LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2012 Annual Progress Report

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OREGON
Fish & Wildlife

LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

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Front cover photo of Holly Stanton with several fifth grade students that are preparing to dissect Wallowa stock steelhead at an elementary school outdoor education day near La Grande, OR. Photo taken by Melissa White, May 2012.

ANNUAL PROGRESS REPORT

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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 2012. 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 2007-2009 broods returned to spawn, and steelhead from the 2011 brood were released as smolts. Adult steelhead that returned to spawn were used to create the 2012 brood.

ACKNOWLEDGMENTS

We would like to thank hatchery managers Ron Harrod and Marc Garst, as well as Terry Blessing, Chad Aschenbrenner and 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 F12AC00092 and F13AC00034, 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 2012. 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. 2012).

The production goal of 800,000 Wallowa stock smolts was achieved in 2012, with 865,643 smolts released. The Imnaha stock production goal of 215,000 smolts was nearly achieved with 212,220 smolts released.

In 2012, 1,764 and 1,425 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped 10 natural steelhead at Wallowa Fish Hatchery and 69 natural steelhead at the Big Canyon Facility, which were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 1,261 Imnaha stock hatchery and 139 natural steelhead adults. Of these, a total of 112 hatchery and 114 natural steelhead were released above the weir, and 253 hatchery steelhead were outplanted to Big Sheep Creek. During spawning in the spring of 2012, we collected 871,200 Wallowa stock production eggs, 386,300 Wallowa fall broodstock eggs, and 323,300 Imnaha stock eggs.

In the 2011-12 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 eleven times in our program history, and the Imnaha stock compensation area goal twelve times. We estimate that 9,075 Wallowa stock hatchery steelhead (98.8% of goal), and 2,080 Imnaha stock hatchery steelhead (104.0% of goal) returned to the LSRCP compensation area in 2012.

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 2011 brood year (BY) released in 2012. Included are collection, spawning, and adult characteristics for the 2012 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

The Grande Ronde and Imnaha river steelhead hatchery programs were initiated in 1976 and 1982 in response to the rapid decline in Snake River steelhead abundance. Annual adult mitigation, brood year specific smolt-to-adult return and total smolt-to-adult survival rates, and annual smolt production goals were established to compensate for the estimated annual loss of 48% of adult production. Adaptive management has resulted in current interim smolt production goals of 800,000 (Wallowa stock released into the Grande Ronde) and 215,000 (Imnaha stock) smolts; less than the original goals of 1,350,000 and 330,000 smolts. Based on original smolt production goals it was assumed that 27,552 Wallowa stock and 6,000 Imnaha stock adults would be produced annually. Furthermore, 66.7% of these fish were expected to be harvested below the compensation area, defined as the watershed above Lower Granite Dam, resulting in compensation area adult return goals of 9,184 (Wallowa stock) and 2,000 (Imnaha stock).

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 2012 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2012, experimental treatments from which fish returned included unmarked releases, off-station direct-stream releases, and progeny from early returning (fall-collected) broodstock release strategies. In 2012, smolts were released at Wallowa Hatchery that were second generation progeny of early returning (fall-collected) broodstock for an experimental comparison with progeny of standard 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; Ruzycki et al. 2003; Warren et al. 2009; 2010; 2011a; 2011b; 2012; 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; 2012), 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; Clarke et al. 2014).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed embryo survival for the 2011 BY was 92.2%, within the range of recent brood years (1993-2010 BY range = 71.8-93.8%), and embryo-to-smolt survival was 82.5%, within the range of recent brood years (1993-2010 BY range = 65.0-98.3%; Table 1). Imnaha stock egg-to-embryo survival for the 2011 BY was 87.2%, within the range of recent brood years (1993-2010 BY range = 76.7-92.1%), and embryo-to-smolt survival was 80.3%, within the range of recent brood years (1993-2010 BY range = 79.5-98.5%; Table 1). We released 865,643 Wallowa stock smolts in 2012, exceeding our production goal of 800,000 smolts. For the Imnaha stock, we released 212,220 Imnaha stock smolts, which was only slightly less than our production goal of 215,000 smolts (Tables 1 and 3). 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 99.4% of Wallowa and Imnaha stock smolts with an adipose fin clip, which was within the range of recent brood years for Wallowa stock (1993-2010 BY range = 95.6-99.9%) and within the range of recent brood years for Imnaha stock (1993-2009 BY range = 96.1-100.0). Fin clip quality and tag retention for release groups averaged 96.8% for Wallowa, within the range of recent years (1993-2010 BY range = 89.1-99.3%) and 90.3% for Imnaha stocks, also within the range of recent years (1993-2010 BY range = 84.7-99.0%). Details of experimental and production releases for the 2011 BY, including the number of fish implanted with passive integrated transponder (PIT) tags, are shown in Table 3.

Densities of residual hatchery steelhead averaged 3.4 fish/100m^2 at index sites in the Grande Ronde basin in 2012 (Table 4), whereas wild *O. mykiss* averaged 11.1 fish/100m^2. In the

Imnaha basin, densities of residual hatchery steelhead and wild *O. mykiss* were 9.4 and 0.5 fish/100m^2. Since sampling for residual hatchery steelhead began in 1996, we have observed a clear pattern of higher densities of residual hatchery steelhead than wild *O. mykiss* in the Imnaha basin index sites.

Adults

Returning PIT-tagged adults from the 2007 to 2009 broods were detected at mainstem dams during the 2011-12 run year. Of the 425 Wallowa stock adults detected at Bonneville Dam on the Columbia River, 271 were detected at Lower Granite Dam on the Snake River. For the Imnaha stock, 285 of the 392 adults detected at Bonneville Dam were detected at Lower Granite Dam (Table 6). Weirs were installed to capture adult steelhead on 10 February at Wallowa Fish Hatchery, 13 February at Big Canyon Facility, and 23 February at Little Sheep Creek Facility (Table 7). Returns to the Little Sheep Creek Facility were predominantly hatchery fish, with only 139 (9.9%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 69 (4.6%) natural steelhead. In addition, 10 (0.6%) natural steelhead returned to Wallowa Fish Hatchery. Sixty-three percent of hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon Facility spent one year in the ocean (Table 8). Similarly, 82% of hatchery fish that returned to Little Sheep Creek Facility spent one year in the ocean before returning. Of the natural origin fish, 49% (68 of 139), 46% (32 of 69), and 40% (4 of 10) of the Little Sheep Creek Facility, Big Canyon Facility, and Wallowa Fish Hatchery, respectively, spent two years in saltwater before returning.

The majority of hatchery adults that returned to Wallowa Fish Hatchery in 2012 were spawned or killed (Table 8). In 2012, 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 237 adult hatchery steelhead from Wallowa Fish Hatchery and the Big Canyon Facility to local ponds for harvest opportunities. In addition, 95 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Fifty-six of these fish returned to the weir a second time and were euthanized. At the Big Canyon Facility, 69 natural fish were passed above the weir to spawn naturally. We retained 9% of the hatchery fish and 18% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 253 hatchery adults to Big Sheep Creek to spawn naturally. Ninety-seven of the 253 outplanted fish (38%) were recaptured at least once at the Little Sheep Creek Facility in 2012. One hundred fourteen natural and 112 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally. In addition, 15 natural males were spawned and then passed above the weir, resulting in 46% of fish above the weir being of hatchery origin. Of the 241 fish passed into Little Sheep Creek, 13 fell back and were recaptured at the weir (Table 9). 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 2012, a total of 68 steelhead were passed above the weir, of which 34 were females (Table 9). Twenty-two redds were counted, which was 65% of the total number of redds constructed, assuming that each female constructs one redd.

In 2011, we reached our egg take goal for the Wallowa stock with 1,257,500 green eggs collected. Of these, 871,200 were for production and 386,300 were for the fall broodstock evaluation. We collected 323,300 green Imnaha stock eggs, which exceeded our goal of 313,850 eggs. Mortality from green egg-to-eyed embryo from six weekly spawns ranged from 4-11% for Wallowa production stock, 6-17% for fall broodstock, and from 5-37% for Imnaha stock (Table 10).

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 2007 to 2009 occurred during the 2011-12 run year, including the sixth 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 1,177 Wallowa fall brood and 2,363 Wallowa production CWTs were recovered (Table 12). During the fiscal year we provided analyses of this experiment at the Lower Snake River Compensation Plan Steelhead Symposium; however, adult return data from the first generation of the experiment was incomplete. We will provide more analysis as data become available. We had Wallowa stock recoveries from 24 CWT codes (Table 12) and Imnaha stock recoveries from three CWT codes (Table 13). Imnaha stock adult returns included Big Sheep Creek (Imnaha basin) unclipped direct stream release evaluation groups. 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 2011-12 run year, 9,075 hatchery origin adults returned to the compensation area, representing 98.8% of the compensation area goal

(Table 14). For the Imnaha stock, we estimate that 2,080 adults returned to the compensation area, representing 104.0% 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 ten times (1997-98, 2001-02, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, and 2010-11 run years) for the Wallowa program, and twelve times for the Imnaha program (1992-93, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, and 2011-12 run years). For both the Grande Ronde and Imnaha programs, we have met our smolt production goals in most years. Returns in the 2011-12 run year represent the final returns of the 2007 BY. For the 2007 BY, SAS for the Wallowa and Imnaha stocks were the highest in the history of these programs at 3.487% and 4.058%, respectively (Figure 3). Smolt-to-adult return to the compensation area above Lower Granite Dam has reached our goal in only nine of the last 23 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 nine years for Imnaha stock and in eight of the last nine years for Wallowa stock. For the Wallowa stock, 22% of the CWT recoveries in the 2011-12 run year occurred downstream of the compensation area. For Imnaha stock, 13% of the recoveries in the 2011-12 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 2001-2006 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).

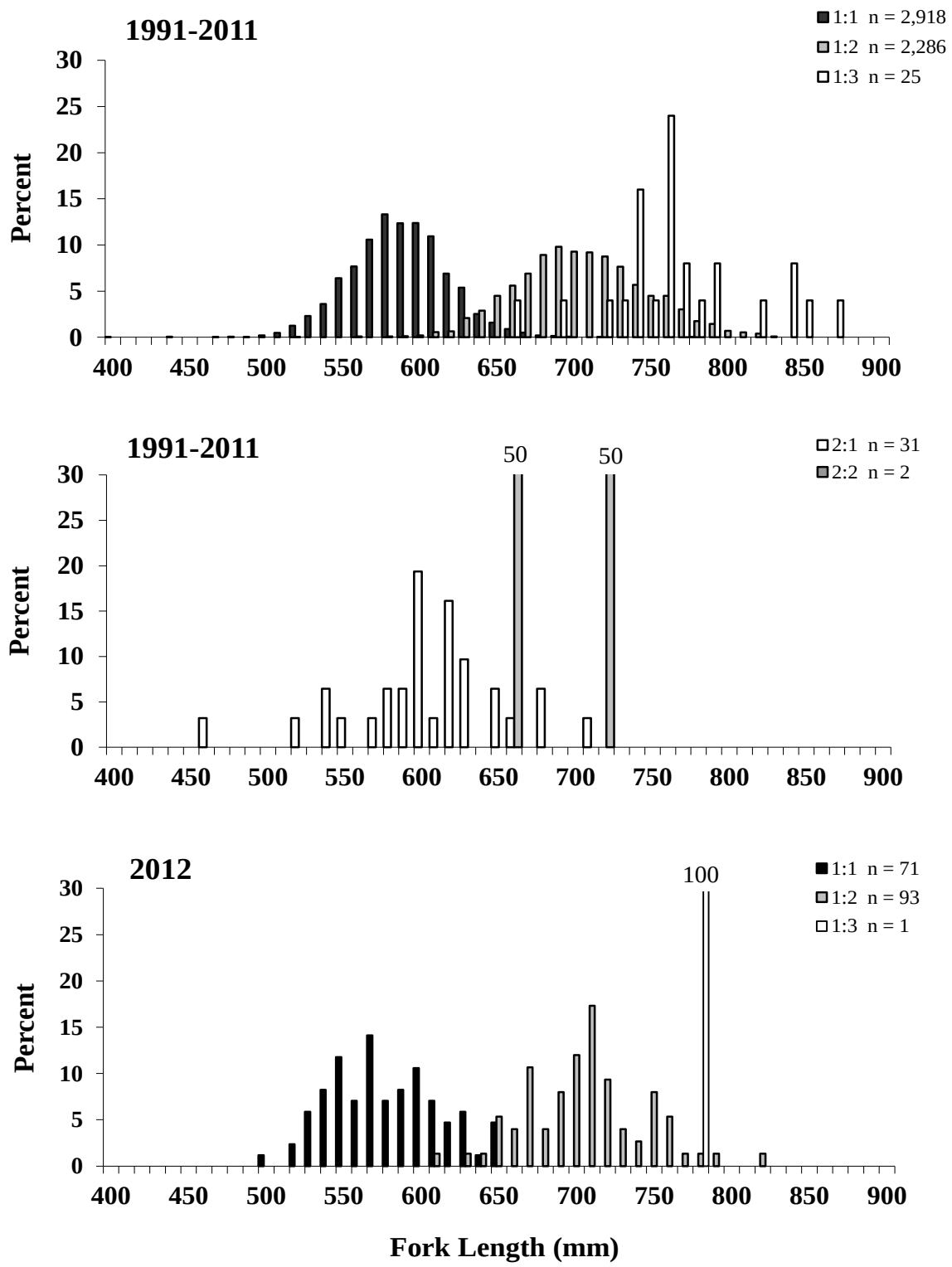

Figure 1. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top) and two freshwater age (middle) Wallowa stock summer steelhead from 1991 to 2011, and in 2012 (bottom).

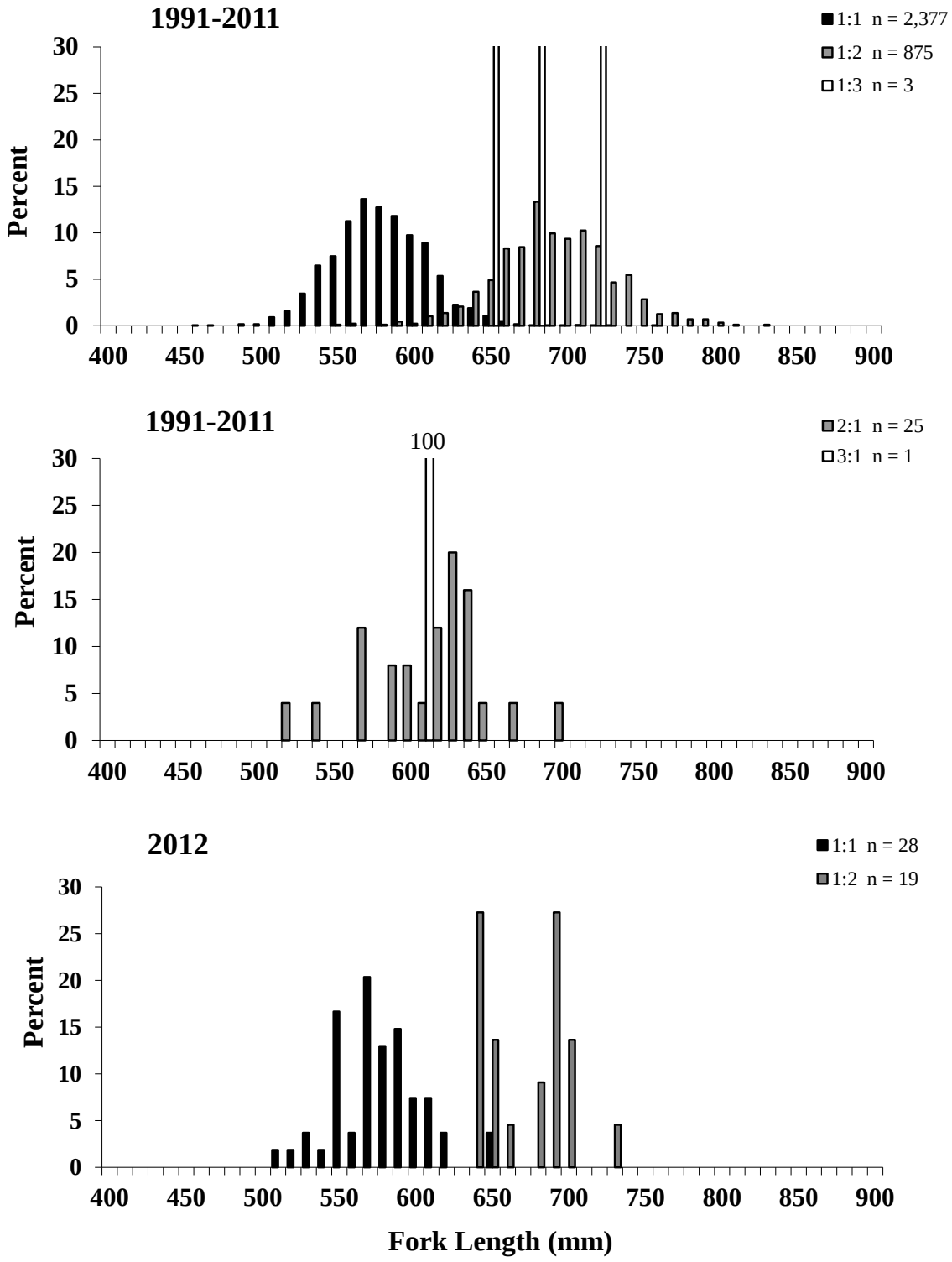

Figure 2. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top), and two and three freshwater age (middle) Imnaha stock summer steelhead from 1991 to 2011, and in 2012 (bottom).

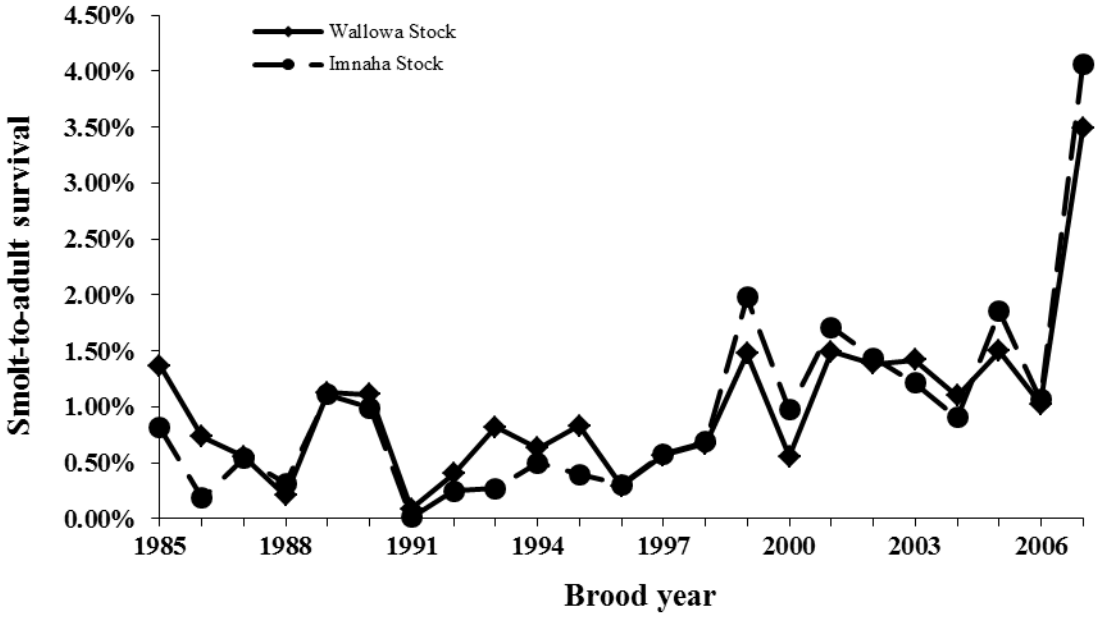

Figure 3. Smolt-to-adult survival (SAS) for Wallowa and Imnaha stock summer steelhead, 1985-2007 brood years. Data is based on CWT recoveries.

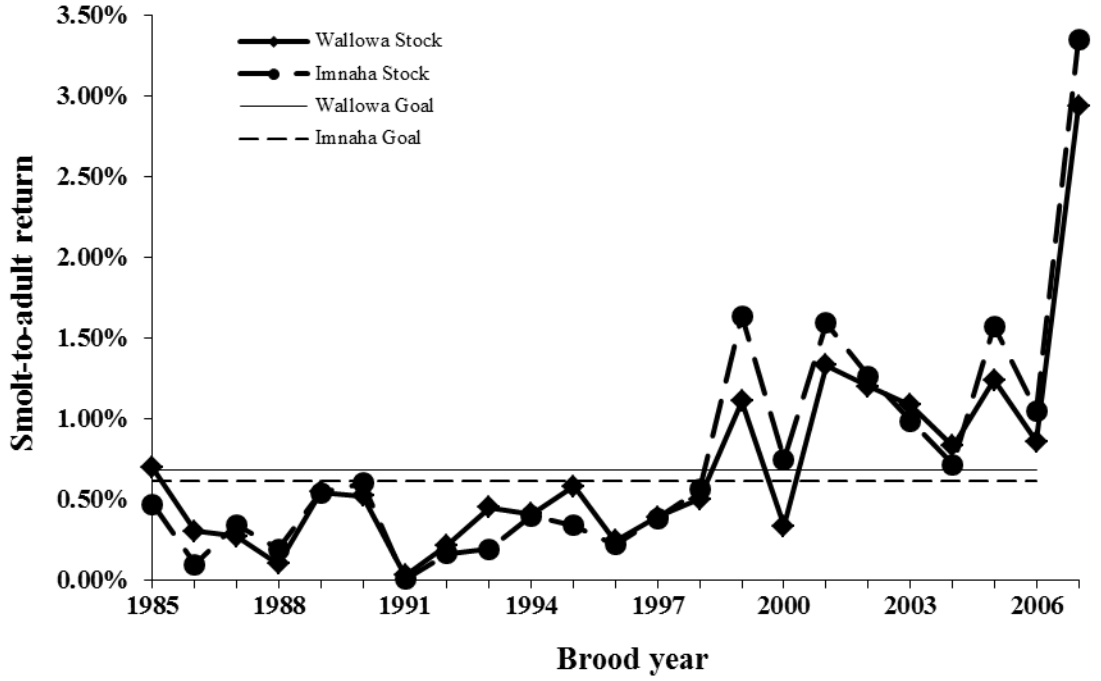

Figure 4. Smolt-to-adult return (SAR) to the compensation area above Lower Granite Dam for Wallowa and Imnaha stock summer steelhead, 1985-2007 brood years. The Wallowa stock goal is 0.68% and the Imnaha stock goal is 0.61%. Data is based on CWT recoveries.

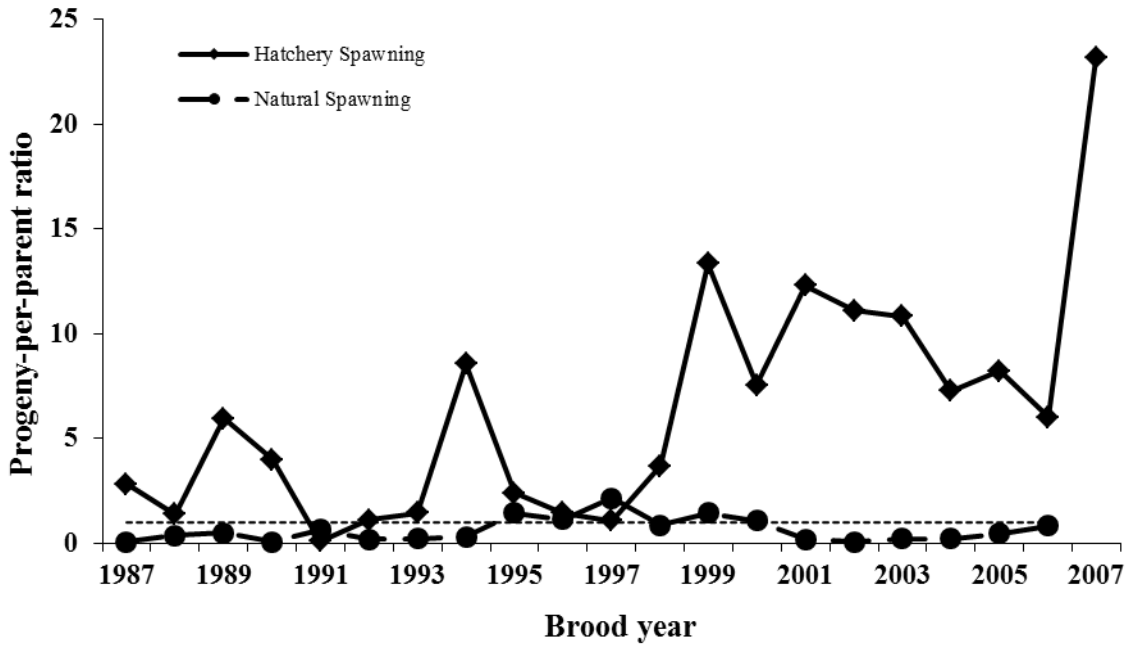

Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-2007 brood years. Both types of spawning include hatchery and natural origin parents. Dotted line represents replacement (P:P ratio = 1.0). Natural origin steelhead data for 2007 is not yet available.

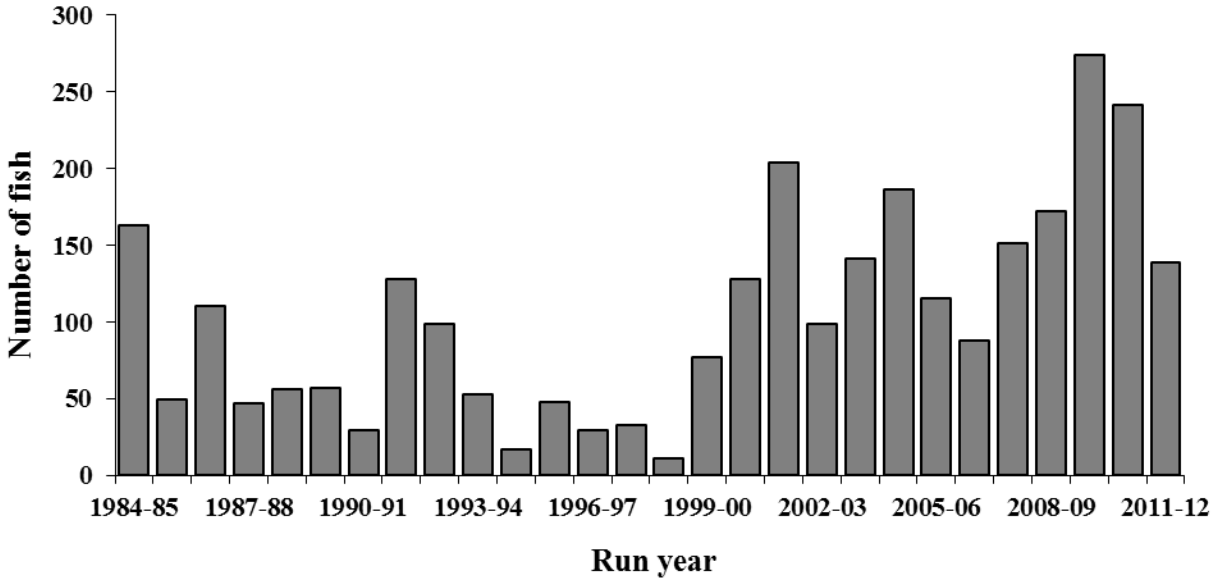

Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2010-12.

Table 1. Summary of egg collection and juvenile survival for 2011 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2012.

Stock	Number of eggs taken	Eyed embryos	Total smolts released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt[a]
Wallowa	1,333,465	1,228,850[b]	865,643[c]	92.2	82.5
Imnaha	337,800	294,450[d]	212,220	87.2	80.3

[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 81,700 embryos that were euthanized because they were excess to program needs and 96,757 embryos that were overestimated in the inventory.*

[c] *Includes a total of 22,890 fish that were outplanted to local water bodies as rainbow trout. This includes 4,096 fish to Umatilla Forest Ponds, 750 fish to Peach Pond, 1,000 fish to Morgan Lake, 1,502 fish to Roulet Pond, 900 fish to Weston Highway Pond, 498 fish to Luger Pond, 1,000 fish to Twin Ponds, 1,992 fish to Morrow County OHV Park Pond, 1,005 fish to Anson Wright Pond, 1,000 fish to Long Creek Pond, 999 fish to Seventh Street Pond, and 8,148 fish to Phillips Reservoir.*

[d] *Includes 30,245 embryos that were overestimated in the inventory.*

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2011 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2012. 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+ clips	CWT+ no clip	No CWT + clip	No CWT + no clip	Ad[b]	No Ad
Wallowa Stock									
Fall Brood, 9	090421	443	-	97.5	0.0	2.5	0.0	-	-
Fall Brood, 11	090422	445	-	98.0	0.0	2.0	0.0	-	-
Fall Brood, 13	090424	552	-	94.9	0.9	4.0	0.2	-	-
Fall Brood, 15	090423	451	-	97.8	0.2	2.0	0.0	-	-
Production, 10	090425	479	-	92.9	5.2[c]	1.9	0.0	-	-
Production, 12	090426	521	-	97.5	1.7[c]	0.8	0.0	-	-
Production, 14	090427	505	-	98.6	1.4	0.0	0.0	-	-
Production, 17	090428	501	-	97.6	1.6	0.8	0.0	-	-
Production, 23	090429	518	-	96.5	2.3	1.2	0.0	-	-
Production, 25	090430	510	-	96.2	2.0	1.8	0.0	-	-
Average[d]	-	493	244	96.8	1.5	1.7	0.0	99.5	0.5
Imnaha Stock									
Production, 29	090420	526	-	90.3	7.4	2.3	0.0	-	-
Average	-	526	325	90.3	7.4	2.3	0.0	99.4	0.6
Overall average		496	254	96.2	2.1	1.7	0.0	99.4	0.6

[a] *Adipose fin (Ad) clip quality checks, conducted at acclimation ponds prior to release, were made on 300, 300, 250, 259, 300, 200, and 100 fish in seven groups of Wallowa stock smolts at Spring and Deer Creek acclimation sites, and on 325 Imnaha stock smolts at Little Sheep Facility acclimation pond.*

[b] *Ad clip quality was 99.3%, 100.0%, 98.4%, 99.6%, 99.3%, 99.5%, and 100.0% in seven Wallowa stock sample groups, and 99.4% in the Imnaha stock sample group.*

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

Table 3. Details of experimental and production groups of 2011 brood year summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2012. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated. 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 7-9	Spring	090425	216 (16)	106.8 (26.8)	1.05 (0.12)	24,189	2,195	84.0 ± 4.4
Production, 12	April 8-9	Spring	090426	219 (17)	111.0 (28.4)	1.04 (0.06)	26,578	2,189	81.5 ± 4.5
Production, 14	April 8-9	Spring	090427	[c]	[c]	[c]	26,524	2,196	82.1 ± 4.1
Production, 7,8,10,12,14,26	April 7-9	Spring	-	219 (18)	110.4 (26.5)	1.02 (0.07)	181,399	-	-
Fall Broodstock, 9	April 7-9	Spring	090421	217 (16)	103.9 (27.3)	1.01 (0.07)	25,535	1,285	79.6 ± 5.9
Fall Broodstock, 11	April 7-9	Spring	090422	[d]	[d]	[d]	25,198	1,290	78.3 ± 6.3
Fall Broodstock, 13	April 8-9	Spring	090424	223 (17)	120.0 (30.2)	1.05 (0.08)	24,428	1,195	77.3 ± 6.4
Fall Broodstock, 9,11,13	April 7-9	Spring	-	220 (17)	111.9 (29.7)	1.03 (0.07)	52,436	-	-
Production, 23	April 14-16	Deer	090429	215 (19)	104.1 (31.2)	1.06 (0.07)	25,724	4,342	80.0 ± 3.4
Production, 18-20,23	April 14-16	Deer	-	212 (17)	99.8 (22.4)	1.07 (0.05)	139,008	-	-
Production, 17	April 21-May 3	Spring	090428	210 (26)	107.5 (27.0)	1.11 (0.07)	25,277	2,096	83.5 ± 5.5
Production, 16-18	April 21-May 3	Spring	-	210 (18)	98.3 (28.0)	1.08 (0.12)	60,171	-	-
Fall Broodstock, 15	April 21-May 3	Spring	090423	213 (17)	109.4 (25.7)	1.08 (0.06)	25,324	1,200	83.9 ± 8.0
Fall Broodstock, 15	April 21-May 3	Spring	-	[e]	[e]	[e]	18,057	-	-
Production, 25	April 24-May 7	Deer	090430	220 (16)	108.5 (23.8)	1.04 (0.07)	25,362	4,393	83.4 ± 3.1
Production, 21,22,24,25	April 24-May 7	Deer	-	216 (18)	104.3 (24.4)	1.06 (0.07)	137,543	-	-
Total released							842,753	22,381	
				Imnaha stock					
Production, 29	Mar 27-April 24	L. Sheep	090420	205 (19)	92.3 (22.7)	1.04 (0.05)	24,049	8,785	69.8 ± 2.2
Production, 27-31	Mar 27-April 24	L. Sheep	-	200 (22)	93.3 (26.7)	1.03 (0.06)	147,427	8,760	70.1 ± 2.3[g]
Production, 31	Mar 27-April 24	L. Sheep	-	[f]	[f]	[f]	40,744	4,392	74.7 ± 3.1
Total released							212,220	21,937	

[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 090426 and 090427 were in the same acclimation pond and were not distinguishable based on an external mark.*

[d] *CWT codes 090421 and 090422 were in the same acclimation pond and were not distinguishable based on an external mark.*

[e] *CWT code 090423 and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[f] *Raceway 31 was in the same acclimation pond with Raceways 27-31 and was not distinguishable based on an external mark.*

[g] *Percent migration for raceway 27 only.*

Table 4. Density (±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 2012. 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	
Grande Ronde basin							
Deer Cr.	25 July	HSTS	549.9	17	189.9 (39.5)	135-267	3.4 ± 0.6
Deer Cr.	25 July	WSTS	549.9	54	96.1 (15.1)	72-135	11.1 ± 0.8
Deer Cr.	25 July	CHS	296.5[c]	21	67.6 (12.4)	32-91	4.1 ± 1.5
Imnaha basin							
Little Sheep Cr.	24 July	HSTS	595.9	53	153.1 (32.4)	100-225	9.4 ± 0.8
Little Sheep Cr.	24 July	WSTS	595.9	3	96.7 (11.6)	86-109	0.5 ± 0.0

[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 lower index site.*

Table 5. Travel days to Lower Granite Dam (LGD) and percent of the PIT tagged releases that were uniquely detected at the four lower Snake River dams for Little Sheep Creek smolts that departed the acclimation pond during the early, middle, and late periods of the volitional release. The early and late time periods were defined as the first and last 25% of the release period, which was typically a minimum of 28 days.

Brood Year	Travel Days to LGD			Percent Detected		
	Early	Middle	Late	Early	Middle	Late
2008	34.2	27.5	27.2	36.4	34.5	28.8
2009	41.7	33.4	32.8	39.1	40.9	39.5
2010	43.9	29.5	26.6	63.1	48.1	48.8
2011	42.5	36.8	27.7	56.7	47.2	46.00

Table 6. Number of PIT tags released and unique adult PIT tag detections at Bonneville and Lower Granite dams during the 2011-12 run year by stock and brood year.

Brood year	PIT tags released	Age at return	Adult Detections	
			Bonneville Dam	Lower Granite Dam
		Wallowa Stock		
2007	16,413	5	2	2
2008	22,240	4	140	88
2009	23,093	3	283	181
Total	61,746		425	271
		Imnaha Stock		
2007	14,863	5	0	0
2008	20,850	4	77	50
2009	21,698	3	315	235
Total	57,411		392	285

Table 7. Timing of adult steelhead returns to LSRCP facilities in 2012 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	0	0	-	-	-	-
Feb 12-18	7	30	0	0	0	-	-
Feb 19-25	8	74	0	100	1	0	0
Feb 26-Mar 04	9	34	0	66	2	0	0
Mar 05-11	10	73	0	66	1	0	0
Mar 12-18	11	165	1	164	1	6	0
Mar 19-25	12	261	2	220	3	24	0
Mar 26-Apr 01	13	313	2	279	4	236	27
Apr 02-08	14	267	2	152	2	159	17
Apr 09-15	15	256	1	215	29	248	29
Apr 16-22	16	167	2	100	12	295	20
Apr 23-29	17	99	0	36	9	187	21
Apr 30-May 06	18	18	0	21	2	36	3
May 07-13	19	5	0	2	0	30	14
May 14-20	20	2	0	4	3	36	8
May 21-27	21	0	0	0	0	4	0
May 28-Jun 03	22	-	-	-	-	0	0
Jun 04-10	23	-	-	-	-	-	-
Jun 11-17	24	-	-	-	-	-	-
Jun 18-24	25	-	-	-	-	-	-
Total		1,764	10	1,425	69	1,261	139

[a] *The ladder was opened on 10 February at Wallowa Fish Hatchery, and weirs were installed 13 February at Big Canyon Facility (Deer Creek) and 23 February at Little Sheep Creek Facility. Adult collections ended 21 May at Wallowa Fish Hatchery, 29 May at Big Canyon Facility, and 31 May at Little Sheep Creek Facility.*

[b] *Includes one 405 mm female which most likely did not migrate to the ocean; as no scales were taken to provide evidence either way, she is included here as an anadromous adult.*

Table 8. Number, disposition, and mean fork length (mm) of adult steelhead that returned to LSRCP facilities in 2012 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		2:3		3:1		3:2			
	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	595	317	122	390	2	6	0	0	1,432	2	1	0	3	0	0	2	1	1	0	10	1,442
Passed	0	0	0	0	0	0	0	0	0	2	1	0	3	0	0	2	1	1	0	10	10
Outplanted	43	19	10	24	0	1	0	0	97	0	0	0	0	0	0	0	0	0	0	0	97
Kept	552	298	112	366	2	5	0	0	1,335	0	0	0	0	0	0	0	0	0	0	0	1,335
Mortality	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Spawned	109	40	55	124	0	0	0	0	328	0	0	0	0	0	0	0	0	0	0	0	328
Killed[c]	442	258	57	242	2	5	0	0	1,006	0	0	0	0	0	0	0	0	0	0	0	1,006
Wallowa Fish Hatchery (Wallowa Stock-Fallbrood)																					
Trapped	132	73	39	84	0	4	0	1	333	0	0	0	0	0	0	0	0	0	0	0	333
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	132	73	39	84	0	4	0	1	333	0	0	0	0	0	0	0	0	0	0	0	333
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned	57	28	25	51	0	2	0	1	164	0	0	0	0	0	0	0	0	0	0	0	164
Killed[c]	75	45	14	33	0	2	0	0	169	0	0	0	0	0	0	0	0	0	0	0	169
Wallowa Fish Hatchery (Total Returns)																					
Trapped	727	390	161	474	2	10	0	1	1,765	2	1	0	3	0	0	2	1	1	0	10	1,775
Fork length (mm)	584	567	717	696	-	-	-	780													
Standard deviation	35	32	41	36	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	47	38	25	50						-	-	-	-	-	-	-	-	-	-		
Big Canyon Facility (Wallowa stock)																					
Trapped[d]	497	377	148	393	2	8	0	0	1,425	13	4	5	17	0	0	14	6	2	8	69	1,494
Passed	0	0	0	0	0	0	0	0	0	13	4	5	17	0	0	14	6	2	8	69	69
Outplanted	48	46	20	25	0	1	0	0	140	0	0	0	0	0	0	0	0	0	0	0	140
Returned to river[e]	8	19	2	10	0	0	0	0	39	0	0	0	0	0	0	0	0	0	0	0	39
Kept	441	312	126	358	2	7	0	0	1,246	0	0	0	0	0	0	0	0	0	0	0	1,246
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]	441	312	126	358	2	7	0	0	1,246	0	0	0	0	0	0	0	0	0	0	0	1,246
Fork length (mm)	-	-	-	-	-	-	-	-		525	-	755	684	-	-	-	-	-	638		
Standard deviation	-	-	-	-	-	-	-	-		-	-	-	19	-	-	-	-	-	4		
Sample size										1		1	3						2		

Table 8. Continued

Facility, stock, Disposition	Hatchery[a,g] 1:1 M	1:1 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	534	495	23	203	0	6	0	0	1,261	24	44	16	49	0	0	3	0	1	2	139	1,400
Passed	54	28	6	24	0	0	0	0	112	20	42	6	41	0	0	2	0	1	2	114	226
Outplanted	84	115	3	49	0	2	0	0	253	0	0	0	0	0	0	0	0	0	0	0	253
Kept	396	352	14	130	0	4	0	0	896	4	2	10	8	0	0	1	0	0	0	25	921
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned[h]	49	25	3	32	0	0	0	0	109	4	2	10	8	0	0	1	0	0	0	25	134
Killed[c,i]	347	327	11	98	0	4	0	0	787	0	0	0	0	0	0	0	0	0	0	0	787
Fork length (mm)	580	569	685	668	-	-	-	-		571	560	715	659	-	-	560	-	-	680		
Standard deviation	25	30	-	27	-	-	-	-		46	40	41	41	-	-	-	-	-	-		
Sample size	28	26	1	21						11	22	3	31			1			1		

[a] *Wallowa stock hatchery ages apportioned using CWT data and 161 scale samples collected in 2012; Imnaha stock hatchery ages apportioned using CWT data, 76 scale samples from 2012, and 47 scale samples from 2011 to increase sample size. Mean fork lengths are from fish with scale samples collected in 2012.*

[b] *Wallowa stock (Wallowa Fish Hatchery and Big Canyon Facility) natural steelhead ages apportioned using historical data (213 samples) and 2012 data (7 samples); Little Sheep Creek Facility natural steelhead ages apportioned using 2011 data (91 samples) and 2012 data (69 samples). Mean fork lengths are from fish with scale samples collected in 2012.*

[c] *For Wallowa stock steelhead, 624 fish that returned to Wallowa Fish Hatchery and 782 fish that returned to Big Canyon Facility were euthanized and donated to local food banks. In addition, 52 fish from Wallowa Fish Hatchery and 181 fish from Big Canyon Facility were euthanized and donated to local schools for educational purposes. For Imnaha stock steelhead, 608 fish that returned to Little Sheep Creek Facility were euthanized and donated to local food banks.*

[d] *Includes one 405 mm female which most likely did not migrate to the ocean; as no scales were taken to provide evidence either way, she is included here as an anadromous adult.*

[e] *Ninety-five fish were returned to the Wallowa River fishery for additional angler opportunity. Of these, 27 males and 29 females returned to the weir a second time and were euthanized. These 56 fish are included in the "killed" category.*

[f] *Includes one age 1:1 female released in Spring Creek (Wallowa Fish Hatchery) which returned to Big Canyon Facility in 2012, tag code 094673.*

[g] *Includes three females originally identified as natural origin fish (due to absence of any external marks). Scale reading determined them to be of hatchery origin.*

[h] *Includes 15 natural males that were live-spawned and passed above the weir.*

[i] *Includes 57 hatchery males and 40 hatchery females that were initially outplanted to Big Sheep Creek. These 97 fish were subsequently recaptured at the weir and euthanized.*

Table 9. 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, 1999-2012.

	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
2010	1,450	166	11.4	346	6	1.7
2011	401	154	38.4	306	2	0.7
2012	350	175	50.0	241	13	5.4
Mean	-	-	25.7	-	-	8.3

[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 10. Summary of summer steelhead spawning surveys in Deer Creek above the Big Canyon Facility weir, 2002-2012.

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	22.8
2011	75	58	133	28	4.75	2.68	37	2.8	14.7
2012	34	34	68	22	3.09	1.54	65	1.8	18.6

[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, 2007-2010, and in 2012. Ten miles of stream were surveyed in 2004-06 and in 2011. 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 11. Spawning summaries for summer steelhead at LSRCP facilities in 2012. The percent mortality is from green egg to eyed embryo after shocking.

Spawn date[a], lot number	Parental origin[b]	Number of females spawned	Number of eggs	Eyed embryos[c]	% mortality
		Wallowa Hatchery (Wallowa stock)			
3/07, WA490	Production	0	0	0	na
	Fall Broodstock	15	71,500	59,400	16.9
3/14, WA491	Production	19	113,200	106,200	6.2
	Fall Broodstock	20	89,900	84,600	5.9
3/21, WA492	Production	33	159,900	145,800	8.8
	Fall Broodstock	16	78,800	71,800	8.9
3/28, WA493	Production	37	191,500	180,300	5.8
	Fall Broodstock	31	146,100	137,000	6.2
4/04, WA494	Production	33	178,500	158,700	11.1
	Fall Broodstock	0	0	0	na
4/11, WA495	Production	27	140,500	135,400	3.6
	Fall Broodstock	0	0	0	na
4/18, WA496	Production	15[d]	87,600	80,000	8.7
	Fall Broodstock	0	0	0	na
Subtotal	Production	164	871,200	806,400	7.4
	Fall Broodstock	82	386,300	352,800	8.7
Total		246	1,257,500	1,159,200	7.8
		Little Sheep Creek Facility (Imnaha stock)			
3/27, LI590	Hatchery Mixed	9	23,278 18,622	36,100	13.8
4/03, LI591	Hatchery Mixed	10	32,340 13,860	30,400	34.2
4/10, LI592	Hatchery Mixed	7	5,057 30,343	33,400	5.6
4/17, LI593	Hatchery Mixed	13	53,462 16,038	65,100	6.3
4/24, LI594	Hatchery Mixed	12	47,250 15,750	39,900	36.7
5/01, LI595	Hatchery Mixed	5	12,720 8,480	19,100	9.9
5/08, LI596	Hatchery Mixed	11	33,527 12,573	43,700	5.2
Subtotal	Hatchery Mixed	67	207,634 115,666	267,700	17.2
Total		67	323,300	267,700	17.2

[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 males spawned equals the number of females spawned. A total of 64 Imnaha Stock males were spawned, including an additional male spawned on 4/29.*

[c] *Includes 1,600 Wallowa production stock eyed embryos that were transferred to the Salmon and Trout Enhancement Program (STEP). Also includes 91,000 eyed embryos that were euthanized because they were excess to program needs: 31,600 Wallowa FCB stock and 59,400 Wallowa production stock.*

[d] *One FCB stock female, confirmed by fin mark and CWT, was inadvertently spawned on 4/18 as part of Wallowa production. Her eggs were fertilized by a production stock male and she is treated as a production female here.*

Table 12. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Wallowa stock summer steelhead for the 2011-12 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 August 2014.

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]
2007						
Deer Cr.	Production, April	094413	0	0	0	0
	Production, May	094414	0	0	0	0
Spring Cr.	Production, April	094409	0	0	0	0
	Production, April	094410	0	0	8	8
	Production, April	094411	0	0	0	0
	Production, May	094412	0	0	1	1
	Fallbrood, April	094544	0	0	4	4
	Fallbrood, April	094545	1	0	0	1
	Fallbrood, April	094546	0	0	0	0
	Fallbrood, May	094547	0	0	0	0
2008						
Deer Cr.	Production, April	094587	34	32	43	109
	Production, May	094589	42	25	62	129
Spring Cr.	Production, April	094581	41	17	42	100
	Production, April	094582	51	15	84	150
	Production, April	094583	39	34	54	127
	Production, May	094588	48	18	56	122
	Fallbrood, April	094580	10	39	45	94
	Fallbrood, April	094584	30	38	39	107
	Fallbrood, April	094585	21	51	56	128
	Fallbrood, May	094586	23	43	71	137
2009						
Deer Cr.	Production, April	094680	51	163	93	307
	Production, May	094679	37	75	90	202
Spring Cr.	Production, April	094672	94	111	95	300
	Production, April	094673	92	59	73	224
	Production, April	094674	71	63	191	325
	Production, April	094678	81	54	125	260
	Fallbrood, April	094671	52	23	107	182
	Fallbrood, April	094675	53	42	41	136
	Fallbrood, April	094676	36	66	72	174
	Fallbrood, April	094677	50	69	95	214
	Total recoveries		957	1,037	1,547	3,541

[a] *Experimental groups include 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 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 13. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Imnaha stock summer steelhead for the 2011-12 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 August 2014.

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]
2007						
Little Sheep	Production, April	094543	0	0	1	1
2008						
Little Sheep	Production, April	094579	24	3	21	48
2009						
Little Sheep	Production, April	094670	119	8	96	223
	Total recoveries		143	11	118	272

[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 14. Harvest and escapement distribution of adult summer steelhead by recovery location for the 2011-12 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 August 2014. "-" 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	1	1	0.0	0	0	0.0
Columbia River harvest						
Treaty net	256	792	7.1	6	36	1.5
C and S	0	0	0.0	0	0	0.0
Sport	417	1,106	9.8	28	189	8.1
Test	0	0	0.0	0	0	0.0
Tributary sport	2	7	0.1	0	0	0.0
Deschutes River harvest						
Sport	85	186	1.7	2	14	0.6
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. basin	24	59	0.5	0	0	0.0
Within Snake R. basin*	3	10	0.1	1	6	0.3
Snake River sport, tribs. harvest*	759	2,047	18.2	81	537	23.2
Oregon tributary harvest* [a]	1,037	3,828	34.1	11	126	5.4
Other in-basin escapement* [b]	-	-	-	-	150	6.5
Hatchery weir* [c]	957	3,190	28.4	143	1,261	54.4
Total estimated return	3,514	11,226	100	272	2,319	100
Return to compensation area		9,075			2,080	
Percent of compensation goal		98.8			104.0	

** 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 for the Imnaha stock where we estimated the 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 2011-12 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 August 2014. "-" 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	1	0	1	0	0	0	0
Columbia River harvest								
Treaty net	473	315	4	792	0	36	0	36
C and S	0	0	0	0	0	0	0	0
Sport	577	499	30	1,106	189	0	0	189
Test	0	0	0	0	0	0	0	0
Tributary sport	7	0	0	7	0	0	0	0
Deschutes River harvest								
Sport	150	36	0	186	14	0	0	14
C and S	0	0	0	0	0	0	0	0
Strays								
Outside Snake R. basin	43	12	4	59	0	0	0	0
Within Snake R. basin*	10	0	0	10	0	6	0	6
Snake River sport, tribs. harvest*	1,322	725	0	2,047	446	84	7	537
Oregon tributary harvest* [a]	2,085	1,743	0	3,828	97	29	0	126
Other in-basin escapement* [b]	-	-	-	-	125	25	0	150
Hatchery weir* [c]	1,991	1,198	1	3,190	1,029	232	0	1,261
Total estimated return	6,658	4,529	39	11,226	1,900	412	7	2,319

** 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 for the Imnaha stock where we estimated the 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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