b).

In this report, data are organized into salmon culture monitoring for juveniles and adults, CWT recoveries, compensation goals, and estimates for total adult escapement. During the period covered in this report, Chinook salmon smolts from the 2003 brood year were released, Chinook salmon from the 2000-2002 brood years returned to spawn, and some of the returning adult Chinook salmon were used to create the 2005 brood year.

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EXECUTIVE SUMMARY

In 2005, we released 435,186 Chinook salmon smolts from the 2003 brood year into the Imnaha River that were released from the Conventional Broodstock Program. We estimated that 5.2% of these smolts were not identifiably marked with an adipose fin clip (ad clip) or coded-wire tag. In addition, we released 2003 brood year smolts from both the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program and Conventional Broodstock Program into the Grande Ronde Basin. We released 62,149 Captive Broodstock smolts and 102,557 Conventional Broodstock smolts into the Lostine River, all identifiably marked with ad clips and/or coded-wire tags. We released 68,827 Captive Broodstock smolts and 120,753 Conventional Broodstock smolts into Catherine Creek with 0.3% having no identifiable mark. We also released 98,023 Catherine Creek Captive Broodstock smolts into Lookingglass Creek with an estimated 2.1% having no identifiable mark. We released 1,019 Captive Broodstock smolts and 104,350 Conventional Broodstock smolts into the upper Grande Ronde River and estimated that 4.4% of these smolts had no identifiable mark.

We trapped 984 hatchery- and 237 naturally-produced Chinook salmon at the Imnaha River weir. In the Grande Ronde Basin we captured 631 hatchery- and 193 naturally-produced Chinook salmon on the Lostine River, 166 hatchery- and 60 naturally-produced Chinook salmon on Catherine Creek, and 263 hatchery- and 14 naturally-produced Chinook salmon on the upper Grande Ronde River. At the Lookingglass Creek weir we trapped 45 hatchery-produced Chinook salmon along with 25 naturally-produced Chinook salmon.

We estimated that 1,307 Imnaha River hatchery Chinook salmon returned to the Lower Snake River Compensation Plan compensation area in 2005, achieving 40.7% of the hatchery adult compensation goal in the Imnaha River Basin. In the Grande Ronde River Basin, we estimated that 734 Lostine River, 174 Catherine Creek, 418 Grande Ronde River, and 59 Lookingglass Creek hatchery adults returned to the basin. Combined, these returns achieved 23.8% of the compensation goal for the Grande Ronde Basin.

The recruits-per-spawner ratio for naturally spawning (spawned in nature from natural and hatchery parents) Imnaha River salmon for the 2000 brood year was 0.2. This was the second consecutive year productivity was below replacement after three consecutive years of natural productivity levels above replacement. The recruits per spawner ratio for the hatchery component was 8.7, better than naturally spawning salmon and well above replacement.

In 2005, we observed 229 carcasses and found 447 redds during spawning ground surveys in the Imnaha River Basin. Only one hatchery stray was recovered in the basin (it was originally released in the Lostine River). In the Grande Ronde Basin, we observed 402 carcasses and found 669 redds. There were 13 known hatchery strays recovered in 2005 within the Grande Ronde Basin. All were strays from the Conventional Broodstock Program that were released into other streams within the Grande Ronde Basin.

INTRODUCTION

This annual progress report summarizes spring Chinook salmon monitoring data for the Lower Snake River Compensation Plan (LSRCP) facilities in 2005. 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, smolt-to-adult survival rate, and successful spawning in nature by hatchery-reared adults, 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 2003 brood year of juvenile Chinook salmon smolts, the collection, spawning, and adult characteristics of adult Chinook salmon in the 2005 return year, and the collection of eggs for the 2005 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.
10.

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 basin Chinook salmon populations.
8. Determine annual escapement and spawner numbers to estimate and compare productivity (recruits per spawner) for natural- and hatchery-produced Chinook salmon in the Imnaha and Grande Ronde basins.
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 2005, spring Chinook salmon from the 2003 brood year produced from Conventional Broodstock were released as smolts into the Imnaha River. In the Grande Ronde River Basin, smolts from the 2003 brood year produced from the Conventional Broodstock program were released into the Lostine River, Catherine Creek, and the Grande Ronde River. Also released into the Lostine River, Catherine Creek, the Grande Ronde River, and Lookingglass Creek were smolts from the 2003 brood year produced from the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program (Carmichael 2006). Adult Chinook salmon from the 2000-2002 brood years returned to spawn and were used as broodstock to create the 2005 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 2003 brood year of Imnaha River Chinook salmon released in 2005 was 87.4% (green egg-to-eyed egg survival rate, 88.0%; eyed-to-smolt survival rate, 99.3%) (Table 1). For the Lostine River, green egg-to-smolt survival rates were 31.7% for Captive Broodstock offspring and 94.3% for Conventional Broodstock offspring. Green egg-to-smolt survival rates for Catherine Creek salmon were 62.0% for Captive Broodstock offspring and 90.0% for Conventional Broodstock offspring. For the Grande Ronde

River, green egg-to-smolt survival rates were 65.8% for Captive Broodstock offspring and 86.4% for Conventional Broodstock offspring. Compared to the Conventional Broodstock Program, survival rates for the Captive Broodstock Program were consistently lower, mostly due to large numbers of eyed eggs being culled because of high enzyme-linked immunosorbent assay (ELISA) levels in female broodstock, in an effort to reduce the incidence of bacterial kidney disease (BKD) in their offspring. Co-managers decided to cull eyed eggs produced from females with ELISA levels $\geq$ 0.8 for Catherine Creek and Grande Ronde River stocks and $\geq$ 0.4 for Lostine River females.

We did not reach mitigation goals for any stock in 2005 release year (Table 1). The release of 435,186 smolts from the 2003 Imnaha River brood year was slightly 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 River, Catherine Creek, and upper Grande Ronde populations and 150,000 smolts for Lookingglass Creek. In the Lostine River, we released 62,149 smolts produced from Captive Broodstock and 102,557 smolts produced from Conventional Broodstock (164,706 total). In Catherine Creek, we released 68,827 smolts produced from Captive Broodstock and 120,753 smolts produced from Conventional Broodstock (189,580 total). We also released 98,023 smolts produced from the Catherine Creek Captive Broodstock Program into Lookingglass Creek. In the Grande Ronde River, we released only 1,019 smolts produced from Captive Broodstock and 104,350 smolts produced from Conventional Broodstock (105,369 total). Mitigation goals were not achieved for these stocks due to numerous reasons. In the Captive Broodstock Program, low broodstock survival due to bacterial kidney disease and low fecundity due to slow broodstock growth rates have limited smolt production. Also, the poor adult return to the Grande Ronde River in 1999 resulted in no age-4 broodstock for use in the 2003 brood year production. In the Conventional Broodstock Program, low adult returns in 2003 limited the number of broodstock collected and subsequent smolt production.

We marked approximately half of the Imnaha River 2003 brood year smolts released in 2005 with ad clip+CWT. The other half of the 2003 Imnaha River brood year smolts received only ad clips. Fin clip application success was estimated at 97.1% for the portion receiving ad clip+CWT and 94.9% for the portion receiving just ad clips (Table 2). CWT application success was 98.8%. We estimated that 4.0% of the Imnaha River 2003 brood year smolts had no identifiable mark (no CWT or ad clip). We attempted to mark all 2003 Lostine River brood year smolts released in 2005 with ad clip+CWT. We had good ad clip+CWT mark retention for this stock (97.1%) and estimated all smolts had at least one identifiable mark. We attempted to mark all Catherine Creek smolts with ad clip+CWT, except a small portion of Conventional Broodstock progeny that received just ad clips. Mark retention for the portion that received ad clip+CWT was 95.8%. We estimated that 0.3% of the smolts released had no identifiable mark. Grande Ronde River smolts produced from the Conventional Broodstock program received just CWTs. We estimated that 95.6% of these smolts retained their CWT marks so 4.4% had with no identifiable mark when released. All 2003 brood year smolts released into Lookingglass Creek in 2005 were Captive Broodstock progeny from Catherine Creek stock. We marked only a portion of the smolts with ad clip+CWT, with the remainder receiving only ad clips. Application success was estimated at 95.7% for the portion receiving just ad clips and 93.3% for the portion

[*] Due to space limitations at Lookingglass Fish Hatchery, the annual production goal is less than the LSRCP mitigation goal.

receiving ad clip+CWT. We estimated that 2.1% of all smolts released in Lookingglass Creek had no identifiable mark.

The 2003 brood year of Imnaha River Chinook salmon was reared in six raceways at LFH (Table 3). Smolts in raceways 13 and 17 were direct stream released into the Imnaha River on 29 March 2005. All other Imnaha River Chinook salmon smolts were acclimated at the Imnaha Acclimation Facility starting as early as 9 March 2005. Smolts were volitionally released beginning on 21 March 2005 and the remaining smolts were forced out on 8 April 2005.

Lostine River Chinook salmon smolts produced from Captive Broodstock parents were reared in two 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 River acclimation ponds in two stages: early and late acclimation periods (Table 3). Smolts from the early acclimation were transported to the acclimation ponds as early as 28 February 2005. Volitional release of smolts began on 11 March 2005 and remaining smolts were forced out on 20 March 2005. Smolts from the late acclimation period were transported to acclimation ponds on 21 March 2005, were volitionally released beginning on 28 March 2005, and remaining smolts were forced out on 11 April 2005.

Catherine Creek Chinook salmon smolts produced from Captive Broodstock parents were reared in one raceway and smolts produced from Conventional Broodstock were reared in two raceways. Smolts produced from both Captive Broodstock and Conventional Broodstock parents were transported to the Catherine Creek acclimation ponds on 7 March 2005, volitionally released on 14 March 2005, and remaining smolts forced out on 27 March 2005. Another group of smolts produced from Conventional Broodstock parents were transported to the acclimation ponds on 28 March 2005, volitionally released beginning 4 April 2005, and forced out on 7 April 2005.

Grande Ronde River Chinook salmon smolts produced from Captive Broodstock parents were few in number and, therefore, were mixed into a raceway with smolts produced from the Conventional Broodstock Program. A total of two raceways were used to rear smolts (Table 3). Smolts from the combined programs were transported to the Grande Ronde River acclimation ponds on 8 March 2005. Due to low water and freezing conditions, smolts were forced out on 14 March 2005, earlier than planned.

Lookingglass Creek Chinook salmon smolts produced from Catherine Creek Captive Broodstock parents were reared in two raceways at LFH. Smolts were volitionally released from the raceways beginning 18 March 2005 and the remaining smolts were forced out on 29 March 2005.

Smolt migration success was monitored based on first-time PIT-tag detections at mainstem dams. Mean detection rates for smolts released in 2005 were: 50.2% for Imnaha River stock; 37.8% for Lostine River stock; 22.0% for Catherine Creek stock; 13.4% for Grande Ronde River stock; and 49.5% for Lookingglass River stock. These detection rates were lower across all stocks than reported in the last several years. Lower than average streamflows in the Imnaha and Grande Ronde basins in 2005 partially explain the lower detection rates. For the Catherine Creek stock, high levels of hematopoietic necrosis (IHN) of the Captive Broodstock progeny most likely resulted in lower detection rates for this group. Also, a mortality event at a screw trap located on the upper Grande Ronde River contributed to the lower detection rates of smolts for the Grande Ronde River. 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

Imnaha River

The Imnaha River weir was installed on 20 June 2005 and operated until 14 September 2005 (Table 4). We trapped 984 hatchery- and 237 naturally-produced salmon and 43.1% (467 hatchery; 60 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 22 (17 hatchery and five natural) were weir mortalities. The remaining salmon collected at the weir were either outplanted to Big Sheep and Lick creeks (292 hatchery) or released above the weir to spawn naturally (225 hatchery, 177 natural). Age structure of salmon captured at the weir was determined from CWT or scale analysis, when available, or from length-at-age relationships developed using fish from previous years with known age information. Age structure of hatchery-produced adults collected at the weir was: 18% age 3; 74% age 4; and 8% age 5. This differed from the age structure of naturally-produced adults collected at the weir: 4% age 3; 72% age 4; and 24% age 5 (Table 5). We spawned 87 hatchery and 29 natural females with 107 hatchery and 24 natural males (Table 5). We collected 531,706 green eggs from broodstock (Table 6). Eggs were incubated at LFH and survival to shocking was 85.1%.

Lostine River

The Lostine River weir was installed by Nez Perce Tribe personnel on 9 May 2005 and operated until 30 September 2005 (Table 4). A total of 631 hatchery- and 193 naturally-produced adult Chinook salmon were captured, with 12.6% (70 hatchery, 34 natural) retained for broodstock (Table 5). The remaining salmon trapped at the weir were either outplanted to Bear Creek (214 hatchery), returned below the weir (five hatchery, three natural), or released above the weir to spawn naturally (342 hatchery, 156 natural). Age 4 adults were the dominant age group returning to the Lostine River weir, comprising 83% of the hatchery-produced salmon and 84% of the naturally produced salmon collected (Table 5). Age 3 adults comprised 11% of hatchery-produced adults and only 6% of naturally-produced adults returning to the weir. Age 5 adults comprised 6% of hatchery-produced salmon and 10% of naturally-produced salmon collected. Adults used as broodstock in the 2005 brood year were both natural and hatchery origin (Conventional Broodstock progeny only – returning Captive Broodstock progeny are allowed to spawn naturally or removed but are not collected for Conventional broodstock due to domestication concerns). We spawned 39 hatchery and 17 natural females with 28 hatchery and 14 natural males. We collected 234,117 eggs (Table 6) and egg survival to shocking was 88.5%.

This is the first year we had a complete brood year return of Lostine River hatchery adults from both the Captive Broodstock and Conventional Broodstock Programs (2000 brood year). Age structure of returning Captive Broodstock progeny from the 2000 brood year was 13% age 3; 82% age 4; and 5% age 5. Age structure of the Conventional Broodstock progeny from the 2000 brood year was 25% age 3; 73% age 4; and 2% age 5. Age structure of natural returns from the 2000 brood year was 6% age 3; 88% age 4; and 6% age 5. Smolt to adult ratios (SAR) for the 2000 brood year was 0.9% for Captive Broodstock progeny and 0.8% Conventional Broodstock progeny.

Catherine Creek

The Catherine Creek weir was operated by personnel from the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) from 11 February to 3 August 2005. Totals of 166 hatchery- and 60 naturally-produced adult Chinook salmon were captured with 24.8% (46 hatchery and 10 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 two hatchery adults were weir mortalities. The remaining salmon collected at the weir were either outplanted to Lookingglass Creek (21 hatchery Captive Broodstock progeny) or released above the weir to spawn naturally (99 hatchery, 50 natural). Age structure of hatchery-produced adults collected at the weir was: 18% age 3; 67% age 4; and 14% age 5. Age structure of naturally-produced adults collected at the weir was: 7% age 3; 82% age 4; and 12% age 5 (Table 5). All age 5 hatchery returns were progeny of the Captive Broodstock Program. Age 3 and age 4 hatchery returns were both Captive Broodstock and Conventional Broodstock progeny. Adults used as broodstock to create the Catherine Creek 2005 brood year were from both natural and hatchery origin (Conventional Broodstock progeny only – returning Captive Broodstock progeny are allowed to spawn naturally or removed and are not collected for broodstock due to domestication concerns). Pre-spawning mortality of broodstock caught at the weir and held at Lookingglass Hatchery was 0.8%. We spawned nine hatchery females and eight natural females with 15 hatchery males and two natural males. We collected 52,107 eggs (Table 6). Egg survival to shocking was high (95.0%).

Grande Ronde River

The upper Grande Ronde River weir was operated by CTUIR personnel from 10 March to 3 August 2005. A total of 263 hatchery- and 14 naturally-produced adult Chinook salmon were captured with 26.0% (65 hatchery and seven natural) retained (Table 5). The remaining salmon caught at the weir were released above the weir to spawn naturally (198 hatchery, seven natural). All age 5 hatchery returns were progeny of the Captive Broodstock Program while age 3 and age 4 hatchery returns were both Captive Broodstock and Conventional Broodstock progeny. Overall age structure of hatchery returns to the weir was 2% age 3; 91% age 4; and 7% age 5. Age structure of naturally produced adults returning to the weir was as follows: 0% age 3; 57% age 4; and 43% age 5. Adults used as broodstock to create the Grande Ronde River 2005 brood year were from both natural and Conventional Broodstock origin. Pre-spawning mortality of the fish held at Lookingglass Hatchery was 11.0%. We spawned 38 hatchery females and two natural females with 22 hatchery and three natural males. We collected 155,070 eggs (Table 6) but egg survival to shocking was low (77.9%).

Lookingglass Creek

The Lookingglass Creek weir was operated by CTUIR personnel from 22 February to 9 September 2005. A total of 45 hatchery adults along with 25 natural-origin adults were collected at the weir. The natural-origin adults were likely offspring of Rapid River hatchery adults that spawned naturally and thus were retained for tribal ceremonial/subsistence purposes as part of the management objective to phase out Rapid River stock in Lookingglass Creek and re-establish a stock endemic to the Grande Ronde Basin (Catherine Creek). Of the 45 hatchery adults collected, 37 were progeny of the Captive Broodstock Program (Catherine Creek stock) that were released into Lookingglass Creek. These adults were released above the weir to spawn

naturally. Seven hatchery adults were known strays from within the Grande Ronde River Basin (based on VIE marks) and used as broodstock for their respective Conventional Programs or outplanted (Table 5). One hatchery jack stray from Catherine Creek was retained for tribal ceremonial/subsistence. There were no broodstock collections this year for a Lookingglass Creek Conventional program. In all, 58 hatchery adults that were progeny of the Captive Broodstock Program were released above the weir to spawn naturally (37 from weir, 21 outplants from Catherine Creek).

Coded-Wire Tag Recoveries

Hatchery salmon 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 groups (if any). 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.

The observed and estimated number of hatchery salmon from each CWT code group recovered in ocean and mainstem river fisheries as well as strays collected in and out of the Snake River Basin were summarized from the RMIS database. Estimated CWT recoveries in the RMIS database were based on recoveries and the 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 estimated total CWT marked hatchery adults from each code group (observed from weir collections and spawning ground recoveries) returning to the Imnaha, Lostine, and Grande Ronde rivers, and Lookingglass and Catherine creeks based on total escapement to each stream and the proportion of each cohort marked with CWTs.

In the Imnaha River, CWT marked returns were estimated by first estimating hatchery escapement to the river for each returning brood year (see Monzyk et al. 2006a). The estimated total number of coded-wire tagged returns for each brood year 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 estimated total number of CWT returns by the relative proportion of each CWT code recovered within a brood year to give the estimated number of CWT returns for each tag group.

In the Grande Ronde River Basin, CWTs from Captive and Conventional Broodstock programs were recovered at different sampling efficiencies. Recovery rates for Conventional Broodstock progeny are usually higher because CWTs are recovered from Conventional Broodstock progeny retained for broodstock as well as from spawning grounds surveys, whereas Captive Broodstock recoveries are typically recovered only on spawning ground surveys, since none are retained for broodstock. This necessitated expanding CWT recoveries for Captive and Conventional hatchery returns separately using the method described above for the Imnaha River.

In both the Imnaha and Grande Ronde basins, the exception to the CWT expansion 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.

For some stocks each year, excess adult hatchery returns are outplanted to nearby streams. CWTs from these stocks that were recovered in outplant streams were not considered strays, but rather were included in escapement calculations (e.g., SAR).

In 2005, a total of 282 hatchery-reared Imnaha River Chinook salmon were recovered with a CWT from the 2000-2002 brood years. Nearly all of these CWT recoveries occurred in the Snake River Basin. Recoveries were expanded to an estimated 1,126 CWT marked adults returning to the Imnaha River with the following age distribution: 103 from the 2000 brood year (age 5); 956 from the 2001 brood year (age 4); and 67 from the 2002 brood year (age 3) (Table 7). In addition, an estimated 11 CWT marked Imnaha River salmon were harvested in ocean fisheries, 69 were harvested in the Columbia River, and two were harvested in the Snake River below Lower Granite Dam. Five were estimated to be strays outside the Snake River Basin.

We recovered 174 hatchery-reared Lostine River Chinook salmon from the 2000-2002 brood years with a CWT in 2005. Recoveries were expanded to an estimated 720 CWT returns to the Lostine River with the following age distribution: 38 from the 2000 brood year (age 5); 607 from the 2001 brood year (age 4); and 75 from the 2002 brood year (age 3) (Table 8). An estimated 18 CWT Lostine River Chinook salmon were harvested in ocean fisheries and 14 in the Columbia River. One stray was recovered out of the Snake River basin, (Willamette River). Five CWT salmon were recovered as in-basin strays (two recovered in the South Fork Salmon River, two in the Rapid River, and one in the Imnaha River).

We recovered 107 hatchery-reared Catherine Creek Chinook salmon with a CWT from the 2000-2002 brood years. Recoveries were expanded to an estimated 167 CWT marked adults returning to Catherine Creek with the following age distribution: 22 from the 2000 brood year (age 5); 115 from the 2001 brood year (age 4); and 30 from the 2002 brood year (age 3) (Table 9). An estimated 32 CWT marked Catherine Creek salmon were also recovered in the Columbia River. An estimated six adults were recovered as strays in the Snake River Basin (two from the upper Grande Ronde River and four caught at the Lookingglass Creek weir), and one was recovered as an out-of-basin stray (John Day River).

We recovered 157 hatchery-reared Grande Ronde River Chinook salmon with a CWT from the 2000-2002 brood years in 2005. Recoveries were expanded to an estimated 400 CWT returns to the Grande Ronde River with the following age distribution: 24 from the 2000 brood year (age 5); 367 from the 2001 brood year (age 4); and nine from the 2002 brood year (age 3) (Table 10). No CWT marked Grande Ronde River salmon were recovered in ocean fisheries but 89 were recovered in the Columbia River. There were no out-of-basin strays recovered but 14 in-basin strays were recovered: one in Catherine Creek and 13 in Lookingglass Creek.

All CWT recoveries of Lookingglass Creek hatchery adults occurred in Lookingglass Creek (Table 11). These adults were Captive Broodstock progeny from the 2000-2002 brood years (Catherine Creek stock released into Lookingglass Creek). We estimated three CWT marked Chinook salmon from the 2000 brood year (age 5), 39 CWT marked Chinook salmon from the 2001 brood year (age 4), and 17 CWT marked Chinook salmon from the 2002 brood year (age 3) returned to Lookingglass Creek (Table 13).

Compensation Goals

To assess LSRCP success of achieving mitigation goals and management objectives, we determined the total number of hatchery-produced salmon for each stock that were caught in fisheries, escaped to the stream of release, or strayed within or outside the Snake River Basin. The number of hatchery-produced salmon that were caught in fisheries or strayed within or outside the Snake River Basin was based on estimated CWT recoveries from the RMIS database. Because not all of a cohort within a stock were CWT marked (i.e., ad-only), the estimated number recovered in each recovery location was further expanded by dividing it by the proportion of the cohort with CWT marks. 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 Lower Granite Dam, we summed all estimated escapement for the 2005 return year above Lower Granite Dam.

The annual compensation goal for the Imnaha Basin is 3,210 hatchery adults. We estimated that 1,307 Imnaha River hatchery adults returned to the compensation area, 40.7% of the goal for the Imnaha River stock and all returned to the Imnaha River (Table 12). We estimated that 124 Imnaha River hatchery adults were harvested in fisheries outside the compensation area, mostly in Columbia River sport fisheries (Table 12). In addition, we estimated five out-of-basin strays in the Deschutes River. The primary factors causing hatchery returns below the compensation goal were low adult returns during the 2000-2002 brood years that limited broodstock collections and subsequent smolt production.

The recruit-per-spawner ratio for hatchery- and natural-origin Imnaha River salmon that spawned naturally (including jacks) in 2000 was 0.231, below replacement, much lower than the previous four years, and below the mean value since 1982 (Figure 1). The recruit-per-spawner ratio for Imnaha River salmon spawned at Lookingglass Fish Hatchery was 8.7, better than naturally spawning salmon and well above replacement. The recruit-per-spawner ratio calculated without jacks was 0.463 for natural spawners and 9.47 for the hatchery component.

In the Grande Ronde Basin, the annual compensation goal for all stocks combined was set at 5,820 hatchery adults. For the Lostine River hatchery stock, we estimated that 734 adults returned to the compensation area, most (99.3%) to the Lostine River. Outside the compensation area, we estimated 18 Lostine River hatchery Chinook salmon were harvested in ocean fisheries and 14 in the Columbia River (Table 13). We estimated one adult strayed out of the Snake River Basin. For Catherine Creek hatchery Chinook salmon, we estimated 174 adults returned to the compensation area (98.9% to Catherine Creek). We estimated 32 Catherine Creek hatchery salmon were harvested in the Columbia River, mostly from sport fisheries and we also estimated one out-of-basin stray. An estimated 418 Grande Ronde River hatchery Chinook salmon returned to compensation area. We estimated 89 adults were harvested in the Columbia River, mostly from sport fisheries. There were no out-of-basin strays. We estimated 59 Lookingglass Creek adults returned to the basin. The combined return to the compensation area was 1,385 hatchery adults, 23.8% of the compensation goal. The primary factors causing low hatchery returns in the basin were low numbers of Conventional broodstock collections and subsequent smolt production, and a Captive Broodstock program that has been beleaguered with low broodstock survival due to bacterial kidney disease and low fecundity due to slow broodstock growth rates (Hoffnagle et al. 2003; Carmichael 2006).

Natural Escapement Monitoring

Stream surveys to enumerate Chinook salmon redds and sample salmon carcasses were conducted as in previous years (see Monzyk et al. 2006a). We surveyed three streams in the Imnaha Basin and nine in the Grande Ronde Basin. In 2005, we counted 447 redds and observed 229 carcasses in the Imnaha Basin (Table 14). Redd counts in the basin were low compared to previous years and represent the fifth year in a row in declining counts since the 2002 return year (Figure 2). All recovered CWTs from marked hatchery salmon on spawning grounds were from Imnaha stock with the exception of one age 4 Lostine River adult (Table 15). The number of natural salmon that returned to the basin to spawn (248) was down considerably from the previous four years (Figure 3). Hatchery salmon comprised the majority (68%) of adults on the spawning grounds in the Imnaha River.

In the Grande Ronde Basin, we observed 669 redds and recovered 402 carcasses on the spawning grounds (Table 14). Redd counts were down from previous years (Figure 2). We recovered 13 known hatchery strays in the Grande Ronde Basin (Table 15). All were strays from within the Grande Ronde Basin: 11 Grande Ronde River stock recovered in Lookingglass Creek; and two Catherine Creek stock recovered in the Grande Ronde River. Marked salmon comprised 69.4% of the observed carcasses. In streams with hatchery supplementation programs, the number of natural salmon that returned was down from the previous four years (Figure 4). The proportion of hatchery salmon on the spawning grounds was 70%, 67%, and 96%, for the Lostine River, Catherine Creek, and the Grande Ronde River, respectively.

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.

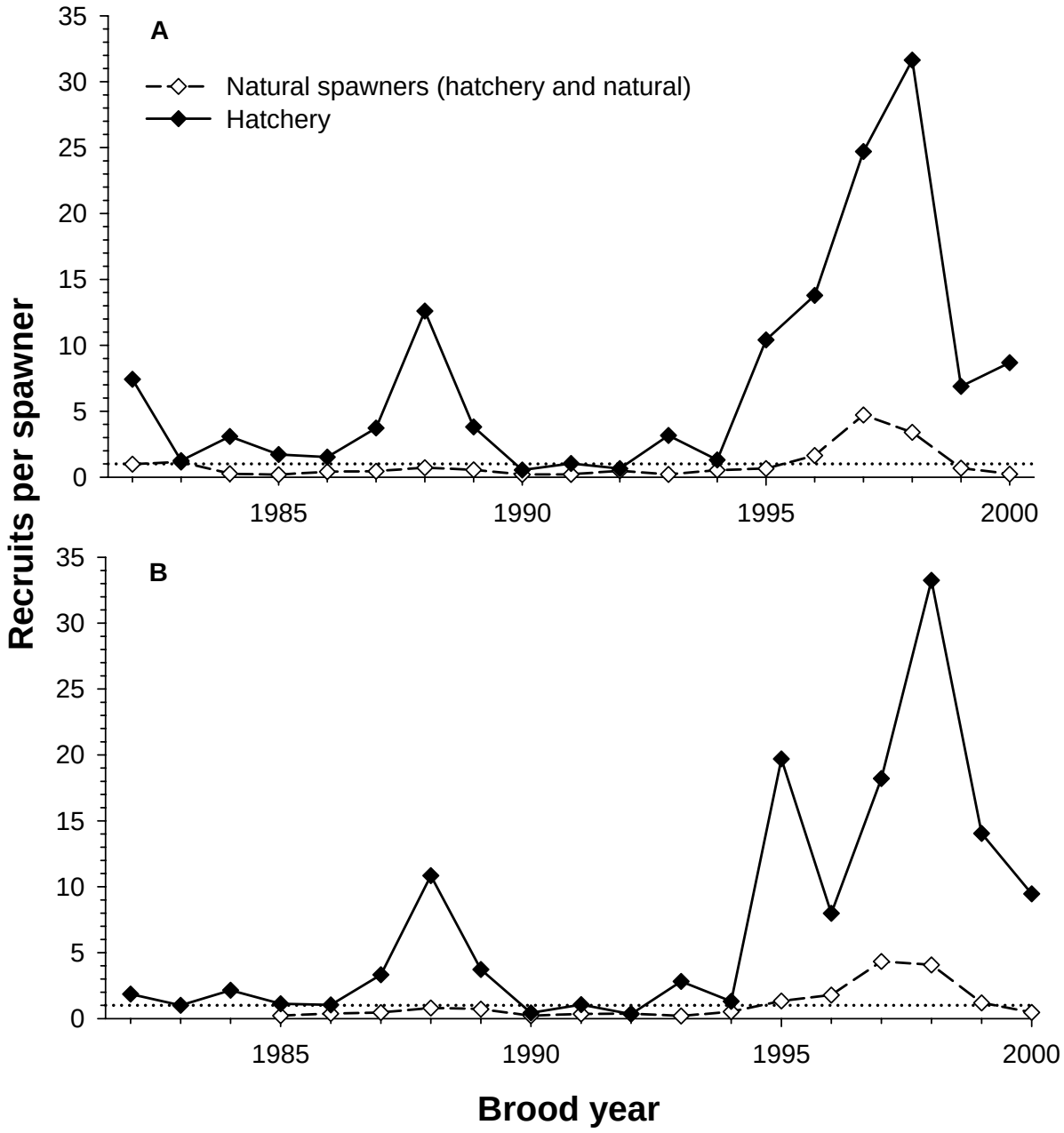

Figure 1. Recruits-per-spawner ratios for completed brood years (1982-2000) of Imnaha River Chinook salmon with age-3 males included (A) and without age-3 males (B). Note: dotted line indicates recruits-per-spawner ratio=1.

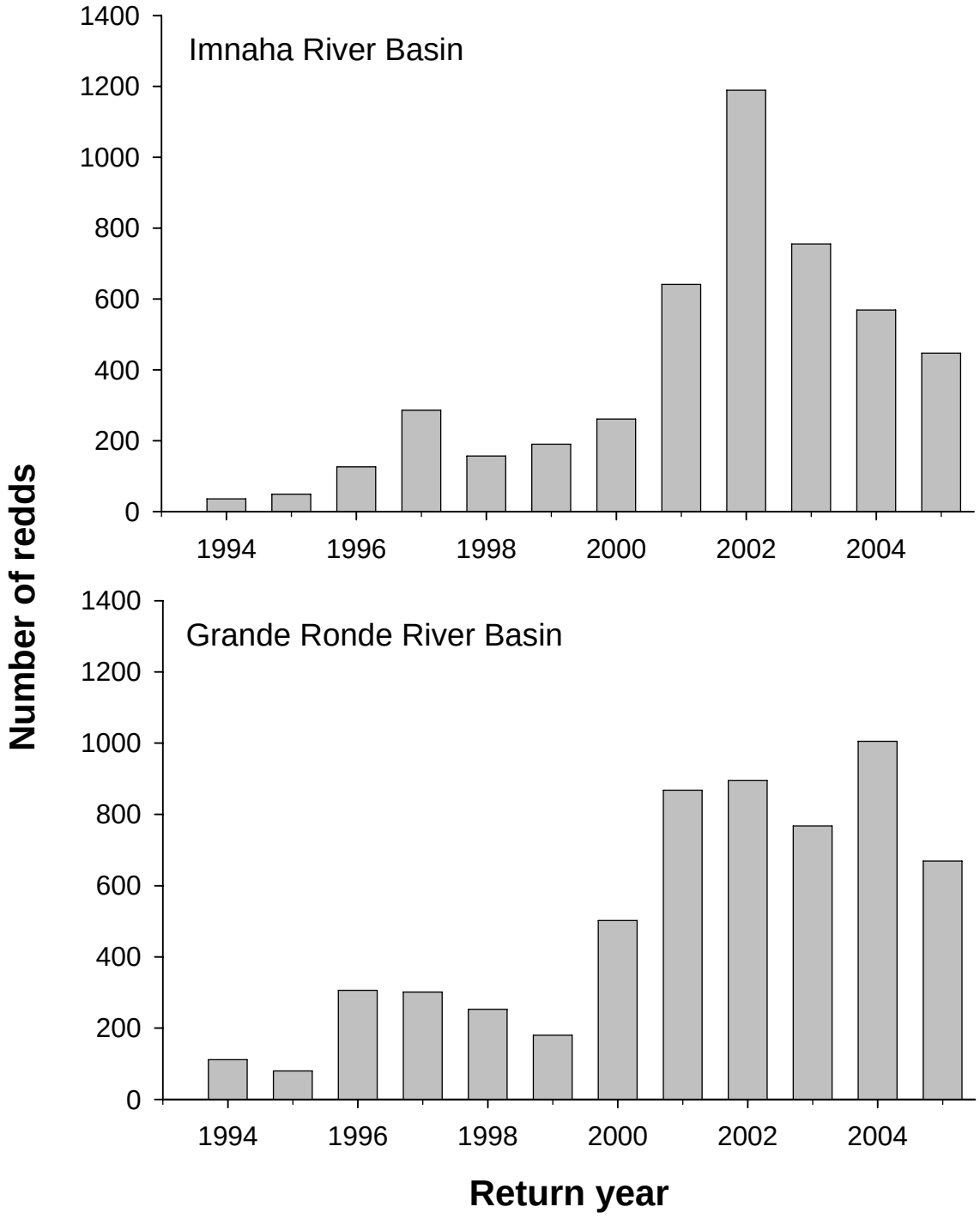

Figure 2. Chinook salmon redd counts in the Imnaha and Grande Ronde basins, 1994-2005.

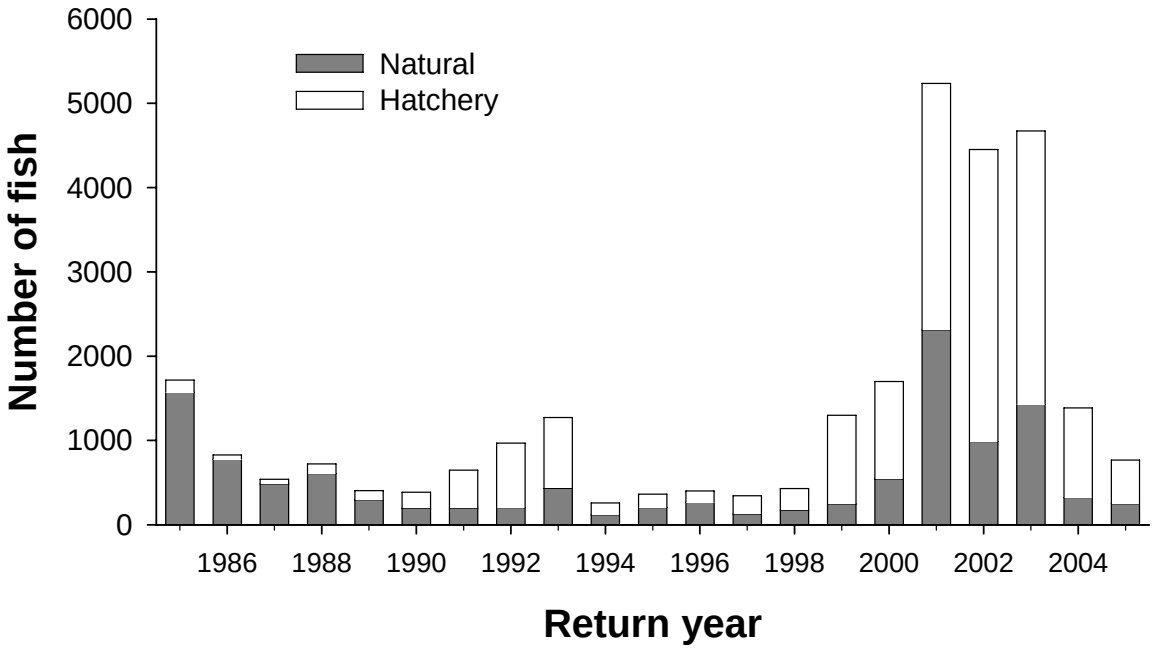

Figure 3. Estimated numbers of natural- and hatchery-origin spring/summer Chinook salmon, including age 3 males, that spawned naturally in the Imnaha River, 1984-2005.

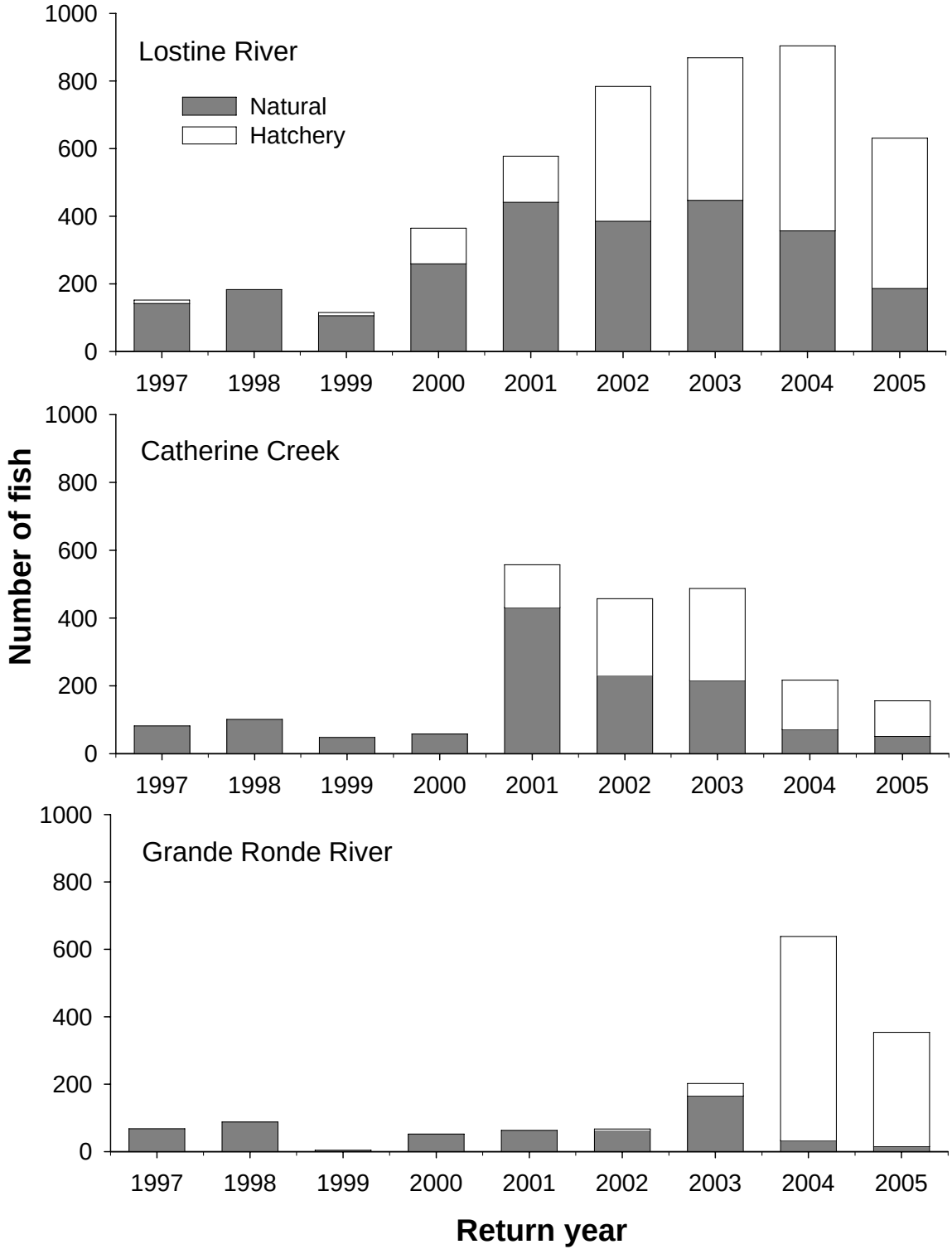

Figure 4. Estimated numbers of natural- and hatchery-origin spring Chinook salmon, including age 3 males, that spawned naturally in the Lostine River, Catherine Creek, and Grande Ronde River, 1997-2005.

Table 1. Rearing summaries for 2003 brood year juvenile Chinook salmon released into the Imnaha and Grande Ronde river basins in 2005.

Stock	Broodstock	Number of green eggs taken	Eyed eggs	Number culled[a]	Percent Survival: Green egg -to- eyed egg	Percent Survival: Eyed egg -to- smolt	Percent Survival: Green egg -to- smolt	Total smolts released
Imnaha River	Conventional	497,969	438,050	0	88.0	99.3	87.4	435,186
Lostine River	Captive	196,043	170,758	56,691	87.1	36.4	31.7	62,149[b]
Lostine River[c]	Conventional	108,758	108,530	0	99.8	94.5	94.3	102,557
Catherine Creek	Captive	268,986	207,295	30,306	77.1	80.5	62.0	166,850[d]
Catherine Creek[c]	Conventional	134,141	133,765	0	99.7	90.3	90.0	120,753
Grande Ronde River	Captive	1,548	1,133	0	73.2	89.9	65.8	1,019
Grande Ronde River[b]	Conventional	120,959	120,770	0	100.0	86.4	86.4	104,350

[a] *Eggs were culled if enzyme-linked immunosorbent assay (ELISA) levels of female broodstock were ≥ 0.8 for Catherine Creek and the Grande Ronde River and ≥0.4 for the Lostine River.*

[b] *An additional 27,042 smolts were culled or died before release due to disease issues.*

[c] *Egg counts reconstructed from smolt numbers plus fry, eyed egg, and green egg losses.*

[d] *Of total, 98,023 Captive Broodstock smolts were released into Lookingglass Creek.*

Table 2. Estimates of percent adipose fin clip (Ad) and coded-wire tag application success for 2003 brood year Chinook salmon stocks reared at Lookingglass Fish Hatchery and released as smolts in 2005.

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	Total released
Imnaha River								
094032	16	Conventional	506	93.7	1.8	4.5	0.0	73,839
094033	17	Conventional	519	97.7	1.0	1.2	0.2	72,247
094034	18	Conventional	501	96.6	0.6	2.8	0.0	73,763
Total/mean			1,526	96.0	1.1	2.8	0.1	219,849
Ad-only	13	Conventional	503	n/a	93.4	n/a	6.6	73,495
Ad-only	12	Conventional	508	n/a	96.3	n/a	3.7	74,031
Ad-only	15	Conventional	505	n/a	95.0	n/a	5.0	67,811
Total/mean			1,516	n/a	94.9	n/a	5.1	215,337
Lostine River								
094037	8	Conventional	510	97.6	1.4	1.0	0.0	50,826
094038	9	Conventional	507	96.8	1.2	2.0	0.0	51,731
092348	10	Captive	503	97.4	1.8	0.8	0.0	43,659
094041	11	Captive	509	96.7	1.8	1.6	0.0	18,490
Total/mean			2,029	97.1	1.5	1.3	0.0	164,706
Catherine Creek								
070753	1[a]	Conventional	n/a	n/a	n/a	n/a	n/a	58,444
Ad-only		Conventional						3,273
070754	2	Conventional	497	95.8	3.6	0.6	0.0	59,036
094039	3	Captive	502	95.8	1.2	2.4	0.6	34,415
094040		Captive						34,412
Total/mean			999	95.8	2.4	1.5	0.3	189,580

Table 2 continued.

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	Total released
Grande Ronde River [b]								
094035	7	Conventional	-	-	-	-	-	49,871
094036	6	Conventional	501	n/a	n/a	95.6	4.4	54,479
094127	7	Captive	-	-	-	-	-	1,019
Total/mean			501	n/a	n/a	95.6	4.4	105,369
Lookingglass Creek								
093824	4	Captive	508	93.3	2.0	3.7	1.0	66,578
Total/mean			508	93.3	2.0	3.7	1.0	66,578
Ad-only	5	Captive	506	n/a	95.7	n/a	4.3	31,445
Total/mean			506	n/a	95.7	n/a	4.3	31,445

[a] *Estimated 0.4% of all fish in raceway 1 had no Ad clip or CWT.*

[b] Captive Broodstock mixed with Conventional Broodstock progeny in Raceway 7. Conventional progeny were not fin clipped. No estimate of fin clip application success for Captive progeny.

Table 3. Mean size of 2003 brood year 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, 2005. Length, weight, and condition factor data collected 8-10 February 2005.

Stock, CWT code	Raceway	Program	Release date	Fork Length (mm) Mean	Fork Length (mm) SD	Weight (g) Mean	Weight (g) SD	Condition factor (K) Mean	Condition factor (K) SD	Total released[a]	Number PIT-tagged	Percent PIT tags detected[b]
Imnaha River												
094033	17	Conventional	29 MAR	111.8	7.5	17.5	3.1	1.3	0.1	72,247	3,467	45.6
094033	16	Conventional	21 MAR-8 APR	115.5	8.1	19.5	4.6	1.2	0.1	73,839	3,502	51.8
094034	18	Conventional	21 MAR-8 APR	112.9	7.8	18.4	4.0	1.3	0.2	73,763	3,499	50.5
Ad-only	13	Conventional	29 MAR	112.6	6.3	17.8	3.4	1.3	0.1	73,495	3,496	51.0
Ad-only	12	Conventional	21 MAR-8 APR	111.1	6.6	19.0	4.6	1.3	0.3	74,031	3,498	51.5
Ad-only	15	Conventional	21 MAR-8 APR	114.2	7.9	18.7	3.3	1.2	0.1	67,811	3,455	50.9
Total										435,186	20,917	50.2
Lostine River												
094037	8	Conventional	28 MAR-11 APR	112.8	7.1	17.5	4.5	1.2	0.2	50,826	3,990	41.3
094038	9	Conventional	11-20 MAR	112.6	9.0	18.8	6.5	1.2	0.1	51,731	4,003	36.2
092348	10	Captive	11-20 MAR	119.9	9.0	20.0	4.9	1.2	0.1	43,659	2,667	30.3
094041	11	Captive	28 MAR-11 APR	122.7	11.5	23.5	6.3	1.3	0.1	18,490	2,661	42.7
Total										164,706	13,321	37.8
Catherine Creek												
070753	1	Conventional	7-27 MAR	112.9	6.4	17.3	4.0	1.2	0.2	58,444	7,004	24.6
Ad-only										3,273		
070754	2	Conventional	28 MAR-7 APR	114.1	6.4	18.2	3.2	1.2	0.1	59,036	6,911	25.2
094039	3	Captive	7-14 MAR	116.0	9.5	18.6	6.9	1.1	0.1	34,415	6,924	16.1
094040										34,412		
Total										189,580	20,839	22.0

[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 3 continued.

Stock, CWT code	Raceway	Program	Release date	Fork Length (mm) Mean	Fork Length (mm) SD	Weight (g) Mean	Weight (g) SD	Condition factor (K) Mean	Condition factor (K) SD	Total released[a]	Number PIT-tagged	Percent PIT tags detected[b]
Grande Ronde River												
094036	6	Conventional	8-14 MAR	119.0	8.7	20.5	4.2	1.2	0.1	54,479	499	14.6
094035 094127	7	Captive	8-14 MAR	118.5	6.8	22.8	5.1	1.4	0.2	49,871 1,019	494	12.1
Total										105,369	993	13.4
Lookingglass Creek												
093824	4	Captive	18-29 MAR	116.5	9.8	19.8	6.4	1.2	0.1	66,578	489	44.8
Ad-only	5	Captive	18-29 MAR	120.6	14.5	22.1	11.0	1.2	0.3	31,445	501	54.1
Total										98,023	990	49.5

Table 4. Recoveries of adult Chinook salmon at northeast Oregon LSRCP facilities, 2005.

Period	Week of year	Imnaha River[a] Marked	Imnaha River[a] Un-marked	Lostine River[b] Marked	Lostine River[b] Un-marked	Catherine Creek[c] Marked	Catherine Creek[c] Un-marked	Grande Ronde River[c] Marked	Grande Ronde River[c] Un-marked	Lookingglass Creek[a] Marked	Lookingglass Creek[a] Un-marked
Dates of trap operation:		20 JUN – 14 SEP		9 MAY – 30 SEP		11 FEB – 3 AUG		10 MAR – 3 AUG		22 FEB – 9 SEP	
30 APR - 6 MAY	18			-	-	0	1	0	0		
7-13 MAY	19	-	-	-	-	0	0	0	0	0	0
14-20 MAY	20	-	-	0	0	0	1	0	0	0	0
21-27 MAY	21	-	-	0	0	1	0	0	0	0	0
28 MAY - 3 JUN	22	-	-	0	0	25	16	17	4	6	7
4-10 JUN	23	-	-	24	3	50	17	111	5	5	8
11-17 JUN	24	-	-	24	6	38	13	93	2	12	4
18-24 JUN	25	74	13	51	9	13	1	29	2	5	2
25 JUN – 1 JUL	26	190	26	96	27	30	8	10	0	3	1
2-8 JUL	27	20	3	137	29	9	3	1	0	1	1
9-15 JUL	28	114	35	111	48	0	0	1	0	0	0
16-22 JUL	29	244	54	109	34	0	0	0	0	1	0
23-29 JUL	30	104	20	25	6	0	0	0	0	1	0
30 JUL – 5 AUG	31	57	13	10	0	0	0	1	1	0	0
6-12 AUG	32	45	10	2	1	-	-	-	-	0	0
13-19 AUG	33	10	3	0	1	-	-	-	-	1	0
20-26 AUG	34	74	42	11	5	-	-	-	-	3	0
27 AUG – 2 SEP	35	45	19	20	7	-	-	-	-	4	2
3-9 SEP	36	4	2	8	8	-	-	-	-	3	0
10-16 SEP	37	0	0	3	9	-	-	-	-	-	-
17-23 SEP	38	-	-	0	0	-	-	-	-	-	-
Total		984	237	631	193	166	60	263	14	45	25

[a]*Operated by Oregon Department of Fish and Wildlife*
[b]*Operated by Nez Perce Tribe*
[c]*Operated by Confederated Tribes of the Umatilla Indian Reservation*

Table 5. Number and disposition of adult Chinook salmon returning to northeast Oregon LSRCP facilities in 2005 by origin, age, and sex.

	Hatchery							Natural							
	Age 3		Age 4		Age 5			Age 3		Age 4		Age 5			Grand
Stock, Disposition	M	F	M	F	M	F	Total	M	F	M	F	M	F	Total	total
Imnaha River															
Trapped	178	0	283	444	32	47	984	10	0	112	58	23	34	237	1,221
Passed	1	0	74	125	10	15	225	10	0	83	38	22	24	177	402
Returned below weir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	0	0	122	151	7	12	292	0	0	0	0	0	0	0	292
Kept	177	0	87	168	15	20	467	0	0	29	20	1	10	60	527
Actual spawned	41	0	61	79	5	8	194	0	0	23	19	1	10	53	247
Killed, not spawned	133	0	21	78	3	10	245	0	0	0	0	0	0	0	245
Pre-spawn mortality	3	0	5	11	7	2	28	0	0	6	1	0	0	7	35
Mean length (mm)[a]	552	-	759	779	875	917		n/a	-	744	753	862	918		
Age composition (%)	18.1	0.0	28.8	45.1	3.3	4.8	100.0	4.2	0.0	47.3	24.5	9.7	14.3	100.0	
Lostine River															
Trapped	70	0	202	324	16	19	631	11	0	95	67	12	8	193	824
Passed	12	0	107	196	14	13	342	9	0	80	50	9	8	156	498
Returned below weir	3	0	0	1	1	0	5	1	0	2	0	0	0	3	8
Outplanted	55	0	67	87	1	4	214	0	0	0	0	0	0	0	214
Kept	0	0	28	40	0	2	70	1	0	13	17	3	0	34	104
Actual spawned	0	0	28	37	0	2	67	1	0	11	17	2	0	31	98
Killed, not spawned	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
Pre-spawn mortality	0	0	0	3	0	0	3	0	0	1	0	1	0	2	5
Mean length (mm)[a]	n/a	-	793	755	n/a	828		466	-	756	751	956	n/a		
Age composition (%)	11.1	0.0	32.0	51.3	2.5	3.0	100.0	5.7	0.0	49.2	34.7	6.2	4.1	100.0	

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

Table 5 continued.

Stock, Disposition	Hatchery							Natural							Grand total
	Age 3		Age 4		Age 5			Age 3		Age 4		Age 5			
	M	F	M	F	M	F	Total	M	F	M	F	M	F	Total	
Catherine Creek															
Trapped	30	0	58	54	8	16	166	4	0	22	27	3	4	60	226
Passed	6	0	40	31	6	16	99	4	0	20	19	3	4	50	149
Returned below weir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	0	0	8	11	2	0	21	0	0	0	0	0	0	0	21
Kept	24	0	10	12	0	0	46	0	0	2	8	0	0	10	56
Spawned[b]	5	0	10	9	0	0	25	0	0	2	8	0	0	10	35
Killed not spawned	21	0	0	0	0	0	20	0	0	0	0	0	0	0	20
Pre-spawn mortality	0	0	2	3	0	0	5	0	0	0	0	0	0	0	5
Mean length (mm)[a]	446	-	731	721	n/a	n/a		n/a	-	712	677	n/a	n/a		
Age composition (%)	18.1	0.0	34.9	32.5	4.8	9.6	100.0	6.7	0.0	36.7	45.0	5.0	6.7	100.0	
Grande Ronde River															
Trapped	6	0	106	134	11	6	263	0	0	4	4	3	3	14	277
Passed	1	0	85	95	11	6	198	0	0	3	2	0	2	7	205
Returned below weir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	5	0	21	39	0	0	65	0	0	1	2	3	1	7	72
Spawned[c]	4	0	18	38	0	0	60	0	0	1	1	2	1	5	65
Killed not spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-spawn mortality	1	0	3	1	0	0	5	0	0	0	1	1	0	2	7
Mean length (mm)[a]	512	-	756	738	n/a	n/a		-	-	685	782	922	n/a	n/a	
Age composition (%)	2.3	0.0	40.3	51.0	4.2	2.3	100.0	0.0	0.0	28.6	28.6	21.4	21.4	100.0	

[b] *Additional fish collected at Lookingglass weir were used as Catherine Creek broodstock (2 jacks and 2 age-4 males).*

[c] *Additional fish collected at Lookingglass weir were used as Grande Ronde River broodstock (1 age-4 male and 1 age-4 female).*

Table 5 continued.

	Hatchery							Natural							
	Age 3		Age 4		Age 5			Age 3		Age 4		Age 5			Grand
Stock, Disposition	M	F	M	F	M	F	Total	M	F	M	F	M	F	Total	total
Lookingglass Creek															
Trapped	14	0	17	12	2	0	45	1	0	14	9	0	1	25	70
Passed[d]	11	0	14	10	2	0	37	0	0	0	0	0	0	0	37
Returned below weir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept[e]	2	0	3	2	0	0	7	0	0	0	0	0	0	0	7
Spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killed not spawned[f]	1	0	0	0	0	0	1	1	0	14	9	0	1	25	26
Pre-spawn mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean length (mm)[a]	n/a	-	n/a	n/a	n/a	-		n/a	-	n/a	n/a	-	n/a		
Age composition (%)	29.5	0.0	38.6	27.3	4.5	0.0	100.0	4.0	0.0	56.0	36.0	0.0	4.0	100.0	

[d] *Fish were initially kept but later released above the weir.*

[e] *Kept fish were strays from Catherine Creek (4), Grande Ronde River (2,) and the Lostine River (1). The Catherine Creek and Grande Ronde River strays were used as broodstock for those programs. The Lostine River 'stray' was re-outplanted to Bear Creek.*

[f] *All natural returns were assumed to be Rapid River stock and killed not spawned.*

Table 6. Timing of spawning and spawning summaries for the Conventional Broodstock of Chinook salmon at Lookingglass Fish Hatchery, 2005. Mixed includes hatchery and natural origin fish.

Stock, spawn date	Number of parents				Number of green eggs collected	Average fecundity	Number of eyed eggs	Percent mortality to shocking
	Hatchery		Natural					
	F	M[a]	F	M[a]				
Imnaha River								
16 AUG	0	2	1	0	5,605	5,605	5,549	1.0
23 AUG	10	15	7	2	82,397	4,847	54,976	33.3
30 AUG	19	12	11	0	132,533	4,418	103,274	22.1
6 SEP	54	66	9	9	284,689	4,519	263,154	7.6
13 SEP	5	5	1	0	26,482	4,414	25,780	2.7
Total	88	100	29	11	531,706	4,760	452,733	14.9
Lostine River								
12 AUG	1	2	1	0	8,658	4,329	7,310	15.6
24 AUG	5	2	1	3	25,719	4,287	18,786	27
31 AUG	16	13	6	5	91,778	4,172	81,915	10.7
7 SEP	13	16	5	8	75,267	4,182	68,467	9.0
13 SEP	4	4	2	1	21,785	4,357	20,475	6.0
12 SEP	0	2	2	1	10,910	3,637	10,338	5.2
Total	39	39	17	18	234,117	4,160	207,291	11.5
Catherine Creek								
25 AUG	1[b]	2	0	0	2,880	2,880	2,697	6.4
1 SEP	3	4	1	0	11,385	2,846	10,014	12.0
8 SEP	6	11	6	1	37,842	3,154	36,765	2.8
Total	10	17	7	1	52,107	2,960	49,476	5
Grande Ronde River								
11 AUG	0	1	0	1	4,114	4,114	1,518	63.1
18 AUG	2	1	0	1	6,486	3,243	3,728	42.5
25 AUG	11	9	2	1	46,983	3,614	37,678	19.8
1 SEP	10	9	0	0	41,196	4,120	26,607	35.4
8 SEP	12	0	0	0	48,958	4,080	44,178	9.8
14 SEP	0	1	0	1	7,333	3,667	7,022	4.2
Total	37	21	2	4	155,070	3,806	120,731	22.1

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

[b] *The coded wire tag in this female showed her to be from the Grande Ronde River.*

Table 7. Estimated adult recoveries by coded-wire tag group of Imnaha River spring/summer Chinook salmon for the 2005 return year. In-basin strays were recovered in non-natal streams in the Snake River Basin. 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]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000	075851	27,730	17 (3)	0	0	0	0	0	17
	093413	61,615	6 (1)	0	0	0	0	0	6
	093414	61,578	17 (3)	0	0	0	0	0	17
	093415	61,511	23 (4)	0	0	0	0	0	23
	093417	61,497	29 (5)	0	0	0	0	0	29
	093443	29,806	11 (2)	0	0	0	0	0	11
	Total	303,737	103 (18)	0	0	0	0	0	103
2001	093642	54,853	183 (42)	5 (1)	23 (8)	0	0	2 (2)	211
	093643	54,836	191 (44)	0	4 (3)	0	0	1 (1)	196
	093644	49,056	156 (36)	4 (2)	3 (2)	0	0	2 (2)	164
	093659	54,842	256 (59)	0	4 (3)	0	0	0	259
	093660	54,839	170 (39)	2 (1)	18 (4)	2 (1)	0	0	192
	Total	268,426	956 (220)	11 (4)	54 (21)	2 (1)	0	5 (5)	1,026
2002	093822	57,053	20 (3)	0	10 (3)	0	0	0	29
	093823	56,992	47 (7)	0	7 (1)	0	0	0	54
	Total	114,045	67 (10)	0	17 (4)	0	0	0	84
Grand Total		686,208	1,126 (248)	11 (4)	69 (24)	2 (1)	0 (0)	5 (5)	1,213

[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. Estimated adult recoveries by coded-wire tag group of Lostine River spring Chinook salmon for the 2005 return year. In-basin strays were recovered in non-natal streams in the Snake River Basin other than outplant streams. 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	Broodstock	CWT code	Number released	Lostine River[a]	Ocean catch[b]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000	Conventional	075852	31,464	4 (3)	0	0	0	0	0	4
	Captive	093419	2,363	0	0	0	0	0	0	0
	Captive	093421	7,800	10 (2)	0	0	0	0	0	10
	Captive	093422	10,514	5 (1)	0	0	0	1 (1)	0	6
	Captive	093423	13,178	5 (1)	0	0	0	0	0	5
	Captive	093425	16,537	10 (2)	0	0	0	0	0	10
	Captive	093426	20,265	5 (1)	0	0	0	0	0	5
	Captive	093428	3,815	0	0	0	0	0	0	0
	Total		105,936	38 (10)	0	0	0	1 (1)	0	39
2001	Conventional	093539	51,795	137 (52)	1 (1)	2 (1)	0	1 (1)	0	141
	Conventional	093540	49,087	158 (60)	6 (2)	3 (3)	0	0	0	167
	Captive	093507	29,158	96 (8)	0	2 (2)	0	0	0	98
	Captive	093535	50,559	60 (5)	7 (3)	0	0	1 (1)	0	68
	Captive	093536	46,752	120 (10)	4 (2)	7 (1)	0	0	0	131
	Captive	093537	7,971	36 (3)	0	0	0	0	1 (1)	37
	Captive	093538	7,427	0	0	0	0	1 (1)	0	1
	Total		242,749	607 (138)	18 (8)	14 (7)	0	3 (3)	1 (1)	643

[a] *Expansion based on estimated number of CWT fish returning (brood year escapement x proportion with CWT x tag retention rate). Includes recoveries from the Wallowa River and Bear Creek that were assumed to be the result of outplanting.*

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

Table 8 continued.

Brood year	Broodstock	CWT code	Number released	Recovery location: Lostine River[a]	Ocean catch[b]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2002	Conventional	093830	58,004	26 (2)	0	0	0	0	0	26
	Conventional	093831	58,366	0	0	0	0	0	0	0
	Captive	093821	58,030	0	0	0	0	0	0	0
	Captive	093827	12,830	16 (1)	0	0	0	0	0	16
	Captive	093829	27,773	33 (2)	0	0	0	0	0	33
	Captive	093839	26,727	0	0	0	0	1 (1)	0	1
	Total		241,730	75 (5)	0	0	0	1 (1)	0	76
Grand Total			590,415	720 (153)	18 (8)	14 (7)	0	5 (5)	1 (1)	758

Table 9. Estimated adult recoveries by coded-wire tag group of Catherine Creek spring Chinook salmon for the 2005 return year. In-basin strays were recovered in non-natal streams in the Snake River Basin other than outplant streams. 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						
Brood year	Broodstock	CWT code	Number released	Catherine Creek[a]	Ocean catch[b]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000	Captive	093420	5,553	2 (1)	0	0	0	0	0	2
	Captive	093429	3,260	2 (1)	0	0	0	0	0	2
	Captive	093430	6,560	0	0	0	0	0	0	0
	Captive	093431	9,404	0	0	0	0	1 (1)	1 (1)	2
	Captive	093432	10,524	2 (1)	0	0	0	0	0	2
	Captive	093433	14,490	4 (2)	0	0	0	0	0	4
	Captive	093435	46,365	6 (3)	0	0	0	0	0	6
	Captive	093436	43,986	4 (2)	0	6 (2)	0	0	0	10
	Captive	093438	23,348	2 (1)	0	0	0	0	0	2
	Total		163,490	22 (11)	0	6 (2)	0	1 (1)	1 (1)	30
2001	Conventional	093543	24,392	27 (26)	0	5 (1)	0	2 (2)	0	34
	Captive	093541	52,989	74 (27)	0	21 (5)	0	1 (1)	0	96
	Captive	093542[c]	52,303	14 (5)	0	0	0	0	0	14
	Total		129,684	115 (58)	0	26 (6)	0	3 (3)	0	144
2002	Conventional	093840	70,071	21 (17)	0	0	0	2 (2)	0	23
	Captive	093835	45,413	7 (5)	0	0	0	0	0	7
	Captive	093836	46,384	2 (1)	0	0	0	0	0	2
	Total		161,868	30 (23)	0	0	0	2 (2)	0	32
Grand Total			455,042	167 (92)	0	32 (8)	0	6 (6)	1 (1)	206

[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.*
[c] *At time of release, CWT code group 093542 had high ELISA levels for bacterial kidney disease.*

Table 10. Estimated adult recoveries by coded-wire tag group of Grande Ronde River spring Chinook salmon for the 2005 return year. In-basin strays were recovered in non-natal streams in the Snake River Basin other than outplant streams. 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						
Brood year	Broodstock	CWT code	Number released	Grande Ronde River[a]	Ocean catch[b]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000	Captive	070149	42,152	12 (1)	0	3 (2)	0	0	0	15
	Captive	092611	2,029	0	0	0	0	0	0	0
	Captive	093416	24,669	12 (1)	0	0	0	0	0	12
	Captive	093424	13,214	0	0	0	0	0	0	0
	Captive	093439	30,376	0	0	0	0	0	0	0
	Captive	093440	31,824	0	0	5 (1)	0	0	0	5
	Captive	093441	20,394	0	0	0	0	0	0	0
	Captive	093442	4,544	0	0	0	0	0	0	0
	Captive	093444	42,200	0	0	2 (2)	0	0	0	2
	Total		211,402	24 (2)	0	10 (5)	0	0	0	34
2001	Conventional	092607	480	4 (3)	0	5 (1)	0	0	0	9
	Conventional	093549	26,443	91 (67)	0	8 (3)	0	3 (3)	0	102
	Captive	093544	57,750	78 (10)	0	40 (12)	0	2 (2)	0	120
	Captive	093545	57,797	86 (11)	0	15 (6)	0	3 (3)	0	104
	Captive	093546	4,821	23 (3)	0	0	0	0	0	23
	Captive	093547	31,881	23 (3)	0	1 (1)	0	1 (1)	0	25
	Captive	093548	52,252	39 (5)	0	5 (1)	0	4 (4)	0	48
	Captive	093649	5,612	23 (3)	0	5 (1)	0	1 (1)	0	29
	Total		237,036	367 (105)	0	79 (25)	0	14 (14)	0	460

[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 10 continued.

Brood year	Broodstock	CWT code	Number released	Recovery location: Grande Ronde River[a]	Ocean catch[b]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2002	Conventional	093833	69,856	9 (6)	0	0	0	0	0	9
	Captive	093832	15,676	0	0	0	0	0	0	0
	Captive	093834	59,387	0	0	0	0	0	0	0
	Total		144,919	9 (6)	0	0	0	0	0	9
Grand Total			593,357	400 (113)	0	89 (30)	0	14 (14)	0	503

Table 11. Estimated adult recoveries by coded-wire tag group for the 2005 return year of Lookingglass Creek spring Chinook salmon. In-basin strays were recovered in non-natal streams in the Snake River Basin other than outplant streams. 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	Lookingglass Creek[a]	Ocean catch[b]	Columbia River[b]	Snake River[b]	In-basin strays[b]	Out-of-basin strays[b]	Total
2000	093434	24,176	2 (0)	0	0	0	0	0	2
	093437	23,756	1 (0)	0	0	0	0	0	1
	Total	47,932	3 (0)	0	0	0	0	0	3
2001[c]	093506	17,880	39 (0)	0	0	0	0	0	39
2002	093837	15,843	11 (2)	0	0	0	0	0	11
	093838	37,352	6 (1)	0	0	0	0	0	6
		53,195	17 (3)	0	0	0	0	0	17
Grand Total		119,007	59 (3)	0	0	0	0	0	59

[a] *Expansion based on estimated number of CWT fish returning (brood year escapement x proportion with CWT x tag retention rate).*
[b] *Expanded number of total CWT fish recovered from PSMFC and ODFW databases.*
[c] *Catherine Creek stock released as parr into Lookingglass Creek.*

Table 12. Catch and escapement distribution of Imnaha River hatchery adult spring/summer Chinook salmon by recovery location in 2005 (estimated CWT recovery data summarized through December 2006 from the PSMFC and ODFW recovery databases).

Location, recovery type	Estimated CWT recoveries[a]	Expanded adults	Percent of total
Ocean catch	11	11	0.8
Columbia River			
Ceremonial and subsistence	0	0	0.0
Treaty net	12	17	1.2
Non-treaty net	10	12	0.8
Sport	47	82	5.7
Test fishery	0	0	0.0
Snake River			
Sport	2	2	0.1
Lower Granite Dam[b]	0	0	0.0
Deschutes River			
Trap	5	5	0.3
Sport	0	0	0.0
Ceremonial and subsistence	0	0	0.0
Other Strays			
Outside Snake River Basin	0	0	0.0
Within Snake River Basin[b]	0	0	0.0
Recruitment to river[b]	n/a	1,307[c]	91.0
Total catch/escapement		1,436	
Return to compensation area		1,307	
Percent of compensation goal[d]		40.7	

[a] *Estimated recoveries in the PSMFC database.*
[b] *Indicates areas defining the compensation area.*
[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 13. Catch and escapement distribution of Grande Ronde Basin hatchery adult spring Chinook salmon by stock and recovery location in 2005 (estimated CWT recovery data summarized through April 2007 from the PSMFC and ODFW databases).

	Lostine River			Catherine Creek			Grande Ronde River			Lookingglass Creek		
Location, recovery type	Est. CWT	Expanded adults	Percent of total	Est. CWT	Expanded adults	Percent of total	Est. CWT	Expanded adults	Percent of total	Est. CWT	Expanded adults	Percent of total
Ocean catch	8	18	2.3	0	0	0.0	0	0	0.0	0	0	0.0
Columbia River												
Ceremonial/subsistence	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Treaty net	1	2	0.3	0	0	0.0	0	0	0.0	0	0	0.0
Non-treaty net	2	2	0.3	2	2	1.0	16	20	3.9	0	0	0.0
Sport	4	10	1.3	6	30	14.5	14	69	13.6	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	0	0	0.0	0	0	0.0	0	0	0.0	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	0	0	0.0
Sport	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Ceremonial/subsistence	0	0	0.0	0	0		0	0	0.0	0	0	0.0
Other Strays												
Outside Snake R. Basin	1	1	0.1	1	1	0.5	0	0	0.0	0	0	0.0
Within Snake R. Basin[a]	5	5	0.7	2	6	2.9	14	14	2.8	0	0	0.0
Recruitment to stream[a]	651[b]	729[c]	95.0	169[b]	172[c]	83.1	311[b]	404[c]	79.7	55[b]	59	100.0
Total estimated return		767			207			507			59	
Compensation area return		734			174			418			59	

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

Table 14. Summary of marked and unmarked Chinook salmon carcass recoveries and number of redds observed by stream during spawning ground surveys, 2005.

Basin, stream	Marked	Unmarked	Unknown Mark	Percent marked	Number of redds
Imnaha River Basin					
Big Sheep Creek	0	0	1	0.0	25
Imnaha River	95	80	10	54.3	349
Lick Creek	36	0	7	100.0	73
Totals	131	80	18	62.1	447
Grande Ronde River Basin					
Bear Creek	7	0	0	100.0	11
Hurricane Creek	0	2	2	0.0	14
Lostine River	87	22	16	79.8	148
Wallowa River	20	15	3	57.1	46
Catherine Creek	35	17	2	67.3	74
Grande Ronde River	74	4	7	94.9	90
Lookingglass Creek	31	6	3	83.8	39
Minam River	0	14	0	0.0	100
Wenaha River	2	33	0	5.7	147
Totals	256	113	33	69.4	669

Table 15. Summary of adipose-clipped Chinook salmon carcass with coded-wire tags recovered during spawning ground surveys, 2005.

Recovery location	Brood year	CWT code	Number recovered	Release site
Imnaha River Basin				
Imnaha River	2000	075851	2	Imnaha River
		093414	1	Imnaha River
		093415	1	Imnaha River
		093417	3	Imnaha River
	2001	093535	1	Lostine River
		093642	10	Imnaha River
		093643	16	Imnaha River
		093644	9	Imnaha River
		093659	8	Imnaha River
		093660	15	Imnaha River
Lick Creek[a]	2000	093417	1	Imnaha River
	2001	093642	5	Imnaha River
		093643	3	Imnaha River
		093644	8	Imnaha River
		093659	6	Imnaha River
		093660	3	Imnaha River
Grande Ronde River Basin				
Bear Creek[b]	2001	093537	1	Lostine River
		093539	1	Lostine River
		093540	5	Lostine River
Catherine Creek	2000	093420	1	Catherine Creek
		093429	1	Catherine Creek
		093435	3	Catherine Creek
		093436	1	Catherine Creek
		093438	1	Catherine Creek
	2001	093541	11	Catherine Creek
		093542	4	Catherine Creek
		093543	8	Catherine Creek
	2002	093835	1	Catherine Creek
		093840	4	Catherine Creek

[a] *Recoveries of Imnaha River adults in Lick Creek were most likely the result of outplanting.*

[b] *Recoveries of Lostine River adults in Bear Creek and Wallowa River were most likely the result of outplanting.*

Table 15 continued.

Recovery location	Brood year	CWT code	Number recovered	Release site
Grande Ronde River	2000	070149	1	Grande Ronde River
		093416	1	Grande Ronde River
		093431	1	Catherine Creek
	2001	093541	1	Catherine Creek
		093544	10	Grande Ronde River
		093545	10	Grande Ronde River
		093546	3	Grande Ronde River
		093547	3	Grande Ronde River
		093548	5	Grande Ronde River
		093549	15	Grande Ronde River
		093649	3	Grande Ronde River
	2002	093833	1	Grande Ronde River
Lookingglass Creek[c]	2000	093433	1	Catherine Creek
		093436	1	Catherine Creek
	2001	093541	13	Catherine Creek
		093542	1	Catherine Creek
		093544	2	Grande Ronde River
		093545	3	Grande Ronde River
		093547	1	Grande Ronde River
		093548	4	Grande Ronde River
		093649	1	Grande Ronde River
	2002	093837	2	Lookingglass Creek
		093838	1	Lookingglass Creek
Lostine River	2000	075852	1	Lostine River
		093421	1	Lostine River
		093422	1	Lostine River
		093423	1	Lostine River
		093425	2	Lostine River
		093426	1	Lostine River
	2001	093507	8	Lostine River
		093535	3	Lostine River
		093536	9	Lostine River
		093537	2	Lostine River
		093539	17	Lostine River
		093540	15	Lostine River
	2002	093829	2	Lostine River
		093830	1	Lostine River

[c] *Recoveries of Catherine Creek adults in Lookingglass Creek were most likely the result of outplanting.*

Table 15 continued.

Recovery location	Brood year	CWT code	Number recovered	Release site
Wallowa River[b]	2000	093421	1	Lostine River
	2001	093535	2	Lostine River
		093536	1	Lostine River
		093539	4	Lostine River
		093540	5	Lostine River
	2002	093827	1	Lostine River
		093830	1	Lostine River

References

Carmichael, R.W. 2006. Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program, 2005 Annual Report, Project No. 199801001, BPA Report DOE/BP-00004023-3). Prepared for Bonneville Power Administration, Portland, Oregon. Oregon Department of Fish and Wildlife, Salem.

Carmichael, R.W. and E.J. Wagner. 1983. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project 14-16-0001-83269, 1983 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Carmichael, R.W. and R.T. Messmer. 1985. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project FRI/LSR-86-35, 1985 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Carmichael, R.W., B.A. Miller and R.T. Messmer. 1986a. Lower Snake River Compensation Plan - Oregon evaluation studies, Fish Research Project FRI/LSR-86-35, 1986 Annual Progress Report. Oregon Department of Fish and Wildlife Portland.

Carmichael, R.W., R. Boyce and J. Johnson. 1986b. Grande Ronde River spring Chinook production report (U.S. v. Oregon). Oregon Department of Fish and Wildlife, Portland.

Carmichael, R.W., R.T. Messmer and B.A. Miller. 1987. Lower Snake River Compensation Plan - Oregon evaluation studies, Fish Research Project FRI/LSR-88-16, 1987 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Carmichael, R.W., R.T. Messmer and B.A. Miller. 1988. Lower Snake River Compensation Plan--Oregon evaluation studies, Fish Research Project AFFI/LSR-90-17, 1988 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Carmichael, R.W., D.L. Eddy, M.W. Flesher, M. Keefe, P.J. Keniry, S.J. Parker and T.A. Whitesel. 1999. Lower Snake River Compensation Plan: Oregon evaluation studies, 1994 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Carmichael, R.W., T.L. Hoffnagle and G. C. Grant. 2005. Lower Snake River Compensation Plan: Oregon evaluation studies. Work statement submitted to the U. S. Fish and Wildlife Service, Lower Snake River Compensation Plan office, Boise, ID. Contract Number 14-11-03-J050. Oregon Department of Fish and Wildlife, La Grande.

Carmichael, R.W., D.L. Eddy, M.W. Flesher, T.L. Hoffnagle, P.J. Keniry and J.R. Ruzycki. 2004. Lower Snake River Compensation Plan: Oregon evaluation studies, 1995 and 1996 Bi-Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Hoffnagle, T. L., R. W. Carmichael and W. T. Noll. 2003. Grande Ronde Basin Chinook salmon captive broodstock program. 1995-2002 status report. Submitted to Bonneville Power

Administration, Portland, Oregon. Northeast Region Fish Research and Development, Oregon Department of Fish and Wildlife, La Grande.

Hoffnagle, T.L., R. W. Carmichael, D.L. Eddy, P.J. Keniry, F. M. Monzyk and G. Vonderohe. 2005. Lower Snake River Compensation Plan: Oregon evaluation studies, 1997 and 1998 Bi-Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Messmer, R.T., R.W. Carmichael and M.W. Flesher. 1989. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project, 1989 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Messmer, R.T., R.W. Carmichael and M.W. Flesher. 1990. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project, 1990 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Messmer, R.T., R.W. Carmichael, M.W. Flesher and T.A. Whitesel. 1991. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project, 1991 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Messmer, R.T., R.W. Carmichael, M.W. Flesher and T.A. Whitesel. 1992. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project, 1992 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Messmer, R.T., R.W. Carmichael, M.W. Flesher and T.A. Whitesel. 1993. Evaluation of Lower Snake River Compensation Plan facilities in Oregon, Fish Research Project, 1993 Annual Progress Report. Oregon Department of Fish and Wildlife, Portland.

Monzyk, F. R., G. Vonderohe, T. L. Hoffnagle, R. W. Carmichael, D.L. Eddy and P.J. Keniry. 2006a. Lower Snake River Compensation Plan: Oregon spring Chinook salmon evaluation studies, 1999 Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Monzyk, F. R., G. Vonderohe, T. L. Hoffnagle, R. W. Carmichael, D.L. Eddy and P.J. Keniry. 2006b. Lower Snake River Compensation Plan: Oregon spring Chinook salmon evaluation studies, 2000 Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Monzyk, F. R., G. Vonderohe, T. L. Hoffnagle, R. W. Carmichael, D.L. Eddy and P.J. Keniry. 2006c. Lower Snake River Compensation Plan: Oregon spring Chinook salmon evaluation studies, 2001 Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Monzyk, F. R., G. Vonderohe, T. L. Hoffnagle, R. W. Carmichael, D.L. Eddy and P.J. Keniry. 2006d. Lower Snake River Compensation Plan: Oregon spring Chinook salmon evaluation studies, 2002 Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Monzyk, F. R, M., G. Vonderohe, T. L. Hoffnagle, R. W. Carmichael, D.L. Eddy and P.J. Keniry. 2006e. Lower Snake River Compensation Plan: Oregon spring Chinook salmon evaluation studies, 2003 Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.

Monzyk, F. R., T. L. Hoffnagle, R. W. Carmichael, D.L. Eddy and P. J. Keniry. 2007. Lower Snake River Compensation Plan: Oregon spring Chinook salmon evaluation studies, 2004 Annual Progress Report. Oregon Department of Fish and Wildlife, Salem.