

LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Spring Chinook Salmon Evaluation Studies
2008 Annual Progress Report

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



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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 2008. Also included in this report are summaries of data collected at adult broodstock collection facilities operated by our co-managers, 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 2008 work statement (Carmichael and Hoffnagle 2008).

We used coded-wire tag (CWT) data collected from 2008 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 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; 2008a; b; Feldhaus et al. 2010) 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, estimates for total adult escapement, and natural escapement monitoring. During the period covered in this report, Chinook salmon smolts from the 2006 brood year were released, Chinook salmon from the 2003-2005 brood years returned to spawn, and some of the returning adult Chinook salmon were used to create the 2008 brood year.

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EXECUTIVE SUMMARY

In 2008, we released 348,910 Chinook salmon smolts from the 2006 brood year into the Imnaha River. We estimated that 99.4% of these smolts were identifiably marked with an adipose fin clip (ad clip) and/or coded-wire tag. In addition, we released 2006 brood year smolts from both the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program (CBS) and Conventional Hatchery Program (CHP) into three Grande Ronde Basin streams. We released 116,882 CHP smolts into Catherine Creek with 97.6% identifiably marked. We released 1,263 CBS eyed eggs into Meadow Creek (Upper Grande Ronde River) and 259,932 CHP smolts into the Upper Grande Ronde River, with 99.1% of the smolts released being identifiably marked. We released 43,218 smolts from the Catherine Creek CBS into Lookingglass Creek in 2008, with 97.3% identifiably marked. We released 10,470 CBS smolts and 194,594 CHP smolts into the Lostine River, with 99.6% identifiably marked.

We trapped 1,912 hatchery- and 153 naturally-produced adult Chinook salmon at the Imnaha River weir. In the Grande Ronde Basin we captured 255 hatchery- and 90 naturally-produced Chinook salmon in Catherine Creek, 112 hatchery- and 21 naturally-produced Chinook salmon in the Upper Grande Ronde River, 319 hatchery- and 53 naturally-produced Chinook salmon in Lookingglass Creek. Approximately 614 hatchery- and 338 naturally-produced Chinook salmon were captured at the Lostine River weir. The Nez Perce Tribe reported that some members of their hatchery production staff had falsified weir data from 2001-2008, so some Lostine River data in this report are reconstructed estimates, based on spawning ground survey, hatchery and outplant data.

For the 2008 brood year spawn at Lookingglass Fish Hatchery, from the Imnaha River, we spawned 82 hatchery and 22 natural females and collected 480,620 green eggs. From Catherine Creek, we spawned 21 hatchery and 11 natural females and collected 124,317 green eggs. In the Upper Grande Ronde River, we spawned 8 hatchery and 4 natural females, and collected 47,402 green eggs. In Lookingglass Creek, we spawned 76 hatchery females and 0 natural females and collected 286,383 green eggs. In the Lostine River, we spawned 37 hatchery females and 19 natural females, and collected 267,834 green eggs.

Without accounting for age or stock specific differences, natural origin salmon had heavier eggs than hatchery salmon. In general, the mean egg weight of salmon from the Imnaha River was greater than for salmon from the Grande Ronde Basin. Within the Grande Ronde Basin, salmon from the Lostine River had the heaviest eggs.

We estimated that 4,220 Imnaha River hatchery Chinook salmon returned to the Lower Snake River Compensation Plan compensation area above Lower Granite Dam in 2008, achieving 131.5% of the hatchery adult compensation goal for the Imnaha River Basin. Of the hatchery returns to the compensation area, 4,218 returned to the Imnaha River. In addition, we estimate that 411 natural origin salmon returned to the Imnaha River. An estimated 515 hatchery Chinook were harvested in sport and tribal fisheries in the Imnaha River. The recruits-per-spawner ratio (R:S) for naturally spawning Imnaha River salmon for the 2003 brood year was 0.05; the fifth consecutive year in which productivity was below replacement after four consecutive years of natural productivity levels above replacement.

In the Grande Ronde Basin, an estimated 277 Catherine Creek, 549 Grande Ronde River, 365 Lookingglass Creek, and 1,610 Lostine River hatchery adults returned, achieving 48.1% of the compensation goal for the Grande Ronde Basin. Nearly 100% of the hatchery returns to the compensation area are accounted for by returns to Grande Ronde Basin streams. In 2008, 270

hatchery and 94 natural salmon returned to Catherine Creek, 530 hatchery and 79 natural salmon returned to the Upper Grande Ronde River, 357 hatchery and 61 natural salmon returned to Lookingglass Creek. We estimate that 1,599 hatchery and 442 natural salmon returned to the Lostine River. Within the Grande Ronde basin, 29 hatchery fish were reported to be harvested in a limited recreation and tribal fishery that occurred in the Wallowa and Lostine rivers.

In the Imnaha River, the R:S ratio for naturally spawning salmon (any origin) was 0.05, and the hatchery component was 3.6. In the Grande Ronde Basin, the 2003 brood year R:S for the CHP component was 2.3 in Catherine Creek, 0.6 in the Upper Grande Ronde River. The natural component R:S for the 2003 brood year was 0.1 in Catherine Creek and 0.2 in the Upper Grande Ronde River. In Lookingglass Creek, the R:S for the hatchery component was 0.8, and 0.7 for the natural component. The hatchery R:S for the Lostine River was 5.2, and 6.4 for the natural component.

In 2008, we observed 679 carcasses and found 642 redds during spawning ground surveys in the Imnaha River Basin, and no known strays were recovered. In the Grande Ronde Basin, we observed 712 carcasses and found 969 redds. We recovered fifteen known in-basin hatchery strays and no out-of-basin strays within the Grande Ronde Basin.

To monitor bacterial kidney disease (BKD) in 2008, 291 kidney samples were collected from salmon recovered in Grande Ronde Basin streams and 162 kidney samples were collected from Imnaha River Chinook salmon. ELISA values remain very low in both the hatchery and in nature and we found no evidence that hatchery salmon releases are causing an increase in BKD prevalence in the monitored streams.

INTRODUCTION

This annual progress report summarizes spring Chinook salmon monitoring data collected by ODFW for the Lower Snake River Compensation Plan (LSRCP) facilities in 2008. Also summarized are the associated adult broodstock monitoring data collected in the Grande Ronde Basin by our co-managers, Nez Perce Tribe (NPT) and 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. Our co-managers, CTUIR and NPT, have specific program goals for Chinook returns to Catherine Creek, the Upper Grande Ronde River, Lookingglass Creek, and the Lostine River, that are discussed and evaluated in reports prepared by each co-management agency. Overall, these data are used to modify culture practices as needed in order to optimize the egg-to-smolt survival, smolt quality, smolt-to-adult survival rate, and to track spawning in nature by hatchery-reared adults. This report provides information on rearing and release operations for the 2006 brood year of juvenile Chinook salmon smolts, the collection of eggs for the 2008 brood year, Chinook spawning in nature, numbers and characteristics of adult Chinook salmon in the 2008 return year, recruit summary and age composition of the 2003 brood year, and bacterial kidney disease (BKD) monitoring.

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, Catherine Creek, Upper Grande Ronde River, Lookingglass Creek, and Lostine River.
4. Estimate annual hatchery returns to compensation areas and determine success in meeting mitigation goals.
5. Estimate annual smolt survival to Lower Granite Dam (LGD) 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 the 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 fish in the Imnaha and Grande Ronde basin Chinook 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 2008, spring Chinook salmon from the 2006 brood year produced from the Conventional Hatchery program (CHP) were released into Catherine Creek, the Upper Grande Ronde River (UGR), Lostine River, and Imnaha River. Smolts from the 2006 brood year produced from the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program (CBS) were also released into Lookingglass Creek (Catherine Creek stock) and the Lostine River. In addition, we released eyed eggs from the UGR CBS program into Meadow Creek, a tributary to the Upper Grande Ronde River near Starkey, OR. Adult Chinook salmon from the 2003-2005 brood years, for all supplemented streams, that returned to spawn were used as broodstock to create the 2008 brood year. These were reared at Lookingglass Fish Hatchery, except for the Lookingglass Creek stock which were reared at Irrigon Fish Hatchery until fall due to capacity limitations at Lookingglass Fish Hatchery. 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.

2006 Brood Year Juveniles

2006 Brood Year Egg to Smolt Survival

Green egg-to-smolt survival rate for the 2006 brood year of Imnaha River Chinook salmon released in 2008 was 86.0% (90.3% green egg-to-eyed egg survival rate; 95.3% eyed

egg-to-smolt survival rate; Table 1). Green egg-to-smolt survival rates for Catherine Creek salmon were 69.4% for CBS offspring and 88.2% for CHP offspring. For the Upper Grande Ronde River, green egg-to-smolt survival rates were 87.4% for CHP offspring. Green egg-to-smolt survival rates were not calculated for the Upper Grande Ronde River CBS because the entire production of 1,263 eyed eggs was released into Meadow Creek (UGR) on 22 and 30 November 2006. For the Lostine River, green egg-to-smolt survival rates were 34.9% for CBS offspring and 80.5% for CHP offspring. Compared to the CHP, survival rates for the CBS 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 CBS females with ELISA levels ≥ 0.8 for Catherine Creek and Upper Grande Ronde River females and ≥ 0.4 for Lostine River females.

2006 Brood Year Production and Tagging

The release of 348,910 smolts from the Imnaha River 2006 brood year in 2008 was below the long-term mitigation goal of 490,000, but near the specific annual production goal of 360,000* for this brood year (Table 1). The recently modified long-term mitigation goals for the Grande Ronde Basin were set at 150,000 smolts per year for Catherine Creek and 250,000 smolts per year for each of the Lookingglass Creek, Upper Grande Ronde River and Lostine River populations. In Catherine Creek, we released 116,882 BY 2006 CHP smolts in 2008. In the Upper Grande Ronde River, from the 2006 CBS brood year, 3,731 green eggs were collected, 2,174 were transferred from Bonneville Fish Hatchery to Lookingglass Fish Hatchery, and after transfer, there was a pick loss of 115 eggs, and 796 were culled. On 22 and 30 November 2006, CTUIR released the remaining 1,263 eyed eggs into Meadow Creek (UGR). A total of 259,932 BY 2006 Upper Grande Ronde River CHP smolts were released, which achieved the mitigation goal. In Lookingglass Creek, we released 43,218 smolts from the 2006 Catherine Creek CBS production. In the Lostine River, we released 205,064 smolts from the 2006 brood year: 10,470 CBS smolts CBS and 194,594 CHP smolts. Mitigation goals were not achieved from all the stocks due to numerous reasons. In the CBS, low broodstock survival due to bacterial kidney disease and low fecundity due to small female size have limited smolt production. In the CHP, low adult returns in 2006 limited the number of broodstock collected and subsequent smolt production, and in Lookingglass Creek no returning adults were spawned in 2006 (Monzyk et al. 2008b).

We evaluated the 2006 brood year smolts released in 2008 for mark application success from 12-14 February 2008, a few weeks prior to their release. We sampled at least 500 smolts from each raceway at Lookingglass Fish Hatchery and checked for the presence of a coded-wire tag (CWT) and adipose fin clip quality (Table 2). We attempted to mark (ad clip+CWT) 50% (three of six raceways) of the Imnaha River smolts. The remaining 50% of the Imnaha River smolts received only ad clips. For the portion of smolts receiving ad clip+CWT, we estimated that 97.7% were successfully marked with both marks. Fin clip application success was estimated at 99.1% for the portion receiving just ad clips. We estimated that 0.6% of the Imnaha River smolts released had no identifiable mark (neither ad clip nor CWT). We attempted to mark (ad clip+CWT) 50% of the Catherine Creek smolts. The remaining 50% of the Catherine

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

Creek smolts received only ad clips. For the portion of smolts receiving ad clip+CWT, we estimated that 90.2% were successfully marked with both clips. Fin clip application success was estimated at 96.0% for the portion receiving just ad clips. We estimated that 2.3% of all Catherine Creek smolts released had no identifiable mark. We attempted to mark 50 % the Upper Grande Ronde River CHP smolts (2 of 4 raceways) with just CWTs, 25% receiving ad clip+CWT, and the remaining 25% receiving only an ad clip. We estimated that 98.6% of the smolts receiving only CWTs retained them when released. For the smolts receiving an ad clip+CWT, we estimated that 95.9% of them were successfully marked with both marks. Fin clip application success for the remainder of the Grande Ronde River smolts only receiving an ad clip was estimated at 99.4%. For the Grande Ronde River smolts we estimated that 99.1% were identifiably marked. As a result of not spawning any of the returning fish to Lookingglass Creek, we used the smolts from the Catherine Creek CBS as Lookingglass Creek stock. We attempted to mark all smolts with an ad clip+CWT and estimated that 91.8% had received both identifiable marks, and 0.7% had no identifiable mark. We attempted to mark all Lostine River CHP smolts released in 2008 with ad clip+CWT and achieved a 97.6% application success rate. We estimated that 1.1% had an ad clip but no CWT, 1.0% had a CWT but no ad clip, and less than 0.3% of smolts had no identifiable mark. For the Lostine River CBS smolts, we attempted to mark all of them with only CWTs. We estimated that we achieved a 97.4% application success rate leaving an estimated 2.6% with no identifiable mark.

2006 Brood Year Downstream Survival

Smolt migration success was monitored for all stocks based on survival to Lower Granite Dam (LGD). We developed release-recapture information for PIT-tagged smolts from each raceway to calculate Cormack-Jolly-Seber survival probabilities to LGD using the PIT Pro 4 Program (Westhagen and Skalski 2009) with a single release recapture model (Skalski et al. 1998). Mean stock survival was calculated as the weighted average of the raceways for each stock with the number of smolts in each raceway as the weight.

The Imnaha River 2006 brood year Chinook salmon were acclimated at the Imnaha River Acclimation Facility starting 12 March 2008 and were volitionally released beginning 25 March (Table 3). All fish remaining in the acclimation ponds were forced out on 10 April 2008. Mean survival probability to LGD for Imnaha River smolts released in 2008 was 0.70 (Table 3).

Smolts produced from CHP were transported to the Catherine Creek acclimation ponds on 10 March 2008, volitionally released starting on 24 March 2008, and the remaining smolts were forced out on 14 April 2008 (Table 3). Mean survival probability to LGD for CHP smolts released into Catherine Creek was 0.42.

There were no smolts produced from the Upper Grande Ronde River CBS because the eyed eggs were released into Meadow Creek. Smolts from the CHP were transported to the Upper Grande Ronde River acclimation ponds in two stages: early and late acclimation periods. Smolts from raceways 5 and 7 were transported to the acclimations ponds on 11 March 2008 for the early acclimation period (Table 3). Volitional release of the early acclimation smolts began on 17 March 2008 and remaining smolts were forced out on 24 March 2008. Smolts from the late acclimation period (raceways 6 and 8) were transported to the acclimation ponds from 25-26 March 2008, volitionally released beginning on 7 April 2008 and the remaining smolts forced out on 14 April 2008. Mean survival rates to LGD for Upper Grande Ronde River CHP stock was 41%. The late period acclimation smolts had a higher survival probability (0.47) than the early acclimation period smolts (0.35-0.36).

Smolts from the Lostine River CHP production group 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 3 March 2008. Smolts from the Lostine River CBS were part of the early release group. Volitional release of smolts began on 19 March 2008 and remaining smolts were forced out on 1 April 2008. Smolts from the late acclimation period were transported to acclimation ponds on 3 April 2008, volitionally released beginning on 10 April 2008, and remaining smolts were forced out on 17 April 2008. The Lostine River CHP released during early acclimation periods had a lower survival probability to LGD (0.53) than CBS smolts (0.59). CHP smolts released during the late acclimation period had survival probabilities higher than the early acclimation groups (0.63-0.68).

Catherine Creek Chinook salmon smolts produced from CBS parents released into Lookingglass Creek were volitionally released from the rearing raceways at Lookingglass Fish Hatchery starting on 1 April, and were forced out into Lookingglass Creek on 14 April 2008 (Table 3). Mean survival probability to LGD for CBS smolts released into Lookingglass Creek was 0.72.

2008 Return Year Adult Collections

Imnaha River

The Imnaha River weir was installed by ODFW Lookingglass Fish Hatchery personnel on 10 July 2008 and operated until 23 September 2008 (Table 4). Based on the adipose fin and CWT marks, we trapped 1,880 hatchery and 190 naturally-produced salmon. Additionally, 19 salmon released below the weir were recaptured. After accounting for estimates of hatchery returns that lacked both a fin clip and CWT, we estimated that we trapped 1,912 hatchery and 153 natural origin salmon. We retained 213 hatchery and 62 natural salmon for broodstock. To limit the number of hatchery salmon on spawning grounds, 768 jacks and 325 adult salmon were retained for distribution to NPT and Oregon foodbanks. Additionally, 79 hatchery jacks and 300 hatchery adults were outplanted to Big Sheep and Lick creeks (Table 5). The remaining salmon collected at the weir were released above the weir to spawn naturally (127 hatchery, 81 natural origin).

Catherine Creek

The Catherine Creek weir was operated by personnel from CTUIR from 3 March to 9 September 2008 (Table 4). The last fish captured at the Catherine Creek weir was on 2 September 2008. Without adjusting for estimates of unmarked hatchery returns, a total of 250 hatchery and 95 natural origin salmon were captured. After adjusting for unmarked hatchery returns, we estimated that 255 hatchery and 90 naturally-produced salmon were captured, of which 125 hatchery and 72 natural salmon were release above the weir to spawn naturally (Table 5). Additionally, two adults and two jacks, identified as Catherine Creek stock based in Green VIE tags, were captured in the Lookingglass Creek weir.

This is the third complete brood year to return of Catherine Creek hatchery adults from both CBS and CHP (2001-2003 brood years). Returning CBS adult Chinook were marked with an Ad clip and CHP returns were marked with an Ad clip and VIE tag. Based on visual identification of returning adults, CTUIR staff identified 114 CBS and 136 CHP Chinook

returns. We have the same concern about misidentification of CHP returns in 2008 that we expressed for the 2007 returns (Feldhaus et al. 2010) and suspect that VIE tag loss is resulting in a visual underestimate of CHP and overestimate of CBS returns. Based on visual observations, the age structure of CBS progeny that returned to the Catherine Creek weir was 4% age 3 (N = 4); 89% age 4 (N = 102); and 7% age 5 (N = 8). Age structure of the CHP progeny based on a visual observation was 73% age 3 (N = 99); 23% age 4 (N = 32); and 4% age 5 (N = 5).

Upper Grande Ronde River

The Upper Grande Ronde River weir was operated by CTUIR personnel from 5 March to 28 July 2008 (Table 4). A total of 112 hatchery- and 21 naturally-produced salmon were captured. The last fish was captured at the Upper Grande Ronde River weir on 21 July 2008. An additional 29 salmon that returned to the Lookingglass Creek weir were identified as Upper Grande Ronde hatchery stock, based the absence of an adipose fin clip and presence of a CWT, and are included in the estimated total return to the Upper Grande Ronde River. Forty-one hatchery (27 age 3) and nine natural salmon were retained for broodstock (Table 5). Ninety-four hatchery (92 age 3, 2 age 4) salmon were sacrificed for tribal distribution. The remaining salmon caught at the Upper Grande Ronde River weir were released above the weir to spawn naturally (6 hatchery, 12 natural).

This is the third year we had a complete brood year return of Upper Grande Ronde River hatchery adults from both the CBS and CHP (2001 – 2003 brood years). Six age 3 Chinook identified as CBS progeny were captured at the Upper Grande Ronde River weir in 2008. Age structure of the CHP was 91% age 3; 8% age 4; and 1% age 5.

Lookingglass Creek

The Lookingglass Creek weir was operated by Lookingglass Fish Hatchery (ODFW) personnel from 3 March to 9 September 2008. A total of 319 hatchery and 53 natural salmon were collected at the weir. At the time of capture, 30 hatchery Chinook were visually identified as strays based on the combination of fin clips, presence or absence of a CWT, and VIE marks: 28 from the Upper Grande Ronde River CHP and from the Catherine Creek CHP. The 28 Upper Grande Ronde River CHP strays were used as broodstock for the Upper Grande Ronde River CHP and the two Catherine Creek CHP strays were treated as Lookingglass Creek stock. Of the 140 hatchery fish kept for spawning, it was later determined after spawning that two age four Lostine River CHP females were mistakenly spawned as Lookingglass Creek stock. A total of 151 hatchery and 38 natural origin Chinook were passed above the weir to spawn naturally. Based on ODFW spawning records and outplant records provided by CTUIR, it appears that two additional hatchery fish were utilized in the Lookingglass Creek program. We are unable to determine how these two additional fish were incorporated into the Lookingglass Creek hatchery program.

Lostine River

The Lostine River weir was installed by NPT personnel on 22 May 2008 and operated until 1 October 2008 (Table 4). In a letter from NPT dated 26 May 2009, co-managers were informed about inaccuracies associated with data collected at the Lostine River weir. NPT determined that three aspects of data collection protocols were compromised or falsified between 2001 and 2008. The pass:keep criteria were not strictly followed, hatchery origin fish with poor or questionable quality adipose fin clips were recorded as natural origin fish, and genetic tissues

were dropped or lost and replaced by a “backup supply of tissue” from previously sampled fish, resulting in multiple samples from a single fish being recorded as multiple fish. In order to reconcile the data as well as possible, NPT created a rule set for evaluating all data collected between 2001 and 2008:

- 1) Any genetic sample matching two or more fish is defined as a group of replicates.
- 2) There can only be one real fish within a group of replicates with the exception of hatchery fish shown with a disposition of “kept” or “out-planted.” If a hatchery fish has been duplicated as “kept” or “out-planted,” assume replicate records represent actual fish.
- 3) Assume that records with dispositions of “kept” or “out-planted” represent the actual fish within a group of replicates. Eliminate all other records unless Rule 1 applies.
- 4) If the origin of the fish was not consistently duplicated within a group of replicates as either natural or hatchery, assign an unknown origin type to the fish.
- 5) Assume a fish was real if a valid PIT tag ID exists.

Using the rule set, an escapement estimate using mark-recapture data from spawning ground surveys and the modified weir records was used to estimate the annual number of returning hatchery and natural Chinook to the Lostine River between 2001 and 2008. Additionally, there is doubt about the reliability of size data collected for fish handled at the Lostine River weir, so we are not able to reliably report age structure for fish handled at the weir (Table 5).

We estimate that a total of 614 hatchery and 338 natural salmon were collected at the weir (Table 5). A limited tribal harvest removed approximately 29 hatchery adults below the weir. Adults used as broodstock in the 2008 brood year were both natural and hatchery origin (CHP progeny only – returning CBS progeny are allowed to spawn naturally or are removed but are not collected for the CHP broodstock due to domestication concerns). This is the fourth year we had a complete brood year return of Lostine River hatchery adults from both the CBS and CHP programs (2000-2003 brood year).

2008 Brood Year Hatchery Spawning

Imnaha River

For the 2008 brood year, we spawned 82 hatchery and 22 natural females with 157 hatchery and 76 natural males. The number of male parents is greater than the number of males kept because each male was used 1-3 times. We collected 480,620 green eggs from broodstock (Table 6). Eggs were incubated at Lookingglass Fish Hatchery and percent mortality to shocking was 9.9%, resulting in 433,171 eyed eggs

Catherine Creek

Adults used as broodstock to create the Catherine Creek 2008 brood year were from both natural and hatchery origin (CHP progeny only – returning CBS progeny are allowed to spawn naturally or are removed but are not collected for CHP due to domestication concerns). For the 2008 brood year, we spawned 21 hatchery and 11 natural females with 41 hatchery and 20 natural males. The male numbers are greater than the number of males collected for broodstock

because some males were spawned more than one time. We collected 124,317 green eggs and percent mortality to shocking was 5.4%, resulting in 117,605 eyed eggs (Table 6).

Upper Grande Ronde River

Adults used as broodstock to create the Upper Grande Ronde River 2008 brood year were from both natural and CHP origin (returning CBS progeny are allowed to spawn naturally or are removed but are not collected for CHP broodstock due to domestication concerns). We spawned eight hatchery and four natural females with 16 hatchery and 10 natural males. The number of males spawned is greater than the number of males used for spawning because some males were spawned more than once. From the eight hatchery females spawned as Upper Grande Ronde River stock, based on CWT data, one female was from Lostine River stock and two were from Lookingglass Creek stock. We collected 47,402 green eggs and percent mortality to shocking was 10.4%, resulting in 42,458 eyed eggs (Table 6).

Lookingglass Creek

For the 2008 brood year, we spawned 76 hatchery females with 97 hatchery and 23 natural origin males. The number of males spawned is greater than the number of males kept because some males were spawned more than once. Based on CWT information, two hatchery females spawned as Lookingglass Creek stock were strays from the Lostine River CHP and one female was a Catherine Creek CBS stray. Based on CWT data, we spawned five age 3 males 1-2 times each that were in-basin strays; four from Catherine Creek CHP and one from the Upper Grande Ronde River CHP. We collected 286,383 green eggs with percent mortality to shocking at 7.4%, resulting in 265,191 eyed eggs (Table 6).

Lostine River

For the 2008 Brood Year, we spawned 37 hatchery and 19 natural females with 36 hatchery and 23 natural males. The number of male parents is greater than the number of males kept because some males were spawned more than once. We collected 267,834 green eggs and percent mortality to shocking was 7.7%, resulting in 247,274 eyed eggs (Table 6).

Egg Weight

Without accounting for age or stock, we found a significant ($P = 0.035$) difference in mean egg weight (g) between hatchery (0.233 g) and natural (0.245 g) origin Chinook salmon collected for the 2008 brood year. Incorporating the age, but not stock, we found no difference ($P = 0.572$) in mean egg weight between age 4 hatchery and age 4 natural returns, or between age 5 hatchery and age 5 natural returns ($P = 0.463$). Age 5 returns had significantly greater egg weights ($P < 0.001$; 0.289 g) than age 4 returns (0.230 g). In general, the mean egg weight of Chinook salmon from the Imnaha River was greater than for salmon from the Grande Ronde Basin. Within the Grande Ronde River Basin, Lostine River salmon had the greatest mean egg weight (Table 7).

Coded-Wire Tag Recoveries

Methods

Hatchery salmon from most production groups were marked with a coded-wire tag to provide basic information on survival, harvest, escapement, straying, and specific information on experimental groups, if any. 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 numbers of hatchery salmon from each CWT code group recovered in ocean and main stem river fisheries, as well as strays collected in and out of the Snake River Basin, were summarized. Estimated CWT recoveries in the RMIS database were expanded from observed recoveries based on sampling efficiencies at some recovery locations, but not 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 River, Upper Grande Ronde River, Lookingglass Creek, Catherine Creeks, and Lostine River based on total escapement to each stream, sampling rate, and the proportion of each cohort marked with CWTs.

In the Imnaha River, observed recoveries were expanded for unrecovered CWT adults by first estimating hatchery escapement to the river for each brood year. 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. 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 recovered within a brood year to give the expanded number of CWT returns for each tag group.

The methodology for estimating hatchery and natural escapement to the Imnaha River for the 2008 return year differed from previous years. We have adjusted estimates to the Imnaha River from 1991 to present using the following methods. Separate mark-recapture population estimates were constructed for hatchery and natural origin adults (ages 4 and 5) passed above the weir. Within each age class above the weir, we used in-season recovery rates of carcasses recovered with a hole punch in the operculum (OP punch, indicating the fish was handled at the weir and released upstream) to expand unmarked (i.e., no OP mark) carcasses recoveries. To estimate adult age structure above the weir, for both hatchery and natural origin salmon, we use both carcass recovery and weir data indicating the size and origin of salmon passed above the weir. To estimate the number of age 3 salmon above the weir, we used a mark-recapture estimate if the sum of the OP marked jacks passed above the weir and the number of OP marked jacks recovered exceeded 4 times the population estimate (Robson and Regier 1964). When the ratio of marked and recovered fish was less than 4 times the population estimate, we expanded jack recoveries by 11%, which was the mean recovery rate of OP marked jacks passed above the Imnaha River weir between 1991 and 2008.

To estimate the number of salmon below the Imnaha River weir, we used the in-season adult fish per redd value calculated from above the weir and multiplied this value by the number of redds counted below the weir. Jack recoveries below the weir were expanded by 11%. The proportion of hatchery and natural salmon below the weir was calculated by multiplying the total adult estimate below the weir by the ratio of weir and expanded carcass recoveries from above the weir. Carcass recoveries below the weir were expanded by 22 and 29% for ages 4 and 5 salmon, respectively. The escapement estimate was the sum of untrapped fish above and below

the weir added to the number of known origin (i.e., hatchery or natural) Chinook removed at the weir - kept for broodstock, outplanted, trap mortalities, sacrificed, and harvested.

In the Grande Ronde River Basin, CWTs from the CBS and CHP were recovered at different sampling efficiencies. Recovery rates for CHP progeny are usually higher because CWTs are recovered from CHP progeny retained for broodstock, as well as from spawning grounds surveys, whereas CBS recoveries are typically recovered only on spawning ground surveys, since none are retained for broodstock. This necessitated expanding CWT recoveries for CBS and CHP hatchery returns separately. On the Upper Grande Ronde River and Catherine Creek, we used the CWT code to enumerate CBS and CHP returns for any fish that was kept (e.g., broodstock, trap mort, sacrifice). To estimate the numbers of CBS and CHP returns left in the river to spawn naturally (e.g., passed above the weir, untrapped) within a brood year, we multiplied the estimated number of fish left in the river by the relative proportion of CBS and CHP CWT recoveries on spawning ground surveys.

NPT reported that some members of their hatchery production staff had falsified weir data from 2001-2008. One result of this is that for the Lostine River, we were unable to expand CBS and CHP recoveries in the same way we expanded for Catherine Creek and the Upper Grande Ronde River because we are unable to rely on Lostine River weir data to correctly identify CBS and CHP returns. Therefore, we did not differentiate between broodstock origin, and simply expanded CWT recoveries as “hatchery” salmon using the method described for the Imnaha River. To estimate total return of hatchery and natural salmon to the Lostine River, we used two sets of non-weir data that were known to be reliable for an adult (age 4-5) estimate of hatchery and natural returns above the weir: 1) a mark-recapture estimate was calculated using spawning ground survey carcass recoveries, and 2) weir data for 2008 that was reconciled by NPT research biologists using data known to be reliable (Peter Cleary, NPT Biologist, personal communication).

The methodology for estimating hatchery and natural escapement to the Lostine River for the 2008 return year differed from previous years. This change in methodology was a direct result of the falsified weir data from 2001-2008. To reconcile the data, ODFW and NPT research biologists developed an agreed upon approach for calculating escapement to the Lostine River. We have adjusted estimates to the Lostine River from 1997 – present using the following methods. First, we calculated an adult (age 4-5) estimate above the weir using a Lincoln-Petersen mark-recapture estimate, and divided this estimate by the total number of redds above the weir. The adult/redd estimate from above the weir was multiplied by the number of redds below the weir to estimate adult spawners below the weir. To estimate age 3 jack returns above the weir, we used a Lincoln-Petersen mark-recapture estimate in years when the data were believed to be reliable and enough jacks were passed and recovered above the weir for a valid mark-recapture estimate. If the number of jacks passed above the weir was believed to be incorrect, or there were too few jack recoveries for a mark-recapture estimate, we expanded jack carcass recoveries by 50% of the adult recovery rate. Based on mean age 3 carcass recovery rates from Catherine Creek and the Imnaha River (ODFW, unpublished data). To estimate jacks below the weir, we multiplied the ratio of jacks to adults trapped at the weir by the below weir adult estimate.

To partition the origin (i.e., hatchery or natural), age, and sex of Chinook salmon returns to the Lostine River from 1997-2000, we applied the origin, age, and sex data from fish trapped at the weir and from non-OP marked Chinook carcass recoveries on spawning ground surveys. For 2001-2008, we used carcass recoveries from spawning ground surveys to partition the origin,

age, and sex of spawners above and below the weir. For all years, the estimate of fish in the river was added to the number of known origin Chinook handled at the weir that were kept for broodstock, outplanted, trap mortalities, sacrificed, and harvested to arrive at an escapement estimate.

In both the Imnaha and Grande Ronde basins, the exception to the CWT expansion method is when we did not have any CWT recoveries for a particular brood year, but weir data indicated adults from that brood year had returned. In these cases, we estimated the total number of returning adults by age class. 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 the 2008 return, it was necessary to partition CWTs in this manner for the 2003 brood year returns to Catherine Creek.

For some stocks, 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 for the stream to which they returned.

Results

Imnaha River

In 2008, 250 hatchery-reared Imnaha River Chinook salmon from the 2003-2005 brood years with a CWT were recovered (Table 8). Nearly all of these CWT recoveries occurred in the Snake River Basin. Recoveries were expanded to an estimated 1,799 CWT-marked Chinook returning to the Imnaha River (95% of total recoveries) with the following age distribution: 130 from the 2003 brood year (age 5); 1,052 from the 2004 brood year (age 4); and 617 from the 2005 brood year (age 3). In addition, we estimated that five CWT Imnaha River salmon were harvested in ocean fisheries, 71 were harvested in the Columbia River, and no CWT recoveries were reported from sport or tribal fisheries in the Snake River. Below LGD, 10 CWT-marked Chinook were recovered; four were in the Methow River, five in the Deschutes River, and one was recovered outside the Snake and Columbia river basins at Cole River Fish Hatchery in Southern Oregon. Of the Columbia and Snake rivers recoveries, an estimated 33 CWTs were recovered in treaty net fisheries, four in commercial net fisheries, and 34 were recovered in sport fisheries (Table 9).

Catherine Creek

We recovered 196 hatchery-reared Catherine Creek Chinook salmon with a CWT from the 2003-2005 brood years (Table 10). Recoveries were expanded to an estimated 264 CWT marked adults returning to Catherine Creek with the following age distribution: 6 from the 2003 brood year (age 5); 151 from the 2004 brood year (age 4); and 107 from the 2005 brood year (age 3). Catherine Creek Chinook salmon were not recovered in ocean fisheries, or in the Snake River, but an estimated 112 were recovered from the Columbia River (Table 11). Of the Columbia River recoveries, an estimated 32 were recovered in tribal net fisheries, 25 in commercial net fisheries, and 56 in sport fisheries. We recovered seven salmon released into Catherine Creek in Lookingglass Creek (i.e., in-basin stray).

Upper Grande Ronde River

We recovered 165 hatchery-reared Upper Grande Ronde River Chinook salmon with a CWT from the 2003-2005 brood years in 2008 (Table 12). Recoveries were expanded to an

estimated 517 CWT returns to the Grande Ronde River with the following age distribution: three from the 2003 brood year (age 5); 53 from the 2004 brood year (age 4); and 461 from the 2005 brood year (age 3). Upper Grande Ronde River Salmon salmon were not recovered in ocean fisheries, or in the Columbia or Snake rivers. Sixteen Upper Grande Ronde River salmon, all age 3 returns, were recovered as in-basin strays: one from the Tucannon River and 15 from Lookingglass Creek. The lack of identified recoveries outside the Upper Grande Ronde River is probably because none of the 2003 and 2004 brood year releases received an adipose fin clip. From the 2005 brood year returns, none of the 118,803 Upper Grande Ronde River CHP smolts and 95.8% of the 20,620 CBS smolts received an adipose fin clip. Therefore, unless a snout is collected for all fish with an intact adipose fin or a CWT wand is used to check for the presence or absence of a CWT for all fish handled that have an intact adipose fin, it is likely that Upper Grande Ronde River Chinook salmon were mistakenly identified as a natural returns and the CWT was not recovered. Furthermore, many sport fisheries prohibit harvesting Chinook salmon with an intact adipose fin, further diminishing the chances of recovering a CWT from Upper Grande Ronde River hatchery salmon.

Lookingglass Creek

We recovered 190 hatchery-reared Lookingglass Creek Chinook salmon with a CWT from the 2003-2005 brood years in 2008 (Table 13). Recoveries were expanded to an estimated 330 CWT returns to Lookingglass Creek with the following age distribution: 12 from the 2003 brood year (age 5); and 318 from the 2004 brood year (age 4). We did not release any Chinook into Lookingglass Creek from the 2005 brood year. All hatchery age 3 returns to Lookingglass Creek in 2008 were hatchery strays. No Lookingglass Creek salmon marked with a CWT were recovered in ocean fisheries. An estimated 268 were recovered in the Columbia River, 61 in treaty net fisheries, 62 in commercial net fisheries, and 145 in sport fisheries. An estimated three CWT marked salmon were recovered in Snake River sport fisheries and one stray was recovered below LGD (i.e., out-of-basin stray) in the Deschutes River (Table 11). Of the five in-basin strays recovered, two were recovered from the Wallowa River, two from the Minam River and one from the Wenaha River.

Lostine River

We recovered 343 hatchery-reared Lostine River Chinook salmon with a CWT from the 2003-2005 brood years in 2008 (Table 14). The 298 CWT recoveries from the Lostine River expanded to the following age distribution: 22 from the 2003 brood year; 974 from the 2004 brood year; and 568 from the 2005 brood year. One Lostine River Chinook salmon was harvested in ocean fisheries, 100 were harvested in the Columbia River migration corridor, none were recovered in the Snake River migration corridor and no out-of-basin strays were recovered (Table 11). Nineteen CWT salmon were recovered as in-basin strays: one at the Rapid River trap, one at the Powell Rack, one in the Imnaha River, three in the Minam River, four in Hurricane Creek, two in the Wallowa River, six in Lookingglass Creek and one at the Upper Grande Ronde River trap. Since NPT outplanted fish from the Lostine River to the Wallowa River in 2008, it is possible the stray recoveries on the Wallowa River and Hurricane Creek were outplants from the Lostine River that lost their identifying outplant mark.

Compensation Goals

To assess LSRCP success at 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 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 or failed CWT application), 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 2008 return year above Lower Granite Dam.

Innaha River

Return to Compensation Area

The annual compensation goal for the Innaha Basin is 3,210 hatchery adults (age 3-5). We estimated that 4,220 Innaha River hatchery adults returned to the compensation area, 131.5% of the hatchery adult goal for the Innaha River stock (Table 9).

Return to the River

We estimate 4,218 hatchery and 411 natural origin salmon returned to the Innaha River. The hatchery salmon return was comprised of 1,477 age 3, 2,478 age 4, and 263 age 5 returns. For natural salmon, we estimate 129 age 3, 227 age 4, and 45 age 5 returned. The estimated total return to the river includes an estimate of 129 hatchery jacks and 64 hatchery adults harvested by sport anglers, and an estimated incidental hooking mortality of two natural adults. The area open to anglers on the Innaha River extended from the mouth of the Innaha River upstream to Summit Creek bridge, and the fishery was conducted from 4-13 July 2008. Additionally, NPT reported an estimate of 23 hatchery jacks, 299 hatchery adults, and eight wild adults were harvested by tribal members. Snouts from hatchery fish were not collected from either the sport or tribal fishers so CWT data are not available from these harvest efforts. In total, 515 hatchery fish were harvested, representing 12% of the total estimated return to the compensation area.

Recruits:Spawner (R:S) and Smolt-to-Adult Return Rates (SAR)

The recruits-per-spawner (R:S) ratio for naturally spawning Innaha River salmon (any origin) in 2003 was 0.05, the fifth consecutive year below replacement (Figure 1). The R:S ratio for the hatchery component was 3.6. The R:S ratios reported here include jacks and are not adjusted for estimates of pre-spawn mortality. The 2003 brood year smolt-to-adult return rate (SAR) above LGD was 0.3, the fifth consecutive year of declining SAR rates since the 1998 brood year (Table 15).

Grande Ronde Basin

Return to Compensation Area

In the Grande Ronde Basin, the annual compensation goal for all stocks combined was set at 5,820 hatchery adults. We estimated that 277 Catherine Creek, 549 Upper Grande Ronde River, 365 Lookingglass Creek and 1,610 Lostine River hatchery Chinook returned to the

compensation area (Table 11). The combined return to the compensation area of Grande Ronde Basin Chinook was 2,801 salmon, 48.1% of the compensation goal. Several factors have caused these low hatchery returns to the basin. Low numbers of CHP collections and limited rearing space at Lookingglass Fish Hatchery have resulted in low smolt production. Also, in many years, the CBS 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 et al. 2007). Another explanation is that hatchery returns without an adipose fin clip are not being identified and numerated in other compensation area streams.

Return to the River

We estimate that 109 age 3, 152 age 4, and nine age 5 hatchery salmon returned to Catherine Creek in 2008. We also estimate that five age 3, 77 age 4, and 12 age 5 natural origin salmon returned. There were no sport or tribal fishing efforts on Catherine Creek in 2008.

We estimate that 471 age 3, 56 age 4, and three age 5 hatchery salmon returned to the Upper Grande Ronde River in 2008. We also estimate that fifteen age 3, 53 age 4, and 11 age 5 natural origin salmon returned. There were no sport or tribal fishing efforts on the Upper Grande Ronde River in 2008.

We estimate that 16 age 3, 323 age 4, and 18 age 5 hatchery salmon returned to Lookingglass Creek in 2008 and that four age 3, 51 age 4, and six age 5 natural origin salmon returned. There were no sport or tribal fishing efforts on Lookingglass Creek in 2008.

We estimate that 594 age 3, 984 age 4, and 21 age 5 hatchery salmon returned to the Lostine River in 2008. We also estimate that 60 age 3, 335 age 4, and 47 age 5 natural origin salmon returned. A limited recreation sport harvest was conducted on the Wallowa River from 4 – 13 July 2008, targeting Lostine River Hatchery Salmon. The fishery extended from the Minam State Park up to the mouth of the Lostine River. On the Wallowa River, no anglers reported catching any marked or unmarked Chinook during the fishery. The NPT reported that 29 hatchery adults were harvested.

Recruits:Spawner (R:S) and Smolt-to-Adult Return Rates (SAR)

For Catherine Creek and the Upper Grande Ronde River, the 2003 brood year is the third brood year where we were able to calculate R:S for hatchery salmon produced from the CHP. The R:S ratios include jacks and all fish kept for broodstock, and are not adjusted for estimates of pre-spawn mortality.

In Catherine Creek, the CHP R:S ratio for brood years 2001-2003 were 3.08, 5.1, and 2.3, respectively. For the natural component in Catherine Creek, the R:S ratios from the 2001-2003 brood years were 0.1, 0.3, and 0.1, respectively. The SAR over LGD for the 2003 brood year was 0.065% and 0.108% for CBS and CHP returns, respectively. Compared to the 2002 brood year, the SAR for the 2003 brood year decreased for both CBS and CHP returns (Table 16).

In the Upper Grande Ronde River, the R:S ratio for the CHP component from the 2001-2003 brood years were 5.2, 3.3, and 0.6, respectively. In the Upper Grande Ronde River, the R:S for the naturally spawning salmon from the 2001-2003 brood years were 0.4, 1.1, and 0.2, respectfully. Only 1,019 smolts were released from the 2003 CBS program, and there were no adult returns. The SAR over LGD for the 2003 brood year CHP progeny was 0.05% (Table 16).

The 2003 Catherine Creek CBS program produced 166,850 smolts from 347 parents and 98,023 of these smolts were released into Lookingglass Creek. We estimate the smolts released into Lookingglass Creek were produced from 203 parents. The 2003 brood year R:S for the

hatchery component was 0.8 and 0.7 for the natural returns. The SAR back to Lookingglass Creek was 0.169%.

NPT reported that some members of their hatchery production staff falsified weir data from 2001-2008. For this reason, we were unable to reliably differentiate between CBS and CHP returns. Using data that we believe to be correct, the R:S ratios for the CHP component from the 2000-2003 brood years were 12.5, 8.0, 5.3, and 5.2, and the natural component R:S ratios were 17.9, 8.9, 6.0, and 6.5, respectively. SARs over LGD for the 2003 brood year were 0.181% and 0.248% for CBS and CHP returns, respectively. Compared to the 2002 brood year, SAR for the 2003 brood year increased for CBS and decreased for CHP returns (Table 16).

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 2008, we counted 642 redds and observed 679 carcasses in the Imnaha Basin (Table 17). Redd counts in the basin were high compared to previous years and is the second consecutive year of increasing counts since the 2002 return year (Figure 2). All CWTs recovered on the spawning grounds were from Imnaha River hatchery salmon (Table 18). With 190 natural salmon returning to the basin to spawn, 2008 is the 5th consecutive year of <500 natural origin salmon spawning naturally in the Imnaha River (Figure 3). Hatchery salmon comprised the majority (76.5%) of adults on the spawning grounds in the Imnaha River. On two tributary streams to the Imnaha River, Big Sheep Creek and Lick Creek, 77.8% and 100%, respectively, of salmon carcasses recovered were hatchery origin and were most likely the result of hatchery outplants from the Imnaha River. For the entire Imnaha Basin, hatchery fish represented 79.5% of carcasses recovered.

In the Grande Ronde Basin, we observed 969 redds and recovered 712 carcasses on the spawning grounds (Table 17). Hatchery salmon comprised 63.6% of the observed carcasses in the Grande Ronde Basin. This is the first year of increasing redd counts and is the second highest number of redds (1,005 redds were counted in 2004; Figure 2). We recovered fifteen in-basin strays: three Catherine Creek and four Lostine River salmon were recovered in Lookingglass Creek; three Lostine River and two Lookingglass Creek salmon in the Minam River; two Lookingglass Creek salmon were found in the Wallowa River and one was recovered in the Wenaha River (Table 18). Outside of these fifteen known in-basin strays, there were ten other salmon recovered in the Wallowa River and Hurricane Creek that are potential in-basin strays. In Hurricane Creek there were no known outplants, but five Lostine River salmon were recovered there along with one salmon that was fin-clipped but did not have a CWT. On the Wallowa River we recovered three salmon that lacked the opercle punch mark used to identify fish previously handled at the Lostine River weir as outplants. Two of those fish were Lostine River salmon and the other was fin-clipped with no CWT.

In streams with hatchery supplementation programs, returns over the last five years are largely comprised of hatchery salmon (Figure 4). The percentage of hatchery salmon on the spawning grounds was 58%, 67% and 74%, for Catherine Creek, the Upper Grande Ronde River and the Lostine River, respectively (Table 17, Figures 6-8).

Bacterial Kidney Disease Monitoring

We collected 162 kidney samples from Imnaha River Chinook salmon in 2008 (Table 19). Of those, 127 came from hatchery-reared salmon and 35 from natural salmon. We collected 135 samples at Lookingglass Fish Hatchery and 27 from carcasses recovered on spawning ground surveys. Individual ELISA OD levels ranged from 0.053-0.213 and 98% were from salmon with ELISA OD level <0.2 (Table 20).

We collected 291 kidney samples from salmon from Grande Ronde Basin streams in 2008 (Table 19): 209 from hatchery-reared salmon and 82 from natural salmon. We collected 199 kidney samples from salmon spawned at Lookingglass Fish Hatchery and 92 from salmon that spawned in nature and were recovered as carcasses during spawning ground surveys. Individual ELISA OD levels ranged from 0.053 - 1.715 but were generally low, with 97% of the samples being <0.2 OD units (Table 20). Mean ELISA OD levels for each Grande Ronde Basin stream in 2008 ranged from 0.0683 - 0.2709.

The highest mean ELISA OD level was measured in the Minam river (0.2709), a wilderness stream. This stream also had the highest ELISA OD level measured (1.715) in any of the fish sampled in 2008. In the Minam River, mean ELISA OD was nearly double that measured in the supplemented streams. In the other wilderness stream, the Wenaha River, only one fish was sampled and the ELISA OD level was 0.1070.

We found no evidence that the release of hatchery salmon is causing an increase in BKD prevalence in the monitored streams. The only change that we saw was a decrease in mean ELISA OD level in natural salmon and, at the levels we measured, it was probably biologically meaningless. Even in the Upper Grande Ronde River, where we have released smolts that were offspring of females with very high ELISA OD levels and from raceways in which there were BKD outbreaks, we saw no change in mean ELISA OD level. The CBS has released offspring of females with ELISA OD levels >1.0, particularly into the Upper Grande Ronde River. Both natural and CHP females returning to Grande Ronde Basin streams tend to have low ELISA OD levels and those >0.2 are culled if they are spawned at Lookingglass Fish Hatchery. Therefore, smolts released from the CHP are always from females with ELISA OD levels <0.2. It seems likely that any sick salmon that we may have been released were either unable to survive in nature or they were able to fight off the infection, leaving only the healthy fish to survive to maturation and return to spawn.

Acknowledgments

Roger Elmore, Lookingglass Fish Hatchery Manager, Diane Deal, Assistant Hatchery Manager, and many other hatchery personnel exhibited great dedication and provided essential assistance. Numerous personnel from ODFW, U.S. Fish and Wildlife Service, U.S. Forest Service, Nez Perce Tribe, and Confederated Tribes of the Umatilla Indian Reservation were supportive during spawning ground surveys and spawning at Lookingglass Fish Hatchery. In addition, personnel from the Nez Perce Tribe and 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 14-11-08-J009, a cooperative agreement with the Oregon Department of Fish and Wildlife.

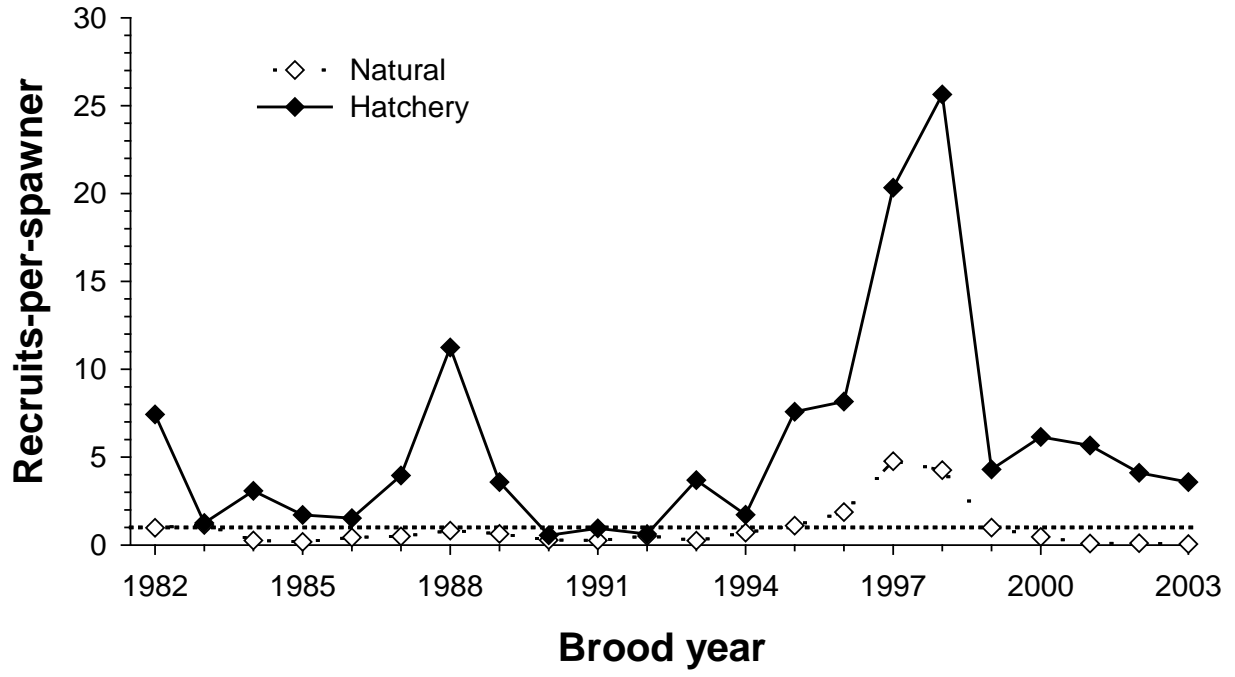


Figure 1. Recruits-per-spawner ratios (including jacks) for completed brood years (1982-2003) of Imnaha River Chinook salmon. Note: dotted line indicates recruits-per-spawner ratio=1.

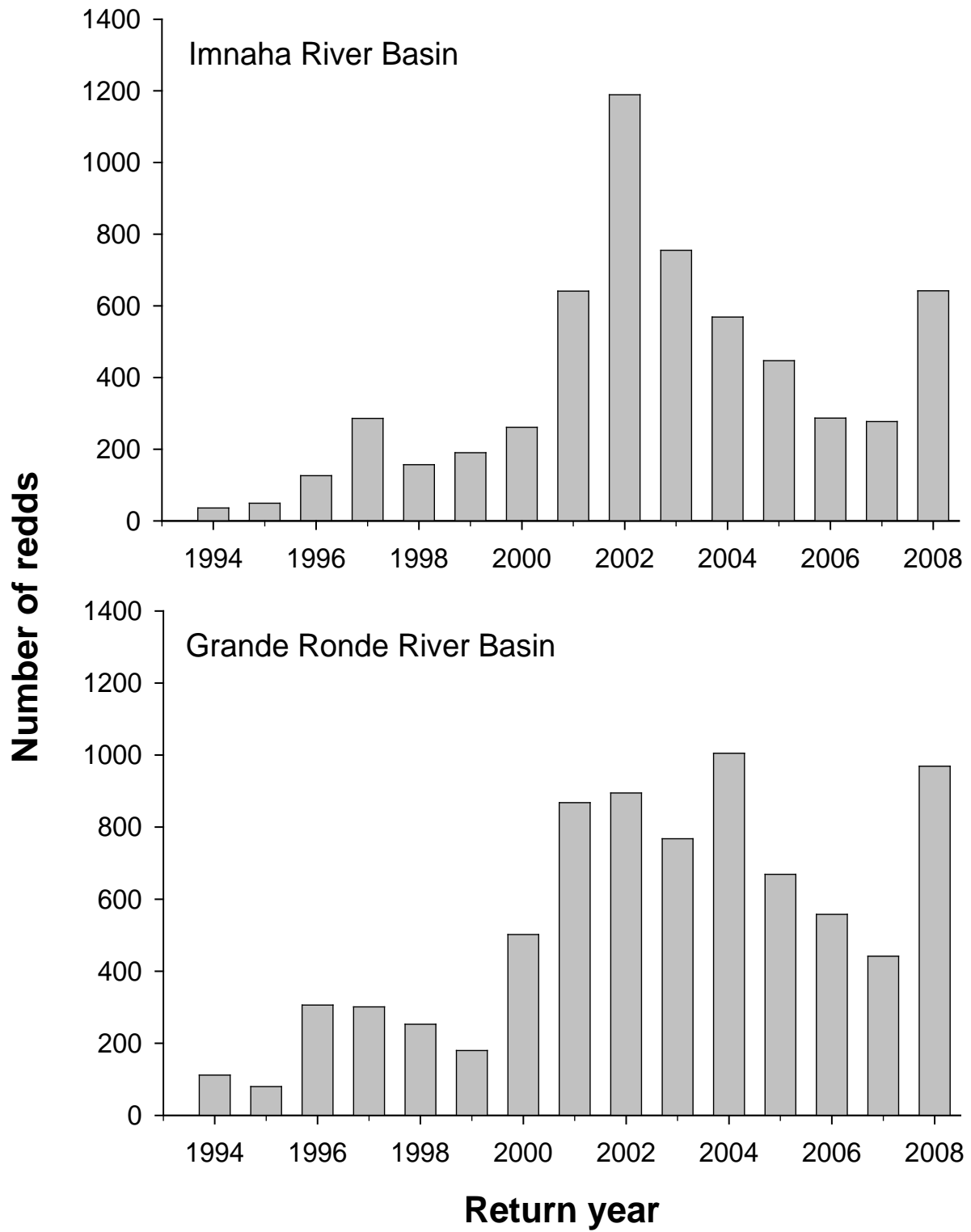


Figure 2. Total redd counts in the Imnaha and Grande Ronde river basins, 1994-2008.

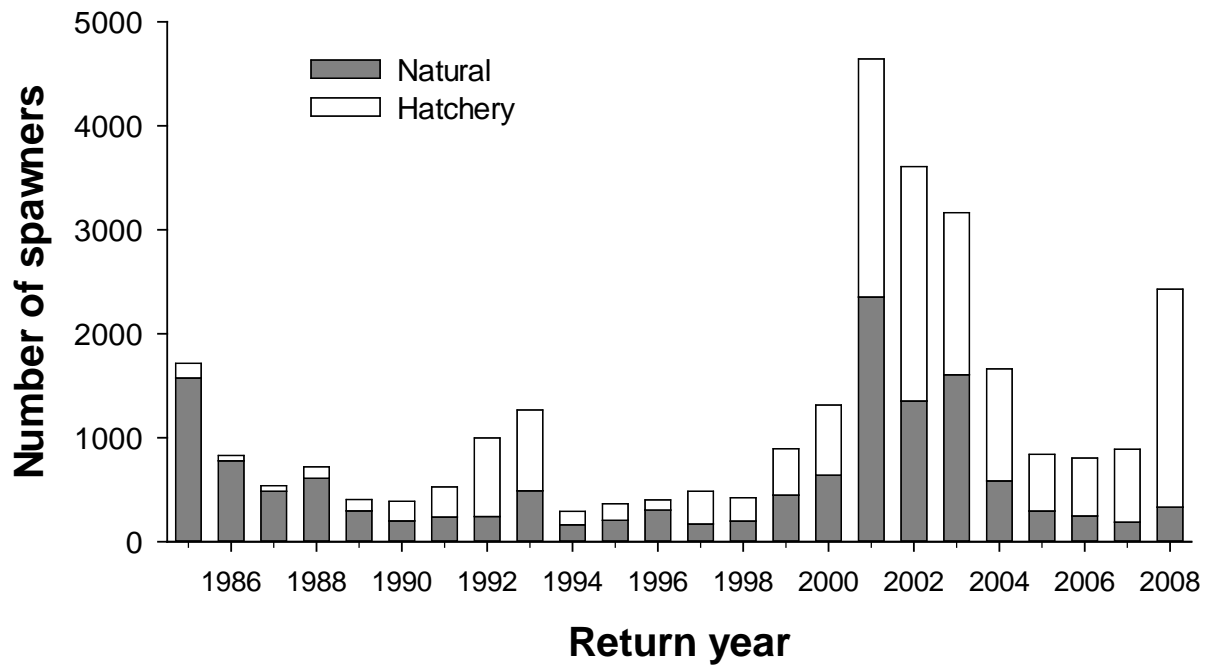


Figure 3. Estimated numbers of natural- and hatchery-origin spring/summer Chinook salmon (including jacks) that spawned naturally in the Imnaha River, 1985-2008.

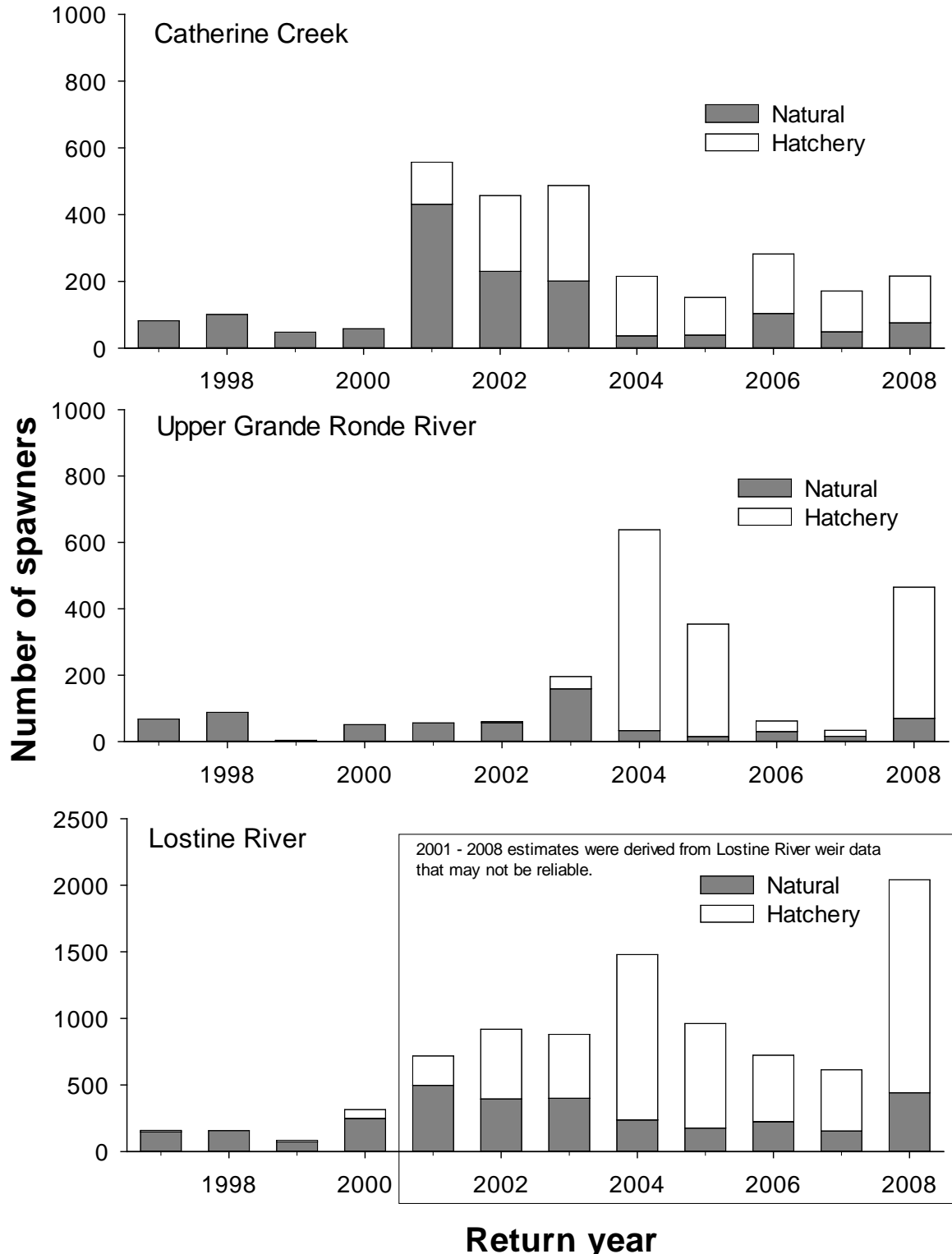


Figure 4. Estimated numbers of natural- and hatchery-origin Chinook salmon (including jacks) that spawned naturally in Catherine Creek, and the Grande Ronde and Lostine rivers, 1997-2008. Note: the Nez Perce Tribe reported that some members of the hatchery production staff falsified weir data from 2001-2008, therefore data for the Lostine River between 2001 and 2008 may not be reliable.

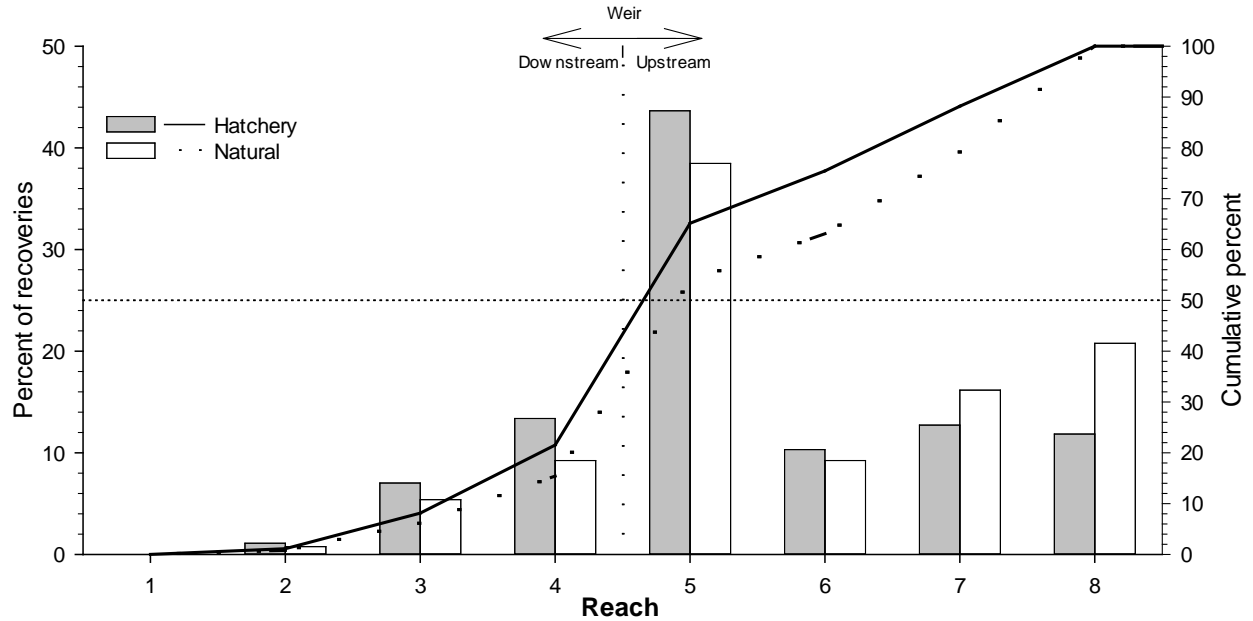


Figure 5. Percent of natural-and hatchery-origin Chinook salmon carcasses recovered during spawning ground surveys on the Imnaha River, 2008. Reach 1- Gorge to Freezeout Creek, Reach 2-Grouse Creek to the Gorge, Reach 3-Crazyman Creek to Grouse Creek, Reach 4-Weir to Crazyman Creek, Reach 5-Macs Mine to the weir, Reach 6-Log to Macs Mine, Reach 7-Indian Crossing to Log, Reach 8-Blue Hole to Indian Crossing.

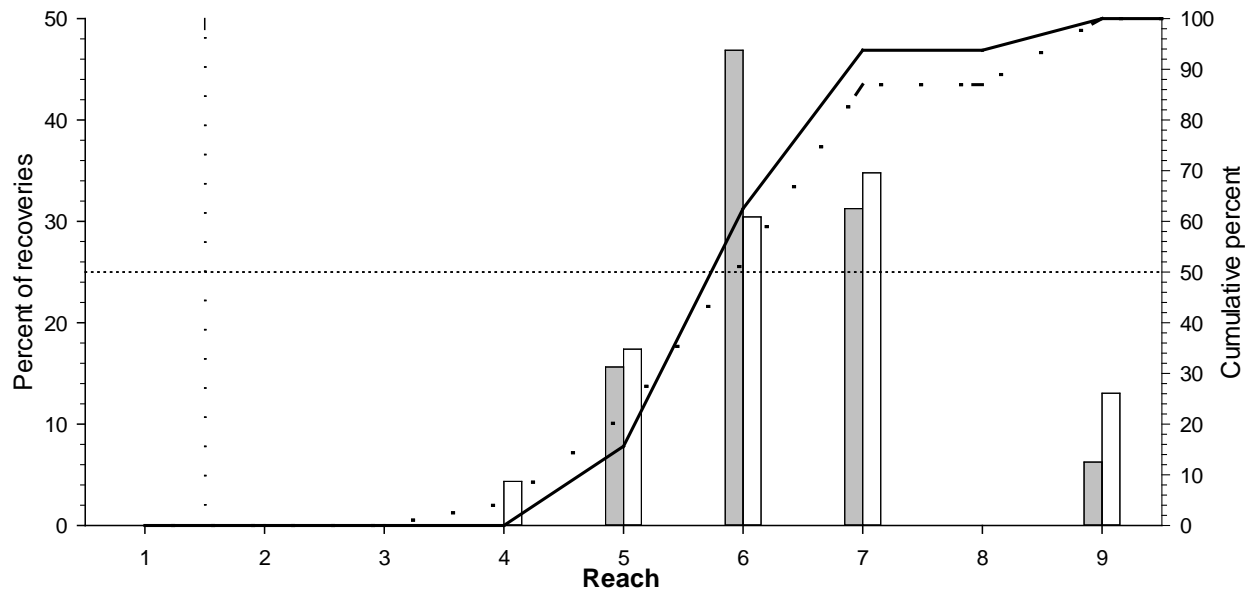


Figure 6. Percent natural-and hatchery-origin Chinook salmon carcasses recovered during the spawning ground surveys on Catherine Creek, 2008. Reach 1-Weir to 2nd Union Bridge, Reach 2-Bottom of Southern Cross Ranch to the Weir, Reach 3-Mile post five to top of Southern Cross Ranch, Reach 4-Badger Flat to mile post five, Reach 5- Highway Bridge to Badger Flat, Reach 6-7735 Bridge to Highway Bridge, Reach 7-Forks to 7735 Bridge, Reach 8-South Fork Catherine Creek, Reach 9-North Fork Catherine Creek.

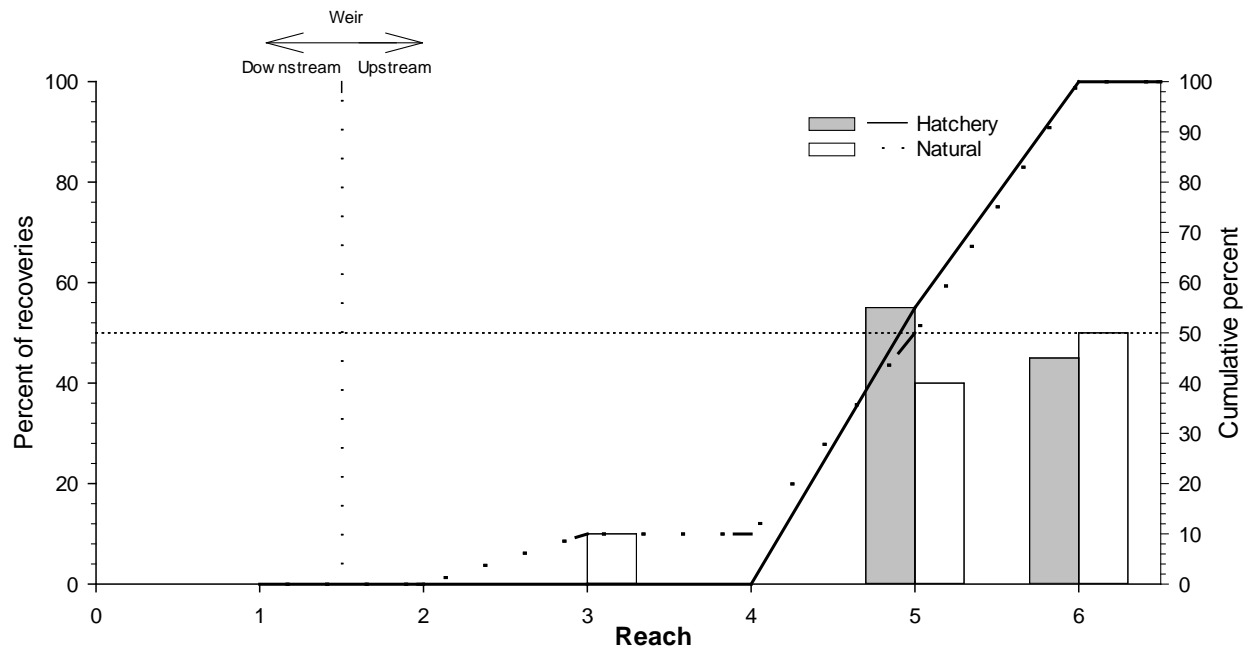


Figure 7. Percent natural- and hatchery-origin Chinook salmon carcasses recovered during spawning ground surveys on the Upper Grande Ronde River, 2008. Reach 1-Weir to Starkey Store Reach, Reach 2-Spoolcart Campground to the Weir, Reach 3-Time and a Half Campground to Spoolcart Campground, Reach 4-Forest Service Boundary below Vey Meadows to Time and a Half Campground, Reach 5-Carson Campground Bridge to Forest Service Boundary below acclimation facility, Reach 6- Three Penny Claim to Carson Campground Bridge.

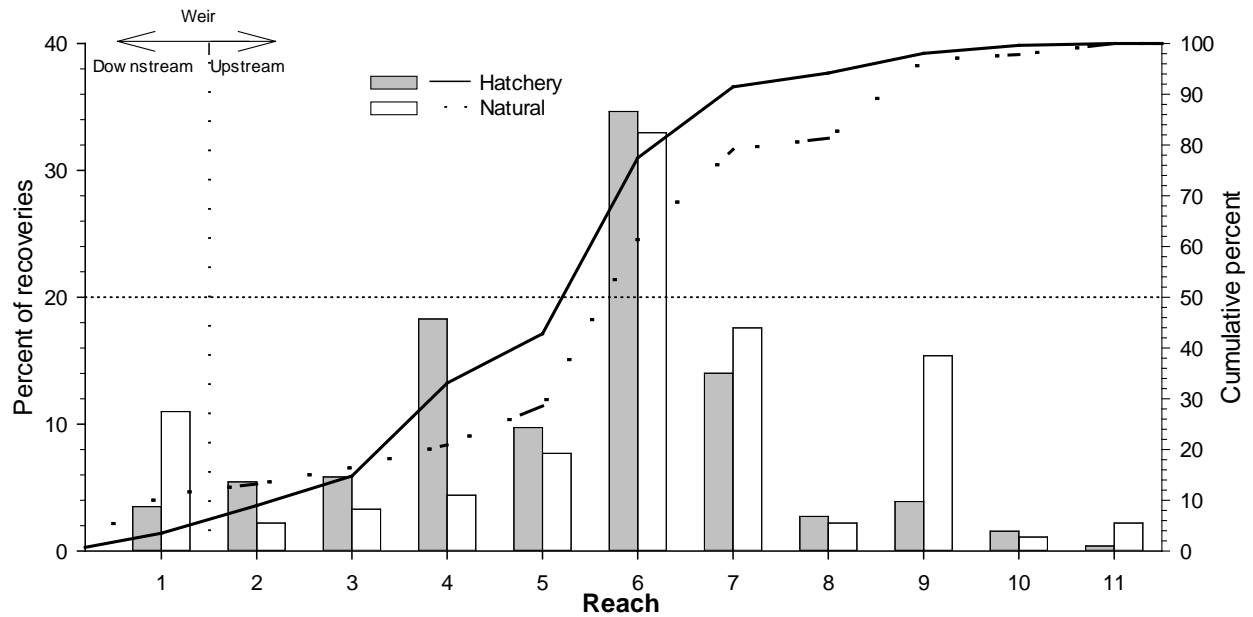


Figure 8. Percent natural-and hatchery-origin Chinook salmon carcasses recovered during spawning ground surveys on the Lostine River, 2008. Reach 1-Weir to the Mouth, Reach 2-McLain's Ranch to the Weir, Reach 3-Highway 82 Bridge in Lostine to McLain's Ranch, Reach 4-Westside Ditch to the trout farm, Reach 5-Lostine River Ranch Bridge to Westside Ditch, Reach 6-Aclimation Facility to Lostine River Ranch Bridge, Reach 7-Six Mile Bridge to Aclimation Facility, Reach 8-Pole Bridge to Six Mile Bridge, Reach 9-Above Walla Walla Campground to Williamson Campground, Reach 10-Lapover Meadows to Bowman Trailhead, Reach 11-Turkey Flat to Lapover Meadows.

Table 1. Rearing summaries for the 2006 brood year of juvenile spring Chinook Captive Broodstock (CBS) and Conventional (CHP) Hatchery program salmon released into the Imnaha and Grande Ronde river basins, 2008.

Stock	Program	Number of Females	Number of green eggs taken	Eyed eggs	Number culled ^a	Percent Survival			Total smolts released
						Green egg -to- eyed egg	Eyed egg -to- smolt ^b	Green egg -to- smolt ^b	
Imnaha River	CHP	98	405,538	366,221	0	90.3	95.3	86.0	348,910
Catherine Creek ^c	CBS	83	100,485	88,616	38,225	88.2	85.8	69.4	43,218
	CHP	37	132,501	121,868	0	89.9	95.9	88.2	116,882
Upper Grande Ronde River ^d	CBS	5	3,731	2,174	796	58.3	n/a	n/a	0
	CHP	84	297,271	269,466	0	90.6	96.5	87.4	259,932
Lostine River	CBS	63	73,674	58,283	43,634	79.1	71.5	34.9	10,470
	CHP	58	241,715	206,309	0	85.4	94.3	80.5	194,594

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

^b Embryos culled from production were subtracted from the calculation of eyed egg-to-smolt and green egg-to-smolt survival.

^c All of the 2006 brood year Catherine Creek CBS production were released into Lookingglass Creek.

^d After transfer of 2,174 eyed eggs from Bonneville Fish Hatchery to Lookingglass Fish Hatchery, 796 eggs were culled, and there was a pick loss of 115 eggs. The remaining 1,263 eyed eggs from the 2006 broodyear Grande Ronde CBS production were released as eyed eggs into Meadow Creek on 22 and 30 November, 2006.

Table 2. Estimates of percent adipose (Ad) fin clip and coded-wire tag application success for 2006 brood year spring Chinook salmon produced from the Captive Broodstock (CBS) and Conventional Hatchery (CHP) programs reared at Lookingglass Fish Hatchery and released as smolts in 2008.

Stock, CWT code	Raceway	Program	Number checked	Ad clip, with CWT	Ad clip, no CWT	No Ad clip, with CWT	No Ad clip, no CWT	Total released
<u>Imnaha River</u>								
094532	13	CHP	507	96.6	2.4	0.8	0.2	59,728
094533	14	CHP	502	97.6	1.2	0.6	0.6	59,682
094534	15	CHP	<u>500</u>	<u>98.8</u>	<u>0.4</u>	<u>0.6</u>	<u>0.2</u>	<u>59,731</u>
Total/mean			1,509	97.7	1.3	0.7	0.3	179,141
Ad-only	16-18	CHP	1,518	n/a	99.1	n/a	0.9	169,769
<u>Catherine Creek</u>								
094542	1	CHP	511	90.2	2.5	6.5	0.8	58,456
Ad-only	2	CHP	531	n/a	96.0	n/a	4.0	58,426
<u>Upper Grande Ronde River</u>								
094536	5	CHP	500	n/a	n/a	98.2	1.8	63,613
094537	6	CHP	<u>472</u>	<u>n/a</u>	<u>n/a</u>	<u>98.9</u>	<u>1.1</u>	<u>63,522</u>
Total/mean			972	/a	n/a	98.6	1.4	127,135
094539	7	CHP	511	95.9	0.4	3.7	0.0	63,878
Ad-only	8	CHP	503	n/a	99.4	n/a	0.6	68,919
<u>Lookingglass Creek^a</u>								
094540	3	CBS	503	87.9	4.2	6.9	1.0	25,252
094541	4	CBS	<u>503</u>	<u>97.4</u>	<u>0.2</u>	<u>2.2</u>	<u>0.2</u>	<u>17,966</u>
Total/mean			1,006	91.8	2.5	5.0	0.7	43,218

Table 2 continued.

Stock, CWT code	Raceway	Program	Number checked	Ad clip, with CWT	Ad clip, no CWT	No Ad clip, with CWT	No Ad clip, no CWT	Total released
<u>Lostine River</u>								
094351	9	CHP	511	96.3	2.9	0.2	0.6	65,351
094352	11	CHP	515	97.1	0.0	2.7	0.2	63,724
094538	12	CHP	<u>503</u>	<u>99.4</u>	<u>0.4</u>	<u>0.0</u>	<u>0.2</u>	<u>65,519</u>
Total/mean			1,529	97.6	1.1	1.0	0.3	194,594
094535	10	CBS	503	n/a	n/a	97.4	2.6	10,470

^a Catherine Creek Captive Broodstock offspring were used for Lookingglass Creek stock.

Table 3. Mean size of 2006 brood year spring Chinook salmon smolts produced from the Captive Broodstock (CBS) and Conventional Hatchery (CHP) programs, total number released into the Imnaha and Grande Ronde river basins, number PIT-tagged, and survival probability to Lower Granite Dam, 2008. Length and weight data were collected at Lookingglass Fish Hatchery, 12-14 February 2008.

Stock, CWT code	Raceway	Program	Release date	Fork Length (mm)		Weight (g)		Condition factor (K)		Total released	Number PIT- tagged	Survival probability to Lower Granite Dam
				Mean	SD	Mean	SD	Mean	SD			
<u>Imnaha River</u>												
094532	13	CHP	25 MAR-10 APR	121.8	11.4	21.1	5.2	1.2	0.1	59,728	3,465	0.69
094533	14	CHP	25 MAR-10 APR	120.5	8.4	21.1	5.4	1.2	0.2	59,682	3,475	0.73
094534	15	CHP	25 MAR-10 APR	119.0	10.2	20.5	4.7	1.2	0.1	59,731	3,461	0.70
Ad-only	16	CHP	25 MAR-10 APR	122.8	13.1	27.4	11.6	1.3	0.1	59,368	3,462	0.68
Ad-only	17	CHP	25 MAR-10 APR	119.2	10.6	23.4	8.4	1.3	0.2	59,165	3,441	0.69
Ad-only	18	CHP	25 MAR-10 APR	116.5	10.5	20.1	5.1	1.2	0.2	<u>51,236</u>	<u>3,457</u>	<u>0.69</u>
Total/mean										348,910	20,761	0.70
<u>Catherine Creek</u>												
094542	1	CHP	24 MAR-14 APR	118.3	10.0	21.6	5.4	1.3	0.3	58,456	10,350	0.45
Ad-only	2	CHP	24 MAR-14 APR	120.8	11.4	21.7	7.5	1.2	0.1	<u>58,426</u>	<u>10,367</u>	<u>0.46</u>
Total/mean										116,882	20,717	0.45
<u>Upper Grande Ronde River</u>												
094536	5	CHP	17 -24 MAR	118.4	9.6	21.7	3.8	1.2	0.1	63,613	499	0.35
094537	6	CHP	07-14 APR	119.3	9.9	20.5	4.3	1.2	0.1	63,522	492	0.47
094539	7	CHP	17-24 MAR	118.4	9.3	18.9	4.7	1.2	0.2	63,878	496	0.36
Ad-only	8	CHP	07-14 APR	116.3	8.5	20.6	6.2	1.2	0.1	<u>68,919</u>	<u>496</u>	<u>0.47</u>
Total/mean										259,932	1,983	0.41

Table 3 continued.

Stock, CWT code	Raceway	Program	Release date	Fork length (mm)		Weight (g)		Condition factor (K)		Total released	Number PIT- tagged	Survival to Lower Granite Dam
				Mean	SD	Mean	SD	Mean	SD			
<u>Lookingglass Creek^a</u>												
094540	3	CBS	01-14 APR	115.2	12.3	20.3	4.5	1.2	0.1	25,252	496	0.75
094541	4	CBS	01-14 APR	118.3	10.0	21.5	5.8	1.3	0.2	<u>17,966</u>	<u>497</u>	<u>0.70</u>
Total/mean										43,218	993	0.72
<u>Lostine River</u>												
094351	9	CHP	10-17 APR	114.8	12.0	18.9	7.4	1.2	0.1	65,351	1,645	0.63
094352	11	CHP	19 MAR-01 APR	115.5	8.2	19.0	5.1	1.2	0.1	63,724	1,651	0.53
094538	12	CHP	10-17 APR	120.2	14.2	23.0	7.8	1.2	0.3	65,519	1,642	0.68
094535	10	CBS	19 MAR-01 APR	115.9	14.3	21.6	9.8	1.2	0.1	<u>10,470</u>	<u>1,493</u>	<u>0.59</u>
Total/mean										205,064	6,431	0.61

^a Catherine Creek Captive Broodstock offspring were used for Lookingglass Creek stock.

Table 4. Number of adult spring Chinook salmon handled each week at northeast Oregon LSRCF facilities, 2008. The total for the Imnaha River excludes recaptures of fish released below the weir. The total for Lookingglass Creek includes stray hatchery fish from Catherine Creek and Upper Grande Ronde River stock. These numbers do not account for unmarked hatchery returns.

Period	Week of year	Imnaha River ^a		Catherine Creek ^b		Upper Grande Ronde River ^b		Lookingglass Creek ^a		Lostine River ^c	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Dates of trap operation:		10 JUL – 23 SEP		3 MAR – 9 SEP		5 MAR- 28 JUL		3 MAR – 9 SEP		22 May – 1 OCT	
21-27 May	21	-	-	0	1	0	0	0	0		
28 May-3 JUN	22	-	-	0	0	0	0	0	0		
4-10 JUN	23	-	-	1	0	0	0	1	0		
11-17 JUN	24	-	-	12	15	0	0	15	2		
18-24 JUN	25	-	-	83	41	10	2	45	9		
25 JUN – 1 JUL	26	-	-	96	26	52	8	78	14		
2-8 JUL	27	20 ^d	1 ^d	46	10	36	8	62	10		
9-15 JUL	28	99	14	4	0	12	2	22	4		
16-22 JUL	29	442	45	2	1	2	1	27	3		
23-29 JUL	30	299	21	3	0	0	0	6	0		
30 JUL – 5 AUG	31	298	16	0	0	-	-	5	1		
6-12 AUG	32	356	43	0	0	-	-	2	0		
13-19 AUG	33	205	36	1	0	-	-	20	5		
20-26 AUG	34	8	3	1	0	-	-	22	0		
27 AUG – 2 SEP	35	98	9	1	1	-	-	13	4		
3-9 SEP	36	55	2	0	0	-	-	1	1		
10-16 SEP	37	0	0	-	-	-	-	-	-		
17-23 SEP	38	0	0	-	-	-	-	-	-		
24-30 SEP	39	-	-	-	-	-	-	-	-		
Total		1,880	190	250	95	112	21	319	53	-	-

^aOperated by Oregon Department of Fish and Wildlife

^bOperated by Confederated Tribes of the Umatilla Indian Reservation

^cOperated by Nez Perce Tribe

^dAdults were trapped prior to complete weir installation.

The Nez Perce Tribe reported that some members of the hatchery production staff falsified weir data from 2001-2008. Therefore, these data are unreliable.

Table 5. Number and disposition, by origin, age, and sex of adult spring Chinook salmon returning to northeast Oregon LSRCF facilities in 2008. The numbers of Chinook trapped/passed above the weir were adjusted to account for the estimated number of returning unclipped hatchery fish without a coded wire tag. Note: within each age class, because of errors identifying fish sex at time of capture, the number of male and female salmon collected may not match the numbers kept and spawned at Lookingglass Fish Hatchery.

Stock, Disposition	Hatchery							Natural							Grand total
	Age 3		Age 4		Age 5		Total	Age 3		Age 4		Age 5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<u>Innaha River</u>															
Trapped ^a	952	0	445	446	36	33	1912	52	0	61	24	7	9	153	2065
Passed above the weir	19	0	44	51	3	10	127	51	0	23	5	2	0	81	208
Released below the weir	0	0	43	49	3	4	99	0	0	0	0	0	0	0	99
Outplanted	79	0	137	129	18	16	379	0	0	0	0	0	0	0	379
Tribal Distribution/Foodbank	768	0	171	120	19	15	1078	0	0	0	0	0	0	0	1078
Kept ^b	48	0	71	80	6	8	213	1	0	35	15	4	8	62	275
Actual spawned	38	0	62	75	5	7	187	1	0	33	13	3	7	56	243
Killed, not spawned	5	0	2	0	0	0	7	0	0	1	0	1	0	2	9
Pre-spawn mortality	5	0	7	5	1	1	19	0	0	1	2	0	1	4	23
Mean length (mm) ^c	530		791	807	1055	886		648		787	792	1067	907		
(Sample Size)	(12)	-	(21)	(23)	(1)	(4)		(1)	-	(28)	(13)	(3)	(10)		
Weir age composition (%)	47.9	0.0	24.3	22.5	2.6	2.8	100	34.0	0.0	39.3	13.3	5.3	8.0	100	
<u>Catherine Creek</u>															
Trapped at Catherine Creek ^d	103	0	55	88	7	2	255	5	0	31	42	6	6	90	345
Passed above the weir	6	0	43	68	6	2	125	5	0	27	33	3	4	72	197
Tribal Distribution/Foodbank	93	0	0	0	0	0	93	0	0	0	0	0	0	0	93
Returned to Lookingglass	0	0	1	1	0	0	3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
Kept ^e	4	0	12	20	1	0	37	0	0	4	9	3	2	18	55
Spawned	4	0	13	21	1	0	39	0	0	4	9	3	2	18	57
Killed not spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-spawn mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean length (mm) ^c	512		784	730	950					738	691	853	895		
(Sample Size)	(4)	-	(13)	(20)	(1)	-		-	-	(3)	(9)	(2)	(1)		
Age composition (%)	40.4	0.0	21.6	34.5	2.7	0.8	100	5.6	0.0	34.4	46.7	6.7	6.7	100	

Table 5 continued.

Stock, Disposition	Hatchery							Natural							Grand total
	Age 3		Age 4		Age 5		Total	Age 3		Age 4		Age 5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<u>Upper Grande Ronde River (UGR)</u>															
Trapped at UGR ^d	103	0	4	4	1	0	112	4	0	6	8	2	1	21	133
Trapped at Lookingglass	22	0	3	4	0	0	29	0	0	0	0	0	0	0	29
Passed above the weir	6	0	0	0	0	0	6	4	0	2	5	1	0	12	18
Tribal Distribution/Foodbank	92	0	2	0	0	0	94	0	0	0	0	0	0	0	94
Kept ^e	27	0	5	8	1	0	41	0	0	4	3	1	1	9	50
Spawnd	3	0	4	8	1	0	16	0	0	4	3	1	1	9	25
Killed not spawned	23	0	1	0	0	0	24	0	0	0	0	0	0	0	24
Pre-spawn mortality	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Mean length (mm) ^c	513		693	753	908					716	677		934		
(Sample Size)	(26)	-	(3)	(7)	(1)	-		-	-	(2)	(2)	-	(1)		
Age composition (%)	88.7	0.0	5.0	5.7	0.7	0.0	100	19.0	0.0	28.6	38.1	9.5	4.8	100	
<u>Lookingglass Creek</u>															
All trapped Chinook Identified as Lookingglass	35	1	125	156	0	2	319	4	0	33	15	1	0	53	372
Creek Returns ^g	12	1	124	152	0	1	291	4	0	33	15	1	0	53	344
Passed	7	1	66	76	0	1	151	2	0	12	24	0	0	38	189
Kept ^{e,h}	5	0	58	76	0	1	140	1	0	10	0	1	0	12	152
Spawnd ⁱ	5	0	55	75	0	1	136	1	0	10	0	1	0	12	148
Killed not spawned	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
Pre-spawn mortality	0	0	2	1	0	0	3	0	0	0	0	0	0	0	3
Mean length (mm) ^c	471		743	726				439		760		820			
(Sample Size)	(5)	-	(52)	(69)	-	-		(1)	-	(10)	-	(1)	-		
Age composition (%)	4.1	0.3	42.6	52.2	0	0.7	100	7.5	-	62.3	28.3	1.9	0	100	

Table 5 continued.

Stock, Disposition	Hatchery							Natural ⁱ							Grand Total
	3		4		5		Total	3		4		5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<u>Lostine River</u>															
Trapped ⁱ	193		M = 207; F = 214				614	66		M = 150; F = 122				338	952
Passed ⁱ	34		M = 143; F = 150				327	65		M = 128; F = 101				294	621
Returned below weir ^j	1		M = 6; F = 0				7	0		M = 1; F = 0				1	8
Outplant/Weir Mort ^j	154		M = 23; F = 26				203	0		M = 0; F = 0				203	203
Kept ^f	4	0	35	37	0	1	77	1	0	18	17	2	4	41	118
Actual spawned	2	0	31	36	0	1	70	1	0	15	15	1	4	36	106
Killed, not spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-spawn mortality	2	0	4	1	0	0	7	0	0	3	2	1	0	5	12
Mean length (mm) ^c	623		785					580		760	779		915		
(Sample Size)	(3)	-	(33)	(35)	-	(1)		(1)	-	(15)	(16)	-	(4)		
Spawned fish age composition (%)	3.8	0.0	47.4	47.4	0.0	1.3	100	2.6	0.0	38.5	43.6	5.1	10.3	100	

^a Number of fish per age class determination based on Imnaha River age-length key (<630 = Age 3; 630-850 = Age 4; >850 = Age 5)

^b Age composition based on CWT data, scale ages, and the Imnaha River age-length key.

^c Mean length per age class determined from known age fish based on either CWT, or scales.

^d Number of fish per age class determination based on Catherine Creek/Upper Grande Ronde River age-length key (≤ 600 = Age 3; 601-799 = Age 4; ≥ 800 = Age 5)

^e Age composition based on CWT data, scale ages, and the Catherine Creek/Upper Grande Ronde River age-length key.

^f Age composition based on CWT data, scale ages, and the Lostine River age-length key (<630 = Age 3; 630-850 = Age 4; >850 = Age 5).

^g Total includes 30 visually identified in-basin strays used in their respective programs.

^h Kept fish were strays from Catherine Creek and Upper Grande Ronde River. The Catherine Creek and Upper Grande Ronde River strays were used as broodstock for those programs. Fish that were not identified as strays were included as fish kept and spawned.

ⁱ Males spawned multiple times are only counted once.

^j Values reported by NPT that are believed to be correct. Data could not be sufficiently reconciled to represent age specific sex structure.

Table 6. Spawning summaries of spring Chinook salmon at Lookingglass Fish Hatchery for the Conventional Hatchery Program, 2008.

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				
<u>Innaha River</u>								
19 AUG	3	3	0	3	13,860	4,620	4,254	69.3
26 AUG	7	15	4	7	47,116	4,283	43,635	7.4
29 AUG	4	15	3	4	38,105	5,444	32,500	14.7
2 SEP	33	51	6	27	186,177	4,774	167,094	10.2
5 SEP	15	30	2	14	75,815	4,460	71,502	5.7
10 SEP	18	40	6	18	107,673	4,486	103,469	3.9
12 SEP	<u>2</u>	<u>3</u>	<u>1</u>	<u>3</u>	<u>11,874</u>	<u>3,958</u>	<u>10,717</u>	<u>9.7</u>
Total	82	157	22	76	480,620	4,621	433,171	9.9
<u>Catherine Creek</u>								
20 AUG	0	1	1	1	4,174	4,174	3,617	13.3
27 AUG	5	7	1	5	26,087	4,348	24,906	4.5
3 SEP	9	17	5	9	53,605	3,829	51,185	4.5
8 SEP	<u>7</u>	<u>16</u>	<u>4</u>	<u>5</u>	<u>40,451</u>	<u>3,677</u>	<u>37,897</u>	<u>6.3</u>
Total	21	41	11	20	124,317	3,885	117,605	5.4
<u>Upper Grande Ronde River</u>								
13 AUG	0	1	1	1	3,977	3,977	3,202	19.5
20 AUG	1	1	0	1	3,568	3,568	3,525	1.2
27 AUG	1 ^b	3	1	1	8,486	4,243	6,096	28.2
3 SEP	3 ^c	5	1	2	17,329	4,332	15,869	8.4
8 SEP	2	5	1	4	11,155	3,718	10,934	2.0
12 SEP	<u>1</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>2,887</u>	<u>2,887</u>	<u>2,832</u>	<u>1.9</u>
Total	8	16	4	10	47,402	3,950	42,458	10.4
<u>Lookingglass Creek</u>								
20 AUG	3 ^d	4	0	2	11,167	3,722	9,351	16.3
27 AUG	19 ^e	20	0	9	77,055	4,056	72,368	6.1
3 SEP	46 ^f	58 ^g	0	11	170,666	3,710	157,368	7.8
8 SEP	<u>8</u>	<u>15^h</u>	<u>0</u>	<u>1</u>	<u>27,495</u>	<u>3,437</u>	<u>26,157</u>	<u>4.9</u>
Total	76	97	0	23	286,383	3,768	265,244	7.4

^a The numbers of male parents is greater than the number kept because some males were spawned more than once.

^b One females spawned was a Lostine River stray.

^c Two of the three females spawned were Lookingglass Creek CHP strays.

^d One of the three females spawned was a Lostine River CHP stray.

^e One of the 19 females spawned was a Lostine River CHP stray.

^f One of the 46 females spawned was a Catherine Creek CBS stray.

^g Of the 58 spawned males, two were Catherine Creek CHP strays and one was a Upper Grande Ronde River CBS stray.

^h Two Catherine Creek CHP males were spawned as Lookingglass Creek stock..

Table 6 continued.

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				
<u>Lostine River</u>								
19 AUG	0	2	3	1	17,709	5,903	16,182	8.6
26 AUG	10	7	2	5	51,917	4,326	45,407	12.5
2 SEP	14	13	8	9	107,063	4,867	99,576	7.0
5 SEP	7	4	1	4	39,521	4,940	37,050	6.3
10 SEP	<u>6</u>	<u>10</u>	<u>5</u>	<u>4</u>	<u>51,624</u>	<u>4,693</u>	<u>49,059</u>	<u>5.0</u>
Total	37	36	19	23	267,834	4,783	247,274	7.7

Table 7. Number (*N*) of female spring/summer Chinook salmon and mean egg weight (g) by stock, origin (hatchery or natural), and age collected for brood year 2008. Within an age class, shared letters are not significantly different between stocks (Tukey-Kramer; $P > 0.05$).

Stock		Hatchery			Natural			Grand total/ mean
		Age 4	Age 5	Total/ mean	Age 4	Age 5	Total/ mean	
Imnaha River	<i>N</i>	71	8	79	13	9	22	101
	Mean	0.249 ^A	0.290 ^A	0.254 ^A	0.228 ^A	0.299 ^A	0.257 ^A	0.254 ^A
Catherine Creek	<i>N</i>	21	--	21	8	2	10	31
	Mean	0.203 ^C	--	0.203 ^C	0.207 ^{A,B}	0.272 ^{A,B}	0.220 ^{A,B}	0.209 ^B
Upper Grande Ronde River*	<i>N</i>	7	--	7	2	1	3	10
	Mean	0.220 ^{B,C}	--	0.220 ^{B,C}	0.172 ^B	0.231 ^B	0.192 ^B	0.212 ^B
Lookingglass Creek**	<i>N</i>	72	1	73	--	--	--	73
	Mean	0.216 ^{B,C}	0.287 ^A	0.217 ^{B,C}	--	--	--	0.217 ^B
Lostine River	<i>N</i>	36	1	37	14	2	16	53
	Mean	0.240 ^{A,B}	0.223 ^A	0.240 ^{A,B}	0.246 ^A	0.319 ^A	0.255 ^A	0.244 ^A

* Total females include one age 4 hatchery Chinook from Lostine River stock and two age 4 hatchery Chinook from Lookingglass Creek stock.

** Total females include one age 4 hatchery Chinook from Lostine River stock and one age 4 Chinook from Catherine Creek stock.

Table 8. Expanded recoveries by coded-wire tag group of Imnaha River spring/summer Chinook salmon for the 2008 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/Columbia rivers migration corridor. Numbers in parenthesis are unexpanded CWT recoveries.

Brood year	CWT code	Number released	Recovery location						Total
			Imnaha River ^a	Ocean catch ^b	Columbia River ^b	Snake River ^b	In-basin strays ^b	Out-of-basin strays ^b	
2003 ^c	094032	73,839	17 (2)	0	0	0	0	0	17
	094033	72,247	26 (3)	0	9 (2)	0	0	0	35
	094034	<u>73,763</u>	<u>87 (10)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>87</u>
	Total	219,849	130 (15)	0	9 (2)	0	0	0	139
2004 ^d	094206	64,167	362 (55)	0	0	0	1 (1)	1 (1)	364
	094207	63,864	322 (49)	1 (1)	19 (3)	0	0	4 (1)	346
	094208	<u>64,105</u>	<u>368 (56)</u>	<u>2 (1)</u>	<u>22 (5)</u>	<u>0</u>	<u>0</u>	<u>4 (4)</u>	<u>396</u>
	Total	192,136	1,052 (160)	3 (2)	41 (8)	0	1 (1)	9 (6)	1,106
2005 ^e	093825	61,648	227 (18)	0	0	0	0	0	227
	093826	61,805	176 (14)	0	11 (4)	0	0	1 (1)	188
	094350	<u>61,741</u>	<u>214 (17)</u>	<u>2 (1)</u>	<u>10 (1)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>226</u>
	Total	<u>185,194</u>	<u>617 (49)</u>	<u>2 (1)</u>	<u>21 (5)</u>	<u>0</u>	<u>0</u>	<u>1 (1)</u>	<u>641</u>
Grand Total		597,179	1,799 (224)	5 (3)	71 (15)	0	1 (1)	10 (7)	1,886

^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.

^c 215,337 juvenile Chinook released from the 2003 brood year marked with an AD clip and no CWT.

^d 249,544 juvenile Chinook released from the 2004 brood year marked with an AD clip and no CWT.

^e 247,336 juvenile Chinook released from the 2005 brood year marked with an AD clip and no CWT.

Table 9. Catch and escapement distribution of Imnaha River spring/summer hatchery Chinook salmon by stock and recovery location for the 2008 return year. Estimated CWT recoveries were summarized through 24 January 2011 from the PSMFC database and expanded to account for recoveries of adipose clipped Chinook without a CWT.

Location, recovery type	Estimated CWT recoveries	Expanded hatchery returns	Percent of total
Ocean catch	5	10	0.23
Columbia River			
Tribal net	33	72	1.63
Commercial net	4	8	0.18
Sport	34	81	1.83
Snake River			
Sport ^a	0	0	0.0
Tribal ^a	0	0	0.0
Stray below LGD ^b	10	24	0.54
Stray above LGD ^a	1	2	0.05
			95.54
Recruitment to river ^a	n/a	4,218 ^c	
Total catch/escapement		4,415	
Return to compensation area		4,220	
Percent of compensation goal (3,210 hatchery adults)		131.5	

^a Indicates areas defining the LSRCP compensation area.

^b Includes strays recovered outside the Snake and Columbia river basins.

^c Estimated total return of hatchery Chinook (Age 3-5) to the Imnaha River.

Table 10. Expanded adult recoveries by coded-wire tag group of Catherine Creek spring Chinook salmon for the 2008 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 recoveries.

Brood year	Broodstock	CWT code	Number released	Recovery location						Total
				Catherine Creek ^a	Ocean catch ^b	Columbia River ^b	Snake River ^b	In-basin strays ^b	Out-of-basin strays ^b	
2003 ^c	CHP	070753	58,444	2 (0)	0 (0)	5 (2)	0 (0)	0 (0)	0 (0)	7
	CHP	070754	59,036	4 (1)	0 (0)	10 (3)	0 (0)	0 (0)	0 (0)	14
	CBS	094039	34,415	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	CBS	094040	<u>34,412</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0</u>
	Total		186,307	6 (1)	0 (0)	15 (5)	0 (0)	0 (0)	0 (0)	21
2004	CHP	094218	23,216	73 (43)	0 (0)	52 (17)	0 (0)	1 (1)	0 (0)	126
	CBS	093427	28,824	45 (11)	0 (0)	26 (8)	0 (0)	0 (0)	0 (0)	71
	CBS	094215	<u>16,780</u>	<u>33 (8)</u>	<u>0 (0)</u>	<u>17 (5)</u>	<u>0 (0)</u>	<u>1 (1)</u>	<u>0 (0)</u>	<u>51</u>
			68,820	151 (62)	0 (0)	95 (30)	0 (0)	2 (2)	0 (0)	248
2005	CBS	094361	21,573	9 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9
	CHP	094357	<u>49,696</u>	<u>98 (83)</u>	<u>0 (0)</u>	<u>2 (1)</u>	<u>0 (0)</u>	<u>5 (5)</u>	<u>0 (0)</u>	<u>105</u>
			<u>71,269</u>	<u>107 (90)</u>	<u>0 (0)</u>	<u>2 (1)</u>	<u>0 (0)</u>	<u>5 (5)</u>	<u>0 (0)</u>	<u>114</u>
Grand Total			326,396	264 (153)	0 (0)	112 (36)	0 (0)	7 (7)	0 (0)	383

^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 3,273 juvenile Chinook released from the 2003 brood year marked with an AD clip and no CWT.

Table 11. Catch and escapement distribution of Grande Ronde Basin hatchery adult spring Chinook salmon by stock and recovery location for the 2008 return year. Estimated CWT recoveries were summarized through 24 January 2011 from the PSMFC database and expanded to account for recoveries of adipose clipped Chinook without a CWT.

Location, recovery type	Catherine Creek			Upper Grande Ronde River			Lookingglass Creek			Lostine River		
	Est. CWT	Expanded returns	Percent of total	Est. CWT	Expanded returns	Percent of total	Est. CWT	Expanded returns	Percent of total	Est. CWT	Expanded returns	Percent of total
Ocean catch	0	0	0.0	0	0	0.0	0	0	0.0	1	1	0.1
Columbia River												
Tribal net	32	33	8.4	10	10	1.8	60	61	9.8	40	41	3.2
Commercial net	25	26	6.6	0	0	0.0	60	62	9.8	12	12	1.0
Sport	55	56	14.3	0	0	0.0	141	145	22.8	41	42	3.3
Snake River												
Sport ^a	0	0	0.0	0	0	0.0	3	3	0.5	0	0	0.0
Tribal ^a	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Stray below LGD ^b	0	0	0.0	0	0	0.0	1	1	0.1	0	0	0.0
Stray above LGD ^a	7	7	1.8	19	19	3.4	5	5	0.8	11	11	0.9
Recruitment to river ^a	n/a	270 ^c	68.9	n/a	530 ^c	94.8	n/a	357 ^c	56.2	n/a	1,599 ^{c,d}	91.5
Total estimated return		392			559			632			1,706	
Compensation area return		277			549			365			1,610	

^a Indicates areas within LSRCP compensation area.

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

^c Expansion factor based on estimated total return to natal stream of hatchery adults (Age 3-5).

^d Escapement estimate based on revised weir data provided by Nez Perce Fisheries Research.

Table 12. Expanded adult recoveries by coded-wire tag group of Upper Grande Ronde River spring Chinook salmon from the Captive (CBS) and Conventional Hatchery (CHP) programs for the 2008 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/Columbia rivers migration corridor. Numbers in parenthesis are unexpanded recoveries.

Brood year	Program	CWT code	Number released	Recovery location						Total
				Grande Ronde River ^a	Ocean catch ^b	Columbia River ^b	Snake River ^b	In-basin strays ^b	Out-of-basin strays ^b	
2003	CHP	094035	49,871	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	CHP	094036	54,479	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3
	CBS	094127	<u>1,019</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0</u>
	Total		105,369	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3
2004 ^c	CHP	094213	<u>18,901</u>	<u>53 (20)</u>	<u>0 (0)</u>	<u>5 (1)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>58</u>
	Total		18,901	53 (20)	0 (0)	5 (1)	0 (0)	0 (0)	0 (0)	58
2005	CHP	094358	39,366	126 (40)	0 (0)	5 (1)	0 (0)	8 (5)	0 (0)	139
	CHP	094359	39,290	110 (35)	0 (0)	0 (0)	0 (0)	5 (5)	0 (0)	115
	CHP	093162	40,147	132 (42)	0 (0)	0 (0)	0 (0)	5 (5)	0 (0)	137
	CBS	094362	<u>20,620</u>	<u>93 (9)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>1 (1)</u>	<u>0 (0)</u>	<u>93</u>
	Total		<u>139,423</u>	<u>461 (126)</u>	<u>0 (0)</u>	<u>5 (1)</u>	<u>0 (0)</u>	<u>19 (16)</u>	<u>0 (0)</u>	<u>485</u>
Grand Total			263,693	517 (147)	0 (0)	10 (2)	0 (0)	19 (16)	0 (0)	546

^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 76 juvenile Chinook released from the 2004 brood year marked with an AD clip and no CWT.

Table 13. Expanded adult recoveries by coded-wire tag group of Lookingglass Creek spring Chinook salmon for the 2008 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/Columbia rivers migration corridor. Numbers in parenthesis are unexpanded CWT recoveries.

Brood year	CWT code	Number released	Recovery location						Total
			Lookingglass Creek ^a	Ocean catch ^b	Columbia River ^b	Snake River ^b	In-basin strays ^b	Out-of-basin strays ^b	
2003 ^c	093824	<u>66,578</u>	<u>12</u> (1)	<u>0</u> (0)	<u>2</u> (1)	<u>0</u> (0)	<u>0</u> (0)	<u>0</u> (0)	<u>14</u>
	Total	66,578	12 (1)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	14
2004	094216	71,466	185 (106)	0 (0)	140 (47)	0 (0)	5 (5)	1 (1)	331
	094217	<u>73,769</u>	<u>133</u> (76)	<u>0</u> (0)	<u>126</u> (37)	<u>3</u> (1)	<u>0</u> (0)	<u>0</u> (0)	<u>262</u>
	Total	<u>145,235</u>	318 (182)	0 (0)	266 (84)	3 (1)	5 (5)	1 (1)	593
Grand Total		211,813	330 (183)	0 (0)	268 (85)	3 (1)	5 (5)	1 (1)	607

^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 31,445 juvenile Chinook released from the 2003 brood year marked with an AD clip and no CWT.

Table 14. Expanded adult recoveries by coded-wire tag group of Lostine River spring Chinook salmon from the Captive Broodstock (CBS) and Conventional Hatchery (CHP) programs for the 2008 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/Columbia rivers migration corridor. Numbers in parenthesis are unexpanded CWT recoveries.

Brood year	Broodstock	CWT code	Number released	Recovery location						Total
				Lostine River ^a	Ocean catch ^b	Columbia River ^b	Snake River ^b	In-basin strays ^b	Out-of-basin strays ^b	
2003	CHP	094037	50,826	6 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6
	CHP	094038	51,730	7 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7
	CBS	092348	43,659	5 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5
	CBS	094041	<u>18,490</u>	<u>4 (1)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>4</u>
	Total		164,705	22 (6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	22
2004	CHP	094209	64,582	284 (74)	1 (1)	15 (3)	0 (0)	3 (3)	0 (0)	303
	CHP	094210	65,339	215 (56)	0 (0)	9 (2)	0 (0)	2 (2)	0 (0)	226
	CHP	094211	49,051	273 (71)	0 (0)	21 (6)	0 (0)	9 (9)	0 (0)	303
	CHP	094214	18,978	81 (21)	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	83
	CBS	094212	15,894	32 (5)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	33
	CBS	094248	<u>25,088</u>	<u>89 (14)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>89</u>
	Total		238,932	974 (241)	1 (1)	45 (11)	0 (0)	17 (17)	0 (0)	1,037
2005	CHP	094353	53,313	167 (15)	0 (0)	20 (5)	0 (0)	0 (0)	0 (0)	187
	CHP	094354	49,693	123 (11)	0 (0)	3 (2)	0 (0)	0 (0)	0 (0)	126
	CHP	094355	50,604	89 (8)	0 (0)	26 (5)	0 (0)	0 (0)	0 (0)	115
	CHP	094356	51,796	145 (13)	0 (0)	6 (2)	0 (0)	2 (2)	0 (0)	153
	CBS	094360	<u>24,604</u>	<u>44 (4)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>0 (0)</u>	<u>44</u>
	Total		<u>230,010</u>	<u>568 (51)</u>	<u>0 (0)</u>	<u>55 (14)</u>	<u>0 (0)</u>	<u>2 (2)</u>	<u>0 (0)</u>	<u>625</u>
Grand Total			633,647	1,564 (298)	1 (1)	100 (25)	0 (0)	19 (19)	0 (0)	1,684

^a Expansions based on estimated escapement to the Lostine River using revised weir data provided by NPT Fisheries Research.

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

Table 15. Smolt-to-adult return rates (SAR) to Lower Granite Dam (LGD) for spring Chinook salmon released into the Imnaha River for complete brood year returns (1982-2003).

Brood Year	Total number of smolts released	Total adults over LGD	SAR
1982	24,920	208	0.835
1983	59,595	80	0.134
1984	35,264	112	0.315
1985	123,533	207	0.167
1986	199,506	499	0.250
1987	142,320	384	0.270
1988	253,869	1,878	0.740
1989	267,670	630	0.235
1990	262,500	103	0.039
1991	157,659	76	0.048
1992	438,617	178	0.041
1993	394,304	735	0.186
1994	91,240	90	0.099
1995	50,903	519	1.020
1996	93,112	857	0.920
1997	194,958	3,479	1.784
1998	179,972	4,409	2.450
1999	123,009	1,168	0.950
2000	303,716	2,169	0.714
2001	268,420	2,000	0.745
2002	398,178	1,294	0.325
2003	435,187	1,299	0.298

Table 16. Smolt-to-adult return rates (SAR) to Lower Granite Dam (LGD) for Grande Ronde River basin spring Chinook smolts produced from the Captive Broodstock (CBS) and Conventional Hatchery (CHP) programs released into Catherine Creek, Upper Grande Ronde River, and Lostine River for complete brood year returns, 1998-2003.

Stream of release	Brood year	Program	Total number of smolts released	Total adults over LGD	SAR
Catherine Creek	1998	CBS	38,149	421	1.104
	1999	CBS	136,833	250	0.183
	2000	CBS	180,343	684	0.379
	2001	CHP	24,392	79	0.324
	2001	CBS	105,292	130	0.123
	2002	CHP	70,071	209	0.298
	2002	CBS	91,797	74	0.081
	2003	CBS	68,827	45	0.065
	2003	CHP	120,753	130	0.108
Upper Grande Ronde River	1998	CBS	1,508	7	0.464
	1999	CBS	2,560	12	0.469
	2000	CBS	151,444	666	0.440
	2001	CHP	26,923	118	0.438
	2001	CBS	210,113	371	0.177
	2002	CHP	69,856	178	0.255
	2002	CBS	75,063	1	0.001
	2003	CBS	1,019	0	0.000
	2003	CHP	104,350	50	0.048
Lostine River	1997	CHP	11,870	223	1.856
	1998	CBS	35,100	590	1.681
	1999	CBS	133,880	332	0.248
	2000	CBS	77,312	637	0.824
	2000	CHP	31,464	415	1.312
	2001	CBS	141,867	430	0.303
	2001	CHP	100,882	637	0.627
	2002	CBS	133,729	185	0.138
	2002	CHP	116,870	314	0.263
	2003	CBS	62,149	112	0.181
2003	CHP	102,556	261	0.248	

Table 17. Summary of hatchery and natural spring Chinook salmon carcasses recovered and number of redds observed by stream during spawning ground surveys in the Imnaha River and Grande Ronde River basins, 2008.

Basin, stream	Hatchery	Natural	Unknown origin	Percent hatchery	Number of redds
<u>Imnaha River Basin</u>					
Big Sheep Creek	13	4	8	76.5	60
Imnaha River	456	130	15	77.8	536
Lick Creek	<u>52</u>	<u>0</u>	<u>1</u>	<u>100.0</u>	<u>46</u>
Total	521	134	24	79.5	642
<u>Grande Ronde River Basin</u>					
Bear Creek	1	3	0	25.0	23
Catherine Creek	32	23	0	58.2	101
Upper Grande Ronde River	20	10	7	66.7	32
Hurricane Creek	7	12	1	36.8	45
Lookingglass Creek ^a	85	15	0	85.0	143
Lostine River	257	91	16	73.9	293
Minam River ^b	9	51	5	15.0	157
Wallowa River	17	24	0	41.5	67
Wenaha River	<u>1</u>	<u>17</u>	<u>8</u>	<u>5.6</u>	<u>108</u>
Total	429	246	37	63.6	969

^a Includes Little Lookingglass Creek.

^b Includes Little Minam River.

Table 18. Summary of hatchery Chinook salmon carcasses with coded-wire tags recovered during spawning ground surveys in the Imnaha River and Grande Ronde River basins, 2008.

Recovery location	Brood year	CWT code	Number recovered	Release site
<u>Imnaha River Basin</u>				
Big Sheep Creek ^a	2004	094206	1	Imnaha River
		094207	1	Imnaha River
		094208	2	Imnaha River
Imnaha River	2003	094033	3	Imnaha River
		094034	8	Imnaha River
	2004	094206	37	Imnaha River
		094207	33	Imnaha River
		094208	33	Imnaha River
	2005	093825	13	Imnaha River
093826		6	Imnaha River	
094350		11	Imnaha River	
Lick Creek ^a	2004	094206	2	Imnaha River
		094207	1	Imnaha River
		094208	5	Imnaha River
	2005	093825	1	Imnaha River
		093826	1	Imnaha River
		094350	1	Imnaha River
<u>Grande Ronde River Basin</u>				
Catherine Creek	2004	094215	8	Catherine Creek
		094218	10	Catherine Creek
		093427	11	Catherine Creek
Upper Grande Ronde River	2004	094213	11	Upper Grande Ronde River
	2005	094358	4	Upper Grande Ronde River
		094362	2	Upper Grande Ronde River
		093162	2	Upper Grande Ronde River
Hurricane Creek ^b	2004	094209	1	Lostine River
		094210	2	Lostine River
		094211	2	Lostine River
	2005	094353	1	Lostine River
	Lookingglass Creek ^c	2003	093824	1
2004		094210	1	Lostine River
		094211	3	Lostine River
		094216	33	Lookingglass Creek
		094217	27	Lookingglass Creek
		094218	1	Catherine Creek
2005	094357	1	Catherine Creek	

Table 18 continued.

Recovery location	Brood year	CWT code	Number recovered	Release site
Lostine River	2003	094037	2	Lostine River
		094038	1	Lostine River
		094041	1	Lostine River
		092348	1	Lostine River
	2004	094209	54	Lostine River
		094210	37	Lostine River
		094211	48	Lostine River
		094212	5	Lostine River
		094214	12	Lostine River
		094248	14	Lostine River
		2005	094353	9
	094354		9	Lostine River
	094355		7	Lostine River
	094356		11	Lostine River
094360	4		Lostine River	
094209	1		Lostine River	
Minam River ^d	2004	094211	2	Lostine River
		094216	2	Lookingglass Creek
		094211	2	Lostine River
Wallowa River ^b	2004	094212	1	Lostine River
		094214	1	Lostine River
		094216	2	Lookingglass Creek
		094353	4	Lostine River
	2005	094354	1	Lostine River
		094355	1	Lostine River
		094356	1	Lostine River
		094216	1	Lookingglass Creek
Wenaha River	2004	094216	1	Lookingglass Creek

^a Recoveries of Imnaha River adults are probably the result of outplanting.

^b Recoveries of Lostine River adults are probably the result of outplanting.

^c Includes Little Lookingglass Creek.

^d Includes Little Minam River.

Table 19. Number of hatchery and natural Chinook salmon kidney samples analyzed for bacterial kidney disease, mean, standard deviation (STD), and minimum and maximum ELISA OD levels for salmon from streams in the Grande Ronde River and Imnaha River basins sampled at Lookingglass Fish Hatchery (LFH) or from carcasses sampled on spawning ground surveys (SGS), 2008.

Population, origin	Sampling location	N	ELISA OD			
			Mean	STD	Minimum	Maximum
<u>Imnaha River</u>						
Hatchery	LFH	106	0.0824	0.0257	0.053	0.213
Hatchery	SGS	21	0.1048	0.0346	0.070	0.200
Natural	LFH	29	0.0810	0.0170	0.056	0.143
Natural	SGS	6	0.1197	0.0283	0.076	0.156
<u>Catherine Creek</u>						
Hatchery	LFH	21	0.1009	0.0244	0.065	0.165
Hatchery	SGS	6	0.1145	0.0226	0.092	0.156
Natural	LFH	11	0.0976	0.0238	0.065	0.148
Natural	SGS	10	0.1160	0.0236	0.077	0.152
<u>Upper Grande Ronde River</u>						
Hatchery	LFH	9	0.0756	0.0156	0.053	0.097
Hatchery	SGS	1	0.1200	.	0.120	0.120
Natural	LFH	4	0.0683	0.0120	0.057	0.085
Natural	SGS	11	0.1523	0.0882	0.078	0.405
<u>Lookingglass Creek</u>						
Hatchery	LFH	84	0.0997	0.0263	0.056	0.181
Hatchery	SGS	16	0.1174	0.0169	0.094	0.155
<u>Lostine River</u>						
Hatchery	LFH	48	0.0762	0.0120	0.055	0.102
Hatchery	SGS	21	0.1277	0.0739	0.069	0.400
Natural	LFH	22	0.0789	0.0179	0.061	0.131
Natural	SGS	9	0.0942	0.0215	0.067	0.124
<u>Minam River</u>						
Hatchery	SGS	3	0.1877	0.1092	0.113	0.313
Natural	SGS	14	0.2709	0.4179	0.097	1.715
<u>Wenaha River</u>						
Natural	SGS	1	0.1070	.	0.107	0.107

Table 20. Number and percent of natural and hatchery-reared adult Chinook salmon from streams in the Grande Ronde River and Imnaha River basins sampled for BKD with ELISA OD levels in each category, 2008.

Population, origin	ELISA category						Total
	Low (<0.2)		Moderate ($0.2 - <0.8$)		High (≥ 0.8)		
	N	%	N	%	N	%	
<u>Imnaha River</u>							
Hatchery	124	98	3	2	0	0	127
Natural	35	100	0	0	0	0	35
<u>Catherine Creek</u>							
Hatchery	27	100	0	0	0	0	27
Natural	21	100	0	0	0	0	21
<u>Upper Grande Ronde River</u>							
Hatchery	10	100	0	0	0	0	10
Natural	14	93	1	7	0	0	15
<u>Lookingglass Creek</u>							
Hatchery	100	100	0	0	0	0	100
<u>Lostine River</u>							
Hatchery	67	97	2	3	0	0	69
Natural	31	100	0	0	0	0	31
<u>Minam River</u>							
Hatchery	2	67	1	33	0	0	3
Natural	10	71	3	21	1	7	14
<u>Wenaha River</u>							
Natural	1	100	0	0	0	0	1

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