LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2009 Annual Progress Report

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

Shelby M. Warren
Michael W. Flesher
Debra L. Eddy
Lance R. Clarke
Richard W. Carmichael

OREGON
Fish & Wildlife

LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

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Front cover photo of hatchery personnel releasing steelhead smolts into the lower acclimation pond at Big Canyon Facility. Photo taken by Chad Aschenbrenner, April 2009.

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Prepared By: Shelby M. Warren
Michael W. Flesher
Debra L. Eddy
Lance R. Clarke
Richard W. Carmichael

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Oregon Department of Fish and Wildlife
3406 Cherry Avenue NE
Salem, OR 97303

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PREFACE

The purpose of this progress report is to provide summary information for Lower Snake River Compensation Plan (LSRCP) summer steelhead (*Oncorhynchus mykiss*) programs operated by ODFW in the Grande Ronde and Imnaha river basins during 2009. These ongoing monitoring programs provide technical, logistical, and biological information to managers charged with maintaining viable salmon and steelhead populations and associated fisheries in northeast Oregon. This report is organized into fish culture monitoring for juveniles, adults, CWT recoveries, and estimates for total escapement. During the period covered in this report, steelhead from the 2004-2006 broods returned to spawn, and steelhead from the 2008 brood were released as smolts. Adult steelhead that returned to spawn were used to create the 2009 brood.

ACKNOWLEDGMENTS

We would like to thank hatchery managers Ron Harrod and Mike Gribble, as well as many other hatchery personnel who exhibited great dedication and provided essential assistance. Numerous personnel from the Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife Service, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation provided enthusiastic support. We also thank Chris Starr, Joe Krakker, Steve Yundt, and Scott Marshall, who provided administrative and technical support. This project was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, contract numbers 1411-09-J010 and 1411-A-J010, a cooperative agreement with the Oregon Department of Fish and Wildlife.

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EXECUTIVE SUMMARY

Objectives

1. Document summer steelhead 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 summer steelhead smolts.

3. Document summer steelhead adult returns by stock to each LSRCP broodstock collection facility.

4. Determine if the total production of summer steelhead adults meets mitigation goals, and index annual smolt survival and adult returns to Lower Granite Dam for production groups.

5. Participate in planning activities associated with anadromous fish production and management in the Grande Ronde and Imnaha river basins, and participate in ESA permitting, consultation, and rearing activities.

6. Monitor natural spawning of summer steelhead in selected areas within the Grande Ronde basin.

7. Determine the number of summer steelhead harvested annually and angler effort in recreational fisheries on the Grande Ronde, Wallowa, and Imnaha rivers.

Accomplishments and Findings

We accomplished each of our objectives for 2009. In this report, we present data and results for objectives 1, 2, 3, 4, and 6. To accomplish objective 5, project staff participated in planning and coordination with co-managers to develop and write the annual operation plan. Data and results for objective 7 are published in separate annual creel survey reports (e.g., Flesher et al. 2011).

The production goal of 800,000 Wallowa stock smolts was not achieved in 2009, with 652,424 smolts released. The Imnaha stock production goal of 215,000 smolts was also not achieved in 2009, with 187,401 smolts released.

In 2009, 3,227 and 1,790 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped 24 natural steelhead at Wallowa Fish Hatchery and 80 natural steelhead at the Big Canyon Facility, which were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 1,087 Imnaha stock hatchery and 172 natural steelhead adults. Of these, we released 124 hatchery and 157 natural steelhead above the weir, and outplanted 869 hatchery steelhead to Big Sheep Creek. During spawning in the spring of 2009, we collected 1,139,350 Wallowa stock production eggs, 248,170 Wallowa fall broodstock eggs, and 361,675 Imnaha stock eggs.

In the 2008-09 run year, the compensation area goals of 9,184 Wallowa stock and 2,000 Imnaha stock adult steelhead above Lower Granite Dam were exceeded. We have met the Wallowa stock compensation area goal eight times in our program history, and the Imnaha stock compensation area goal nine times. We estimate that 10,864 Wallowa stock hatchery steelhead (118.3% of goal), and 3,290 Imnaha stock hatchery steelhead (164.5% of goal) returned to the LSRCP compensation area in 2009.

INTRODUCTION

The objectives of this report are to document fish culture practices, describe adult returns, and assess progress toward meeting LSRCP goals for Grande Ronde and Imnaha steelhead *(Oncorhynchus mykiss)*. We report on juvenile steelhead rearing and release activities for the 2008 brood year (BY) released in 2009. Included are collection, spawning, and adult characteristics for the 2009 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

In general, the data in this report were derived from hatchery inventories and standard databases (e.g., Pacific States Marine Fisheries Commission Regional Mark Information System (RMIS), ODFW mark recovery) or through standard measuring techniques. As such, specific protocols are usually not described. In cases where expansions of data or unique methodologies were used, protocols are described in more detail. Additional descriptions of protocols can be found in our work statements (Carmichael et al. 2008, Carmichael et al. 2009). Coded-wire tag (CWT) data collected from 2009 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2009, experimental treatments from which fish returned included an unclipped blank-wire tagged release, off-station direct-stream releases, and progeny from early returning (fall-collected) broodstock release strategies. In 2009, experimental fish were released at Wallowa Hatchery to continue evaluation of progeny from early returning (fall-collected) broodstock vs. production broodstock. Methods for the fall broodstock experiment are described in Warren et al. (2011). We also continued unmarked off-station direct-stream releases into Big Sheep Creek. Analysis of specific survival studies will be completed and published in separate reports once all brood years have returned and CWT data are complete for each experiment. In addition, much of the data that we discuss in this report will be used in separate and specific evaluations of ongoing supplementation programs for steelhead in the Imnaha River basin. We began culture evaluations in 1983 and have dramatically improved many practices. Progress for work completed in previous years is presented in annual progress reports (Carmichael and Wagner 1983; Carmichael and Messmer 1985; Carmichael et al. 1986a; 1987; 1988a; 1999; 2004; 2005a; 2005b; Flesher et al. 2005a; 2009a; Gee et al. 2007; 2008; Messmer et al. 1989; 1990; 1991; 1992; 1993; Jonasson et al. 1994; 1995; 1996; Ruzycki et al. 2003; Warren et al. 2009; 2010; 2011; Whitesel et al. 1993), annual creel survey reports (Carmichael et al. 1988b; 1989; 1990; Flesher et al. 1991; 1992; 1993; 1994; 1995; 1996; 1997; 1999; 2000; 2001; 2004a; 2004b; 2005b; 2007; 2008a; 2008b; 2009a; 2009b, 2010), a United States vs. Oregon production report (Carmichael et al. 1986b), a five-year study plan (Carmichael 1989), and journal articles (Clarke et al. 2010; Clarke et al. 2011). Progress on related work completed in 2009 is presented in the summer steelhead creel annual progress report (Flesher et al. 2011).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed embryo survival for the 2008 BY was 91.4%, within the range of recent brood years (1993-2007 BY range = 71.8-91.7%), and embryo-to-smolt survival was 73.2%, below the range of recent brood years (1993-2007 BY range = 84.7-98.3%; Table 1). Imnaha stock egg-to-embryo survival for the 2008 BY was 88.5%, within the range of recent brood years (1993-2007 BY range = 76.7-92.1%), and embryo-to-smolt survival was 83.5%, also within the range of past years (1993-2007 BY range = 79.5-98.5%; Table 1). We released 652,424 Wallowa stock smolts in 2009, less than our production goal of 800,000 smolts. For the Imnaha stock, we released 187,401 Imnaha stock smolts, also less than our production goal of 215,000 smolts (Tables 1 and 3). A higher than normal loss of 2008 brood year juveniles was primarily due to bacterial coldwater disease, caused by *Flavobacterium psychrophilum* (S. Onjukka, July 2008 Monthly Activity Report for Fish Health Services). Hatchery managers attempt to meet production goals every year; however, variation in mortality at various stages of rearing, from fertilized eggs to acclimated smolts, results in fewer or more fish being released in any given year. Managers periodically adjust the number of eggs collected based on recent hatchery performance.

To evaluate different rearing and release strategies, we marked and released six groups of Wallowa stock steelhead and one group of Imnaha stock steelhead smolts with adipose-left ventral clips and coded-wire-tags (AdLV and CWT), and four groups of Wallowa fall broodstock steelhead with adipose-right ventral clips and coded-wire tags (AdRV and CWT; Table 2). We marked 97.8% of Wallowa stock smolts and 96.4% of Imnaha stock smolts with an adipose fin clip, which was within the range of recent brood years for Wallowa stock (1993-2007 BY range = 95.6-99.6%) and within the range of recent brood years for Imnaha stock (1993-2007 BY range = 96.1-100.0%). Fin clip quality and CWT retention checks determined that Wallowa and Imnaha stock production raceways had poor ventral fin clip quality (66.0-78.6% CWT + clip). In February 2009, six Wallowa stock production raceways and the Imnaha stock raceway were re-clipped (one Wallowa stock raceway was not re-clipped due to insufficient funds). After re-clipping, fin clip quality and tag retention for experimental groups averaged 91.4% for Wallowa, within the range of recent years (1993-2007 BY range = 89.1-99.3%) and 93.3% for Imnaha stocks, within the range of recent years (1993-2007 BY range = 84.7-99.0%). Details of experimental and production releases for the 2008 BY, including the number of fish implanted with passive integrated transponder (PIT) tags, are shown in Table 3.

Densities of residual hatchery steelhead were less than those of wild *O. mykiss* at index sites in the Grande Ronde basin in 2009 (Table 4). In the Imnaha basin, residual hatchery steelhead had a higher density than wild *O. mykiss*, the same pattern that we have observed since sampling for residual hatchery steelhead began in 1996.

Adults

Returning PIT-tagged adults from the 2004 to 2006 broods were detected at mainstem dams during the 2008-09 run year. Of the 114 Wallowa stock adults detected at Bonneville Dam

on the Columbia River, 77 were detected at Lower Granite Dam on the Snake River. For the Imnaha stock, 6 of the 11 adults detected at Bonneville Dam were detected at Lower Granite Dam (Table 5). Weirs were installed to capture adult steelhead on 5 February at Wallowa Fish Hatchery, 6 February at Big Canyon Facility, and 26 February at Little Sheep Creek Facility (Table 6). Returns to the Little Sheep Creek Facility were predominantly hatchery fish, with only 172 (13.7%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 80 (4.3%) natural steelhead. In addition, 24 (0.7%) natural steelhead returned to Wallowa Fish Hatchery. The majority of hatchery adults that returned to Wallowa Fish Hatchery, Big Canyon Facility and Little Sheep Creek Facility spent one year in the ocean (Table 7). Of the natural origin fish, seventy percent (120 of 172), 56% (45 of 80), and 63% (15 of 24) of the Little Sheep Creek Facility, Big Canyon Facility, and Wallowa Fish Hatchery, respectively, spent one year in saltwater before returning.

The majority of hatchery adults that returned to Wallowa Fish Hatchery in 2009 were spawned or killed (Table 7). In 2009, Big Canyon Facility hatchery returns were not needed for the Grande Ronde steelhead hatchery program due to the large number of adults returning to Wallowa Fish Hatchery. We outplanted 260 adult hatchery steelhead from Wallowa Fish Hatchery to local ponds for harvest opportunities. In addition, 108 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Sixty of these fish returned to the weir a second time and were euthanized. At the Big Canyon Facility, 80 natural fish were passed above the weir to spawn naturally. We retained 10% of the hatchery fish and 15% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 869 hatchery adults to Big Sheep Creek to spawn naturally. Three hundred ninety-four of the 869 outplanted fish (45%) were recaptured at least once at the Little Sheep Creek Facility in 2009. One hundred forty-six natural and 111 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally. In addition, 11 natural males and 2 hatchery males were spawned and then passed above the weir, and three hatchery males and eight hatchery females were outplanted to Big Sheep Creek, subsequently recaptured, and passed above the weir, resulting in 124 hatchery fish (44%) above the weir being of hatchery origin. Of the 281 fish passed into Little Sheep Creek, 15 fell back and were recaptured at the weir (Table 8). Length-at-age data for Wallowa and Imnaha stock adults are presented in Figures 1 and 2, respectively.

We conducted multiple spawning surveys for steelhead that were passed above the Big Canyon Facility weir into Deer Creek using protocols described in Gee et al. (2008). In 2009, a total of 80 steelhead were passed above the weir, of which 42 were females (Table 9). Twenty-one redds were counted, which was 50% of the total number of redds constructed, assuming that each female constructs one redd.

In 2009, we accomplished our egg take goal for the Wallowa stock with 1,387,520 green eggs collected. Of these, 1,139,350 were for production and 248,170 were for the fall broodstock evaluation. We collected 361,675 green Imnaha stock eggs, which exceeded our goal of 318,816 eggs. Mortality from green egg-to-eyed embryo from seven weekly spawns ranged from 5-26% for Wallowa production stock, 4-35% for fall broodstock, and from 5-34% for Imnaha stock (Table 10). Over the last fifteen brood years (1993-2008 BY), weekly green egg-

to-eyed embryo mortality ranged from 0-52% for Wallowa stock and from 1-57% for Imnaha stock.

Experimental Group Returns

The number of coded-wire tag (CWT) and adipose-clipped adults that were harvested or returned to collection sites is used to estimate various performance parameters. These numbers allow us to monitor our success toward meeting the LSRCP goals, to estimate stray rates, and to determine the contribution to recreational, tribal, and commercial fisheries. They also provide the basis for evaluating the success of experimental rearing and release strategies. Recoveries for each CWT code were summarized from the CWT recovery database maintained by PSMFC, ODFW's mark recovery database, and from data reported by the Washington Department of Fish and Wildlife and Idaho Department of Fish and Game. Our protocol was to collect and enumerate all fish marked with a CWT when they were spawned, dispatched, or died. A summary of these data is provided in this report. Final analyses, results, and discussion of production and release strategies will be presented in special reports once all adults have returned from the experimental groups.

Adult returns from BY 2004 to 2006 occurred during the 2008-09 run year, including the third year of adult returns from the Wallowa fall broodstock experiment. Of approximately 200,000 total coded-wire-tagged fish released for both production and fall brood groups, a total of 1,086 Wallowa fall brood and 1,694 Wallowa production CWTs were recovered (Table 11). We will provide more analysis from this experiment as data become available. We had Wallowa stock recoveries from 24 CWT codes (Table 11) and Imnaha stock recoveries from two CWT codes (Table 12). We also had eight Wallowa stock CWT codes and two Imnaha stock CWT codes with no reported recoveries. Imnaha stock adult returns came from the following evaluation groups: Big Sheep Creek (Imnaha basin) marked and unclipped direct stream release groups and Little Sheep Creek unclipped and blank-wire-tagged release groups for BY 2004. For the last five complete brood years of Little Sheep Creek Facility April releases, the average smolt-to-adult survival for unclipped, blank-wire tagged release groups was 1.77% compared to 1.23% for AdLV CWT release groups (Table 13). In addition to evaluation group returns, we had returns from major production release groups for both stocks.

Compensation Area Goals

Goals for smolt-to-adult return (SAR) rates and the number of adults produced to the compensation area are 0.68% and 9,184 for the Grande Ronde basin (Wallowa stock) and 0.61% and 2,000 for the Imnaha basin (Imnaha stock). The compensation area is defined as the watershed above Lower Granite Dam. To provide a cumulative summary of disposition for all adults that returned to the compensation area, we expanded CWT recoveries to account for the non-CWT fish that returned.

For the Wallowa stock, we estimate that in the 2008-09 run year, 10,864 hatchery origin adults returned to the compensation area, representing 118.3% of the compensation area goal (Table 14). For the Imnaha stock, we estimate that 3,290 adults returned to the compensation

area, representing 164.5% of the compensation area goal. Age composition of returning adults is shown in Table 15. Development of the compensation plan goals assumed that twice as many adult steelhead would be harvested in downriver fisheries as return to the compensation area (USACOE 1975); however, that harvest level was not reached for either stock.

There are three principal factors that influence success in meeting the compensation goals: number of smolts released for the brood years that produced the adults; smolt-to-adult survival (SAS) rates to the mouth of the Columbia River; and capture of fish below the compensation area in fisheries and as out-of-basin strays. Over the history of the LSRCP project, we have now reached our adult production compensation goal eight times (1997-98, 2001-02, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, and 2008-09 run years) for the Wallowa program, and nine times for the Imnaha program (1992-93, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, and 2008-09 run years). For both the Grande Ronde and Imnaha programs, we have met our smolt production goals in most years. Returns in the 2008-09 run year represent the final returns of the 2004 BY. For the 2004 BY, SAS for the Wallowa and Imnaha stocks were 1.132% and 0.902%, respectively (Figure 3). Smolt-to-adult return to the compensation area above Lower Granite Dam has reached our goal in only six of the last 20 brood years for both Wallowa and Imnaha stocks (Figure 4). This suggests that low SAS rates may be the primary factor for rarely achieving our compensation goals. However, the SAR compensation area goal has been reached in each of the last six years for Imnaha stock and in five of the last six years for Wallowa stock. For the Wallowa stock, 14% of the recoveries in the 2008-09 run year occurred downstream of the compensation area. For Imnaha stock, only 1% of the recoveries in the 2008-09 run year occurred downstream of the compensation area.

The Imnaha steelhead supplementation program allows us to evaluate and compare productivity (adult progeny produced per parent) of hatchery and naturally spawning fish. Hatchery and natural origin fish are used both for hatchery spawning and they are passed above the weir to spawn naturally; therefore, progeny-per-parent ratios include both hatchery and natural origin parents. Progeny-per-parent ratios for naturally spawning fish were below 1.0 for completed brood years 1987-1994, 1998, and 2001-2003 and above 1.0 for completed brood years 1995-1997, 1999, and 2000 (Figure 5). Progeny-per-parent ratios for fish spawned in the hatchery (weir returns only) have been above 1.0 for all brood years except 1991. Hatchery ratios exceeded natural ratios for all brood years except for the 1991 and 1997 broods. One purpose of the supplementation program is to enhance or stabilize natural fish abundance. Annual abundance of naturally-produced fish has been highly variable; however, recent years of data suggest an increasing trend in natural returns (Figure 6).

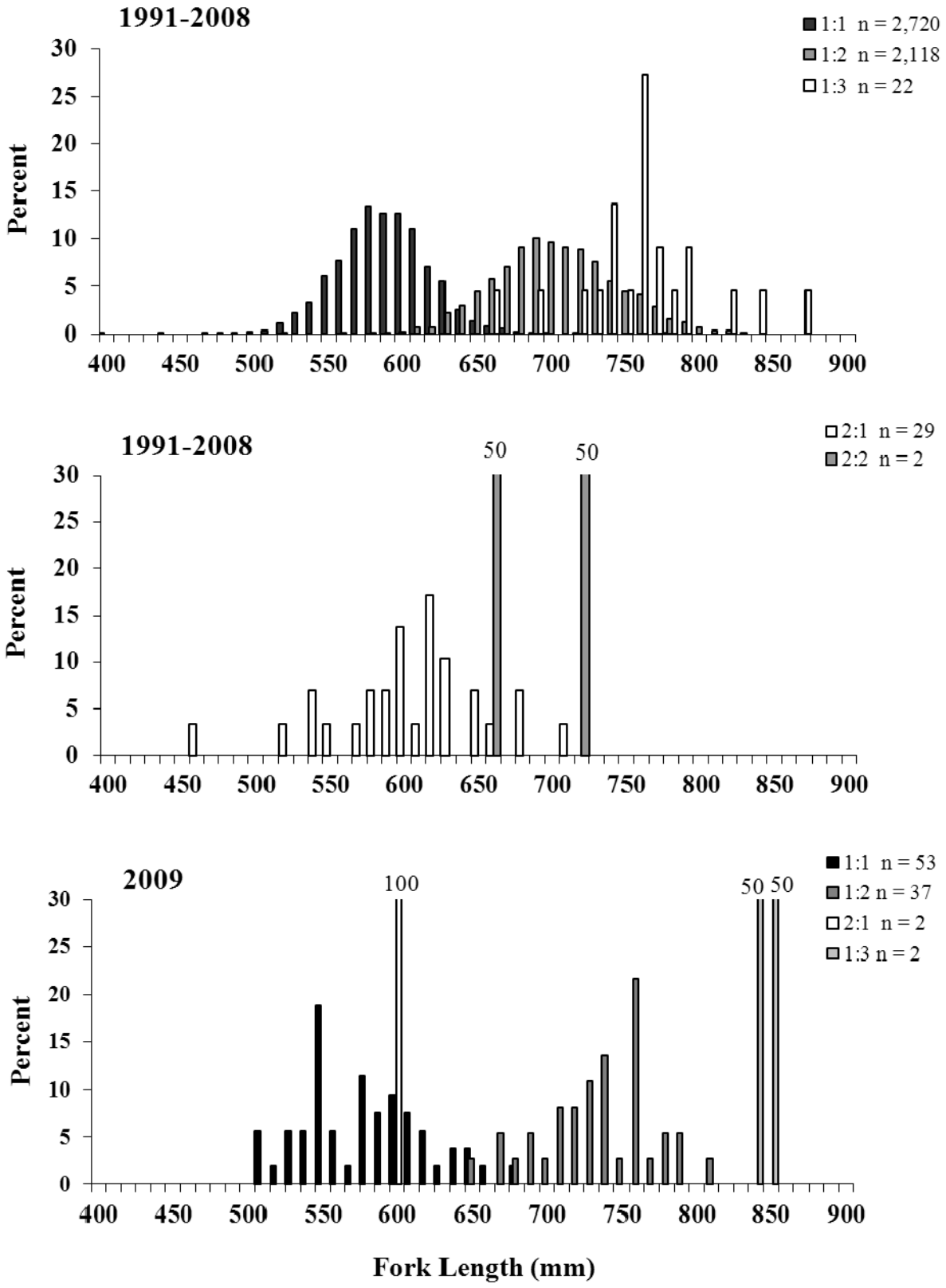

Figure 1. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top) and two freshwater age (middle) Wallowa stock summer steelhead from 1991 to 2008, and in 2009 (bottom).

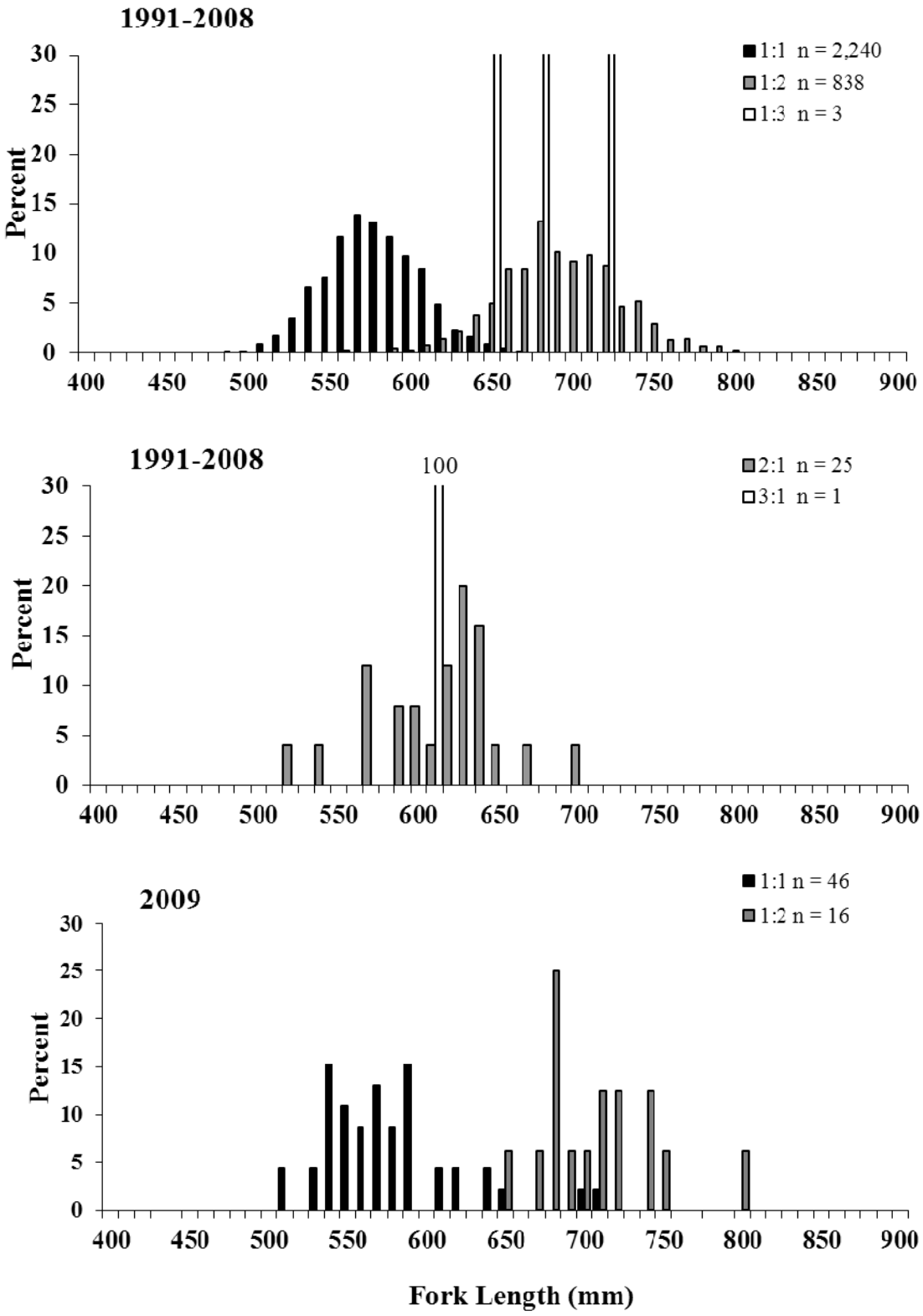

Figure 2. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top), and two and three freshwater age (middle) Imnaha stock summer steelhead from 1991 to 2008, and in 2009 (bottom).

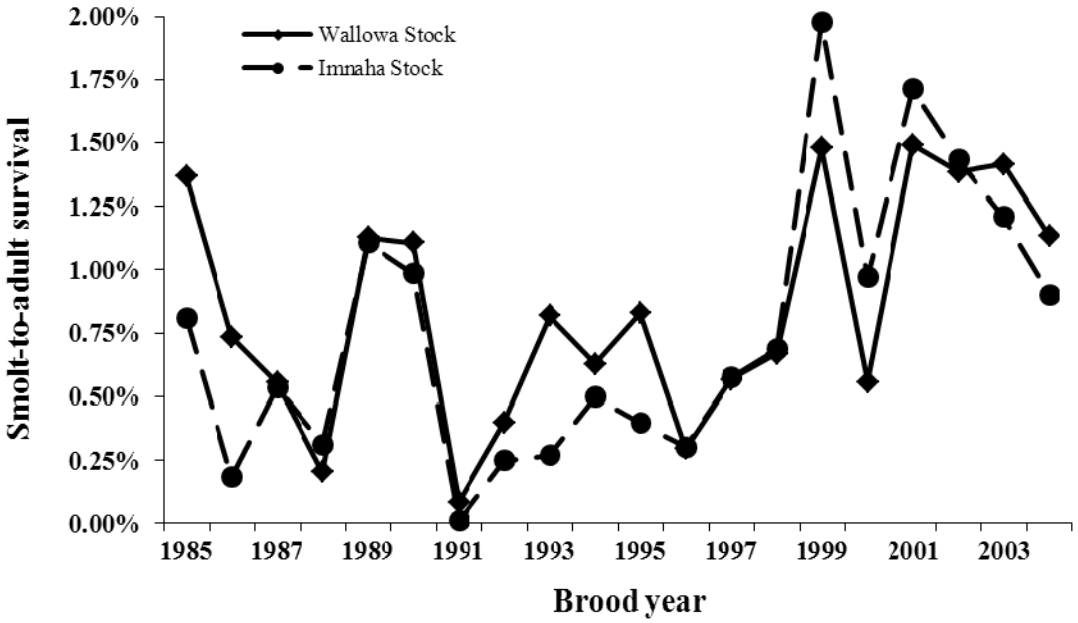

Figure 3. Smolt-to-adult survival (SAS) for Wallowa and Imnaha stock summer steelhead, 1985-2004 brood years. Data is based on CWT recoveries.

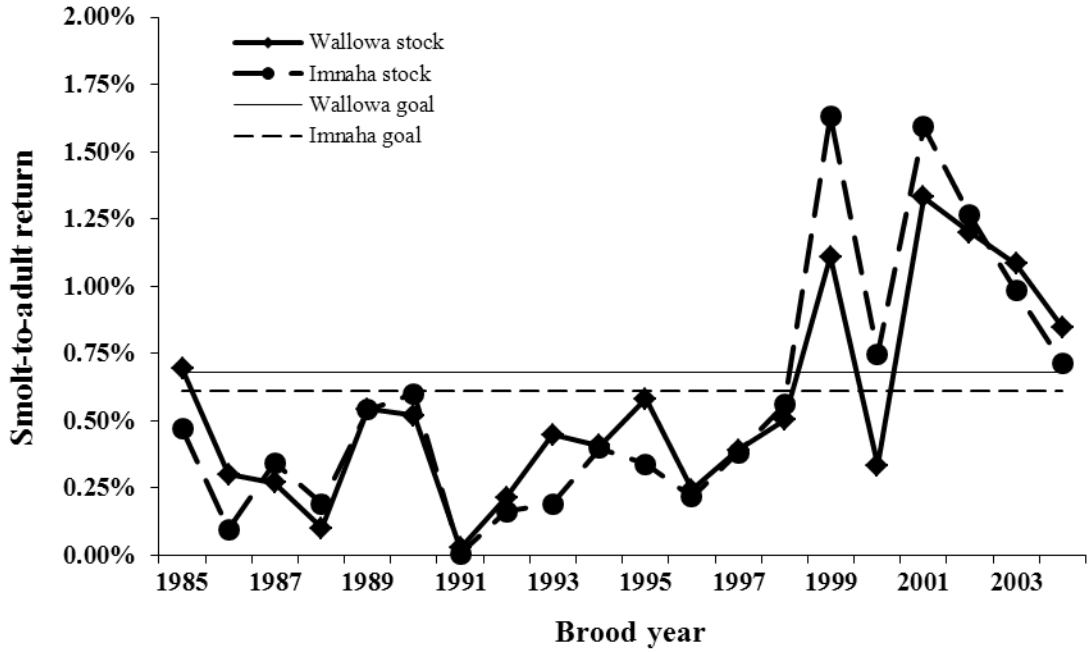

Figure 4. Smolt-to-adult return (SAR) to the compensation area above Lower Granite Dam for Wallowa and Imnaha stock summer steelhead, 1985-2004 brood years. The Wallowa stock goal is 0.68% and the Imnaha stock goal is 0.61%. Data is based on CWT recoveries.

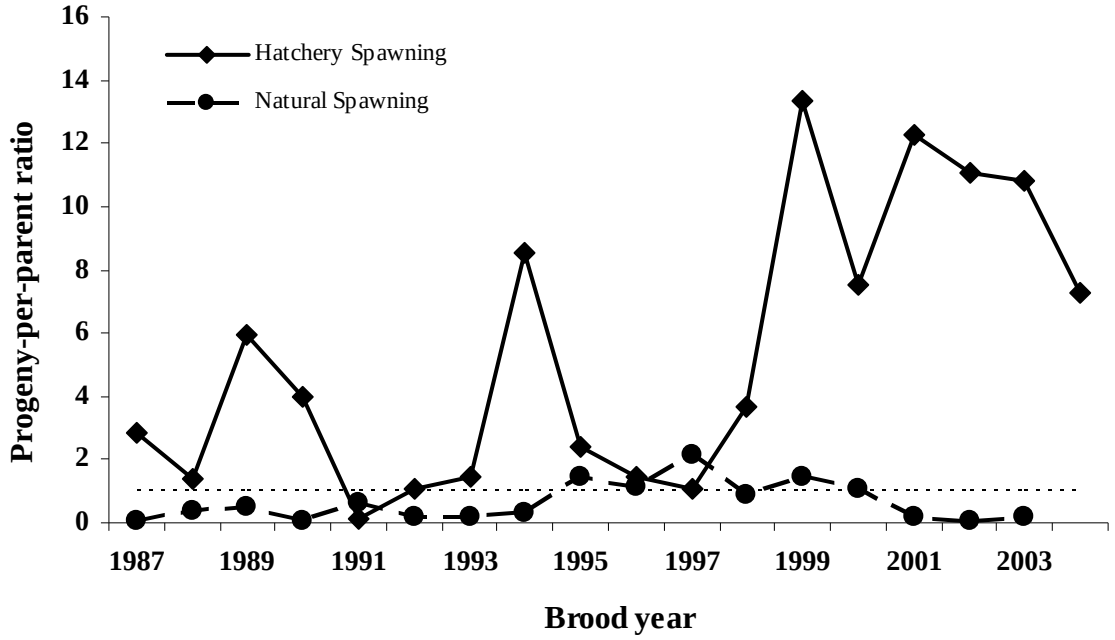

Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-2003 brood years. Both types of spawning include hatchery and natural origin parents. Dotted line represents replacement (P:P ratio = 1.0). Natural origin steelhead data for 2004 is not yet available.

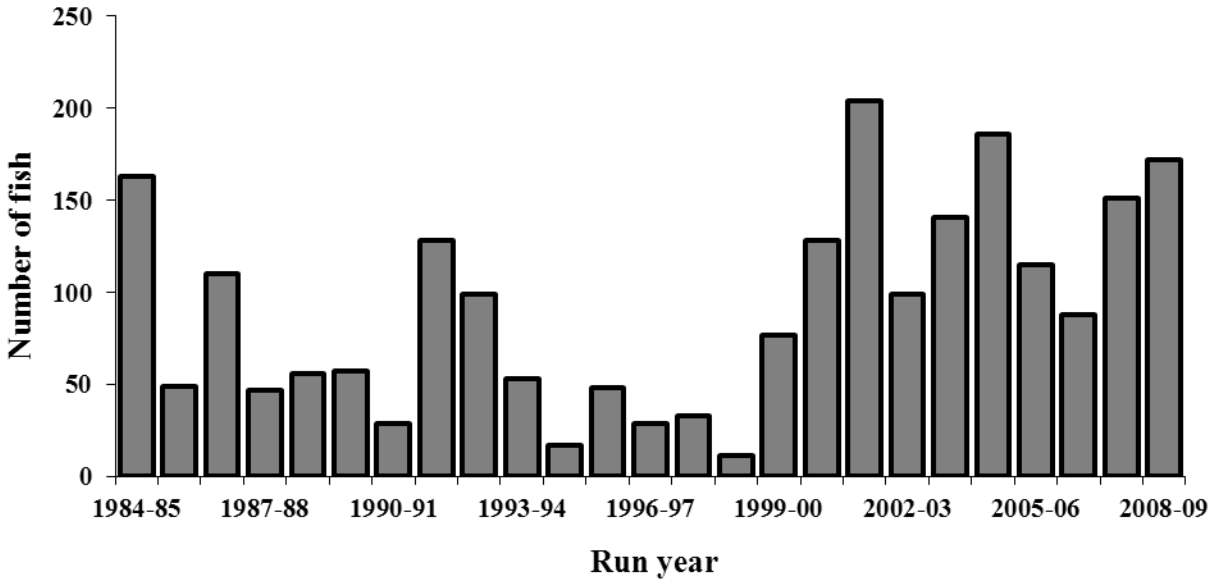

Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2008-09.

Table 1. Summary of egg collection and juvenile survival for 2008 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2009.

Stock	Number of eggs taken	Eyed embryos	Total smolts released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt[a]
Wallowa	1,185,685	1,084,100[b]	654,881[c]	91.4	73.2
Imnaha	297,350	263,300[d]	192,134[e]	88.5	83.5

[a] *Embryos that were culled from or not part of production were subtracted from the calculation of embryo-to-smolt survival.*

[b] *Includes 1,200 embryos that were transferred to the Salmon and Trout Enhancement Program (STEP) Coordinator. Also includes 57,650 embryos that were culled because they were excess to program needs and 130,044 embryos that were overestimated in the inventory.*

[c] *Includes a total of 2,457 fish that were outplanted as rainbow trout at the end of the volitional release period. These fish were determined to be mostly male and were expected to residualize. This includes 819 fish to Victor Pond and 1,638 fish to Wallowa Wildlife Pond.*

[d] *Includes 33,302 embryos that were overestimated in the inventory.*

[e] *Includes 4,733 fish outplanted to Kinney Lake as rainbow trout at the end of the volitional release period. These fish were determined to be mostly male and were expected to residualize.*

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2008 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2009. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose fin-clipped. Targets for tagged production groups were 100% AdLV+CWT and for tagged fall brood (progeny of broodstock collected in early fall) were 100% AdRV+CWT.

Experimental group	Tag code	Number checked		Percent					
		CWT	Ad	CWT+ clips[a]	CWT+ no clip	No CWT + clip	No CWT + no clip	Ad	No Ad
				Wallowa Stock					
Fall Brood, 9	094580	560	-	88.6	8.7	2.5	0.2	-	-
Fall Brood, 11	094584	541	-	93.2	5.9	0.7	0.2	-	-
Fall Brood, 13	094585	539	-	95.4	3.7	0.6	0.3	-	-
Fall Brood, 15	094586	548	-	94.5	5.1	0.4	0.0	-	-
Production, 10	094581	530	-	93.0	1.7[b]	4.9	0.4[c]	-	-
Production, 12	094582	505	-	89.9	4.2[d]	5.9	0.0	-	-
Production, 14	094583	514	-	94.6	3.1	2.3	0.0	-	-
Production , 19	094587	540	-	95.4	2.0	2.4	0.2[e]	-	-
Production, 21	094588	546	-	93.6	3.8	2.6	0.0	-	-
Production, 23	094589	533	-	76.4	20.2	3.4	0.0	-	-
Average	-	536	237[f]	91.4	5.9	2.6	0.1	97.8[g]	2.2
				Imnaha Stock					
Production, 27	094579	509	-	93.3	3.2	3.5	0.0	-	-
Average	-	509	222	93.3	3.2	3.5	0.0	96.4	3.6
Overall average		533	234	91.6	5.6	2.7	0.1	97.5	2.5

[a] *Fin clip quality and CWT retention checks determined raceways 10,12,14,19,21,23, and 27 to have poor fin clip quality (66.0-78.6% CWT + clip). In February 2009, raceways 10,12,14,19,21, and 27 were re-clipped; fin clip quality and CWT retention checks followed. Data presented here reflects fin clip quality after re-clipping.*

[b] *This percentage includes 0.6% that were inadvertently marked RV instead of LV.*

[c] *This percentage includes 0.4% that were inadvertently marked RV instead of LV.*

[d] *This percentage includes 0.2% that were inadvertently marked RV instead of LV.*

[e] *This percentage includes 0.2% that were inadvertently marked RV instead of LV.*

[f] *Adipose fin (Ad) clip quality checks, conducted prior to tagging and final ponding, were made on 279, 211, 225, and 231 fish in four Wallowa stock raceways, and on 222 fish in the Imnaha stock raceway.*

[g] *Ad clip quality was 98.9%, 97.6%, 97.3%, and 97.4% in four Wallowa stock raceways, and 96.4% in the Imnaha stock raceway.*

Table 3. Details of experimental and production groups of 2008 brood year summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2009. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated, except for Big Sheep Creek groups that were direct stream released. Target size was 113 g for Wallowa stock and 91g for Imnaha stock. Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam; percent migration includes ±95% confidence intervals.

Experimental group[a]	Release date	Creek of release	Tag code	Fork length (mm)	Weight (g)	Condition factor	Total fish Released	PIT tags released	Percent migration to LGD[b]
				Wallowa stock					
Production, 10	April 13-14	Spring	094581	219 (19)	111.6 (31.6)	1.01 (0.10)	23,846	1,767	80.4 ± 3.8
Production, 12	April 13-14	Spring	094582	[c]	[c]	[c]	21,940	1,582	80.8 ± 4.2
Production, 14	April 13-14	Spring	094583	[c]	[c]	[c]	23,913	1,783	82.0 ± 3.9
Production,10,12,14,16,20	April 13-14	Spring	-	220 (21)	112.3 (31.2)	1.04 (0.07)	92,990	-	-
Fall Broodstock, 9	April 12-13	Spring	094580	224 (28)	121.2 (40.0)	1.06 (0.06)	23,436	1,183	78.6 ± 4.6
Fall Broodstock, 11	April 12-13	Spring	094584	[d]	[d]	[d]	25,603	1,410	83.1 ± 4.7
Fall Broodstock, 13	April 12-13	Spring	094585	[d]	[d]	[d]	25,083	1,051	81.0 ± 5.0
Fall Broodstock, 9,11,13	April 12-13	Spring	-	[d]	[d]	[d]	21,540	-	-
Production, 19	April 16-17	Deer	094587	215 (21)	103.2 (31.4)	1.01 (0.10)	24,706	4,891	82.4 ± 2.5
Production, 15-20	April 15-17	Deer	-	216 (20)	113.3 (30.7)	1.06 (0.06)	120,172	-	-
Production, 21	April 25-May 7	Spring	094588	228 (27)	121.2 (48.5)	0.95 (0.14)	23,753	2,566	79.6 ± 4.6
Production, 20-22	April 25-May 7	Spring	-	232 (24)	121.2 (45.7)	0.93 (0.20)	54,568	-	-
Fall Broodstock, 15	April 25-May 7	Spring	094586	237 (23)	134.1 (48.8)	0.94 (0.12)	24,917	1,192	83.2 ± 7.5
Fall Broodstock, 15	April 25-May 7	Spring	-	[e]	[e]	[e]	8,814	-	-
Production, 23	April 28-May 11	Deer	094589	231 (25)	118.9 (51.0)	0.88 (0.14)	18,819	4,815	81.3 ± 4.3
Production, 22-26	April 28-May 11	Deer	-	236 (25)	126.6 (42.3)	0.96 (0.11)	118,324	-	-
Total released							652,424	22,240	
				Imnaha stock					
Production, 27	Mar 31-April 28	L. Sheep	094579	206 (29)	105.7 (56.0)	1.10 (0.13)	23,552	8,044	80.8 ± 2.0
Production, 27, 29-31	Mar 31-April 28	L. Sheep	-	203 (27)	98.0 (40.1)	1.13 (0.08)	118,551	7,946	79.2 ± 1.9[f]
Production, 32	April 7	B. Sheep	-	207 (28)	-	-	45,298	4,860	78.2 ± 2.2
Total released							187,401	20,850	

[a] *All fish were reared at Irrigon Fish Hatchery.*

[b] *The percent of PIT tag release groups that migrated to Lower Granite Dam are Cormack-Jolly-Seber estimates of survival probabilities calculated using PITPro 4 (Westhagen and Skalski 2009).*

[c] *CWT codes 094581, 094582, and 094583 were in the same acclimation pond and were not distinguishable based on an external mark.*

[d] *CWT codes 094580, 094584, 094585, and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[e] *CWT code 094586 and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[f] *Percent migration for raceway 29 only.*

Table 4. Density (±95% confidence interval) and mean fork length (standard deviation in parentheses) of residual hatchery steelhead and wild rainbow trout/juvenile steelhead from index sites on Deer (Grande Ronde basin) and Little Sheep (Imnaha basin) creeks in 2009. Hatchery steelhead were classified as residuals after 20 June. HSTS indicates residual hatchery steelhead and WSTS indicates wild rainbow trout/juvenile steelhead for ages one and older.

Location[a]	Date	Species	Area (m^2)	Size of fish (mm)			Density[b] (fish/100m^2)
				N	Fork length	Range	
Grande Ronde basin							
Deer Cr.	29 July	HSTS	279.1	12	160.2 (23.5)	106-212	5.6 ± 3.4
Deer Cr.	29 July	WSTS	80.5[c]	17	109.8 (22.4)	83-158	9.9 ± 6.3
Imnaha basin							
Little Sheep Cr.	28 July	HSTS	450.7	34	191.7 (45.9)	101-287	8.2 ± 0.6
Little Sheep Cr.	28 July	WSTS	450.7	20	114.1 (38.4)	79-235	5.1 ± 0.7

[a] *Index sites located on Deer Creek (Rkm 0.1) at Big Canyon Facility and on Little Sheep Creek (Rkm 8.0) at Little Sheep Creek Facility. Two adjacent sites were sampled at each location and each site typically included both riffle and pool habitat.*

[b] *Density (±95% confidence interval) was determined using a multiple pass removal method (Zippen 1958) with a backpack electrofisher (Smith-Root Model 12) and block seines.*

[c] *Includes only the upper index site.*

Table 5. Number of PIT tags released and unique adult PIT tag detections at Bonneville and Lower Granite dams during the 2008-09 run year by stock and brood year.

Brood year	PIT tags released	Age at return	Adult Detections	
			Bonneville Dam	Lower Granite Dam
Wallowa Stock				
2004	8,059	5	0	0
2005	7,735	4	36	26
2006	7,751	3	78	51
Total	23,545		114	77
Imnaha Stock				
2004	751	5	0	0
2005	600	4	3	1
2006	594	3	8	5
Total	1,945		11	6

Table 6. Timing of adult steelhead returns to LSRCP facilities in 2009 by location and origin.

Period	Week of the year	Number of fish trapped[a]					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Jan 22-28	4	-	-	-	-	-	-
Jan 29-Feb 04	5	-	-	-	-	-	-
Feb 05-11	6	25	0	0	0	-	-
Feb 12-18	7	3	0	0	0	-	-
Feb 19-25	8	86	0	0	0	-	-
Feb 26-Mar 04	9	139	0	26	0	0	0
Mar 05-11	10	322	0	361	4	3	1
Mar 12-18	11	413	3	62	0	0	0
Mar 19-25	12	568	0	113	1	41	8
Mar 26-Apr 01	13	494	6	108	2	141	13
Apr 02-08	14	490	5	195	4	178	20
Apr 09-15	15	295	5	491	27	375	55
Apr 16-22	16	267	5	119	10	140	23
Apr 23-29	17	54	0	159	12	152	31
Apr 30-May 06	18	41	0	92	6	25	7
May 07-13	19	17	0	35	7	19	5
May 14-20	20	10	0	25	6	7	6
May 21-27	21	3	0	4	1	6	3
May 28-Jun 03	22	0	0	0	0	0	0
Jun 04-10	23	-	-	-	-	-	-
Jun 11-17	24	-	-	-	-	-	-
Jun 18-24	25	-	-	-	-	-	-
Total		3,227	24	1,790	80	1,087	172

[a] *The ladder was opened on 5 February at Wallowa Fish Hatchery, and weirs were installed 6 February at Big Canyon Facility (Deer Creek) and 26 February at Little Sheep Creek Facility. Adult collections ended 1 June at Wallowa Fish Hatchery, 2 June at Big Canyon Facility, and 3 June at Little Sheep Creek Facility.*

Table 7. Number, disposition, and mean fork length (mm) of adult steelhead that returned to LSRCP facilities in 2009 by stock, origin, estimated age (freshwater:saltwater), and gender. M indicates male and F indicates female.

Facility, stock, disposition	Hatchery[a]									Natural[b]											Grand total
	1:1		1:2		2:1		1:3			2:1		2:2		3:1		3:2		4:1			
	M	F	M	F	M	F	M	F	Total	M	F	M	F	M	F	M	F	M	F	Total	
Wallowa Fish Hatchery (Wallowa Stock-Production)																					
Trapped	792	601	330	982	11	0	3	7	2,726	5	1	1	5	7	2	1	2	0	0	24	2,750
Passed	0	0	0	0	0	0	0	0	0	5	1	1	5	6	2	1	1	0	0	22	22
Outplanted	104	19	59	68	2	0	0	0	252	0	0	0	0	0	0	0	0	0	0	0	252
Kept	688	582	271	914	9	0	3	7	2,474	0	0	0	0	1	0	0	1	0	0	2	2,476
Mortality	12	10	6	12	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	40
Spawned	105	34	69	145	1	0	2	1	357	0	0	0	0	0	0	0	0	0	0	0	357
Killed[c,d]	571	538	196	757	8	0	1	6	2,077	0	0	0	0	1	0	0	1	0	0	2	2,079
Wallowa Fish Hatchery (Wallowa Stock-Fallbrood)																					
Trapped	182	123	62	130	2	0	1	1	501	0	0	0	0	0	0	0	0	0	0	0	501
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	5	0	2	0	0	0	1	0	8	0	0	0	0	0	0	0	0	0	0	0	8
Kept	177	123	60	130	2	0	0	1	493	0	0	0	0	0	0	0	0	0	0	0	493
Mortality	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Spawned	25	15	22	30	1	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0	93
Killed[c]	152	108	38	99	1	0	0	1	399	0	0	0	0	0	0	0	0	0	0	0	399
Wallowa Fish Hatchery (Total Returns)																					
Trapped	974	724	392	1,112	13	0	4	8	3,227	5	1	1	5	7	2	1	2	0	0	24	3,251
Fork length (mm)	577	575	756	713	595	-	844	-		-	-	-	-	-	-	-	-	-	-		
Standard deviation	48	34	27	33	0	-	9	-		-	-	-	-	-	-	-	-	-	-		
Sample size	27	26	16	21	2		2														
Big Canyon Facility (Wallowa stock)																					
Trapped	512	461	158	646	7	0	2	4	1,790	10	8	6	16	17	9	4	9	1	0	80	1,870
Passed	0	0	0	0	0	0	0	0	0	10	8	6	16	17	5	4	9	1	0	80	80
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Returned to river[e]	13	13	5	16	0	0	0	1	48	0	0	0	0	0	0	0	0	0	0	0	48
Kept	499	448	153	630	7	0	2	3	1,742	0	0	0	0	0	0	0	0	0	0	0	1,742
Mortality	8	24	3	4	0	0	0	0	39	0	0	0	0	0	0	0	0	0	0	0	39
Spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killed[c,e]	491	424	150	626	7	0	2	3	1,703	0	0	0	0	0	0	0	0	0	0	0	1,703
Fork length (mm)	-	-	-	-	-	-	-	-		-	-	-	678	-	-	-	-	-	-		
Standard deviation	-	-	-	-	-	-	-	-		-	-	-	57	-	-	-	-	-	-		
Sample size													3								

Table 7. Continued

Facility, stock, Disposition	Hatchery[a] 1:1[f] M	1:1[f] F	1:2 M	1:2 F	2:1 M	2:1 F	1:3 M	1:3 F	Total	Natural[b] 2:1 M	2:1 F	2:2 M	2:2 F	2:3 M	2:3 F	3:1 M	3:1 F	3:2 M	3:2 F	Total	Grand total
Little Sheep Creek Facility (Imnaha stock)																					
Trapped	455	358	35	227	0	6	0	6	1,087	41	49	6	42	0	0	9	21	0	4	172	1,259
Passed	46	38	5	18	0	0	0	4	111	33	46	5	34	0	0	7	19	0	2	146	257
Outplanted[g]	359	292	24	187	0	5	0	2	869	0	0	0	0	0	0	0	0	0	0	0	869
Kept	50	28	6	22	0	1	0	0	107	8	3	1	8	0	0	2	2	0	2	26	133
Mortality	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Spawned[h]	47	28	5	22	0	1	0	0	103	8	3	1	8	0	0	2	2	0	2	26	129
Killed	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Fork Length (mm)	567	584	712	701	-	-	-	-		570	560	-	685	-	-	557	572	-	659		
Standard deviation	30	59	48	31	-	-	-	-		37	32	-	42	-	-	28	25	-	20		
Sample size	30	16	5	11						12	24	-	26	-	-	3	9	-	2		

[a] *Wallowa stock ages apportioned using CWT data and 94 scale samples collected in 2009; Imnaha stock ages apportioned using CWT data, 62 scale samples from 2009, and 55 scale samples from 2008 in order to increase sample size. Mean fork lengths are from fish with scale samples collected in 2009.*

[b] *Wallowa and Big Canyon ages apportioned using historical data (193 samples) and 2009 data (3 samples); at Little Sheep Creek Facility ages were apportioned using 2009 data (76 samples). Mean fork lengths are from fish with scale samples collected in 2009.*

[c] *For Wallowa stock, 2,125 fish that returned to Wallowa Fish Hatchery and 1,603 fish that returned to Big Canyon were euthanized and donated to local food banks. In addition, 92 fish from Wallowa Hatchery and 53 fish from Big Canyon were euthanized and donated to local schools for educational purposes.*

[d] *Includes 15 hatchery females and 15 hatchery males that were spawned for Cottonwood Facility (Washington).*

[e] *One hundred eight fish were returned to the river fishery. Of these, 26 males and 34 females returned to the weir a second time and were euthanized. These 60 fish are included in the "killed" category.*

[f] *Includes seven males and five females originally identified as natural origin fish (due to absence of any external marks). However, scale reading determined them to be of hatchery origin.*

[g] *Includes three hatchery males and eight hatchery females that were outplanted, recaptured, and passed above the weir. Also includes 4 hatchery males and one hatchery female that were outplanted, recaptured, and spawned.*

[h] *Includes 11 natural males and two hatchery males that were live-spawned and passed above the weir.*

Table 8. Number of adult summer steelhead trapped at the Little Sheep Creek Facility weir that were either outplanted to Big Sheep Creek or passed above the weir, and were subsequently recaptured, 1999-2009.

	Big Sheep Creek			Little Sheep Creek		
	Number of fish		%	Number of fish		%
Year	Outplanted	Recaptured[a]	Recaptured[b]	Passed[c]	Recaptured[a]	Recaptured[b]
1999	42	6	14.3	80	1	1.3
2000	138	17	12.3	200	9	4.5
2001	354	48	13.6	784	89	11.4
2002	2,030	907	44.7	1,198	269	22.5
2003	1,403	439	31.3	387	36	9.3
2004	1,719	244	14.1	823	138	16.8
2005	1,555	109	7.0	461	37	8.0
2006	1,934	703	36.3	356	53	14.9
2007	1,315	168	12.8	241	14	5.8
2008	1,365	382	28.0	291	23	7.9
2009	869	394	45.3	281	15	5.3
Mean	-	-	23.6	-	-	9.8

[a] *Total number of recaptures, including multiple recaptures. For 1999-2002, recaptures were opercle punched at the weir and second and third time recaptures recorded.*
[b] *Total recaptured divided by total outplanted.*
[c] *Includes natural males that were live- spawned and passed above the weir. Also includes fish that were outplanted, recaptured, and passed above the weir.*

Table 9. Summary of summer steelhead spawning surveys in Deer Creek above the Big Canyon Facility weir, 2002-2009.

Year	Females passed	Males passed	Total passed	Redds counted	Fish/ redd	Females/ redd	% Redds counted[a]	Redds/ mile[b]	Redd visibility[c]
2002	120	89	209	84	2.49	1.43	70	8.4	19.8
2003	92	48	140	64	2.19	1.44	70	6.4	20.5
2004	47	20	67	46	1.46	1.02	98	4.6	29.8
2005	42	35	77	35	2.20	1.20	83	3.5	16.7
2006[d]	55	41	96	58	1.66	0.95	105	5.8	28.2
2007	27	21	48	41	1.17	0.66	152	4.1	35.1
2008	23	38	61	15	4.07	1.53	65	1.5	8.6
2009	42	38	80	21	3.81	2.00	50	2.1	19.3

[a] *Calculated as number of redds counted ÷ number of females passed x 100. Assumes each female built one redd.*
[b] *Twelve miles of stream were surveyed in 2002, 2003, and 2007 through 2009. Ten miles of stream were surveyed in 2004-06. Redds/mile are based on the lower ten miles, since redds have not been observed between RM 10-12.*
[c] *Indicates the average length of time (in days) each redd was clearly or moderately visible.*
[d] *Includes an estimated seven additional hatchery steelhead (4 females and 3 males) that escaped above the weir prior to weir installation, based on marked and unmarked fallbacks at weir.*

Table 10. Spawning summaries for summer steelhead at LSRCP facilities in 2009. The percent mortality is from green egg to eyed embryo after shocking.

Spawn date, lot number[a]	Parental origin[b]	Number of females spawned[c]	Number of eggs	Eyed embryos[d]	% mortality
		Wallowa Hatchery (Wallowa stock)			
3/11, WA460	Production	15	91,600	74,200	19.0
	Fall Broodstock	4	16,100	13,600	15.5
3/18, WA461	Production	27	161,900	140,300	13.3
	Fall Broodstock	6	34,600	32,500	6.1
3/25, WA462	Production	33	218,600	161,900	25.9
	Fall Broodstock	9	42,100	27,900	33.7
4/01, WA463	Production	33	196,000	148,700	24.1
	Fall Broodstock	9	49,400	32,200	34.8
4/08, WA464	Production	33	200,100	176,500	11.8
	Fall Broodstock	8	60,200	48,000	20.3
4/15, WA465	Production	25	177,450	168,500	5.0
	Fall Broodstock	6	33,070	31,700	4.1
4/23, WA466	Production	14	93,700	79,500	15.2
	Fall Broodstock	3	12,700	10,000	21.3
Subtotal	Production	180	1,139,350	949,600	16.7
	Fall Broodstock	45	248,170	195,900	21.1
Total		225	1,387,520	1,145,500	17.4
		Little Sheep Creek Facility (Imnaha stock)			
3/31, LI560	Hatchery	3	19,300	18,200	5.7
4/07, LI561	Hatchery Mixed	4	12,200 12,200	21,700	11.1
4/14, LI562	Hatchery Mixed	11	48,182 4,818	48,900	7.7
4/21, LI563	Hatchery Mixed	11	14,502 38,673	47,875	10.0
4/28, LI564	Hatchery Mixed	13	16,777 55,923	65,100	10.5
5/05, LI565	Hatchery Mixed	18	76,767 21,933	90,200	8.6
5/12, LI566	Hatchery Mixed	7	17,314 23,086	26,500	34.4
Subtotal	Hatchery Mixed	67	205,042 156,633	318,475	11.9
Total		67	361,675	318,475	11.9

[a] *On 4/23, 15 additional females were spawned for Cottonwood Facility (Washington). A total of 87,100 eggs were collected, amounting to 79,500 eyed embryos (8.7% mortality). Fish were transferred to Lyons Ferry Hatchery as unfed fry.*

[b] *In general, family groups were one male x one female for Wallowa stock and were matrix spawned (three males x three females) for Imnaha stock. Mixed eggs include both natural and hatchery parents.*

[c] *Number of males spawned equals the number of females spawned.*

[d] *Includes 1,200 Wallowa production stock eyed embryos that were transferred to the Salmon and Trout Enhancement Program (STEP). Also includes 40,000 Wallowa production stock eyed embryos and 4,700 Wallowa fall broodstock eyed embryos that were euthanized because they were excess to program needs.*

Table 11. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Wallowa stock summer steelhead for the 2008-09 run year. All CWT fish were hatchery origin fish released into either Deer Creek (at Big Canyon Facility) or Spring Creek (at Wallowa Fish Hatchery). Data were summarized as available through April 2011.

Brood year, release site	Experimental group[a]	CWT code	Recoveries at weirs[b]	Other in-basin recoveries[c]	Out-of-basin recoveries[d]	Total recoveries[e]
2004						
Deer Cr.	Production, April	094112	0	0	0	0
	Production, May	094113	0	0	0	0
Spring Cr.	Production, April	094104	0	0	0	0
	Production, April	094105	1	0	0	1
	Production, April	094106	1	0	0	1
	Production, May	094107	0	0	0	0
	Fallbrood, April	094108	0	0	0	0
	Fallbrood, April	094109	0	0	0	0
	Fallbrood, April	094110	0	0	0	0
	Fallbrood, May	094111	0	0	0	0
2005						
Deer Cr.	Production, April	074134	47	61	38	146
	Production, May	094302	45	31	32	108
Spring Cr.	Production, April	074131	53	5	40	98
	Production, April	074132	62	17	30	109
	Production, April	074133	40	17	21	78
	Production, May	094303	46	15	42	103
	Fallbrood, April	074135	20	17	53	90
	Fallbrood, April	091705	3	0	8	11
	Fallbrood, April	092608	4	12	23	39
	Fallbrood, April	092644	42	13	38	93
	Fallbrood, April	092645	34	23	72	129
	Fallbrood, May	094301	27	9	21	57
2006						
Deer Cr.	Production, April	094407	47	53	79	179
	Production, May	094408	19	13	61	93
Spring Cr.	Production, April	094401	75	25	94	194
	Production, April	094402	112	45	128	285
	Production, April	094305	85	20	102	207
	Production, May	094363	44	5	43	92
	Fallbrood, April	094403	63	33	115	211
	Fallbrood, April	094404	64	28	103	195
	Fallbrood, April	094405	65	36	64	165
	Fallbrood, May	094406	33	25	38	96
	Total recoveries		1,032	503	1,245	2,780

[a] *Experimental groups include the release strategy. All releases were targeted for five fish per pound (91 g/fish). All fish were acclimated. April releases were forced (over a 24-hour period) and May releases were volitional (1-3 weeks) unless otherwise noted.*

[b] *Actual number of CWT fish that were released into Spring Creek and recovered at the Wallowa Fish Hatchery weir or released into Deer Creek and recovered at the Big Canyon Facility weir. The protocol was to collect all CWT fish at the weirs for sampling at the hatchery during spawning.*

[c] *Estimated number (from creel surveys and harvest card returns) of CWT fish that were harvested in the Grande Ronde River basin fisheries.*

[d] *Estimated number (from PSMFC and ODFW databases) of CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Grande Ronde River basin. When CWT expansion factors were 25 or greater (because of a low sampling rate), unexpanded data were used.*

[e] *Estimated total by summing all recoveries.*

Table 12. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Imnaha stock summer steelhead for the 2008-09 run year. All CWT fish were hatchery origin fish either released into Little Sheep Creek at Little Sheep Creek Facility or into Big Sheep Creek. Data were summarized as available through April 2011.

Brood year, release site	Experimental group[a]	CWT code	Recoveries at weirs[b]	Other in-basin recoveries[c]	Out-of-basin recoveries[d]	Total recoveries[e]
2004						
Big Sheep	Production, April	094020	0	0	0	0
Little Sheep	Production, April	094103	0	0	0	0
2005						
Little Sheep	Production, April	074130	32	7	81	120
2006						
Little Sheep	Production, April	094304	86	15	80	181
	Total recoveries		118	22	161	301

[a] *Experimental groups include the release strategy. All releases were targeted for five fish per pound (91 g/fish). Big Sheep fish were direct stream released. All Little Sheep fish were acclimated and volitionally released over a three-week period.*

[b] *Estimated number of CWT fish recovered at the Little Sheep Creek Facility weir based on actual number recovered at the weir and estimated number either passed above the weir to Little Sheep Creek or outplanted to Big Sheep Creek to spawn naturally.*

[c] *Estimated number (from creel surveys and harvest card returns) of CWT fish that were harvested in the Imnaha River basin fishery.*

[d] *Estimated number (from PSMFC and ODFW databases) of CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Imnaha River basin. When CWT expansion factors were 25 or greater (because of a low sampling rate), unexpanded data were used.*

[e] *Estimated total by summing all recoveries.*

Table 13. Smolt-to-adult survival of Imnaha stock blank-wire tagged and coded-wire tagged fish released in April from Little Sheep Creek Facility for completed brood years 2000-2004. Blank-wire tagged fish were unclipped and coded-wire tagged fish were marked with an adipose-left ventral (AdLV) fin clip.

	Percent smolt-to-adult survival	
Brood year	Blank-wire tag[a]	Coded-wire tag
2000	1.34	1.11
2001	2.50	1.48
2002	2.14	1.54
2003	1.68	1.23
2004	1.18	0.80
Average	1.77	1.23

[a] *Includes returns back to the weir and an estimate of harvest in Zone 6 Treaty Net fisheries based on CWT recoveries. Because blank-wire tagged fish were unclipped, they were not recovered in any other locations. Therefore, survival may be underestimated.*

Table 14. Harvest and escapement distribution of adult summer steelhead by recovery location for the 2008-09 run year using the PSMFC and ODFW mark recovery databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data were summarized as available through April 2011. "-" indicates not sampled or undefined.

	Wallowa Stock			Imnaha Stock		
Location	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean harvest	0	0	0.0	0	0	0.0
Columbia River harvest						
Treaty net	138	484	3.8	4	26	0.8
C and S	0	0	0.0	0	0	0.0
Sport	186	623	4.9	1	7	0.2
Test	0	0	0.0	0	0	0.0
Tributary sport	129	405	3.2	0	0	0.0
Deschutes River harvest[a]						
Sport	1	3	0.1	0	0	0.0
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. basin[b]	90	249	2.0	0	0	0.0
Within Snake R. basin*	0	0	0.0	0	0	0.0
Snake River sport, tribs. harvest*	701	2,234	17.7	156	996	30.0
Oregon tributary harvest* [c]	503	3,613	28.6	22	319	9.6
Other in-basin escapement* [d]	-	-	-	-	888	26.7
Hatchery weir* [e]	1,032	5,017	39.7	118	1,087	32.7
Total estimated return	2,780	12,628	100	301	3,323	100
Return to compensation area		10,864			3,290	
Percent of compensation goal		118.3			164.5	

** Indicates areas defining the compensation area. The compensation goal for Wallowa stock is 9,184 adults and the goal for Imnaha stock is 2,000 adults.*

[a] *CWT data from Deschutes River harvest may be incomplete for the 2008-09 run year. Additional recoveries will be reported as they become available.*

[b] *CWT data from Warm Springs National Fish Hatchery was unavailable for the 2008-09 run year. Therefore, total returns in areas outside of the Snake River basin may be underestimated.*

[c] *Harvest in Oregon tributaries are estimates based on angler surveys and harvest card returns.*

[d] *Total returns to other in-basin escapement areas are escapement estimates of off-station direct stream releases based on coded-wire tag returns of direct stream release groups at hatchery weirs.*

[e] *Total returns to the hatchery weir are actual numbers, except with the Imnaha stock where there is an estimated number of CWT fish recovered at the Little Sheep Creek Facility weir. This estimate is based on the actual number of CWT fish recovered at the weir and estimated number either passed above the weir to Little Sheep Creek or outplanted to Big Sheep Creek to spawn naturally.*

Table 15. Harvest and escapement distribution of adult summer steelhead by age and recovery location for the 2008-09 run year using the PSMFC and ODFW mark recovery databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data were summarized as available through April 2011. "-" indicates not sampled or undefined.

	Total returns by age							
	Wallowa Stock				Imnaha Stock			
Location	Age 3	Age 4	Age 5	Total	Age 3	Age 4	Age 5	Total
Ocean harvest	0	0	0	0	0	0	0	0
Columbia River harvest								
Treaty net	138	346	0	484	14	12	0	26
C and S	0	0	0	0	0	0	0	0
Sport	509	114	0	623	7	0	0	7
Test	0	0	0	0	0	0	0	0
Tributary sport	236	169	0	405	0	0	0	0
Deschutes River harvest[a]								
Sport	3	0	0	3	0	0	0	0
C and S	0	0	0	0	0	0	0	0
Strays								
Outside Snake R. basin[b]	203	46	0	249	0	0	0	0
Within Snake R. basin*	0	0	0	0	0	0	0	0
Snake River sport, tribs. harvest*	1,499	735	0	2,234	525	471	0	996
Oregon tributary harvest* [c]	2,096	1,481	36	3,613	179	140	0	319
Other in-basin escapement* [d]	-	-	-	-	705	183	0	888
Hatchery weir* [e]	2,671	2,328	18	5,017	813	268	6	1,087
Total estimated return	7,355	5,219	54	12,628	2,243	1,074	6	3,323

** Indicates areas defining the compensation area. The compensation goal for Wallowa stock is 9,184 adults and the goal for Imnaha stock is 2,000 adults.*

[a] *CWT data from Deschutes River harvest may be incomplete for the 2008-09 run year. Additional recoveries will be reported as they become available.*

[b] *CWT data from Warm Springs National Fish Hatchery was unavailable for the 2008-09 run year. Therefore, total returns in areas outside of the Snake River basin may be underestimated.*

[c] *Total returns to Oregon tributaries are harvest estimates based on angler surveys and harvest card returns.*

[c] *Total returns to other in-basin escapement areas are escapement estimates of off-station direct stream releases based on coded-wire tag returns of direct stream release groups at hatchery weirs.*

[d] *Total returns to the hatchery weir are actual numbers, except with the Imnaha stock where there is an estimated number of CWT fish recovered at the Little Sheep Creek Facility weir. This estimate is based on the actual number of CWT fish recovered at the weir and estimated number either passed above the weir to Little Sheep Creek or outplanted to Big Sheep Creek to spawn naturally.*

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