

LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2010 Annual Progress Report

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



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Front cover photo of hatchery technician Chuck Stelling with a net full of steelhead smolts during prerelease sampling at Big Canyon Facility. Photo taken by Shelby Warren, April 2010.

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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 2010. 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 2005-2007 broods returned to spawn, and steelhead from the 2009 brood were released as smolts. Adult steelhead that returned to spawn were used to create the 2010 brood.

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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-A-J010 and 1411-B-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 2010. 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 2010, with 617,514 smolts released. The Imnaha stock production goal of 215,000 smolts was achieved in 2010, with 215,467 smolts released.

In 2010, 4,875 and 3,275 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped 30 natural steelhead at Wallowa Fish Hatchery and 136 natural steelhead at the Big Canyon Facility. Of these natural steelhead, all from the Wallowa Fish Hatchery and 134 from the Big Canyon Facility were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 3,450 Imnaha stock hatchery and 274 natural steelhead adults. Of these, we released 100 hatchery and 219 natural steelhead above the weir, and outplanted 1,359 hatchery steelhead to Big Sheep Creek. During spawning in the spring of 2010, we collected 1,048,350 Wallowa stock production eggs, 239,225 Wallowa fall broodstock eggs, and 323,140 Imnaha stock eggs.

In the 2009-10 run year, the compensation area goals of 9,184 Wallowa stock and 2,000 Imnaha stock adult steelhead above Lower Granite Dam were greatly exceeded. We have met the Wallowa stock compensation area goal nine times in our program history, and the Imnaha stock compensation area goal ten times. We estimate that 25,777 Wallowa stock hatchery steelhead (280.7% of goal), and 7,846 Imnaha stock hatchery steelhead (392.3% of goal) returned to the LSRCP compensation area in 2010.

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 2009 brood year (BY) released in 2010. Included are collection, spawning, and adult characteristics for the 2010 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. 2009, Carmichael et al. 2010). Coded-wire tag (CWT) data collected from 2010 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2010, 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 2010, 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). 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; Ruzycski et al. 2003; Warren et al. 2009; 2010; 2011a; 2011b; 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; 2011), 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).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed embryo survival for the 2009 BY was 82.6%, within the range of recent brood years (1993-2008 BY range = 71.8-91.7%), and embryo-to-smolt survival was 65.0%, below the range of recent brood years (1993-2008 BY range = 73.2-98.3%; Table 1). Imnaha stock egg-to-embryo survival for the 2009 BY was 88.1%, within the range of recent brood years (1993-2008 BY range = 76.7-92.1%), and embryo-to-smolt survival was 83.7%, also within the range of past years (1993-2008 BY range = 79.5-98.5%; Table 1). We released 617,514 Wallowa stock smolts in 2010, less than our production goal of 800,000 smolts. For the Imnaha stock, we released 215,467 Imnaha stock smolts, achieving our production goal of 215,000 smolts (Tables 1 and 3). A higher than normal loss of 2009 brood year juveniles was primarily due to bacterial coldwater disease, caused by *Flavobacterium psychrophilum* (S. Onjukka, June-July 2009 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 and monitor production groups, 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 98.9% of Wallowa stock smolts and 98.7% of Imnaha stock smolts with an adipose fin clip, which was within the range of recent brood years for Wallowa stock (1993-2008 BY range = 95.6-99.6%) and within the range of recent brood years for Imnaha stock (1993-2008 BY range = 96.1-100.0). Fin clip quality and tag retention for experimental groups averaged 93.5% for Wallowa, within the range of recent years (1993-2008 BY range = 89.1-99.3%) and 92.5% for Imnaha stocks, within the range of recent years (1993-2008 BY range = 84.7-99.0%). Details of experimental and production releases for the 2009 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 2010 (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. Residual hatchery steelhead densities in both locations were at least twice as high as in the prior year.

Adults

Returning PIT-tagged adults from the 2005 to 2007 broods were detected at mainstem dams during the 2009-10 run year. Of the 707 Wallowa stock adults detected at Bonneville Dam on the Columbia River, 557 were detected at Lower Granite Dam on the Snake River. For the Imnaha stock, 492 of the 727 adults detected at Bonneville Dam were detected at Lower Granite

Dam (Table 5). Weirs were installed to capture adult steelhead on 1 February at Wallowa Fish Hatchery, 8 February at Big Canyon Facility, and 23 February at Little Sheep Creek Facility (Table 6). Returns to the Little Sheep Creek Facility were predominantly hatchery fish, with only 274 (7.4%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 136 (4.0%) natural steelhead. In addition, 30 (0.6%) 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, 76% (207 of 274), 70% (95 of 136), and 80% (24 of 30) 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 2010 were spawned or killed (Table 7). In 2010, 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 241 adult hatchery steelhead from Wallowa Fish Hatchery to local ponds for harvest opportunities. In addition, 75 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Twenty-nine of these fish returned to the weir a second time and were euthanized. At the Big Canyon Facility, 134 natural fish were passed above the weir to spawn naturally. We retained 2% of the hatchery fish and 19% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 1,359 hatchery adults to Big Sheep Creek to spawn naturally. One hundred sixty-six of the 1,359 outplanted fish (12%) were recaptured at least once at the Little Sheep Creek Facility in 2010. Two hundred nineteen natural and 100 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally. In addition, 26 natural males and one hatchery male were spawned and then passed above the weir, resulting in 101 hatchery fish (29%) above the weir being of hatchery origin. Of the 346 fish passed into Little Sheep Creek, only 6 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 2010, a total of 134 steelhead were passed above the weir, of which 85 were females (Table 9). Eighty-four redds were counted, which was 99% of the total number of redds constructed, assuming that each female constructs one redd.

In 2010, we accomplished our egg take goal for the Wallowa stock with 1,287,575 green eggs collected. Of these, 1,048,350 were for production and 239,225 were for the fall broodstock evaluation. We collected 323,140 green Imnaha stock eggs, which exceeded our goal of 318,816 eggs. Mortality from green egg-to-eyed embryo from six weekly spawns ranged from 4-11% for Wallowa production stock, 2-7% for fall broodstock, and from 2-12% for Imnaha stock (Table 10). Over the last sixteen brood years (1993-2009 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 2005 to 2007 occurred during the 2009-10 run year, including the fourth year of adult returns from the Wallowa fall broodstock experiment. Of approximately 200,000 total coded-wire-tagged fish released annually for both production and fall brood groups, a total of 2,857 Wallowa fall brood and 3,170 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 21 CWT codes (Table 11) and Imnaha stock recoveries from two CWT codes (Table 12). We also had 11 Wallowa stock CWT codes and one Imnaha stock CWT code—all from brood year 2005 releases—with no reported recoveries. Imnaha stock adult returns included Big Sheep Creek (Imnaha basin) marked and unclipped direct stream release evaluation groups. In addition to experimental 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 2009-10 run year, 25,777 hatchery origin adults returned to the compensation area, representing 280.7% of the compensation area goal (Table 13). For the Imnaha stock, we estimate that 7,846 adults returned to the compensation area, representing 392.3% of the compensation area goal. Age composition of returning adults is shown in Table 14. 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 nine times (1997-98, 2001-02, and 2003-04 through 2009-10 run years) for the Wallowa program, and ten times for the Imnaha program (1992-93, 2001-02 through 2009-10 run years). For both the Grande Ronde and Imnaha programs, we have met our smolt production goals in most years. Returns in the 2009-10 run year represent the final returns of the 2005 BY. For the 2005 BY, SAS for the Wallowa and Imnaha stocks were 1.495% and 1.854%, respectively (Figure 3). Smolt-to-adult return to the compensation area above Lower Granite Dam has reached our goal in only seven 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 seven years for Imnaha stock and in six of the last seven years for Wallowa stock. For the Wallowa stock, 13% of the recoveries in the 2009-10 run year occurred downstream of the compensation area. For Imnaha stock, 12% of the recoveries in the 2009-10 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 2001-2004 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).

We have concluded our comparison of smolt-to-adult survivals of Imnaha stock fish released from Little Sheep Creek in brood years 2000 through 2004 with either a blank-wire tag (BWT) and no fin clips or a CWT and corresponding adipose and ventral fin clip. Brood year specific results are presented in Table 13 of the 2009 annual report. Results show that the average survival of the BWT groups (1.77%) was significantly higher (Paired *t*-test, $P = 0.016$) than those of the CWT groups (1.23%). The higher survival of BWT fish could be due to the lack of a ventral fin clip—if ventral fin clips impose mortality on steelhead—or unaccounted harvest mortality on coded-wire tagged fish that would bias survival estimates low, or both factors.

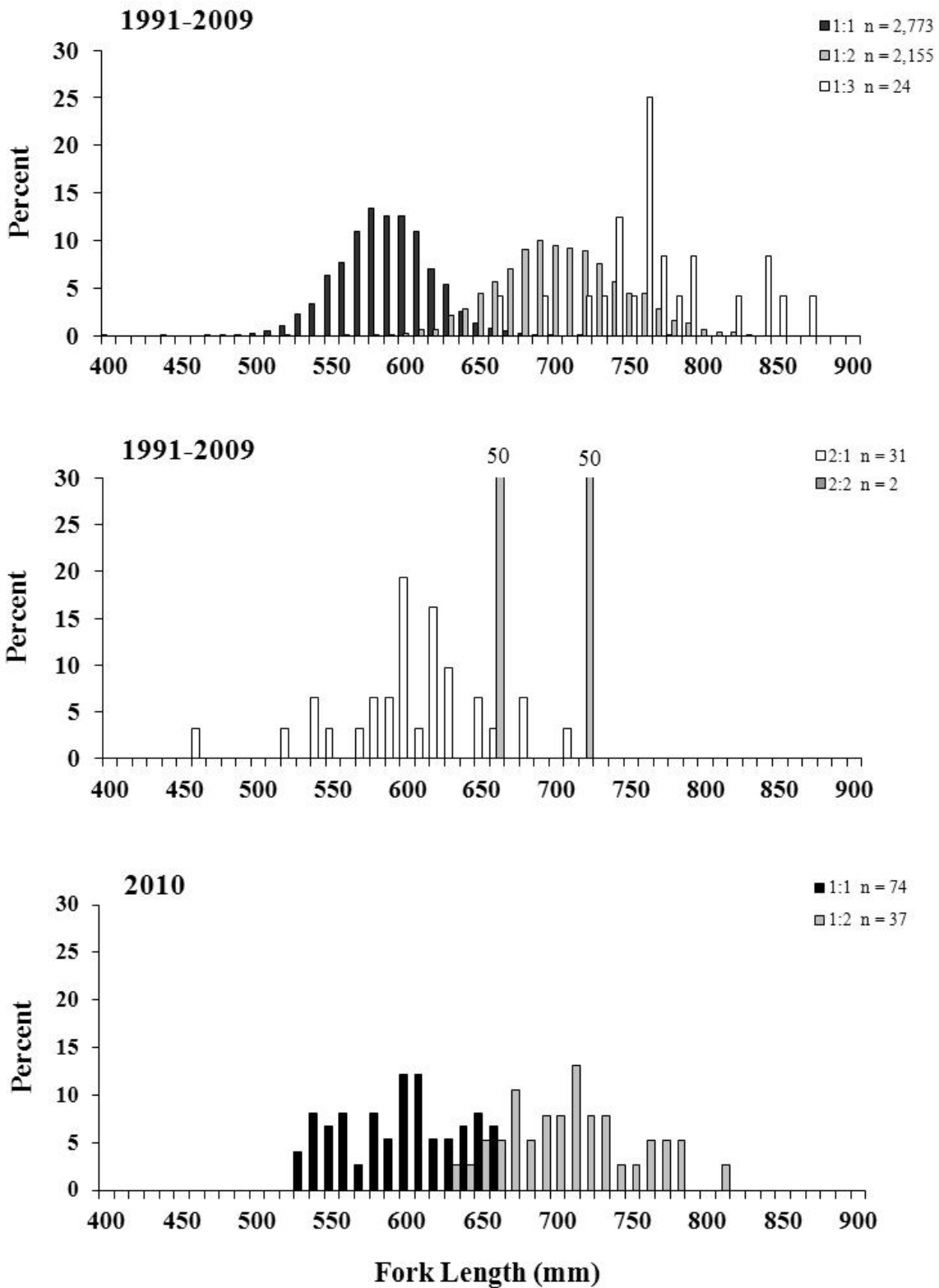


Figure 1. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top) and two freshwater age (middle) Wallowa stock summer steelhead from 1991 to 2009, and in 2010 (bottom).

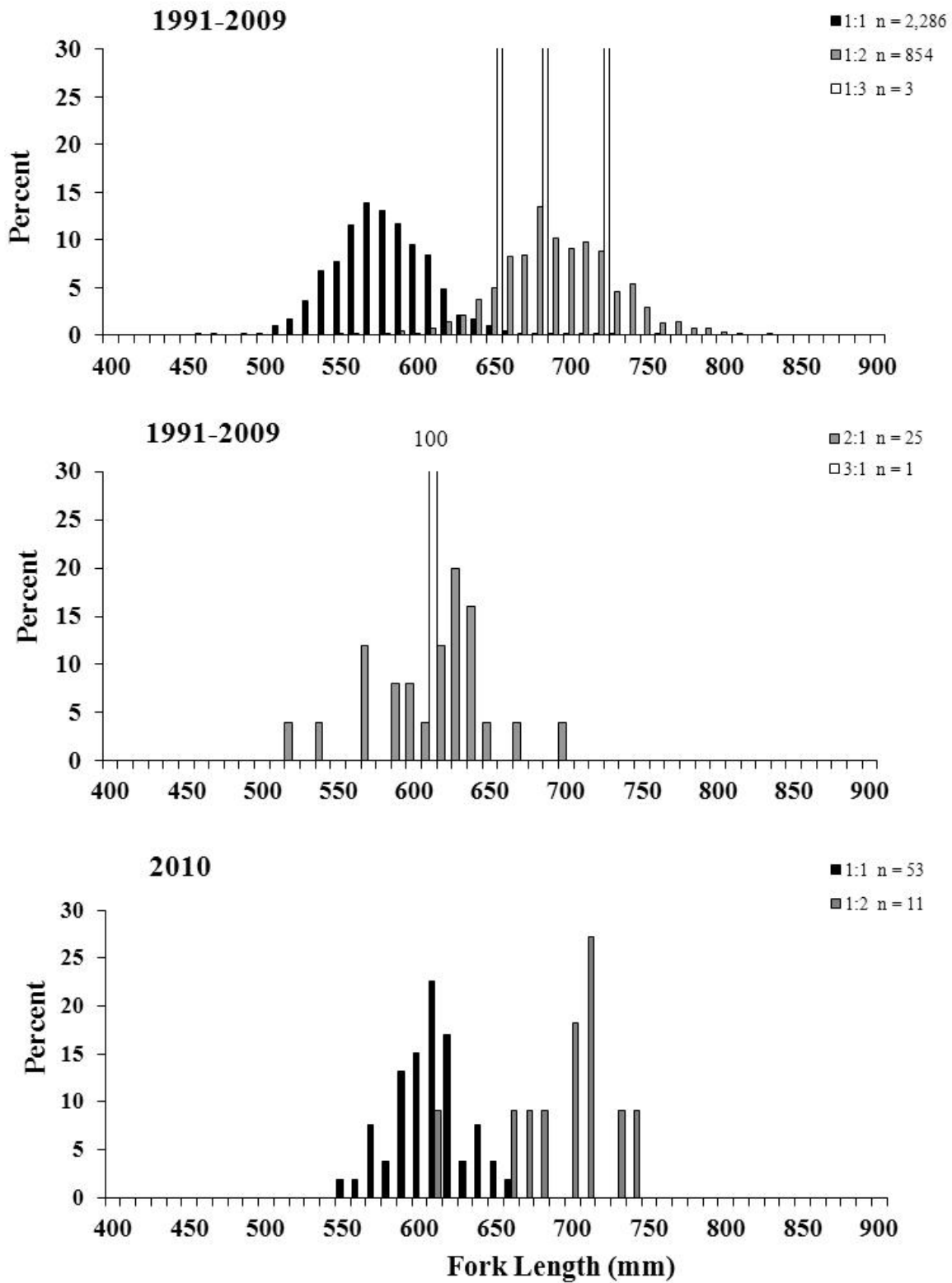


Figure 2. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top), and two and three freshwater age (middle) Imnaha stock summer steelhead from 1991 to 2009, and in 2010 (bottom).

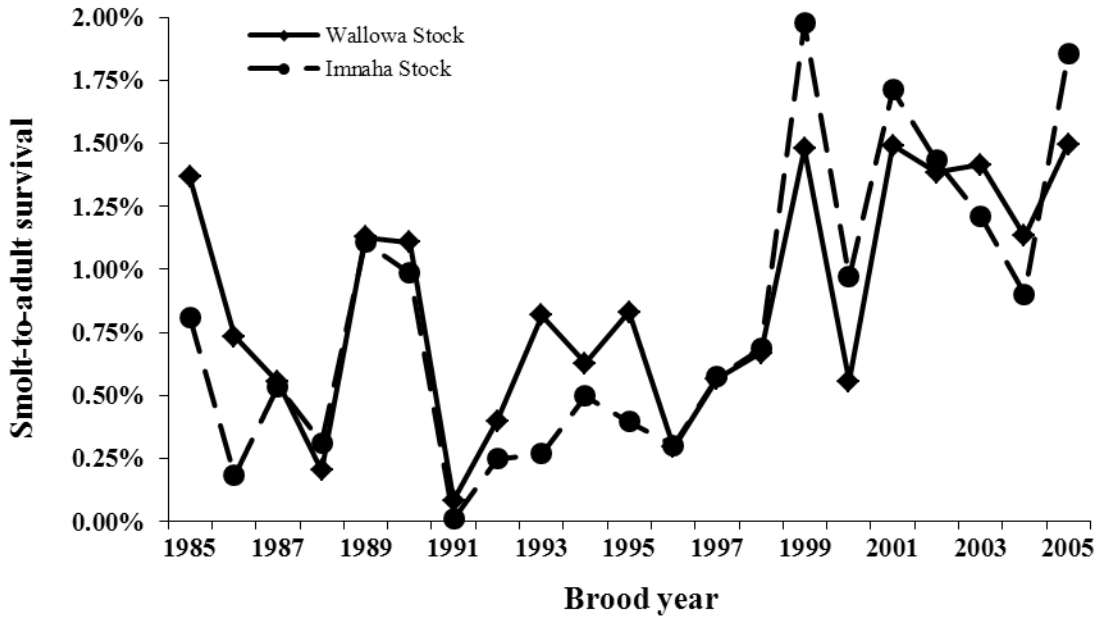


Figure 3. Smolt-to-adult survival (SAS) for Wallowa and Imnaha stock summer steelhead, 1985-2005 brood years. Data is based on CWT recoveries.

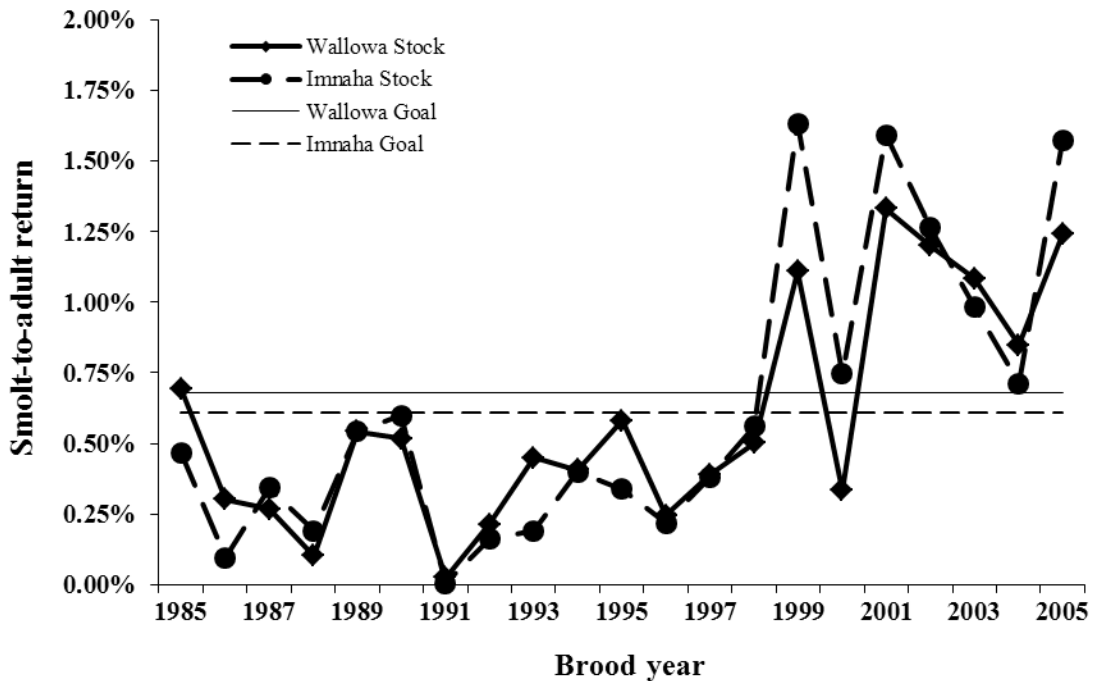


Figure 4. Smolt-to-adult return (SAR) to the compensation area above Lower Granite Dam for Wallowa and Imnaha stock summer steelhead, 1985-2005 brood years. The Wallowa stock goal is 0.68% and the Imnaha stock goal is 0.61%. Data is based on CWT recoveries.

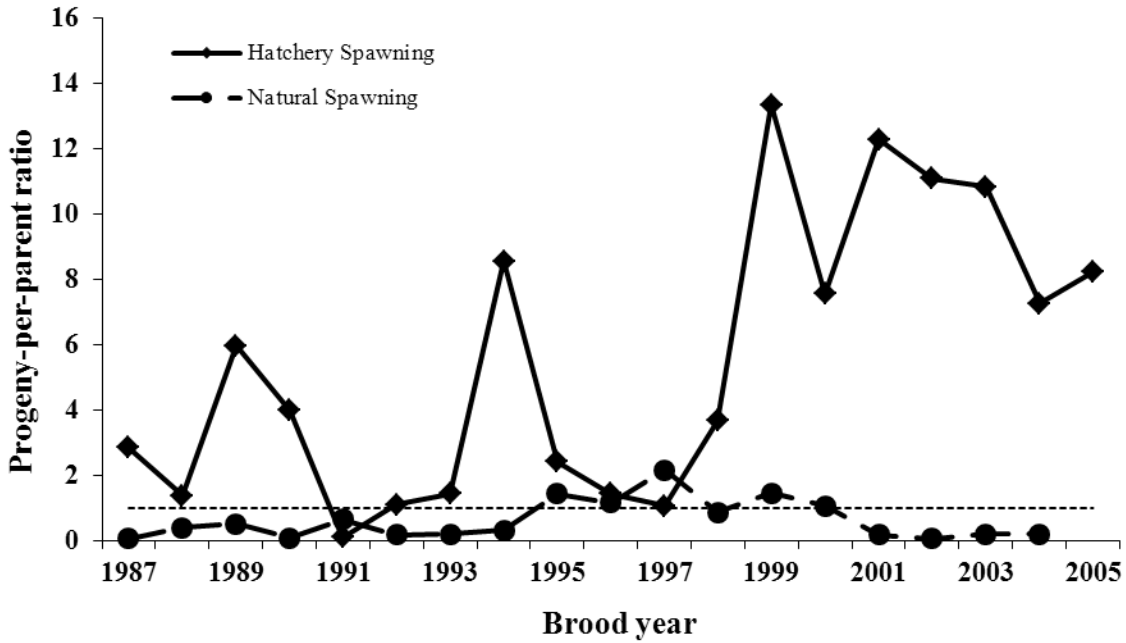


Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-2005 brood years. Both types of spawning include hatchery and natural origin parents. Dotted line represents replacement (P:P ratio = 1.0). Natural origin steelhead data for 2005 is not yet available.

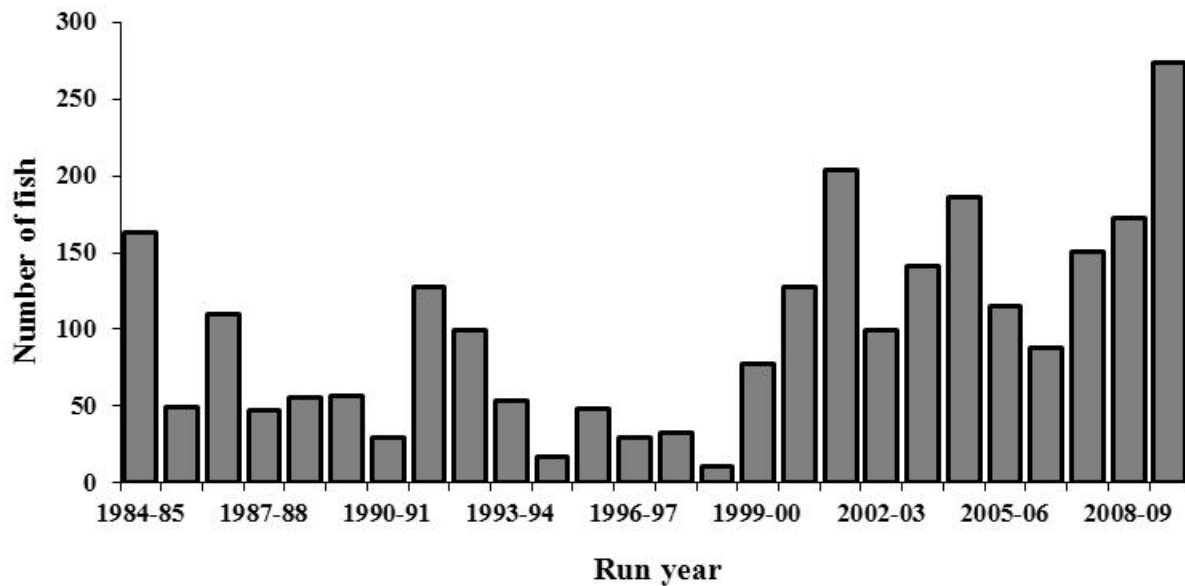


Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2009-10.

Table 1. Summary of egg collection and juvenile survival for 2009 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCF facilities in 2010.

Stock	Number of eggs taken	Eyed embryos	Total smolts released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt ^a
Wallowa	1,387,520	1,145,500 ^b	617,514	82.6	65.0
Imnaha	361,675	318,475 ^c	215,467	88.1	83.7

^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 44,700 embryos that were culled because they were excess to program needs and 149,187 embryos that were overestimated in the inventory.

^c Includes 61,129 embryos that were overestimated in the inventory.

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2009 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2010. 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 ^a	CWT+ clip	CWT+ no clip	No CWT + clip	No CWT + no clip	Ad ^b	No Ad
<i>Wallowa Stock</i>									
Fall Brood, 9	094671	525	-	96.4	3.0 ^c	0.6	0.0	-	-
Fall Brood, 11	094675	514	-	95.7	3.5 ^c	0.8	0.0	-	-
Fall Brood, 13	094676	510	-	97.3	1.6	1.2	0.0	-	-
Fall Brood, 15	094677	501	-	95.6	3.6	0.8	0.0	-	-
Production, 10	094672	518	-	90.2	8.1	1.7	0.0	-	-
Production, 12	094673	512	-	96.3	3.7	0.0	0.0	-	-
Production, 14	094674	511	-	93.3	5.1	1.6	0.0	-	-
Production, 16	094678	527	-	92.8	6.6	0.6	0.0	-	-
Production, 17	094680	521	-	90.6	8.4	1.0	0.0	-	-
Production, 23	094679	524	-	87.0	9.4	3.6	0.0	-	-
Average	-	516	224	93.5	5.3	1.2	0.0	98.9	1.1
<i>Imnaha Stock</i>									
Production, 27	094670	509	-	92.5	6.1	1.4	0.0	-	-
Average	-	509	226	92.5	6.1	1.4	0.0	98.7	1.3
Overall average		516	225	93.4	5.4	1.2	0.0	98.8	1.2

^a Adipose fin (Ad) clip quality checks conducted prior to tagging and final ponding, were made on 219, 240, 224, and 215 fish in four Wallowa stock raceways, and on 226 fish in the Imnaha stock raceway.

^b Ad clip quality was 99.1%, 99.2%, 97.8%, and 99.5% in four Wallowa stock raceways, and 98.7% in the Imnaha stock raceway.

^c This percentage includes 0.2% that were inadvertently marked LV instead of RV.

Table 3. Details of experimental and production groups of 2009 brood year summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2010. 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 $\pm 95\%$ 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
<i>Wallowa stock</i>									
Production, 10	April 20-21	Spring	094672	220 (22)	119.5 (34.8)	1.06 (0.05)	24,726	1,286	91.3 \pm 21.9
Production, 12	April 20-21	Spring	094673	N/A ^c	N/A ^c	N/A ^c	26,050	1,393	121.8 \pm 43.3 ^d
Production, 14	April 21-22	Spring	094674	221 (20)	121.7 (38.9)	1.06 (0.07)	26,058	1,394	77.9 \pm 15.3
Production, 16	April 21-22	Spring	094678	N/A ^e	N/A ^e	N/A ^e	24,928	1,381	85.4 \pm 19.7
Production,10,12,14,16	April 20-22	Spring	-	223 (22)	121.0 (42.0)	1.06 (0.05)	58,426	-	-
Fall Broodstock, 9	April 20-21	Spring	094671	221 (22)	115.1 (35.2)	1.05 (0.05)	22,986	1,174	82.5 \pm 29.2
Fall Broodstock, 11	April 20-21	Spring	094675	N/A ^f	N/A ^f	N/A ^f	22,930	1,173	76.9 \pm 22.8
Fall Broodstock, 13	April 21-22	Spring	094676	219 (26)	124.2 (55.5)	1.07 (0.07)	23,153	1,190	62.8 \pm 21.9
Fall Broodstock, 15	April 21-22	Spring	094677	N/A ^g	N/A ^g	N/A ^g	21,931	1,078	98.3 \pm 42.1
Fall Broodstock, 9,11,13,15	April 20-22	Spring	-	220 (24)	119.7 (46.4)	1.06 (0.06)	3,548	-	-
Production, 9,11,13,15	April 20-22	Spring	-	223 (22)	121.0 (42.0)	1.06 (0.05)	69,825	2,180	74.6 \pm 11.2
Production, 17	April 14-15	Deer	094680	219 (23)	107.4 (40.0)	0.97 (0.17)	23,044	5,404	81.6 \pm 7.6
Production, 17-20	April 14-16	Deer	-	220 (25)	127.0 (39.5)	1.11 (0.07)	131,703	-	-
Production, 23	April 27-May 10	Deer	094679	215 (22)	108.0 (31.7)	1.02 (0.07)	23,241	5,440	80.6 \pm 8.1
Production, 21-24	April 27-May 10	Deer	-	220 (27)	111.0 (40.3)	1.02 (0.07)	<u>114,965</u>	<u>-</u>	-
Total released							617,514	23,093	
<i>Imnaha stock</i>									
Production, 27	Mar 30-April 27	L. Sheep	094670	209 (27)	103.5 (46.3)	1.08 (0.09)	24,689	8,421	78.4 \pm 5.5
Production, 27, 29-31	Mar 30-April 27	L. Sheep	-	197 (30)	83.6 (43.0)	0.91 (0.16)	142,153	8,494	80.1 \pm 5.1 ^h
Production, 32	April 6	B. Sheep	-	210 (28)	-	-	<u>48,625</u>	<u>4,783</u>	80.6 \pm 7.5
Total released							215,467	21,698	

^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 094672 and 094673 were in the same acclimation pond and were not distinguishable based on an external mark.

^d Survival probabilities exceeding 100% occur when true survival is close to 100% and/or when PIT tag detection variability is high (Smith et al. 2000).

^e CWT codes 094674 and 094678 were in the same acclimation pond and were not distinguishable based on an external mark.

^f CWT code 094671 and 094675 were in the same acclimation pond and were not distinguishable based on an external mark.

^g CWT code 094576 and 094677 were in the same acclimation pond and were not distinguishable based on an external mark.

^h Percent migration for raceway 29 only.

Table 4. Density ($\pm 95\%$ confidence interval) and mean fork length (standard deviation in parentheses) of residual hatchery steelhead, wild rainbow trout/juvenile steelhead, and juvenile chinook salmon from index sites on Deer (Grande Ronde basin) and Little Sheep (Imnaha basin) creeks in 2010. Hatchery steelhead were classified as residuals after 20 June. HSTS indicates residual hatchery steelhead, WSTS indicates wild rainbow trout/juvenile steelhead for ages one and older, and CHS indicates young-of-the-year chinook salmon.

Location ^a	Date	Species	Area (m ²)	Size of fish (mm)		Density ^b (fish/100m ²)	
				N	Fork length Range		
<i>Grande Ronde basin</i>							
Deer Cr.	2 Aug	HSTS	234.3	25	183.7 (43.0)	104-275	10.9 \pm 0.7
Deer Cr.	2 Aug	WSTS	234.3	67	111.0 (28.2)	59-182	31.3 \pm 3.5
Deer Cr.	2 Aug	CHS	234.3	5	85.3 (7.0)	77-92	2.3 \pm 1.6
<i>Imnaha basin</i>							
Little Sheep Cr.	27 July	HSTS	557.0	141	172.1 (40.4)	108-289	27.7 \pm 1.5
Little Sheep Cr.	27 July	WSTS	231.0 ^c	18	98.8 (16.2)	72-133	3.5 \pm 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 ($\pm 95\%$ 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 2009-10 run year by stock and brood year.

Brood year	PIT tags released	Age at return	Bonneville Dam	Lower Granite Dam
<i>Willowa Stock</i>				
2005	7,735	5	0	1
2006	7,751	4	39	29
2007	16,417	3	668	447
Total	31,903		707	557
<i>Imnaha Stock</i>				
2005	600	5	0	0
2006	594	4	1	1
2007	14,863	3	726	491
Total	16,057		727	492

Table 6. Timing of adult steelhead returns to LSRCP facilities in 2010 by location and origin.

Period	Week of the year	Number of fish trapped ^a					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery ^b	Natural	Hatchery	Natural
Jan 22-28	4	-	-	-	-	-	-
Jan 29-Feb 04	5	-	-	-	-	-	-
Feb 05-11	6	8	0	0	0	-	-
Feb 12-18	7	106	0	0	0	-	-
Feb 19-25	8	87	0	0	0	0	0
Feb 26-Mar 04	9	378	1	0	0	0	0
Mar 05-11	10	353	4	0	0	99	8
Mar 12-18	11	297	4	100	3	204	4
Mar 19-25	12	426	2	0	0	547	31
Mar 26-Apr 01	13	581	2	70	3	385	23
Apr 02-08	14	439	3	697	15	402	24
Apr 09-15	15	748	4	734	24	592	53
Apr 16-22	16	622	3	0	0	691	69
Apr 23-29	17	553	3	1,173	46	396	34
Apr 30-May 06	18	159	1	315	16	76	10
May 07-13	19	73	0	87	7	42	12
May 14-20	20	36	2	77	17	16	6
May 21-27	21	6	0	19	5	0	0
May 28-Jun 03	22	3	1	3	0	0	0
Jun 04-10	23	0	0	0	0	-	-
Jun 11-17	24	0	0	-	-	-	-
Jun 18-24	25	-	-	-	-	-	-
Total		4,875	30	3,275	136	3,450	274

^a The ladder was opened on 1 February at Wallowa Fish Hatchery, and weirs were installed 8 February at Big Canyon Facility (Deer Creek) and 23 February at Little Sheep Creek Facility. Adult collections ended 1 June at Little Sheep Creek Facility, 3 June at Big Canyon Facility, and 14 June at Wallowa Fish Hatchery.

^b Includes one hatchery male released from Cottonwood Creek Pond (WDFW) in April of 2008, tag code 634099.

Table 7. Number, disposition, and mean fork length (mm) of adult steelhead that returned to LSRCF facilities in 2010 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		Total	2:1		2:2		3:1		3:2		4:1			Total
	M	F	M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F		
<i>Wallowa Fish Hatchery (Wallowa Stock-Production)</i>																					
Trapped	2,047	1,463	190	428	4	0	0	0	4,132	8	2	2	2	11	3	1	1	0	0	30	4,162
Passed	0	0	0	0	0	0	0	0	0	8	2	2	1	11	3	1	1	0	0	29	29
Outplanted	137	54	19	24	1	0	0	0	235	0	0	0	0	0	0	0	0	0	0	0	235
Kept	1,910	1,409	171	404	3	0	0	0	3,897	0	0	0	1	0	0	0	0	0	0	1	3,898
Mortality	6	6	2	1	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
Spawned	166	110	31	89	0	0	0	0	396	0	0	0	0	0	0	0	0	0	0	0	396
Killed ^c	1,738	1,293	138	314	3	0	0	0	3,486	0	0	0	1	0	0	0	0	0	0	1	3,487
<i>Wallowa Fish Hatchery (Wallowa Stock-Fallbrood)</i>																					
Trapped	346	266	35	94	2	0	0	0	743	0	0	0	0	0	0	0	0	0	0	0	743
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	3	1	0	1	1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6
Kept	343	265	35	93	1	0	0	0	737	0	0	0	0	0	0	0	0	0	0	0	737
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned	50	39	3	11	0	0	0	0	103	0	0	0	0	0	0	0	0	0	0	0	103
Killed ^c	293	226	32	82	1	0	0	0	634	0	0	0	0	0	0	0	0	0	0	0	634
<i>Wallowa Fish Hatchery (Total Returns)</i>																					
Trapped	2,393	1,729	225	522	6	0	0	0	4,875	8	2	2	2	11	3	1	1	0	0	30	4,905
Fork length (mm)	597	590	731	685	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Standard deviation	42	33	39	35	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	42	32	16	22																	
<i>Big Canyon Facility (Wallowa stock)</i>																					
Trapped	1,401	1,485	100	285	4	0	0	0	3,275	18	25	5	24	23	28	3	9	1	0	136	3,411
Passed	0	0	0	0	0	0	0	0	0	18	24	5	23	23	28	3	9	1	0	134	134
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	21	21	1	3	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	0	46
Kept	1,380	1,464	99	282	4	0	0	0	3,229	0	1	0	1	0	0	0	0	0	0	2	3,231
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killed ^{c,d,e,f}	1,380	1,464	99	282	4	0	0	0	3,229	0	1	0	1	0	0	0	0	0	0	2	3,231
Fork length (mm)	-	-	-	-	-	-	-	-		599	579	-	707	-	613	-	-	-	-		
Standard deviation	-	-	-	-	-	-	-	-		19	38	-	38	-	42	-	-	-	-		
Sample size										5	5		2		2						

Table 7. Continued

Facility, stock, Disposition	Hatchery ^{a,g}									Natural ^b									Grand total		
	1:1		1:2		2:1		1:3		Total	2:1		2:2		2:3		3:1		3:2		Total	
	M	F	M	F	M	F	M	F		M	F	M	F	M	F	M	F	M			F
<i>Little Sheep Creek Facility (Imnaha stock)</i>																					
Trapped	1,892	1,293	51	200	0	14	0	0	3,450	78	79	22	41	0	0	26	24	3	1	274	3,724
Passed	50	34	2	13	0	1	0	0	100	64	64	13	31	0	0	22	22	3	0	219	319
Outplanted	729	523	21	80	0	6	0	0	1,359	0	0	0	0	0	0	0	0	0	0	0	1,359
Kept	1,113	736	28	107	0	7	0	0	1,991	14	15	9	10	0	0	4	2	0	1	55	2,046
Mortality	2	1	0	0	0	0	0	0	3	1	0	0	1	0	0	0	0	0	0	2	5
Spawned ^h	38	28	3	12	0	0	0	0	81	13	15	9	9	0	0	4	2	0	1	53	134
Killed ^{c,i}	1,073	707	25	95	0	7	0	0	1,907	0	0	0	0	0	0	0	0	0	0	0	1,907
Fork Length (mm)	610	595	720	678	-	-	-	-		581	578	722	677	-	-	586	585	-	646		
Standard deviation	28	23	15	35	-	-	-	-		35	29	42	27	-	-	17	24	-	-		
Sample size	32	21	3	8						24	15	3	17	-	-	5	7	-	1		

^a Wallowa stock ages apportioned using CWT data and 112 scale samples collected in 2010; Imnaha stock ages apportioned using CWT data, 64 scale samples from 2010, and 62 scale samples from 2009 in order to increase sample size. Mean fork lengths are from fish with scale samples collected in 2010.

^b Wallowa and Big Canyon ages apportioned using historical data (196 samples) and 2010 data (14 samples); at Little Sheep Creek Facility ages were apportioned using 2010 data (72 samples). Mean fork lengths are from fish with scale samples collected in 2010.

^c For Wallowa stock, 2,942 fish that returned to Wallowa Fish Hatchery and 2,281 fish that returned to Big Canyon were euthanized and donated to local food banks. In addition, 164 fish from Wallowa Hatchery and 81 fish from Big Canyon were euthanized and donated to local schools for educational purposes. For Imnaha Stock, 1,591 fish that returned to Little Sheep Creek Facility were euthanized and donated to local food banks.

^d Includes 48 hatchery females and 61 hatchery males that were spawned for Cottonwood Facility (Washington).

^e Seventy five fish were returned to the river fishery. Of these, 20 males and 9 females returned to the weir a second time and were euthanized. These 29 fish are included in the "killed" category.

^f Includes one hatchery male released from Cottonwood Creek Pond (WDFW) in April of 2008, tag code 634099.

^g Includes ten 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.

^h Includes 26 natural males and one hatchery male that were live-spawned and passed above the weir.

ⁱ Includes one hatchery male released from Spring Creek (Wallowa Stock) in April of 2008, tag code 094410.

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, 1999-2010.

Year	Big Sheep Creek			Little Sheep Creek		
	Number of fish		%	Number of fish		%
	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
2010	1,359	166	12.2	346	6	1.7
Mean	-	-	22.7	-	-	9.1

^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.

Table 9. Summary of summer steelhead spawning surveys in Deer Creek above the Big Canyon Facility weir, 2002-2010.

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
2010	85	49	134	84	1.60	1.01	99	8.4	24.9

^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 the weir.

Table 10. Spawning summaries for summer steelhead at LSRCF facilities in 2010. The percent mortality is from green egg to eyed embryo after shocking.

Spawn date, lot number	Parental origin ^a	Number of females spawned ^b	Number of eggs	Eyed embryos ^c	% mortality
<i>Wallowa Hatchery (Wallowa stock)</i>					
3/17, WA470	Production	29	156,900	140,500	10.5
	Fall Broodstock	7	35,000	32,300	7.7
3/24, WA471	Production	37	190,000	173,600	8.6
	Fall Broodstock	10	53,900	50,400	6.5
3/31, WA472	Production	44	251,050	240,000	4.4
	Fall Broodstock	11	53,325	50,450	5.4
4/07, WA473	Production	40	200,600	192,500	4.0
	Fall Broodstock	10	45,000	43,500	3.3
4/14, WA474	Production	31	154,900	147,700	4.6
	Fall Broodstock	8	35,400	34,600	2.3
4/21, WA475	Production	18	94,900	85,600	9.8
	Fall Broodstock	4	16,600	16,200	2.4
Subtotal	Production	199	1,048,350	979,900	6.5
	Fall Broodstock	50	239,225	227,450	4.9
Total		249	1,287,575	1,207,350	6.2
<i>Little Sheep Creek Facility (Imnaha stock)</i>					
3/23, LI570	Hatchery	6	18,000	32,800	8.9
	Mixed		18,000		
3/30, LI571	Hatchery	6	14,770	28,900	2.2
	Mixed		14,770		
4/05, LI572	Hatchery	6	9,367	27,000	3.9
	Mixed		18,733		
4/13, LI573	Wild	9	5,400	46,000	5.3
	Mixed		43,200		
4/20, LI574	Wild	11	5,264	53,300	7.9
	Mixed		52,636		
4/27, LI575	Hatchery	12	4,475	47,800	11.0
	Mixed		49,225		
5/04, LI576	Hatchery	9	12,583	33,400	11.5
	Mixed		25,167		
5/10, LI577	Hatchery	8	11,831	28,200	10.6
	Mixed		19,719		
Subtotal	Hatchery		71,026		
	Wild	67	10,664	297,400	8.0
	Mixed		241,450		
Total		67	323,140	297,400	8.0

^a 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.

^b Number of females spawned equals the number of males spawned. A total of 250 Wallowa Stock males were spawned, including an additional male spawned on 4/14.

^c Includes 1,200 Wallowa production stock eyed embryos that were transferred to the Salmon and Trout Enhancement Program (STEP). Also includes 17,100 Wallowa production stock eyed embryos that were euthanized because they were excess to program needs.

Table 11. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Willowa stock summer steelhead for the 2009-10 run year. All CWT fish were hatchery origin fish released into either Deer Creek (at Big Canyon Facility) or Spring Creek (at Willowa Fish Hatchery). Data were summarized as available through May 2012.

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
2005						
Deer Cr.	Production, April	074134	0	0	0	0
	Production, May	094302	0	0	0	0
Spring Cr.	Production, April	074131	0	0	0	0
	Production, April	074132	0	0	0	0
	Production, April	074133	0	0	0	0
	Production, May	094303	0	0	7	7
	Fallbrood, April	074135	0	0	0	0
	Fallbrood, April	091705	0	0	0	0
	Fallbrood, April	092608	0	0	0	0
	Fallbrood, April	092644	0	0	0	0
	Fallbrood, April	092645	0	0	0	0
	Fallbrood, May	094301	0	0	0	0
2006						
Deer Cr.	Production, April	094407	11	37	25	73
	Production, May	094408	9	37	19	65
Spring Cr.	Production, April	094401	32	36	32	100
	Production, April	094402	42	28	53	123
	Production, April	094305	42	56	50	148
	Production, May	094363	29	39	58	126
	Fallbrood, April	094403	26	0	76	102
	Fallbrood, April	094404	31	35	69	135
	Fallbrood, April	094405	34	59	35	128
	Fallbrood, May	094406	7	8	31	46
2007						
Deer Cr.	Production, April	094413	155	133	427	715
	Production, May	094414	132	139	257	528
Spring Cr.	Production, April	094409	206	96	380	682
	Production, April	094410	212	63	359	634
	Production, April	094411	169	145	319	633
	Production, May	094412	128	30	245	403
	Fallbrood, April	094544	149	205	318	672
	Fallbrood, April	094545	132	98	453	683
	Fallbrood, April	094546	158	161	474	793
	Fallbrood, May	094547	107	172	322	601
Total recoveries			1,811	1,577	4,009	7,397

^a Experimental group includes the release strategy. All releases were targeted for four fish per pound (113 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 Willowa 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 2009-10 run year. All CWT fish were hatchery origin fish released into Little Sheep Creek at Little Sheep Creek Facility. Data were summarized as available through May 2012.

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
2005						
Little Sheep	Production, April	074130	0	0	0	0
2006						
Little Sheep	Production, April	094304	25	13	22	60
2007						
Little Sheep	Production, April	094543	202	46	509	757
	Total recoveries		227	59	531	817

^a Experimental groups include the release strategy. All releases were targeted for five fish per pound (91 g/fish). 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. Harvest and escapement distribution of adult summer steelhead by recovery location for the 2009-10 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 May 2012. "-" indicates not sampled or undefined.

Location	Wallowa Stock			Imnaha Stock		
	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean harvest	4	4	0.0	0	0	0.0
Columbia River harvest						
Treaty net	314	1,037	3.5	8	58	0.6
C and S	0	0	0.0	0	0	0.0
Sport	542	1,591	5.4	74	534	6.0
Test	0	0	0.0	0	0	0.0
Tributary sport	338	671	2.3	64	461	5.2
Deschutes River harvest						
Sport	20	53	0.1	0	0	0.0
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. basin	235	494	1.7	8	57	0.6
Within Snake R. basin*	2	8	0.0	0	0	0.0
Snake River sport, tribs. harvest*	2,554	8,492	28.7	377	2,710	30.3
Oregon tributary harvest* ^a	1,577	9,128	30.8	59	736	8.2
Other in-basin escapement* ^b	-	-	-	-	950	10.6
Hatchery weir* ^c	1,811	8,149	27.5	227	3,450	38.5
Total estimated return	7,397	29,627	100	817	8,956	100
Return to compensation area		25,777			7,846	
Percent of compensation goal		280.7			392.3	

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

^b 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.

^c 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 14. Harvest and escapement distribution of adult summer steelhead by age and recovery location for the 2009-10 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 May 2012. "-" indicates not sampled or undefined.

Location	Total returns by age							
	Wallowa Stock				Imnaha Stock			
	Age 3	Age 4	Age 5	Total	Age 3	Age 4	Age 5	Total
Ocean harvest	4	0	0	4	0	0	0	0
Columbia River harvest								
Treaty net	745	272	20	1,037	58	0	0	58
C and S	0	0	0	0	0	0	0	0
Sport	1,364	227	0	1,591	534	0	0	534
Test	0	0	0	0	0	0	0	0
Tributary sport	559	112	0	671	454	7	0	461
Deschutes River harvest								
Sport	43	10	0	53	0	0	0	0
C and S	0	0	0	0	0	0	0	0
Strays								
Outside Snake R. basin	408	86	0	494	57	0	0	57
Within Snake R. basin*	8	0	0	8	0	0	0	0
Snake River sport, tribs. harvest*	7,877	600	15	8,492	2,567	143	0	2,710
Oregon tributary harvest* ^a	7,336	1,792	0	9,128	559	177	0	736
Other in-basin escapement* ^b	-	-	-	-	728	222	0	950
Hatchery weir* ^c	7,007	1,142	0	8,149	3,185	265	0	3,450
Total estimated return	25,351	4,241	35	29,627	8,142	814	0	8,956

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

^b 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.

^c 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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