LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2013 Annual Progress Report

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

Lance R. Clarke
Michael W. Flesher
Holly M. Stanton
Debra L. Eddy
Richard W. Carmichael

OREGON
Fish & Wildlife

LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

This report is available at: http://www.fws.gov/lsnakecomplan/Reports/ODFWreports.html

Front cover photo of Russ McCollister and Mike Flesher seining steelhead smolts at Big Canyon Facility at the end of the volitional release period, May 2013. Photo by Holly Stanton.

ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies

CONTRACT NUMBER: F13AC00034 and F14AC00042

PROJECT PERIOD: January 1, 2013 through December 31, 2013

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

September 2015

Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302

This project was financed by the U.S. Fish and Wildlife Service under
the Lower Snake River Compensation Plan.

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 2013. 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 2008-2010 broods returned to spawn, and steelhead from the 2012 brood were released as smolts. Adult steelhead that returned to spawn were used to create the 2013 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, Scott Marshall, and Rod Engle, 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 F13AC00034 and F14AC00042, a cooperative agreement with the Oregon Department of Fish and Wildlife.

CORRECTION

Complete coded-wire tag information from recreational fisheries in Idaho was not included in the 2012 Annual Report, which summarizes data for the 2011-12 run year. In an addendum to this report we provide an updated Table 14 to the 2012 Annual Progress Report, which presents summaries of tag recovery estimates for the 2011-12 run year, to reflect this new information. All changes are in bold.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (continued)

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 2013. 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. 2014).*

The production goal of 800,000 Wallowa stock smolts was achieved in 2013, with 823,029 smolts released. The Imnaha stock production goal of 215,000 smolts was also achieved with 235,446 smolts released.

In 2012, 1,223 and 1,271 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped 24 natural steelhead at Wallowa Fish Hatchery and 63 natural steelhead at the Big Canyon Facility, which were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 357 Imnaha stock hatchery and 99 natural steelhead adults. Of these, a total of 137 hatchery and 83 natural steelhead were released above the weir, and 53 hatchery steelhead were outplanted to Big Sheep Creek. During spawning in the spring of 2013, we collected 926,000 Wallowa stock production eggs, 517,500 Wallowa fall broodstock eggs, and 351,950 Imnaha stock eggs.

In the 2012-13 run year, the compensation area goals of 9,184 Wallowa stock and 2,000 Imnaha stock adult steelhead above Lower Granite Dam were not met. 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 7,138 Wallowa stock hatchery steelhead (77.7% of goal), and 1,154 Imnaha stock hatchery steelhead (57.7% of goal) returned to the LSRCP compensation area in 2013.

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 2012 brood year (BY) released in 2013. 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. 2012, Carmichael et al. 2013). Coded-wire tag (CWT) data collected from 2013 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2013, the only experimental treatments from which fish returned were second generation progeny from early returning (fall-collected) broodstock. In 2013, smolts were released at Wallowa Hatchery that were third 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. (2011a). 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; Clarke et al. 2014; 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; 2013;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; 2009b; 2010; 2011; 2012; 2013; 2014), 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; 2011; 2014).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed embryo survival for the 2012 BY was 92.2%, within the range of recent brood years (1993-2011 BY range = 71.8-93.8%), and embryo-to-smolt survival was 82.5%, within the range of recent brood years (1993-2011 BY range = 65.0-98.3%; Table 1). Imnaha stock egg-to-embryo survival for the 2012 BY was 82.8%, within the range of recent brood years (1993-2011 BY range = 76.7-92.1%), and embryo-to-smolt survival was 91.4%, within the range of recent brood years (1993-2011 BY range = 79.5-98.5%; Table 1). We released 823,029 Wallowa stock smolts in 2013, exceeding our production goal of 800,000 smolts. For the Imnaha stock, we released 235,446 Imnaha stock smolts, which also exceeded 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% and 99.6% of Wallowa and Imnaha stock smolts with an adipose fin clip, which was within the range of recent brood years for Wallowa stock (1993-2011 BY range = 95.6-99.9%) and within the range of recent brood years for Imnaha stock (1993-2011 BY range = 96.1-100.0). Fin clip quality and tag retention for release groups averaged 97.9% for Wallowa stock, within the range of recent years (1993-2011 BY range = 89.1-99.3%) and 98.8% for Imnaha stock, also within the range of recent years (1993-2011 BY range = 84.7-99.0%). Details of experimental and production releases for the 2012 BY, including the number of fish implanted with passive integrated transponder (PIT) tags, are shown in Table 3.

Densities of residual hatchery steelhead averaged 4.7 fish/100m^2 at index sites in the Grande Ronde basin in 2012 (Table 4), whereas wild *O. mykiss* averaged 15.8 fish/100m^2. In the Imnaha basin, densities of residual hatchery steelhead and wild *O. mykiss* were 17.0 and 0.3

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 2008 to 2010 broods were detected at mainstem dams during the 2012-13 run year. Of the 276 Wallowa stock adults detected at Bonneville Dam on the Columbia River, 193 were detected at Lower Granite Dam on the Snake River. For the Imnaha stock, 130 of the 160 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 95 (26.3%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 63 (4.9%) natural steelhead. In addition, 20 (1.6%) natural steelhead returned to Wallowa Fish Hatchery. Sixty-six percent of hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon Facility spent two years in the ocean (Table 8). However, about half (52%) of hatchery fish that returned to Little Sheep Creek Facility spent one year in the ocean before returning. Of the natural origin fish, 65% (64 of 99), 29% (18 of 63), and 33% (8 of 24) of the Little Sheep Creek Facility, Big Canyon Facility, and Wallowa Fish Hatchery, respectively, spent one year in saltwater before returning.

The majority of hatchery adults that returned to Wallowa Fish Hatchery in 2012 were spawned or killed (Table 8). In 2013, 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 224 adult hatchery steelhead from Wallowa Fish Hatchery and the Big Canyon Facility to local ponds for harvest opportunities. In addition, 101 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Sixty-seven of these fish returned to the weir a second time and were euthanized. At the Big Canyon Facility, 63 natural fish were passed above the weir to spawn naturally. We retained 32% of the hatchery fish and 29% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 58 hatchery adults to Big Sheep Creek to spawn naturally. Five of the 58 outplanted fish (9%) were recaptured at least once at the Little Sheep Creek Facility in 2013. Eighty-three natural and 137 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally. In addition, 10 natural males and 15 hatchery males were spawned and then passed above the weir, resulting in 62% of fish above the weir being of hatchery origin. Of the 245 fish passed into Little Sheep Creek, 20 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 2013, a total of 63 steelhead were passed above the weir, of which 41 were females (Table 9). Thirty-three redds were counted, which was 80% of the total number of redds constructed, assuming that each female constructs one redd.

In 2013, we reached our egg take goal for the Wallowa stock with 1,442,300 green eggs collected. Of these, 924,800 were for production and 517,500 were for the fall broodstock evaluation. We collected 351,950 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 3.5-10.6% for Wallowa production stock, 4.3-8.1% for fall broodstock, and from 4.3-38.1% for Imnaha stock (Table 11).

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 2008 to 2010 occurred during the 2012-13 run year, including the seventh 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 703 Wallowa fall brood and 1,554 Wallowa production CWTs were recovered (Table 12). During the fiscal year we provided written analyses of this experiment for 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 30 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 2012-13 run year, 7,138 hatchery origin adults returned to the compensation area, representing 77.7% of the compensation area goal

(Table 14). For the Imnaha stock, we estimate that 1,154 adults returned to the compensation area, representing 57.7% of the compensation area goal. Age composition of returning adults is shown in Table 15. Development of the compensation plan goals assumed that twice as many adult steelhead would be harvested in downriver fisheries as return to the compensation area (USACOE 1975); however, that harvest level was not reached for either stock.

There are three principal factors that influence success in meeting the compensation goals: number of smolts released for the brood years that produced the adults; smolt-to-adult survival (SAS) rates to the mouth of the Columbia River; and capture of fish below the compensation area in fisheries and as out-of-basin strays. Over the history of the LSRCP project, we have now reached our adult production compensation goal eleven times (1997-98, 2001-02, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, and 2011-12 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 2012-13 run year represent the final returns of the 2008 BY. For the 2008 BY, SAS for the Wallowa and Imnaha stocks were above average at 1.510% and 1.280%, respectively (Figure 3). Smolt-to-adult return to the compensation area above Lower Granite Dam has reached our goal in only ten of the last 24 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 ten years for Imnaha stock and in nine of the last ten years for Wallowa stock. For the Wallowa stock, 27% of the CWT recoveries in the 2012-13 run year occurred downstream of the compensation area. For Imnaha stock, 15% of the recoveries in the 2012-13 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).

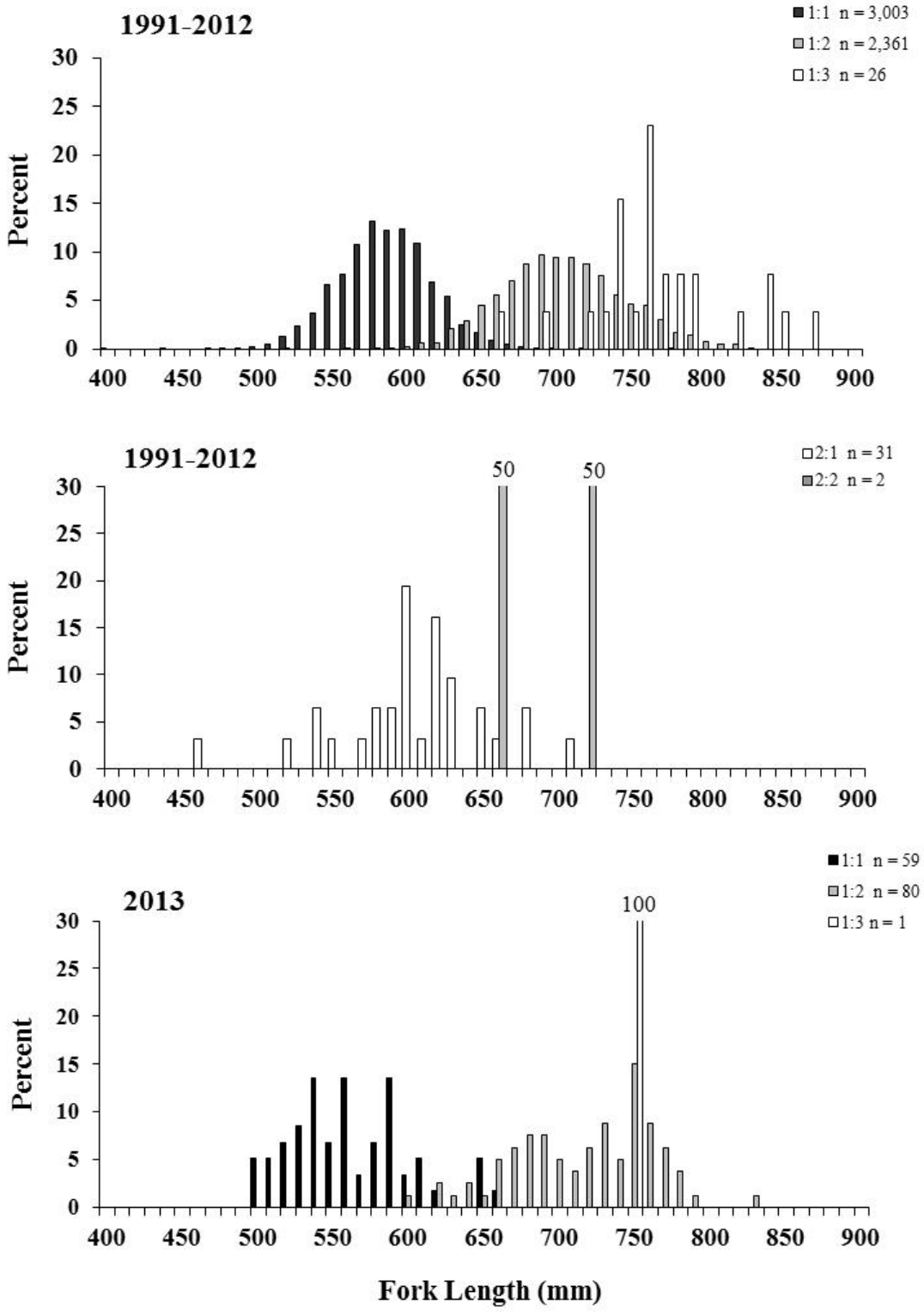

Figure 1. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top) and two freshwater age (middle) Wallowa stock summer steelhead from 1991 to 2012, and in 2013 (bottom).

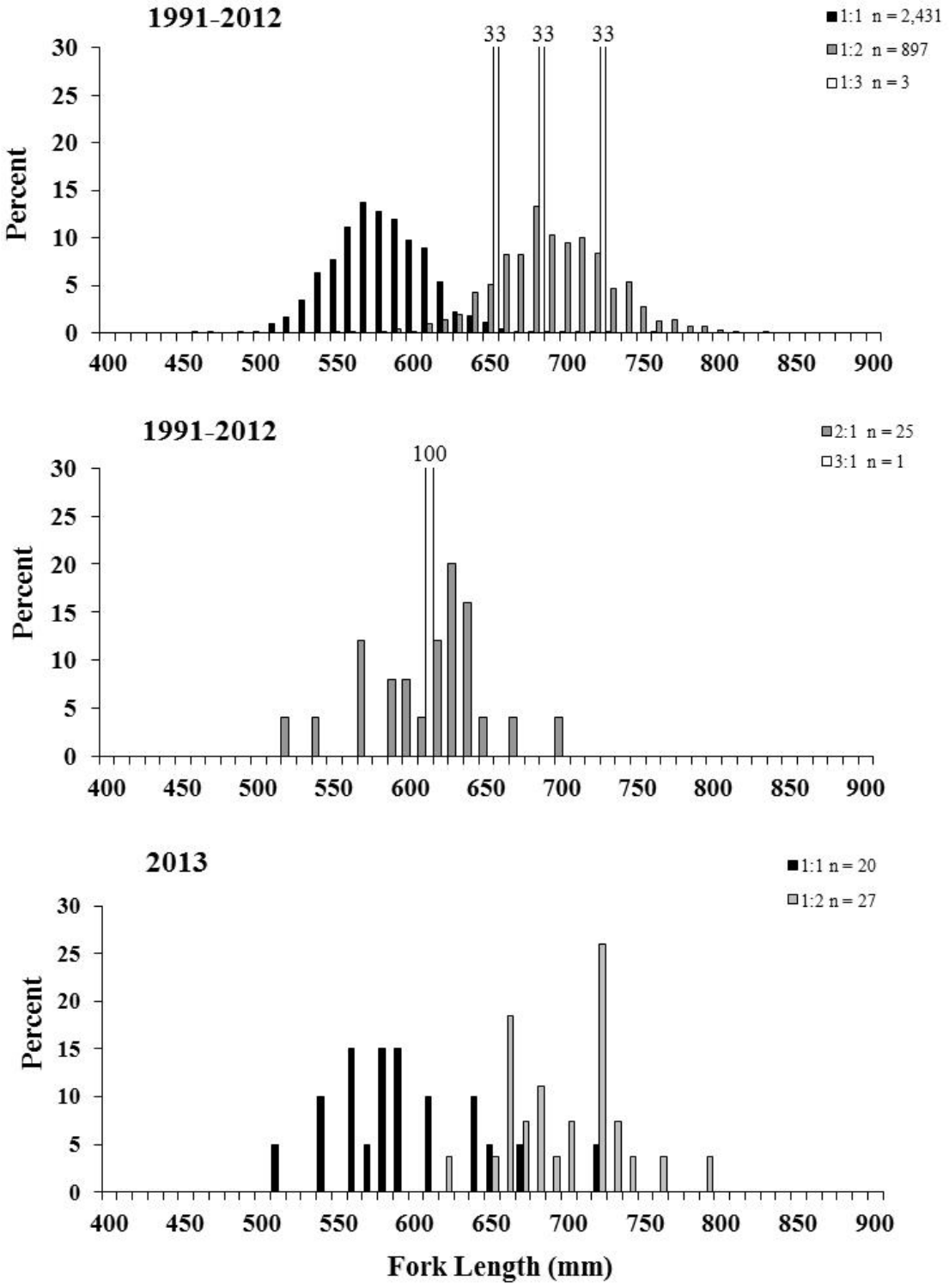

Figure 2. Length-at-age relationships based on scale analysis for hatchery adult returns of one freshwater age (top), and two and three freshwater age (middle) Imnaha stock summer steelhead from 1991 to 2012, and in 2013 (bottom).

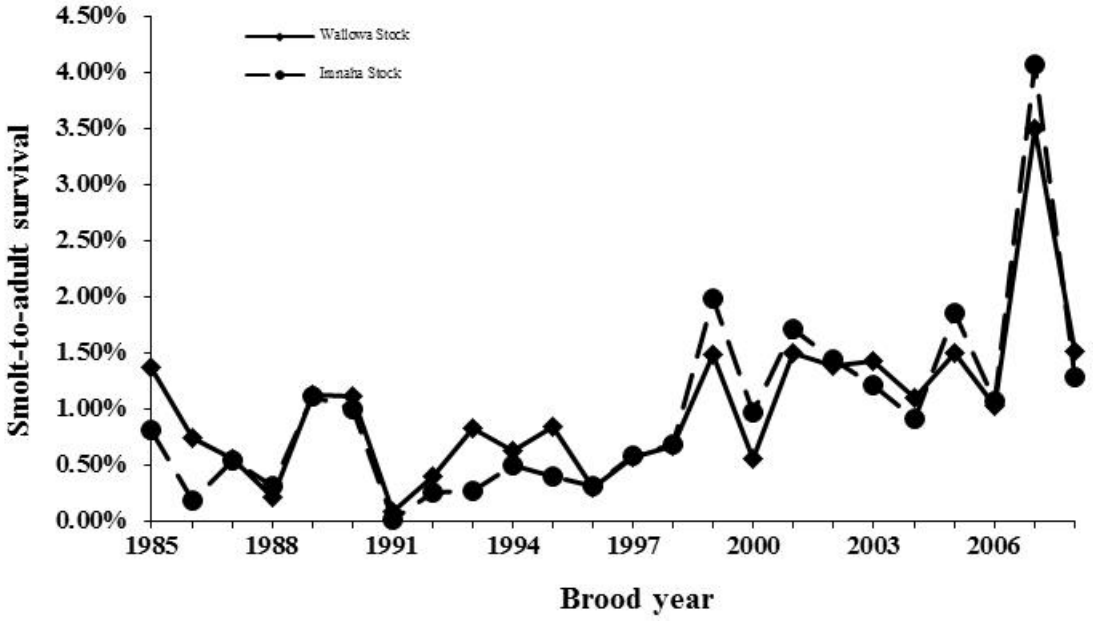

Figure 3. Smolt-to-adult survival (SAS) for Wallowa and Imnaha stock summer steelhead, 1985-2008 brood years. Data is based on CWT recoveries.

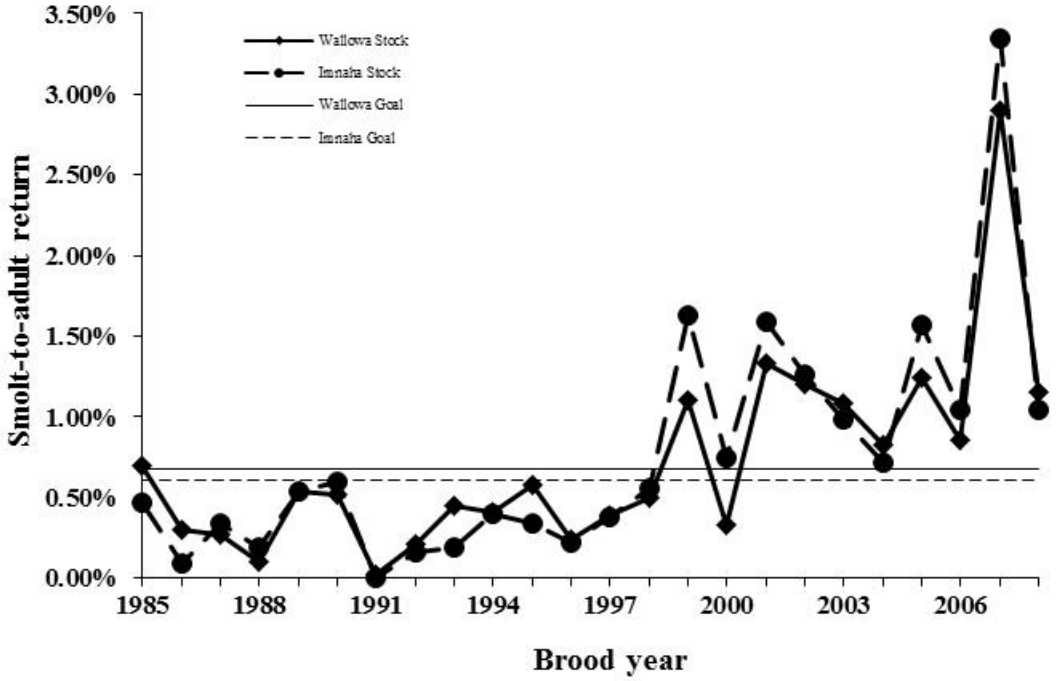

Figure 4. Smolt-to-adult return (SAR) to the compensation area above Lower Granite Dam for Wallowa and Imnaha stock summer steelhead, 1985-2008 brood years. The Wallowa stock goal is 0.68% and the Imnaha stock goal is 0.61%. Data is based on CWT recoveries.

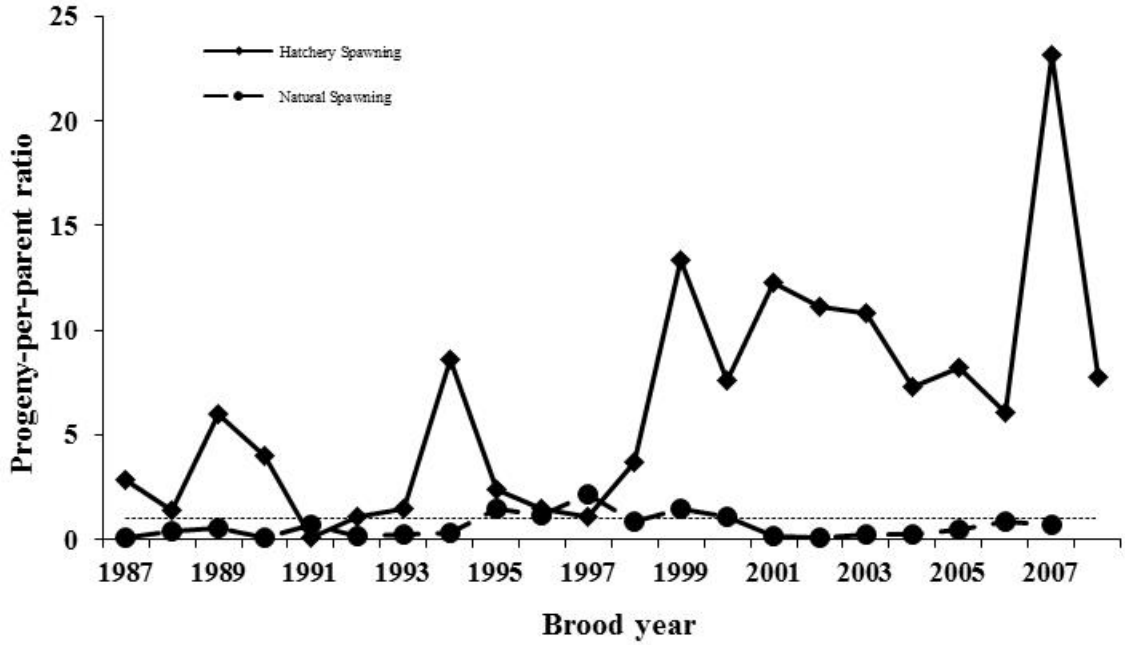

Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-2008 brood years. Both types of spawning include hatchery and natural origin parents. Dotted line represents replacement (P:P ratio = 1.0). Natural origin steelhead data for 2008 is not yet available.

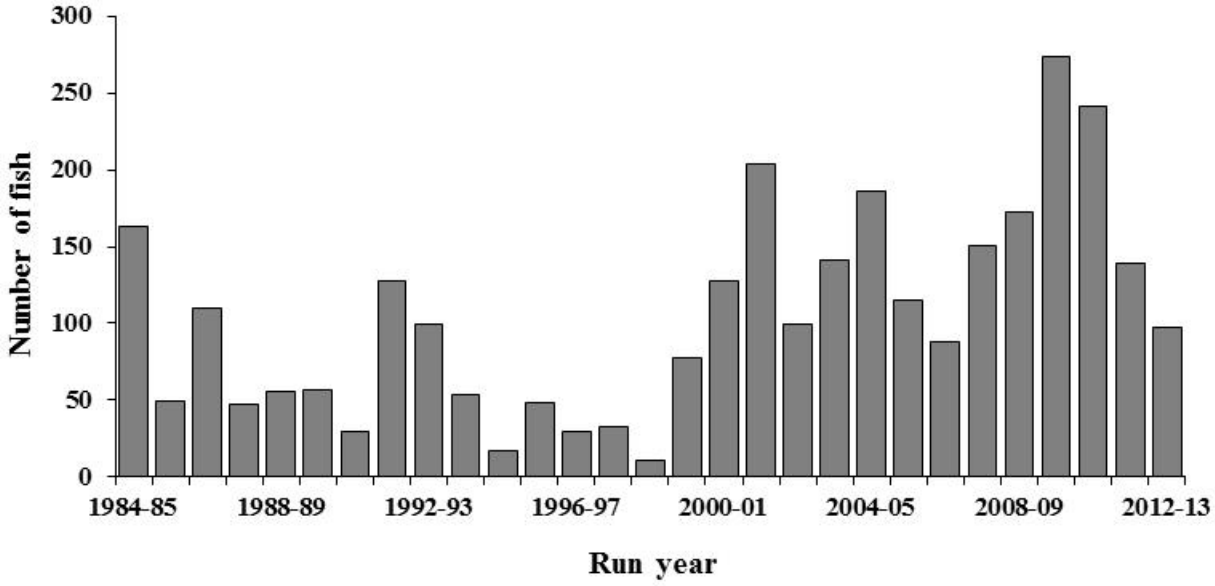

Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2012-13.

Table 1. Summary of egg collection and juvenile survival for 2012 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2013.

Stock	Number of eggs taken	Eyed embryos	Total smolts released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt[a]
Wallowa	1,257,500	1,159,200[b]	823,029[c]	92.2	82.5
Imnaha	323,300	267,700[d]	235,446	82.8	91.4

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

[b] *Includes 1,600 embryos that were transferred to the Salmon and Trout Enhancement Program (STEP) Coordinator. Also includes 91,000 embryos that were euthanized because they were excess to program needs and 68,979 embryos that were overestimated in the inventory.*

[c] *Includes a total of 428 fish that were outplanted to Wallowa Wildlife Pond as rainbow trout at the end of the volitional release period from the Big Canyon Facility. These fish were determined to be mostly male and were expected to residualize.*

[d] *Includes 10,031 embryos that were overestimated in the inventory.*

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2012 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2013. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose fin-clipped. Fall brood (progeny of broodstock collected in early fall) were intended to be 100% AdRV (adipose + right ventral fin-clipped). Targets for tagged production groups were 100% AdLV+CWT and for tagged fall brood 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, 5	090557	554	-	98.7	0.0	1.1	0.2	-	-
Fall Brood, 11	090556	513	-	98.6	0.0	1.4	0.0	-	-
Fall Brood, 13	090555	504	-	99.8	0.0	0.2	0.0	-	-
Fall Brood, 15	090554	529	-	100.0	0.0	0.0	0.0	-	-
Production, 10	090560	509	-	96.1	1.8	2.1	0.0	-	-
Production, 12	090559	543	-	98.5	1.3	0.2	0.0	-	-
Production, 14	090558	528	-	94.7	3.6	1.7	0.0	-	-
Production, 17	090561	509	-	96.7	0.8	2.5	0.0	-	-
Production, 23	090562	539	-	99.3	0.0	0.7	0.0	-	-
Production, 25	090563	504	-	97.0	0.6	2.2	0.2	-	-
Average	-	523	348	98.0	0.8	1.2	0.0	99.4	0.6
				Imnaha Stock					
Production, 31	090553	526	255	98.8	0.6	0.6	0.0	99.6	0.4
Overall average		524	329	98.0	0.8	1.2	0.0	99.5	0.5

[a] *Wallowa stock adipose fin (Ad) clip quality checks were made at Irrigon Hatchery, raceways 8 (n=303), 9 (n=314), 10 (n=320), and 12 (n=455), and at Little Sheep Facility acclimation pond for Imnaha stock smolts.*
[b] *Ad clip quality was 99.7%, 100.0%, 99.3%, 98.7%, in four Wallowa stock raceways.*

Table 3. Details of experimental and production groups of 2012 brood year summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2013. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated. Target size was 113 g for Wallowa stock and 100 g 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 7-8	Spring	090560	210 (19)	99.4 (23.1)	1.01 (0.06)	24,878	1,090	72.5 ± 14.9
Production, 12	April 6-8	Spring	090559	210 (16)	93.4 (23.7)	1.02 (0.05)	25,620	1,099	85.0 ± 12.8
Production, 14	April 6-8	Spring	090558	[c]	[c]	[c]	24,591	1,091	81.8 ± 12.9
Production, 10, 12, 14	April 6-8	Spring	-	209 (19)	96.1 (27.5)	1.02 (0.04)	51,303	-	-
Fall Broodstock, 13	April 7-8	Spring	090555	205 (18)	93.9 (25.7)	1.05 (0.05)	26,871	1,893	84.5 ± 15.8
Fall Broodstock, 11	April 7-8	Spring	090556	[d]	[d]	[d]	26,999	1,881	75.8 ± 10.6
Fall Broodstock, 5	April 6-8	Spring	090557	210 (25)	99.3 (31.8)	1.05 (0.05)	27,096	1,879	82.9 ± 12.4
Fall Broodstock, 5,8,9,11,13	April 6-8	Spring		208 (22)	96.6 (28.9)	1.05 (0.05)	129,244	-	-
Production, 17	April 14-16	Deer	090561	215 (20)	106.7 (25.0)	1.02 (0.16)	25,245	4,080	78.9 ± 6.9
Production, 16-18, 22	April 14-16	Deer	-	208 (19)	102.3 (25.8)	1.05 (0.06)	141,247	-	-
Production, 23	April 20-May 2	Spring	090562	213 (17)	104.0 (21.1)	1.07 (0.05)	26,358	3,374	73.3 ± 8.8
Production, 20, 21, 23	April 20-May 2	Spring	-	212 (18)	101.5 (26.4)	1.05 (0.06)	91,252	-	-
Fall Broodstock, 15	April 20-May 2	Spring	090554	213 (18)	104.0 (31.9)	1.06 (0.06)	24,659	1,100	91.9 ± 27.1
Fall Broodstock, 15	April 20-May 2	Spring	-	[e]	[e]	[e]	17,405	-	-
Production, 25	April 23-May 7	Deer	090563	209 (19)	97.7 (31.4)	1.02 (0.08)	25,482	4,388	79.1 ± 7.6
Production, 19, 24-26	April 23-May 7	Deer	-	209 (18)	96.8 (26.1)	1.01 (0.07)	134,351	-	-
Total released							822,601	21,875	
				Imnaha stock					
Production, 31	Mar 26-April 23	L. Sheep	090553	196 (25)	85.1 (30.4)	0.90 (0.39)	24,978	8,926	76.5 ± 4.0
Production, 27-32	Mar 26-April 23	L. Sheep	-	194 (26)	77.9 (33.8)	1.04 (0.07)	166,903	8,872	72.9 ± 3.9[g]
Production, 27	Mar 26-April 23	L. Sheep	-	[f]	[f]	[f]	43,565	4,084	76.7 ± 5.8
Total released							235,446	21,882	

[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 090559 and 090558 were in the same acclimation pond and were not distinguishable based on an external mark.*

[d] *CWT codes 090555 and 090556 were in the same acclimation pond and were not distinguishable based on an external mark.*

[e] *CWT code 090554 and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[f] *Fish from raceway 27 were in the same acclimation pond with fish from raceways 27-32 and were not distinguishable based on an external mark.*

[g] *Percent migration for raceway 29 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 2013. 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.	31 July	HSTS	351.8	15	183.5 (36.12)	111-249	4.7 ± 1.3
Deer Cr.	31 July	WSTS	351.8	42	108.1 (23.0)	71-184	15.8 ± 1.6
Deer Cr.	31 July	CHS	351.8	117	82.2 (8.3)	69-101	35.9 ± 3.4
Imnaha basin							
Little Sheep Cr.	30 July	HSTS	483.5	71	165.8 (36.5)	99-255	17.0 ± 1.9
Little Sheep Cr.	30 July	WSTS	297.1[c]	1	83	-	0.3

[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	46.0
2012	35.4	28.8	22.3	56.5	47.0	49.3

Table 6. Number of PIT tags released and unique adult PIT tag detections at Bonneville and Lower Granite dams during the 2012-13 run year by stock and brood year.

Brood year	PIT tags released	Age at return	Adult Detections	
			Bonneville Dam	Lower Granite Dam
		Wallowa Stock		
2008	22,240	5	0	0
2009	23,093	4	223	151
2010	22,187	3	53	34
Total	67,520		276	185
		Imnaha Stock		
2008	20,850	5	0	0
2009	21,698	4	74	55
2010	21,900	3	86	58
Total	64,448		160	113

Table 7. Timing of adult steelhead returns to LSRCP facilities in 2013 by location and origin.

Period	Week of the year	Number of fish trapped[a]					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural[b]	Hatchery	Natural	Hatchery	Natural[c]
Jan 22-28	4	-	-	-	-	-	-
Jan 29-Feb 04	5	-	-	-	-	-	-
Feb 05-11	6	-	-	-	-	-	-
Feb 12-18	7	0	0	0	0	-	-
Feb 19-25	8	12	0	5	0	-	-
Feb 26-Mar 04	9	0	0	10	0	0	0
Mar 05-11	10	31	1	91	0	0	0
Mar 12-18	11	36	1	388	5	24	5
Mar 19-25	12	302	4	122	3	7	1
Mar 26-Ap 01	13	177	3	116	6	41	3
Apr 02-Apr 08	14	241	5	318	18	91	25
Apr 09-15	15	255	5	76	9	39	10
Apr 16-22	16	62	1	7	1	54	9
Apr 23-29	17	44	0	80	9	60	15
Apr 30-May 06	18	48	4	40	6	26	20
May 07-13	19	13	0	13	5	13	10
May 14-20	20	4	0	5	1	2	1
May 21-27	21	0	0	0	0	0	0
May 28-June 03	22	-	-	-	-	-	-
Jun 04-10	23	-	-	-	-	-	-
Jun 11-17	24	-	-	-	-	-	-
June 18-24	25	-	-	-	-	-	-
Total		1,225	24	1,271	63	357	99

[a] *The ladder was opened on 12 February at Wallowa Fish Hatchery, and weirs were installed 13 February at Big Canyon Facility (Deer Creek) and 25 February at Little Sheep Creek Facility. Adult collections ended 28 May at Wallowa Fish Hatchery, 29 May at Big Canyon Facility, and 30 May at Little Sheep Creek Facility.*

[b] *Includes one 405 mm female counted as an anadromous adult.*

[c] *Includes one 410 mm female whose scale sample identified her as an anadromous adult.*

Table 8. Number, disposition, and mean fork length (mm) of adult steelhead that returned to LSRCP facilities in 2013 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	224	103	204	446	1	0	0	2	980	1	3	5	5	0	0	2	2	3	3	24	1,004
Passed	0	0	0	0	0	0	0	0	0	1	3	5	5	0	0	2	2	3	3	24	24
Outplanted	42	14	23	34	0	0	0	0	113	0	0	0	0	0	0	0	0	0	0	0	113
Kept	182	89	181	412	1	2	0	0	867	0	0	0	0	0	0	0	0	0	0	0	867
Mortality	2	0	1	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4
Spawned	58	5	86	141	0	0	0	0	290	0	0	0	0	0	0	0	0	0	0	0	290
Killed[c]	122	84	94	270	1	2	0	0	573	0	0	0	0	0	0	0	0	0	0	0	573
Wallowa Fish Hatchery (Wallowa Stock-Fallbrood)																					
Trapped	88	66	32	56	2	0	1	0	245	0	0	0	0	0	0	0	0	0	0	0	245
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	88	66	32	56	2	0	1	0	245	0	0	0	0	0	0	0	0	0	0	0	245
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned	78	56	28	51	2	0	0	0	215	0	0	0	0	0	0	0	0	0	0	0	215
Killed[c]	10	10	4	5	0	0	1	0	30	0	0	0	0	0	0	0	0	0	0	0	30
Wallowa Fish Hatchery (Total Returns)																					
Trapped	312	169	236	502	3	0	1	2	1,225	1	3	5	5	0	0	2	2	3	3	24	1,249
Fork length (mm)	556	562	734	700	-	-	-	742		-	-	-	-	-	-	-	-	-	-		
Standard deviation	38	41	41	45	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	32	27	33	47				1													
Big Canyon Facility (Wallowa stock)																					
Trapped	215	148	271	631	2	0	2	2	1,271	6	2	7	24	0	0	6	4	3	11	63	1,334
Passed	0	0	0	0	0	0	0	0	0	6	2	7	24	0	0	6	4	3	11	63	63
Outplanted	33	30	18	28	1	0	1	0	111	0	0	0	0	0	0	0	0	0	0	0	111
Returned to river[d]	4	1	9	20	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0	34
Kept	178	117	244	583	1	0	1	2	1,126	0	0	0	0	0	0	0	0	0	0	0	1,126
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]	178	117	244	583	1	0	1	2	1,126	0	0	0	0	0	0	0	0	0	0	0	1,126
Fork length (mm)	-	-	-	-	-	-	-	-		-	-	675	716	-	-	-	-	-	683		
Standard deviation	-	-	-	-	-	-	-	-		-	-	-	10	-	-	-	-	-	4		
Sample size												1	3						2		

Table 8. Continued

Facility, stock, Disposition	Hatchery[a] 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	88	98	36	135	0	0	0	0	357	33	27	16	19	0	0	2	2	0	0	99	456
Passed	20	51	10	56	0	0	0	0	137	28	24	11	16	0	0	2	2	0	0	83	220
Outplanted	11	17	3	22	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	53
Kept	57	30	23	57	0	0	0	0	167	5	3	5	3	0	0	0	0	0	0	16	183
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned[e]	32	16	22	44	0	0	0	0	114	5	3	5	3	0	0	0	0	0	0	16	130
Killed[f,g]	25	14	1	13	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	53
Fork length (mm)	560	611	705	690	-	-	-	-		563	576	689	689	-	-	550	618	-	-		
Standard deviation	20	55	44	35	-	-	-	-		52	67	119	35	-	-	-	-	-	-		
Sample size	8	12	7	20						14	11	4	9			1	1				

[a] *Wallowa stock hatchery ages apportioned using CWT data and 140 scale samples collected in 2013; Imnaha stock hatchery ages apportioned using CWT data, 47 scale samples from 2013. Mean fork lengths are from fish with scale samples collected in 2013.*

[b] *Wallowa stock (Wallowa Fish Hatchery and Big Canyon Facility) natural steelhead ages apportioned using historical data (220 samples) and 2013 data (6 samples); Little Sheep Creek Facility natural steelhead ages apportioned 2013 data (47 samples). Mean fork lengths are from fish with scale samples collected in 2013.*

[c] *For Wallowa stock steelhead, 418 fish that returned to Wallowa Fish Hatchery and 550 fish that returned to Big Canyon Facility were euthanized and donated to local food banks. In addition, 47 fish from Wallowa Fish Hatchery and 138 fish from Big Canyon Facility were euthanized and donated to local schools for educational purposes. For Imnaha stock steelhead, 10 fish that returned to Little Sheep Creek Facility were euthanized and donated to local food banks.*

[d] *One hundred one fish were returned to the Wallowa River fishery for additional angler opportunity. Of these, 33 males and 34 females returned to the weir a second time and were euthanized. These 67 fish are included in the "killed" category.*

[e] *Includes 10 natural males and 15 hatchery males that were live-spawned and passed above the weir.*

[f] *Includes one stray male from Wallowa Fish Hatchery.*

[g] *Includes 2 hatchery males and 3 hatchery females that were initially outplanted to Big Sheep Creek. These 5 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, 1999-2013.

	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	14.2	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
2013	58	5	8.6	245	20	8.2
Mean	-	-	24.5	-	-	8.2

[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, 2002-2013.

	Passed			Redds	Fish per	Females	% Redds	Redds	Redd
Year	Females	Males	Total	counted	redd	per redd	counted[a]	per mile[b]	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	2.2	18.6
2013	41	22	63	33	1.91	1.24	80	3.3	25.6

[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 2012-2013. Ten miles of stream were surveyed in 2004-06 and in 2011. Redds per 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 2013. 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
		Wallowa Hatchery (Wallowa stock)			
3/13, WA500	Production	5	30,200	27,000	10.6
	Fall Broodstock	5	23,800	22,000	7.6
3/20, WA501	Production	43	260,200	239,200	8.1
	Fall Broodstock	17	84,100	78,000	7.3
3/27, WA502	Production	32	204,900	185,500	9.5
	Fall Broodstock	11	51,100	48,900	4.3
4/03, WA503	Production	29	183,600	172,900	5.8
	Fall Broodstock	33	164,000	150,700	8.1
4/10, WA504	Production	23	156,700	143,500	8.4
	Fall Broodstock	31	144,500	135,100	6.5
4/17, WA505	Production	14	90,400	87,200	3.5
	Fall Broodstock	10	50,000	50,000	0
Subtotal	Production	146	926,000	855,300	7.6
	Fall Broodstock	107	517,500	484,700	6.3
Total		253	1,443,500	1,340,000	7.2
		Little Sheep Creek Facility (Imnaha stock)			
3/26, LI600	Hatchery	4	23,100	22,100	4.3
4/02, LI601	Hatchery	9	31,633	44,850	5.5
	Mixed		15,817		
4/09, LI602	Hatchery	8	36,137	29,450	28.7
	Mixed		5,163		
4/16, LI603	Hatchery	10	43,920	50,300	8.4
	Mixed		10,980		
4/23, LI604	Hatchery	23	86,470	99,800	19.7
	Mixed		37,830		
4/30, LI605	Hatchery	12	45,675	52,700	13.5
	Mixed		15,225		
Subtotal	Hatchery	66	266,935	299,200	15.0
	Mixed		85,015		
Total		66	351,950	299,200	15.0

[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 males spawned equals the number of females spawned. A total of 64 Imnaha Stock males were spawned*

[c] *Includes 1,200 Wallowa production stock eyed embryos that were transferred to the Salmon and Trout Enhancement Program (STEP). Also includes 56,700 eyed embryos from Wallowa Fall broodstock and 15,000 Imnaha Stock eyed embryos from hatchery parents that were euthanized because they were excess to program needs.*

Table 12. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Wallowa stock summer steelhead for the 2012-13 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 July 2015.

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]
2008						
Deer Cr.	Production, April	094587	0	0	0	0
	Production, May	094589	1	0	0	1
Spring Cr.	Production, April	094581	0	0	0	0
	Production, April	094582	0	0	0	0
	Production, April	094583	0	0	3	3
	Production, May	094588	0	3	2	5
	Fallbrood, April	094580	0	0	0	0
	Fallbrood, April	094584	1	0	0	1
	Fallbrood, April	094585	0	0	0	0
	Fallbrood, May	094586	0	0	0	0
2009						
Deer Cr.	Production, April	094680	43	66	104	213
	Production, May	094679	44	46	32	122
Spring Cr.	Production, April	094672	61	49	131	241
	Production, April	094673	55	45	93	193
	Production, April	094674	71	44	164	279
	Production, April	094678	48	28	84	160
	Fallbrood, April	094671	22	25	49	96
	Fallbrood, April	094675	17	42	57	116
	Fallbrood, April	094676	15	37	77	129
	Fallbrood, April	094677	20	12	33	65
2010						
Deer Cr.	Production, April	090319	27	10	39	76
	Production, May	090318	14	15	30	59
Spring Cr.	Production, April	090320	21	5	36	62
	Production, April	090321	26	0	18	44
	Production, April	090322	21	3	22	46
	Production, May	090317	11	6	33	50
	Fallbrood, April	090297	21	28	56	105
	Fallbrood, April	090298	18	0	36	54
	Fallbrood, April	090299	30	22	52	104
	Fallbrood, May	090316	11	5	17	33
	Total recoveries		598	491	1,168	2,257

[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 2012-13 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 July 2015.

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]
2008						
Little Sheep	Production, April	094579	0	0	8	8
2009						
Little Sheep	Production, April	094670	21	9	51	81
2010						
Little Sheep	Production, April	090296	12	0	61	73
	Total recoveries		33	9	120	162

[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 for the 2008 and 2009 broods and were acclimated and volitionally released from the Little Sheep Creek Facility for the 2010 brood. All Little Sheep fish were acclimated and volitionally released over a four-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 2012-13 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 July 2015. "-" 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	5	11	0.1	0	0	0.0
Columbia River harvest						
Treaty net	117	360	4.1	0	0	0.0
C and S	0	0	0.0	0	0	0.0
Sport	446	1,186	13.5	24	163	12.4
Test	0	0	0.0	0	0	0.0
Tributary sport	5	6	0.1	0	0	0.0
Deschutes River harvest						
Sport	16	38	0.4	0	0	0.0
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. basin	21	45	0.5	0	0	0.0
Within Snake R. basin*	2	3	0.1	1	7	0.5
Snake River sport, tribs. harvest*	556	1,651	18.8	95	642	48.7
Oregon tributary harvest* [a]	491	2,988	34.0	9	126	9.6
Other in-basin escapement* [b]	-	-	-	-	22	1.7
Hatchery weir* [c]	598	2,496	28.4	33	357	27.1
Total estimated return	2,257	8,784	100	162	1,317	100
Return to compensation area		7,138			1,154	
Percent of compensation goal		77.7			57.7	

** 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 2012-13 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 July 2015. "-" 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	11	0	11	0	0	0	0
Columbia River harvest								
Treaty net	43	317	0	360	0	0	0	0
C and S	0	0	0	0	0	0	0	0
Sport	323	863	0	1,186	41	122	0	163
Test	0	0	0	0	0	0	0	0
Tributary sport	0	6	0	6	0	0	0	0
Deschutes River harvest								
Sport	15	23	0	38	0	0	0	0
C and S	0	0	0	0	0	0	0	0
Strays								
Outside Snake R. basin	17	28	0	45	0	0	0	0
Within Snake R. basin*	2	1	0	3	7	0	0	7
Snake River sport, tribs. harvest*	705	932	14	1,651	371	223	48	642
Oregon tributary harvest* [a]	502	2,486	0	2,988	60	66	0	126
Other in-basin escapement* [b]	-	-	-	-	0	22	0	22
Hatchery weir* [c]	844	1,645	7	2,496	186	171	0	357
Total estimated return	2,451	6,312	21	8,784	665	604	48	1,317

** 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.*

REFERENCES

Carmichael, R.W. 1989. Lower Snake River Compensation Plan - Oregon evaluation studies, five-year study plan. Oregon Department of Fish and Wildlife, Fish Research Project, Portland.

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

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

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

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

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

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

Carmichael, R.W., B.A. Miller, and R.T. Messmer. 1988b. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha rivers for the 1987-88 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFFI-LSR-89-02. Annual Progress Report, Portland.

Carmichael, R.W., M.W. Flesher, and R.T. Messmer. 1989. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha rivers for the 1988-89 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFFI-LSR-90-12. Annual Progress Report, Portland.

Carmichael, R.W., M.W. Flesher, and R.T. Messmer. 1990. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1989-90 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFFI-LSR-91-12. Annual Progress Report, Portland.

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

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

Carmichael, R.W., D.L. Eddy, M.W. Flesher, G.C. Grant, J.R. Ruzycki, and G.R. Vonderohe. 2005a. Lower Snake River Compensation Plan: Oregon summer steelhead evaluation studies. Oregon Department of Fish and Wildlife, 1997 and 1998 Bi-Annual Progress Report, Portland.

Carmichael, R.W., D.L. Eddy, M.W. Flesher, G.C. Grant, J.R. Ruzycki and G.R. Vonderohe. 2005b. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 1999 and 2000 Bi-Annual Progress Report, Portland.

Carmichael, R.W., and T.L. Hoffnagle. 2012. Lower Snake River Compensation Plan: Oregon evaluation studies. Work Statement submitted to the U.S. Fish and Wildlife Service, Contract Number F13AC00034. Lower Snake River Compensation Plan Office, Boise, ID.

Carmichael, R.W., T.L. Hoffnagle, and L.R. Clarke. 2013. Lower Snake River Compensation Plan: Oregon evaluation studies. Work Statement submitted to the U.S. Fish and Wildlife Service, Contract Number F14AC00042. Lower Snake River Compensation Plan Office, Boise, ID.

Clarke, L.R., M. W. Flesher, T. A. Whitesel, G. R. Vonderohe, and R. W. Carmichael. 2010. Post-release performance of acclimated and direct-released hatchery summer steelhead into Oregon tributaries of the Snake River. North American Journal of Fisheries Management 30:1098-1109.

Clarke, L.R., M. W. Flesher, S. M. Warren, and R. W. Carmichael. 2011. Survival and straying of hatchery steelhead following forced or volitional release. North American Journal of Fisheries Management 31:116-123.

Clarke, L.R., M. W. Flesher, and R. W. Carmichael. 2014. Hatchery steelhead smolt release size effects on adult production and straying. North American Journal of Aquaculture 76:39-44.

Clarke, L.R., M.W. Flesher, S.M. Warren, D.L. Eddy, and R.W. Carmichael. 2014. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2012 Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and R.T. Messmer. 1991. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha rivers for the 1990-91 run year. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-92-09. Annual Progress Report, Portland.

Flesher, M.W., M.A. Buckman, R.W. Carmichael, R.T. Messmer, and T.A. Whitesel. 1992. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha rivers for the 1991-92 run year. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-LSR-94-07. Annual Progress Report, Portland.

Flesher, M.W., M.A. Buckman, R.W. Carmichael, R.T. Messmer, and T.A. Whitesel. 1993. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1992-93 run year. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-LSR-94-14. Annual Progress Report, Portland.

Flesher, M.W., M.A. Buckman, R.W. Carmichael, R.T. Messmer, and T.A. Whitesel. 1994. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1993-94 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1995. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1994-95 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1996. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1995-96 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1997. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1996-97 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1999. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1997-98 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, T.A. Whitesel, and J.R. Ruzycki. 2000. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1998-99 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2001. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 1999-2000 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2004a. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2000-01 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2004b. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2001-02 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Flesher, M.W., G.R. Vonderohe, G.C. Grant, D.L. Eddy, and R.W. Carmichael. 2005a. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2001 and 2002 Bi-Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and G.C. Grant. 2005b. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2002-03 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and G.C. Grant. 2007. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2003-04 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, G.C. Grant, and L.R. Clarke. 2008a. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2004-05 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, G.C. Grant, and L.R. Clarke. 2008b. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2005-06 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., S.M. Warren, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2009a. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2005 Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2009b. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2006-07 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2010. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2007-08 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2011. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2008-09 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2012. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2009-10 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., S.M. Warren, R.W. Carmichael, and L.R. Clarke. 2013. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2010-11 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Flesher, M.W., S.M. Warren, R.W. Carmichael, and L.R. Clarke. 2014. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2011-12 run year. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Salem.

Gee, S.A., G. R. Vonderohe, M.W. Flesher, D.L. Eddy, G.C. Grant, and R.W. Carmichael. 2007. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2003 Annual Progress Report, Salem.

Gee, S.A., M.W. Flesher, D.L. Eddy, L. R. Clarke, J. R. Ruzycki, and R.W. Carmichael. 2008. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2004 Annual Progress Report, Salem.

Jonasson, B.C., R.W. Carmichael, and T.A. Whitesel. 1994. Residual hatchery steelhead: Characteristics and potential interactions with spring Chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Jonasson, B.C., R.W. Carmichael, and T.A. Whitesel. 1995. Residual hatchery steelhead: Characteristics and potential interactions with spring Chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Jonasson, B.C., R.W. Carmichael, and T.A. Whitesel. 1996. Residual hatchery steelhead: Characteristics and potential interactions with spring Chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Messmer, R.T., R.W. Carmichael, and M.W. Flesher. 1989. Lower Snake River Compensation Plan: Oregon evaluation studies. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-LSR-91-1. Annual Progress Report, Portland.

Messmer, R.T., R.W. Carmichael, and M.W. Flesher. 1990. Lower Snake River Compensation Plan: Oregon evaluation studies. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-LSR-91-1. Annual Progress Report, Portland.

Messmer, R.T., R.W. Carmichael, M.W. Flesher, and T.A. Whitesel. 1991. Evaluation of Lower Snake River Compensation Plan facilities in Oregon. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-LSR-92-10. Annual Progress Report, Portland.

Messmer, R.T., R.W. Carmichael, M.W. Flesher, and T.A. Whitesel. 1992. Evaluation of Lower Snake River Compensation Plan facilities in Oregon. Oregon Department of Fish and Wildlife, Fish Research Project, AFF1-LSR-94-06. Annual Progress Report, Portland.

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

Ruzycki, J.R., M.W. Flesher, R.W. Carmichael, and D.L. Eddy. 2003. Lower Snake River Compensation Plan: Oregon evaluation studies – steelhead life history, genetics, and kelt reconditioning. Oregon Department of Fish and Wildlife, Fish Research and Development. 1997-2001 Progress Report, Portland.

USACOE (U.S. Army Corps of Engineers). 1975. Special report to the Lower Snake River Compensation Plan: Lower Snake River, Washington and Idaho. U.S. Army Engineer District, Walla Walla, Washington.

Warren, S.M., M.W. Flesher, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2009. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2006 Annual Progress Report, Salem.

Warren, S.M., M.W. Flesher, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2010. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2007 Annual Progress Report, Salem.

Warren, S.M., M.W. Flesher, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2011a. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2008 Annual Progress Report, Salem.

Warren, S.M., M.W. Flesher, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2011b. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2009 Annual Progress Report, Salem.

Warren, S.M., M.W. Flesher, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2012. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2010 Annual Progress Report, Salem.

Warren, S.M., M.W. Flesher, D.L. Eddy, L.R. Clarke, and R.W. Carmichael. 2013. Lower Snake River Compensation Plan: Oregon Summer Steelhead Evaluation Studies. Oregon Department of Fish and Wildlife, 2011 Annual Progress Report, Salem.

Westhagen, P., and J.R. Skalski. 2009. PitPro 4: PIT-Tag Processor user manual. University of Washington, Seattle. Available online at: http://www.cbr.washington.edu/paramest/pitpro/manual/pitpro_v4_manual/pitpro4_manual.pdf

Whitesel, T.A., B.C. Jonasson and R.W. Carmichael. 1993. Residual hatchery steelhead: Characteristics and potential interactions with spring Chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project. Annual Progress Report, Portland.

Zippen, C. 1958. The removal method of population estimation. Journal of Wildlife Management 22:82-90.

ADDENDUM

Correction to Table 14 of the
2012 Annual Progress Report

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 July 2015. "-" indicates not sampled or undefined. Numbers in bold are revisions to the table reported in the 2012 annual report.

	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	**6.8**	6	36	**1.2**
C and S	0	0	0.0	0	0	0.0
Sport	417	1,106	**9.4**	28	189	**6.1**
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	**1.6**	2	14	**0.4**
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	**0.2**
Snake River sport, tribs. harvest*	**940**	**2,526**	**21.6**	**195**	**1,304**	**42.3**
Oregon tributary harvest* [a]	1,037	3,828	**32.7**	11	126	**4.1**
Other in-basin escapement* [b]	-	-	-	-	150	**4.9**
Hatchery weir* [c]	957	3,190	**27.2**	143	**1,260**	**40.8**
Total estimated return	**3,722**	**11,705**	100	**386**	**3,085**	100
Return to compensation area		**9,554**			**2,846**	
Percent of compensation goal		**104.0**			**142.3**	

** 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 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.*