

LOWER SNAKE RIVER COMPENSATION PLAN:  
Oregon Summer Steelhead Evaluation Studies  
1999 and 2000 Bi-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 programs operated by ODFW in the Grande Ronde and Imnaha river basins during 1999 and 2000. 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 summarizes fish culture monitoring data for LSRCP facilities for summer steelhead. These data serve as the basis for the analysis of trends in culture performance. Generally speaking, the data in this report were derived from hatchery inventories and standard databases (i.e., PSMFC, Coded-wire tag) 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 the 1999 and 2000 work statements (Carmichael et al. 1999a, Carmichael and Ruzycki 2000). Coded-wire tag (CWT) data that were collected from 1999-2000 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 1999-2000, experimental treatments from which fish returned included acclimated vs. direct stream release, forced vs. volitional release, rearing site, growth, and density treatments. In 1999-2000, experimental treatments for which fish were released included forced vs. volitional, and pre-smolt release strategies. Analysis of specific survival studies will be completed once all brood years have returned and CWT data are complete for a given 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, 1988b, 1989, 1990, 1999b, 2004, 2005; Messmer *et al.*, 1989, 1990, 1991, 1992, 1993; Flesher *et al.*, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1999; Whitesel *et al.*, 1993; and Jonasson *et al.*, 1994, 1995, 1996), United States v. Oregon production report (Carmichael *et al.*, 1986b), and a five-year study plan (Carmichael 1989). Progress of related work completed in 1999 and 2000 is presented in summer steelhead creel annual progress reports (Flesher *et al.*, 2000, and 2001), and in the steelhead life history, genetics, and kelt reconditioning 1997-2001 progress report (Ruzycki *et al.*, 2003).

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 1994-1997 broods returned to spawn, steelhead from the 1998 and 1999 broods were released as smolts, and adult steelhead that returned to spawn were used to create the 1999 and 2000 broods.

## **Acknowledgments**

We would like to thank Tim Whitesel for overseeing the collection of the data presented in this report as well as coordinating many of the experiments, and Chris Starr and Joe Krakker for reviewing the document. Greg Davis, Mike Gribble, and many other hatchery personnel exhibited great dedication and provided essential assistance. Numerous personnel from the U.S. Fish and Wildlife Service, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation provided enthusiastic support. This project was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, contract numbers 14110-9-J071 and 14110-0-J048, 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 meet 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**

In 1999, we released 1,374,881 Wallowa stock steelhead smolts into the Grande Ronde Basin, and 334,672 Imnaha stock smolts and 149,976 presmolts into the Imnaha River Basin. In 2000, we released 889,909 smolts into the Grande Ronde Basin and 328,213 smolts and 93,680 presmolts into the Imnaha Basin. In both 1999 and 2000, we released experimental groups to evaluate forced and volitional release strategies at both Wallowa Fish Hatchery and the Big Canyon Acclimation Facility. In addition in 1999, we also released experimental groups at Little Sheep Creek to evaluate size grades and presmolts versus smolts.

In 1999, a total of 1,165 and 562 Wallowa stock steelhead returned to Wallowa Hatchery and Big Canyon, respectively. In addition, we trapped two natural steelhead at Wallowa Hatchery and trapped and released 39 natural steelhead at Big Canyon. At the Little Sheep Facility, we trapped 332 Imnaha stock hatchery and 11 naturally produced steelhead adults. Of these, we released 75 hatchery and 5 natural steelhead above the weir. In 2000, 966 and 333 hatchery steelhead returned to Wallowa Hatchery and Big Canyon respectively. We also trapped nine natural steelhead at Wallowa Hatchery and trapped and released 50 natural fish at Big Canyon. At Little Sheep Creek, 445 hatchery and 77 natural steelhead returned. During spawning in the

spring of 1999, we collected 2,482,381 Wallowa stock eggs and 606,740 Imnaha stock eggs. In 2000, we collected 2,046,530 Wallowa stock eggs and 568,500 Imnaha stock eggs.

We estimated that 5,625 Wallowa stock hatchery steelhead returned to the LSRCPC compensation area in 1999 (61.2% of goal) and 3,887 returned in 2000 (42.3% of goal). The return of Imnaha steelhead to the compensation area was 651 (32.5% of goal) in 1999 and 567 (28.4% of goal) in 2000.

## INTRODUCTION

The main objectives of this report are to document fish culture practices, describe adult returns, and assess success towards meeting LSRCP goals for Grande Ronde and Imnaha steelhead. We report on juvenile steelhead rearing and release activities for the 1998 and 1999 brood years (BY) released in 1999 and 2000, respectively. Included are collection, spawning, and adult characteristics for the 1999 and 2000 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

## RESULTS AND DISCUSSION

### Juveniles

#### *1999*

Wallowa egg-to-embryo survival for the 1998 BY was 90.1%, within the range of recent brood years (1993-1997 BY range of 71.8-91.6%), and embryo-to-smolt survival was 93.6%, also within the range of recent brood years (1993-1997 BY range of 87.6-100%). Imnaha egg-to-embryo survival for the 1998 BY was 83.0%, within the range of recent brood years (1993-1997 BY range of 76.7-90.8%), whereas Imnaha embryo-to-smolt survival was 87.8%, lower than in the recent past (1993-1997 BY range of 88.3-100%; Table 1). We surpassed both our Wallowa stock production goal of 1,350,000 smolts and our Imnaha stock production goal of 330,000 smolts in 1997. To evaluate different rearing and release strategies, we marked and released eight groups of Wallowa stock steelhead and three groups of Imnaha stock steelhead with adipose-left ventral clips and coded-wire-tags (AdLV and CWT) and one group of Imnaha stock presmolts with adipose clips and coded-wire-tags (Ad and CWT; Tables 2 & 3). We marked 98.5% of Wallowa stock smolts and 98.4% of Imnaha stock smolts with an adipose fin clip, with the target being 100%, which was slightly below the range in recent years (1993-1997 BY range of 98.7-99.6%). Fin clip quality and tag retention for experimental groups averaged 98.2% for Wallowa and 96.9% for Imnaha stocks, which is in the program's range in recent years (1993-1997 BY range of 93.8-99.2%). We marked 98.3% of Imnaha stock presmolts with an adipose fin clip, and fin clip quality and tag retention for presmolts averaged 97.7%. Details of experimental and production releases for the 1998 BY are shown in Tables 4-5. Release information for 1999 BY presmolts released in the Imnaha Basin in 1999 is shown in Table 6.

#### *2000*

Egg-to-embryo survival for Wallowa stock for the 1999 BY was 90.3%, within the range of recent brood years (1993-1998 BY range of 71.8-91.6%), and embryo-to-smolt survival was 86.5%, which is lower than recent years (1993-1998 BY range of 87.6-100%). Imnaha egg-to-embryo and embryo-to-smolt survival of 85.1% and 90.9%, respectively, were within past ranges (1993-1998 BY ranges: egg-to-embryo 76.7-90.8%, embryo-to-smolt 87.8-100%; Table 7). The smolt production goal for Wallowa stock was reduced to 870,000 for the 1999 BY in response to recommendations contained in the NOAA hatchery biological opinion. We achieved our smolt production goals of 870,000 Wallowa stock smolts and nearly reached the production goal of 330,000 Imnaha stock smolts, releasing only 889,909 Wallowa stock smolts and 328,213 Imnaha stock smolts. We released an additional 93,680 Imnaha stock presmolts into the Imnaha system

in 2000. To evaluate the influence of forced versus volitional release on smolt-to-adult survival and to monitor survival of major production releases, we marked (AdLV and CWT) eight groups of Wallowa stock and three groups of Imnaha stock smolts (Table 8). We marked 99.0% of the smolts released in the Grande Ronde and 98.7% of the smolts released in the Imnaha basins with an adipose fin clip. Fin clip quality and tag retention of experimental groups averaged 91.7% for Wallowa stock and 93.5% for Imnaha stock, which is below the program's range in the recent past (1993-1998 BY range of 93.8-99.3%). Release information for production and experimental releases of 1999 BY are presented in Tables 9 and 10. Release information for 2000 BY presmolts released in 2000 is presented in Table 11.

## Adults

### 1999

The weirs were installed on January 25<sup>th</sup> at Big Canyon Facility, February 17<sup>th</sup> at Wallowa Fish Hatchery and February 26<sup>th</sup> at Little Sheep Creek (Table 12). Returns to Little Sheep Creek Facility were predominately hatchery fish and only 11 natural fish returned. Similar to Little Sheep Creek, most of the adults that returned to Big Canyon Facility were hatchery origin and only 39 natural fish returned. Natural fish returned over the same time period as hatchery fish, but few natural adult returns make run timing comparisons difficult. It appears a higher proportion of hatchery steelhead returned to the Big Canyon facility early in the run season compared to natural adults. The majority of hatchery adults that returned to Wallowa Fish Hatchery, Big Canyon and Little Sheep Creek spent one year in the ocean (Table 13). More natural two-ocean than one-ocean fish returned to the Wallow Hatchery (2 of 2) and the Little Sheep Creek trap (7 of 11), and approximately equal numbers of one-ocean and two-ocean natural steelhead returned to the Big Canyon facility (20 and 19, respectively).

The majority of hatchery adults that returned to Wallowa Fish Hatchery in 1999 were retained for spawning (Table 13). In 1999, no Big Canyon hatchery returns were needed for the Grande Ronde steelhead hatchery program due to the large number of adults returning to Wallowa Hatchery. We outplanted 283 hatchery adults to local ponds for harvest opportunity. At Big Canyon all 39 natural fish and no hatchery fish were passed above the weir to spawn naturally. We retained 65% of the hatchery fish and 55% of the natural fish for spawning at Little Sheep Creek, and outplanted 42 adults to Big Sheep Creek. Five natural fish not retained for spawning and 75 hatchery adults were released above the weir to spawn naturally, resulting in 94% of fish above the weir at Little Sheep Creek being of hatchery origin. Length-at-age data for Wallowa stock adults are presented in Figure 1 and Imnaha stock adult data are presented in Figure 2.

We exceeded our egg take goals for both Wallowa and Imnaha stocks in 1999. The percent mortality from green egg-to-eyed embryo ranged from 6-12% for Wallowa stock from 10 weekly spawns, and from 1-28% for Imnaha stock from 10 weekly spawns (Table 14). Over the last five brood years (1994-98 BY), the range of green egg-to-embryo mortality was 1-29% for Wallowa stock and 1-57% for Imnaha stock.

### 2000

Weirs were installed on January 20<sup>th</sup> at the Big Canyon facility, February 16<sup>th</sup> at Wallowa Fish Hatchery and February 23<sup>rd</sup> at Little Sheep Creek (Table 15). Hatchery fish comprised 85% of the returns to Little Sheep Creek with 77 natural fish. Adults that returned to Big Canyon were 87% hatchery origin with 50 natural fish. At Wallowa Fish Hatchery, hatchery fish

comprised 99.1% of the returns with only 9 natural fish. Typical of most years, the majority of hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon were fish that spent one year in the ocean (Table 16). More one-ocean than two-ocean natural fish returned to Wallowa Hatchery, the Big Canyon facility and the Little Sheep Creek trap in 2000.

All adult returns to Wallowa Fish Hatchery in 2000 were retained for spawning (Table 16). Of the adult returns to Big Canyon, we outplanted 71 fish to local ponds for harvest opportunity. We passed all 50 natural fish and no hatchery fish above the weir at Big Canyon for natural production. We retained 196 of 445 hatchery fish (44%) and 31 of 77 natural fish (40%) at Little Sheep Creek for spawning, and outplanted 119 fish to Big Sheep Creek. Hatchery fish comprised 74% of the adults released above the weir to spawn naturally. Length-at-age data for Wallowa stock adults are presented in Figure 3, and Imnaha stock data are presented in Figure 4.

Egg take goals for both Wallowa and Imnaha stocks were exceeded in 2000 (Table 17). The percent mortality from green egg to eyed embryo ranged from 5-19% for Wallowa stock from 10 weekly spawns and ranged from 3-30% for Imnaha stock from eight weekly spawns. Over the last six brood years (1994-99 BY), the range of green egg-to-embryo mortality was 1-29% for Wallowa stock and 1-57% for Imnaha stock.

### **Experimental group returns**

The number of coded-wire-tagged and adipose clipped adults that were harvested and returned to recapture sites were used to estimate various performance parameters. These numbers allow us to monitor our success toward meeting the LSRCP goals, to estimate straying rates, and to determine contributions to recreational, tribal, and commercial fisheries. They also provide the basis for the evaluation of the success of experimental rearing and release strategies. The number of recoveries for each CWT code were summarized from the CWT recovery database maintained by PSMFC, ODFW's CWT recovery database, and from data reported by the Washington Department of Fish and Wildlife and Idaho Department of Fish and Game. We enumerated the actual number of coded-wire tagged fish that returned to each hatchery facility. Our protocol was to collect all fish marked with a CWT when they were spawned or died.

#### *1999*

Adult returns from the 1994-1996 brood years occurred in 1999. Wallowa and Imnaha adults that returned in 1999 were from groups released to evaluate the survival benefits of acclimation (Big Canyon and Little Sheep 1994 & 1995 BY), forced versus volitional release strategies (Wallowa 1995 & 1996 BY and Big Canyon 1996 BY), and growth rates during rearing (Big Canyon and Little Sheep 1996 BY). We had Wallowa stock recoveries from 15 CWT codes (Table 18) and Imnaha stock recoveries from seven CWT codes (Table 19).

#### *2000*

Adult returns from the 1995-1997 brood years occurred in 2000. Wallowa and Imnaha stock adults that returned in 2000 were from releases to evaluate the benefits of acclimation (Big Canyon and Little Sheep 1995 BY), forced versus volitional release strategies (Wallowa 1995-1997 BY and Big Canyon 1996 & 1997 BY), growth rates during rearing (Big Canyon and Little Sheep 1996 BY), and rearing density (Little Sheep 1997 BY). We had Wallowa stock recoveries from 19 CWT codes (Table 20) and Imnaha stock recoveries from six CWT codes (Table 21).

## Compensation goals

Goals for returns to the compensation area are 9,184 adults for the Grande Ronde Basin (Wallowa stock) and 2,000 adults 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.

### *1998-1999 run year*

For the Wallowa stock, we estimated that in the 1998-99 run year, 5,625 hatchery origin adults returned to the compensation area (Table 22). This represented 61.2% of the compensation goal. For the Imnaha stock, we estimated that 651 hatchery origin adults returned to the compensation area, or 32.6% of the compensation goal.

### *1999-2000 run year*

For the Wallowa stock, we estimated that in the 1999-00 run year, 3,887 hatchery origin adults returned to the compensation area, representing 42.3% of the compensation goal (Table 23). For the Imnaha stock, we estimated that 567 adults returned to the compensation area, accounting for 28.4% of the compensation goal.

There are three principle factors that influence success in meeting the compensation goal: number of smolts released for the brood years that produced the adults; smolt-to-adult survival; and capture of fish below the compensation area in fisheries and as strays. Over the history of the LSRCP project, we have only reached our compensation goal once (1997-98 run year) for the Wallowa program, and have yet to reach our compensation goal for the Imnaha program. For both the Grande Ronde and Imnaha programs we have met our smolt production goals in most years. Returns in the 1998-1999 run year represented completed returns for the 1994 BY. Returns in the 1999-2000 run year represented the final returns of the 1995 BY. Total smolt-to-adult survival rates for the 1994 BY Wallowa and Imnaha stocks were 0.63% and 0.50%, respectively. For the 1995 BY, Wallowa and Imnaha stocks smolt-to-adult survival rates were 0.79% and 0.39%, respectively (Figure 5). Beginning with the 1987 BY, when we began meeting our smolt production goals, we have met our SAR goal for Wallowa stock of 0.68% in four out of the last nine complete brood years, and only met our SAR goal for Imnaha stock of 0.61% in two of nine brood years, suggesting low smolt-to-adult survival may be the primary factor for rarely achieving our compensation goals. For the Wallowa stock, 15.5% of the recoveries for the 1998-1999 run year occurred downstream of the compensation area, and for the 1999-2000 run year, 25.5% occurred downstream (Tables 22 & 23). A larger proportion of Imnaha stock were recovered downstream of the compensation area; 19.7% for the 1998-1999 run year and 34.5% for the 1999-2000 run year.

The Imnaha steelhead supplementation program allows us to evaluate and compare productivity (progeny produced per parent) of hatchery fish and naturally spawning fish. Progeny-per-parent ratios for naturally spawning fish have been below 1.0 for completed brood years 1987-1995 (Figure 6). Hatchery fish progeny-per-parent ratios (weir returns only) have been above 1.0 for all brood years except 1991 and 1992. Hatchery rates exceeded natural rates for all brood years except 1991. One purpose of the supplementation program is to enhance or stabilize natural fish abundance. Annual abundance of naturally-produced fish has been highly variable; despite the largest natural return in 1999-2000 in the last seven run years, we have not



observed an increasing trend in the abundance of natural fish as a result of supplementation (Figure 7).

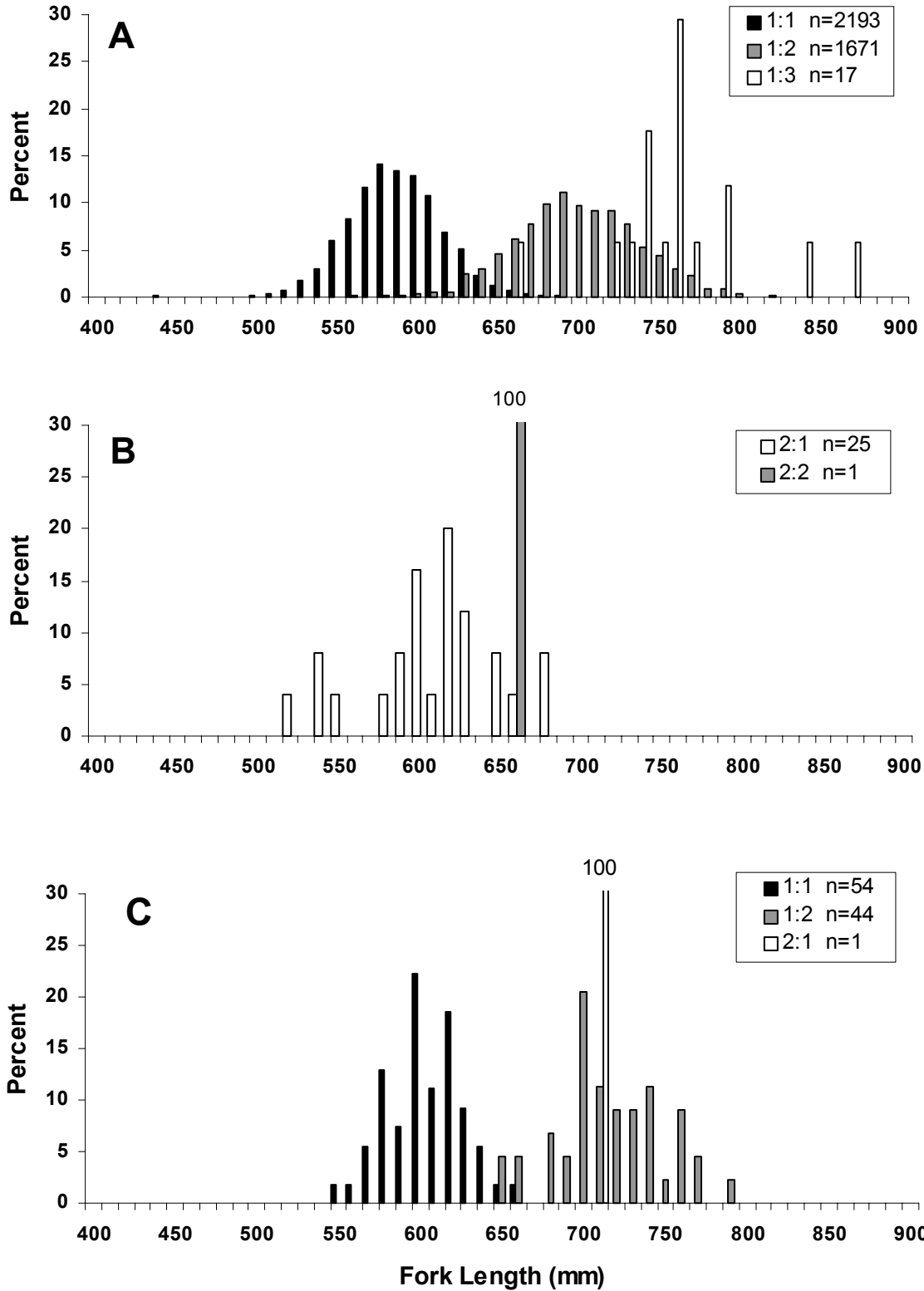


Figure 1. Length-at-age relationships based on scale analysis for Wallowa stock summer steelhead for A and B) 1991-1998 and C) 1999 adult returns. Numbers above bars represent percent for those bars.

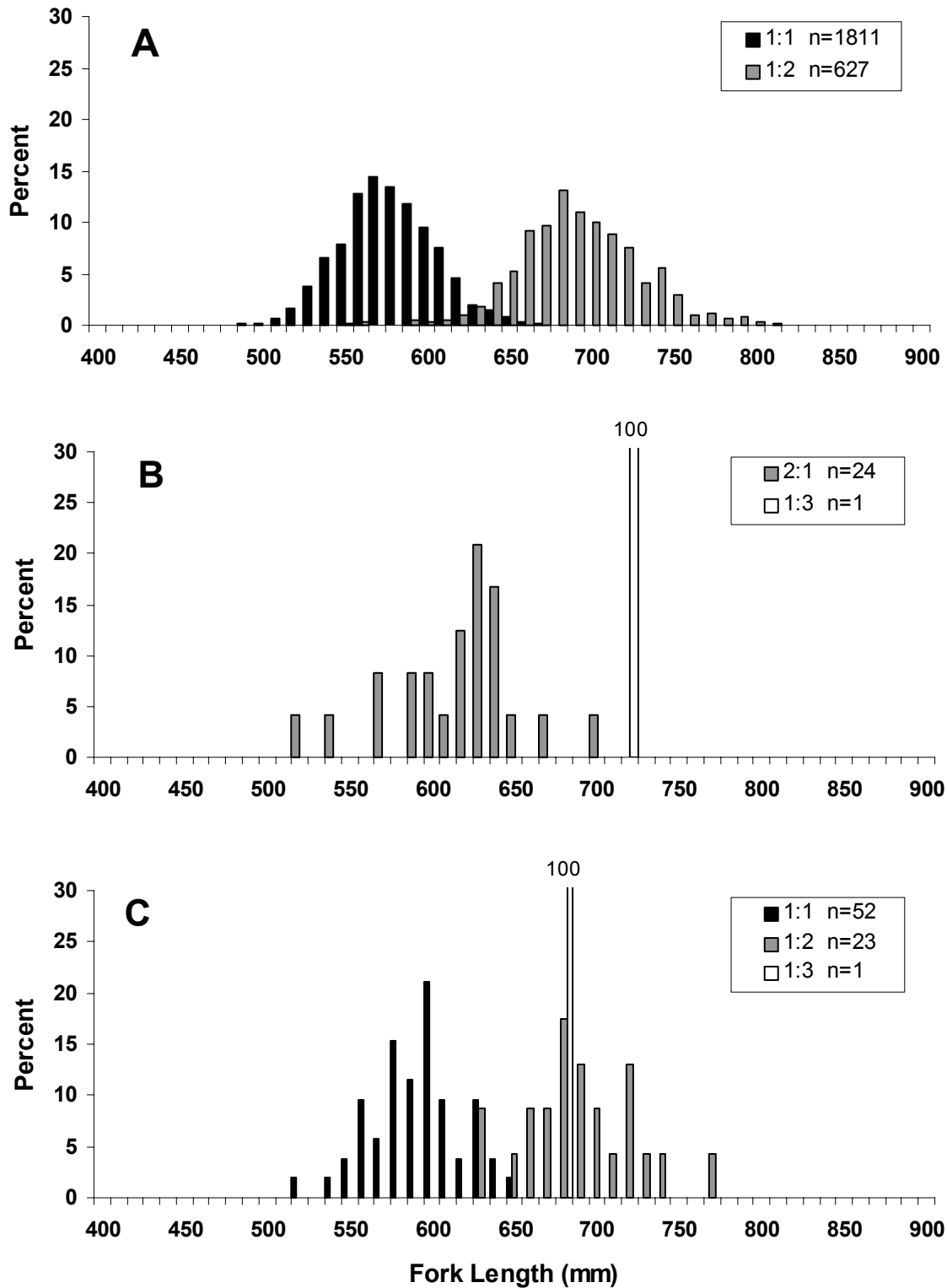


Figure 2. Length-at-age relationships based on scale analysis for Imnaha stock summer steelhead for A and B) 1991-1998 and C) 1999 adult returns. Numbers above bars represent percent for those bars.

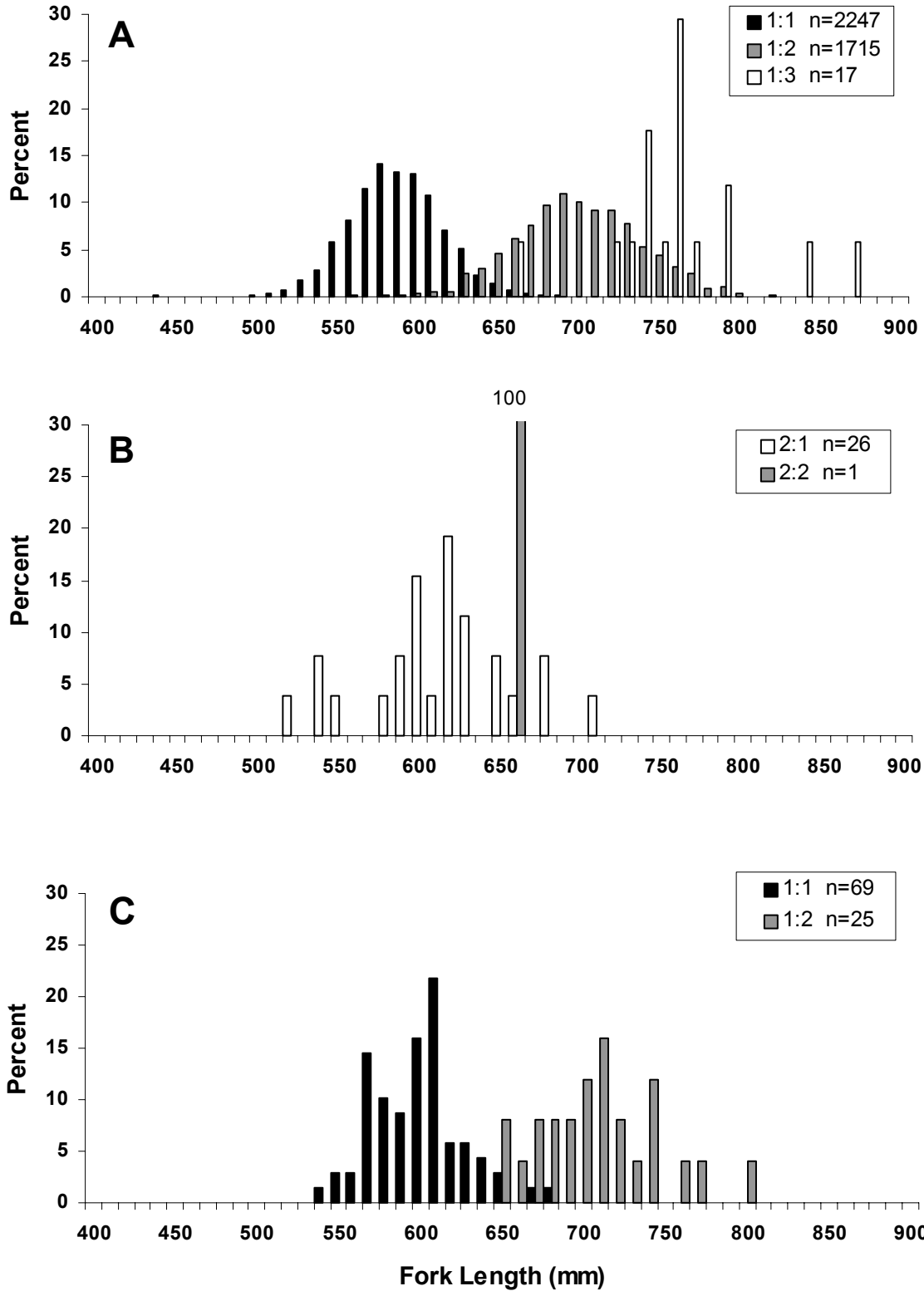


Figure 3. Length-at-age relationships for Wallowa stock summer steelhead for A and B) 1991-1999 and C) 2000 adult returns. Number above bar represents percent for that bar.

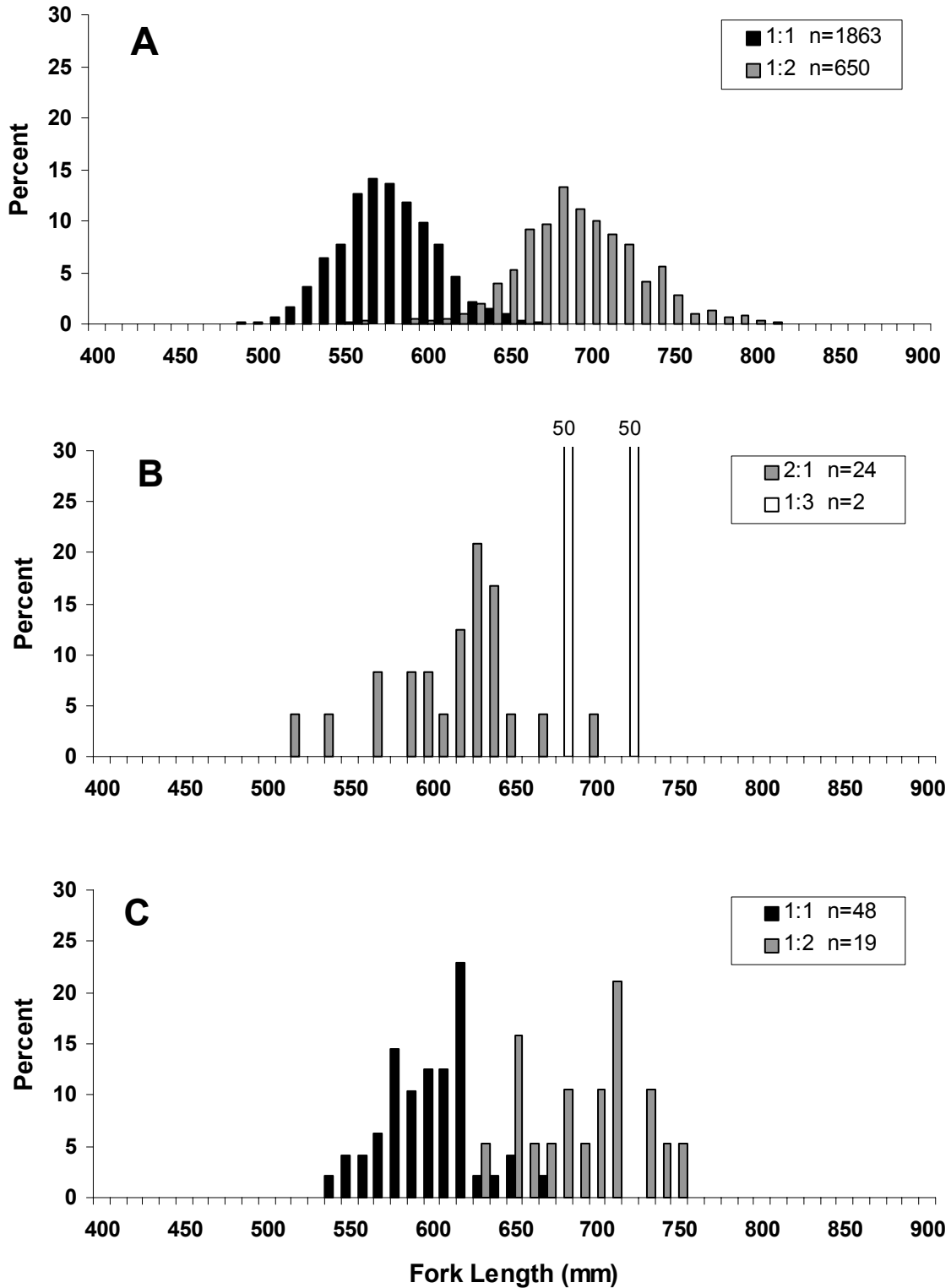


Figure 4. Length-at-age relationships for Imnaha stock summer steelhead for A and B) 1991-1999 and C) 2000 adult returns. Numbers above bars represent percent for those bars.

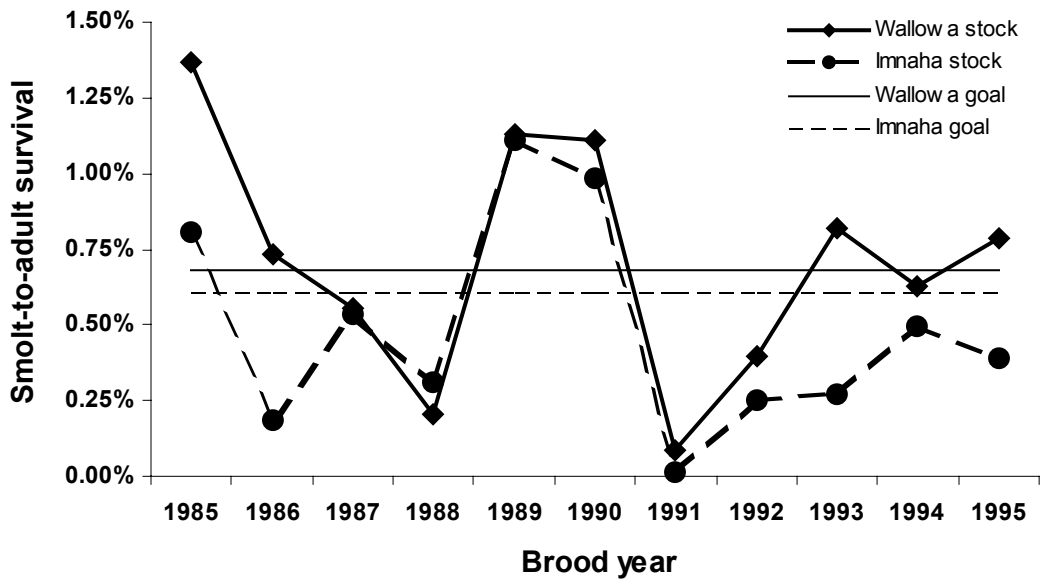


Figure 5. Smolt-to-adult survival for Wallowa and Imnaha stock summer steelhead, brood years 1985-1995. The Wallowa SAR goal is 0.68% and the Imnaha SAR goal is 0.61%.

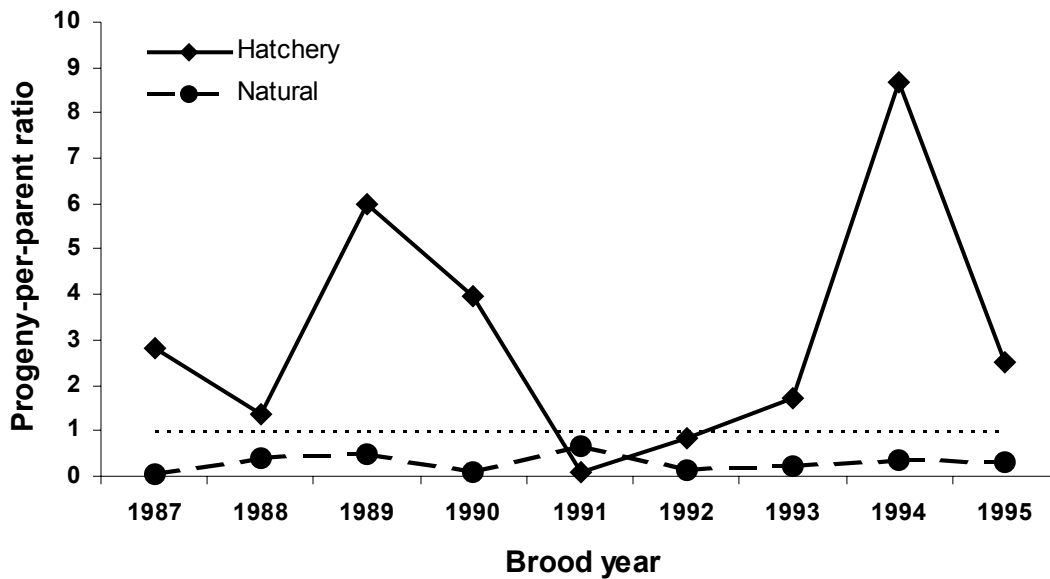


Figure 6. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, brood years 1987-1995. Dashed line represents a progeny-to-parent ratio of one (replacement).

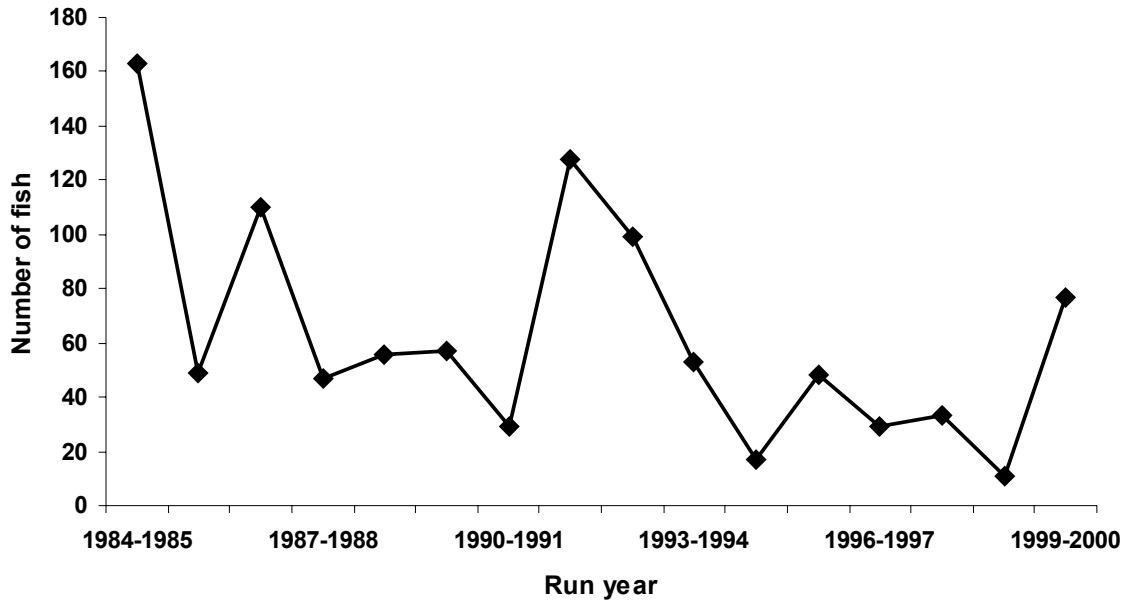


Figure 7. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 1999-00

Table 1. Summary of egg collection and juvenile survival for 1998 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 1999. Eyed embryos are fertilized eggs with pigmented eyes visible through the egg shell.

Stock	Number of eggs taken	Eyed embryos	Total fish released	Estimated survival rate	
				Egg-to-embryo <sup>a</sup>	Embryo-to-smolt <sup>b</sup>
Wallowa	2,883,300	2,598,100 <sup>c</sup>	1,377,454 <sup>d</sup>	90.1	93.6
Imnaha	1,690,529 <sup>e</sup>	860,240 <sup>f</sup>	334,672	83.0	87.8

<sup>a</sup> Eggs that were transferred to Nez Perce Tribe and not incubated at Wallowa Fish Hatchery were subtracted from the calculation of egg-to-embryo survival.

<sup>b</sup> Embryos that were culled from production or transferred to the Nez Perce Tribe and not incubated and reared at Irrigon Fish Hatchery were subtracted from the calculation of embryo-to-smolt survival.

<sup>c</sup> Includes 1,126,425 embryos that were euthanized as gradeouts or as excess to program needs.

<sup>d</sup> Includes 2,573 fish held back and reared as rainbow trout in Kinney Lake.

<sup>e</sup> Includes 654,189 eggs that were transferred to NPT for off-site rearing on the lower Imnaha River.

<sup>f</sup> Includes 479,024 embryos that were either transferred to NPT(468,090 eyed embryos), euthanized as gradeouts (5,919 fish), or outplanted as pre-smolts into Big Sheep Creek (5,015 fish).

Table 2. Estimates of fin clip quality and coded-wire tag retention for 1998 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 1999. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose clipped and target size at release was 5 fish per pound. For experimental groups, targets for both stocks were 100% AdLV+CWT.

Experimental Group	Tag code	Number checked	CWT +LV	CWT + no LV	No CWT + LV	Ad	No Ad
<i>Wallowa stock</i>							
Forced, 3	092601	258	98.8	1.2	0.0	98.7	1.3
Volitional, 5	092602	272	98.9	0.7	0.4	98.8	1.2
Forced, 19	092606	226	98.7	0.9	0.4	97.4	2.6
Volitional, 21	092605	213	98.1	1.9	0.0	98.2	1.8
Volitional, 13	092562	265	98.4	0.8	0.8	98.8	1.2
Forced, 11	092563	253	96.8	2.0	1.2	98.4	1.6
Volitional, 25	092603	212	98.6	0.0	1.4	99.7	0.3
Forced, 23	092604	285	97.5	1.8	0.7	97.9	2.1
Average		248	98.2	1.2	0.6	98.5	1.5
<i>Imnaha stock</i>							
Graded large, 31	092560	197	98.5	0.5	1.0	98.6	1.4
Graded medium, 29	092634	251	96.8	2.4	0.8	<sup>a</sup>	<sup>a</sup>
Graded small, 27	092561	306	95.4	2.9	1.6	98.1	1.9
Average		251	96.9	1.9	1.1	98.4	1.6

<sup>a</sup> CWT codes 092560 and 092634 were held in the same acclimation pond and were not distinguishable based on an external mark.

Table 3. Estimate of fin clip quality and coded-wire tag retention for 1999 brood year, Imnaha stock summer steelhead presmolts reared at Irrigon Fish Hatchery and released in 1999 in the Imnaha Basin. Experimental group indicates treatment. Targets for presmolts were 100% adipose clipped and target size at release was 125.0 fish per pound. For experimental fish, target was 100% Ad+CWT.

Experimental Group	Tag code	Number checked	CWT +Ad	CWT + no Ad	No CWT + Ad	Ad	No Ad
Presmolt	092706	473	97.7	1.7	0.6	98.3	1.7



Table 4. Details of experimental and production groups of 1998 brood year, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 1999. Experimental group indicates release strategy and rearing raceway number(s). All production, volitional, and forced groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

Experimental group <sup>a</sup>	FPP	Release date	Release location <sup>b</sup>	CWT code	Length mm	Weight g	Condition factor	Total fish released	Percent survival to LGD <sup>c</sup>
Direct Stream, 14,17-18	4.7	April 6-7	Gr. Ronde R.	-	200 (17)	-	-	126,995	-
Volitional, 5	4.5	April 1-15	Spring Cr.	092602	212 (18)	100.2 (26.7)	1.01 (0.15)	26,159	62.0
Forced, 3	4.2	March 31	Spring Cr.	092601	214 (18)	109.1 (29.0)	1.06 (0.06)	25,947	57.3
Direct Stream, 12,14-16		April 5-6	Spring Cr.	-	204 (20)	-	-	138,417	-
Production, 1-9	4.5	March 31- April 15	Spring Cr.	-	215(18)	101.5 (240.3)	1.04 (0.06)	383,360	-
Volitional, 21	5.1	May 13-28	Spring Cr.	092605	208 (16)	88.9 (20.7)	1.00 (0.07)	26,070	83.3
Forced, 19	5.4	May 12	Spring Cr.	092606	204 (16)	84.4 (19.2)	0.97 (0.06)	25,317	70.4
Production, 17,19-22,26	5.0	May 12-28	Spring Cr.	-	208 (17)	91.2 (24.3)	1.00 (0.06)	175,042	-
Volitional, 13	4.7	April 8-21	Deer Cr.	092562	208 (16)	92.1 (21.9)	0.99 (0.06)	25,480	59.1
Forced, 11	4.8	April 7	Deer Cr.	092563	206 (19)	94.1 (25.9)	1.06 (0.07)	25,247	60.2
Production, 9-13	4.6	April 8-21	Deer Cr.	-	209 (17)	98.2 (23.0)	1.06 (0.06)	188,529	-
Volitional, 25	4.9	May 20- June 3	Deer Cr.	092603	208 (16)	92.1 (21.9)	0.99 (0.06)	26,234	81.7
Forced, 23	5.0	May 19	Deer Cr.	092604	206 (16)	88.9 (24.3)	0.99 (0.05)	25,275	86.8
Production, 22-26	5.1	May 19- June 3	Deer Cr.	-	207 (17)	88.8 (21.7)	0.98 (0.07)	156,809	-
Total released <sup>d</sup>								1,374,881	

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW). The Spring Creek direct stream release group was hauled to the Wallowa Hatchery lower acclimation pond which leads directly into Spring Creek.

<sup>b</sup> Gr. Ronde R. indicates direct stream releases in the upper Grande Ronde River at river mile 164-170.

<sup>c</sup> Percent survival of PIT tag release groups to Lower Granite Dam is Cormack-Jolly-Seber estimates of survival probabilities from the SURPH.2 program (Lady et al. 2001). Additional PIT tag detections from fish tagged during the volitional release period include 48.5% early migrants and 53.5% non-migrants (fish remaining in raceway after two weeks) at Spring Creek in April, 53.1% and 26.3% at Spring Creek in May, 49.5% and 55.0% at Deer Creek in April, and 69.5% and 19.2% at Deer Creek in May.

<sup>d</sup> Wallowa stock steelhead sex ratio was 46% male and 54% female.

Table 5. Details of experimental and production groups of 1998 brood year, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 1999. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

Experimental group <sup>a</sup>	FPP	Release date	Release location	CWT code	Length mm	Weight g	Condition factor	Total fish Released	Percent survival to LGD <sup>b</sup>
Graded large, 31	4.7	April 13	L. Sheep Cr.	092560	204 (15)	97.5 (19.6)	1.08 (0.06)	25,459	75.4
Graded medium, 29	4.7	April 13	L. Sheep Cr.	092634	<sup>c</sup>	<sup>c</sup>	<sup>c</sup>	26,175	63.8
Production, 29-32	4.6	April 13	L. Sheep Cr.	-	204 (17)	97.6 (19.5)	1.11 (0.08)	163,660	-
Graded small, 27	5.4	May 18	L. Sheep Cr.	092561	203 (16)	83.9 (20.7)	1.00 (0.06)	24,936	71.5
Production, 27-28	5.7	May 18	L. Sheep Cr.	-	197 (20)	79.8 (25.6)	1.02 (0.06)	94,442	-
Total released								334,672	

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW).

<sup>b</sup> Percent survival of PIT tag release groups to Lower Granite Dam is Cormack-Jolly-Seber estimates of survival probabilities from the SURPH.2 program (Lady et al. 2001).

<sup>c</sup> CWT codes 092560 and 092634 were held in the same acclimation pond and were not distinguishable based on an external mark.

Table 6. Details of 1999 brood year, Imnaha stock hatchery summer steelhead released as presmolts in the Imnaha River Basin in 1999. Experimental group indicates release strategy. All fish were direct stream released. Standard deviations are shown in parentheses. FPP indicates fish per pound.

Experimental group <sup>a</sup>	FPP	Release date	Release location	CWT code	Length mm	Total fish released
Presmolt	125.0	November 9	B. Sheep Cr.	-	59 (5)	90,000
Presmolt	125.0	November 10	L. Sheep Cr.	092706	63 (5)	58,581
Presmolt	125.0	November 10	L. Sheep Cr.	-	63 (5)	1,395
Total released						149,976

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW).

Table 7. Summary of egg collection and juvenile survival for 1999 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2000. Eyed embryos are fertilized eggs with pigmented eyes visible through the egg shell.

Stock	Number of eggs taken	Eyed embryos	Total fish released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt <sup>a</sup>
Wallowa	2,482,381	2,241,150 <sup>b</sup>	891,978 <sup>c</sup>	90.3	86.5
Imnaha	606,740	516,190 <sup>d</sup>	328,213	85.1	90.9

<sup>a</sup> Embryos that were culled from production and not incubated and reared at Irrigon Fish Hatchery were subtracted from the calculation of embryo-to-smolt survival.

<sup>b</sup> Includes 1,209,756 embryos excess to program needs that were either euthanized (1,181,150 eyed embryos) or outplanted as gradeouts (28,606 fish) to Phillips Reservoir (Baker County).

<sup>c</sup> Includes 2,069 fish held back and reared as rainbow trout in Kinney Lake.

<sup>d</sup> Includes 154,986 embryos excess to program needs that were outplanted as presmolts into Little Sheep and Big Sheep creeks.

Table 8. Estimates of fin clip quality and coded-wire tag retention for 1999 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2000. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose clipped and target size at release was 5 fish per pound. For experimental fish, targets for both stocks were 100% AdLV+CWT.

Experimental group	Tag code	Number checked	CWT +LV	CWT + no LV	No CWT + LV	Ad	No Ad
<i>Wallowa stock</i>							
Production, 3	092930	503	94.4	4.0	1.6	99.0	1.0
Production, 5	092931	506	89.9	6.3	3.8	98.0	2.0
Forced, 17	092932	509	95.5	3.5	1.0	99.3	0.7
Volitional, 18	092933	446	87.4	11.2	1.4	99.7	0.3
Production, 7	092934	515	89.3	6.6	4.1	99.3	0.7
Production, 9	092935	461	87.4	7.2	5.4	100.0	0.0
Forced, 19	092936	499	98.4	1.2	0.4	97.7	2.3
Volitional, 20	092937	508	91.3	8.1	0.6	99.0	1.0
Average		493	91.7	6.0	2.3	99.0	1.0
<i>Imnaha stock</i>							
Production, 23	092928	477	94.4	4.8	0.8	98.0	2.0
Production, 25	092929	500	89.6	10.0	0.4	100.0	0.0
Production, 21	092927	500	96.6	3.4	0.0	98.0	2.0
Average		492	93.5	6.1	0.4	98.7	1.3

Table 9. Details of experimental and production groups of 1999 brood year, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 2000. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

Experimental group <sup>a</sup>	FPP	Release date	Release location	CWT Code	Length mm	Weight g	Condition Factor	Total fish released	Percent survival to LGD <sup>b</sup>
Forced, 3	4.3	April 5	Spring Cr.	092930	215 (20)	104.5 (31.9)	1.04 (0.06)	22,559	79.0
Forced, 5	3.9	April 6	Spring Cr.	092931	218 (17)	117.3 (30.4)	1.05 (0.05)	24,260	72.8
Production, 2-6, 11, 12	4.0	April 5-6	Spring Cr.	-	218 (19)	113.1 (29.0)	1.06 (0.06)	316,696	-
Volitional, 17	4.3	May 4-18	Spring Cr.	092932	217 (18)	106.3 (28.5)	0.98 (0.07)	26,066	68.2
Forced, 18	4.3	May 3	Spring Cr.	092933	217 (18)	106.1 (26.1)	1.03 (0.06)	23,690	57.3
Production, 13-15, 17,18	4.0	May 3-18	Spring Cr.	-	221 (17)	114.6 (29.4)	1.00 (0.06)	162,935	-
Forced, 7	4.0	April 12	Deer Cr.	092934	216 (19)	114.0 (31.2)	1.09 (0.08)	23,741	72.0
Forced, 9	4.0	April 13	Deer Cr.	092935	217 (19)	114.2 (31.5)	1.07 (0.06)	23,913	62.6
Production, 7-10	4.2	April 12-13	Deer Cr.	-	215 (19)	108.6 (27.0)	1.06 (0.05)	131,001	-
Volitional, 19	4.1	May 11-25	Deer Cr.	092936	218 (17)	111.3 (30.3)	1.01 (0.13)	25,915	65.2
Forced, 20	4.0	May 10	Deer Cr.	092937	219 (17)	113.0 (26.0)	1.03 (0.08)	24,050	52.9
Production, 16,19,20	4.0	May 10-25	Deer Cr.	-	223 (19)	113.2 (39.3)	0.99 (0.07)	85,083	-
Total released <sup>c</sup>								889,909	

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW).

<sup>b</sup> Percent survival of PIT tag release groups to Lower Granite Dam is Cormack-Jolly-Seber estimates of survival probabilities from the SURPH.2 program (Lady et al. 2001).

<sup>c</sup> Wallowa stock steelhead sex ratio (May releases only) was 53% male and 47% female. Male releases (May release at Spring Cr. only) were 0.0 % precocial.

Table 10. Details of experimental and production groups of 1999 brood year, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 2000. Experimental group indicates release strategy and rearing raceway number(s). All production and forced released groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

Experimental group <sup>a</sup>	FPP	Release date	Release location	CWT code	Length mm	Weight g	Condition factor	Total fish released	Percent survival to LGD <sup>b</sup>
Direct stream, 27,28	5.2	April 18-20	B. Sheep Cr.	-	204 (19)	-	-	100,007	-
Forced, 21	4.4	April 12	L. Sheep Cr.	092927	212 (20)	104.4 (27.4)	1.05 (0.06)	25,826	64.5
Forced, 23	4.4	April 12	L. Sheep Cr.	092928	<sup>c</sup>	<sup>c</sup>	<sup>c</sup>	25,098	59.4
Production, 21-24	4.4	April 12	L. Sheep Cr.	-	208 (24)	103.2 (33.4)	1.04 (0.06)	110,658	-
Forced, 25	4.0	May 10	L. Sheep Cr.	092929	224 (21)	113.4 (37.3)	0.99 (0.08)	23,869	43.2
Production, 25,26	4.4	May 10	L. Sheep Cr.	-	220 (22)	102.9 (33.6)	0.97 (0.06)	42,755	-
Total released								328,213	

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW). Beginning with the 1998 brood and continuing with the 1999 brood, embryos that were in excess to program needs were outplanted as presmolts.

<sup>b</sup> Percent survival of PIT tag release groups to Lower Granite Dam is Cormack-Jolly-Seber estimates of survival probabilities from the SURPH.2 program (Lady et al. 2001).

<sup>c</sup> CWT codes 092927 and 092928 were held in the same acclimation pond and were not distinguishable based on an external mark.

Table 11. Details of 2000 brood year, Imnaha stock hatchery summer steelhead released as presmolts in the Imnaha River Basin in 2000. Experimental group indicates release strategy. All fish were direct stream released. FPP indicates fish per pound.

Experimental group <sup>a</sup>	FPP	Release date	Release location	Fin Clip	Total fish released
Presmolt	103.0	November 6	B. Sheep Cr.	Ad	93,680
Total fish released					93,680

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW)

Table 12. Timing of adult steelhead returns to LSRCP facilities in 1999 by location and origin.

Period	Week of the year	Number of fish trapped <sup>a</sup>					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Jan 22-28	4	-	-	0	0	-	-
Jan 29-Feb4	5	-	-	0	0	-	-
Feb 05-11	6	-	-	0	0	-	-
Feb 12-18	7	-	-	0	0	-	-
Feb 19-25	8	3	0	0	0	-	-
Feb 26-Mar 04	9	2	0	42	1	0	0
Mar 05-11	10	11	0	8	0	0	0
Mar 12-18	11	95	0	16	1	4	0
Mar 19-25	12	256	2	163	4	66	2
Mar 26-Apr 01	13	220	0	49	3	52	0
Apr 02-08	14	119	0	7	0	41	0
Apr 09-15	15	173	0	12	0	17	0
Apr 16-22	16	126	0	99	11	83	5
Apr 23-29	17	94	0	71	10	44	2
Apr 30-May 06	18	22	0	37	3	11	0
May 07-13	19	26	0	27	0	8	1
May 14-20	20	11	0	21	3	5	1
May 21-27	21	7	0	10	3	1	0
May 27-Jun 03	22	0	0	0	0	0	0
Jun 04-10	23	0	0	0	0	-	-
Total		1165	2	562	39	332	11

<sup>a</sup> Weirs installed January 25<sup>th</sup> at Big Canyon (Deer Cr.) and February 26<sup>th</sup> at Little Sheep, and ladder opened February 17<sup>th</sup> at Wallowa Fish Hatchery. Adult collections stopped June 8<sup>th</sup> at Big Canyon, May 30<sup>th</sup> at Little Sheep, and June 10<sup>th</sup> at Wallowa. Timing of natural fish to Wallowa is unknown so fish were allocated to the week when the most hatchery fish were trapped.

Table 13. Numbers and disposition of adult steelhead that returned to LSRCF facilities in 1999 by stock, origin, age (freshwater:saltwater), and sex. M indicates male and F indicates female.

Stock, Disposition <sup>a</sup>	Hatchery									Natural									Grand Total
	1:1		1:2		1:3		2:1		Total	2:1		2:2		3:1		3:2		Total	
	M	F	M	F	M	F	M	F	Total	M	F	M	F	M	F	M	F	Total	
<i>Wallowa Hatchery (Wallowa stock)</i>																			
Trapped	421	297	99	334	0	0	10	4	1,165	0	0	1	1	0	0	0	0	2	1,167
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	20	35	5	40	0	0	1	0	101	0	0	0	0	0	0	0	0	0	101
Kept	401	262	94	294	0	0	9	4	1,064	0	0	1	1	0	0	0	0	2	1,066
Mortality	2	0	0	3	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5
Spawned	369	218	91	267	0	0	8	4	957	0	0	1	1	0	0	0	0	2	959
Killed <sup>a</sup>	30	44	3	24	0	0	1	0	102	0	0	0	0	0	0	0	0	0	102
Fork Length (mm)	601	603	731	706	-	-	703	-	-	-	-	-	-	-	-	-	-	-	-
Standard deviation	(23)	(24)	(34)	(30)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Big Canyon Facility (Wallowa stock)</i>																			
Trapped	130	169	36	218	1	1	4	3	562	2	6	4	7	4	8	4	4	39	601
Passed	0	0	0	0	0	0	0	0	0	2	6	4	7	4	8	4	4	39	39
Outplanted	37	57	14	69	0	0	3	2	182	0	0	0	0	0	0	0	0	0	182
Kept	93	112	22	149	1	1	1	1	380	0	0	0	0	0	0	0	0	0	380
Mortality	6	5	2	2	0	0	0	0	15	0	0	0	0	0	0	0	0	0	15
Spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killed <sup>a</sup>	87	107	20	147	1	1	1	1	365	0	0	0	0	0	0	0	0	0	365
Fork Length (mm)	587	569	737	696	-	762	-	-	-	-	598	-	635	582	595	640	686	-	-
Standard deviation	(23)	(30)	(27)	(30)	-	-	-	-	-	-	(103)	-	-	(23)	(65)	(46)	(36)	-	-
<i>Little Sheep Creek Facility (Imnaha stock)</i>																			
Trapped	143	117	11	57	0	1	3	0	332	0	2	1	3	1	1	3	0	11	343
Passed	39	27	2	6	0	0	1	0	75	0	1	1	1	0	1	1	0	5	80
Outplanted	23	15	2	2	0	0	0	0	42	0	0	0	0	0	0	0	0	0	42
Kept	81	75	7	49	0	1	2	0	215	0	1	0	2	1	0	2	0	6	221
Mortality	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Spawned <sup>b</sup>	79	75	7	48	0	1	2	0	212	0	1	0	2	1	0	2	0	6	218
Killed	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Fork Length (mm)	594	583	690	685	-	672	-	-	-	-	605	-	-	-	-	-	-	-	-
Standard deviation	(31)	(24)	(48)	(31)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<sup>a</sup> Includes two fish (1 F 1:1 and 1 F 1:2) from Wallowa Hatchery that were transferred to a male kelt fertilization experiment and four fish (2 F 1:1's from Wallowa Hatchery and 2 F 1:2's from Big Canyon Facility) that were transferred to the Life History Characterization study.

<sup>b</sup> Includes all six live-spawned natural fish from Little Sheep that were transferred to the Kelt Reconditioning study.



Table 14. Spawning summaries for summer steelhead at LSRCP facilities in 1999. The percent mortality is from green egg to eyed embryo after shocking.

Spawn date, Lot number	Parental origin <sup>a</sup>	Number of eggs	Eyed embryos <sup>b</sup>	% mortality
<i>Wallowa Hatchery (Wallowa stock)</i>				
3/24, wa340	Hatchery	433,796	392,300	10
3/31, wa341	Hatchery	627,100	552,100	12
4/07, wa342	Hatchery	413,900	387,300	6
4/14, wa343	Hatchery	353,215	321,000	9
4/21, wa344	Hatchery	229,700	201,900	12
4/28, wa345	Hatchery	179,900	164,670	8
5/05, wa346	Hatchery	111,520	101,880	9
5/12, wa347	Hatchery	82,100	73,100	11
5/19, wa348	Hatchery	28,200	26,200	7
5/25, wa349	Hatchery	22,950	20,700	10
Total		2,482,381	2,241,150	10
<i>Little Sheep Creek Facility (Imnaha stock)</i>				
3/30, li350	Hatchery	13,590	12,050	11
4/06, li351	Hatchery	24,192	24,730	15
4/06, li351	Mixed	4,838	-	-
4/13, li352	Hatchery	77,836	63,690	22
4/13, li352	Mixed	4,324	-	-
4/20, li353	Hatchery	109,930	90,120	18
4/27, li354	Hatchery	231,720	216,230	9
4/27, li354	Mixed	4,930	-	-
5/04, li355	Hatchery	46,390	38,230	18
5/11, li356	Hatchery	40,000	32,600	28
5/11, li356	Mixed	5,000	-	-
5/18, li357	Hatchery	26,740	23,500	12
5/25, li358	Hatchery	4,720	7,340	22
5/25, li358	Mixed	4,720	-	-
6/07, li359	Hatchery	3,905	7,700	1
6/07, li359	Mixed	3,905	-	-
Subtotal	Hatchery	579,023	-	-
Subtotal	Mixed	27,717	-	-
Total		606,740	516,190	15

<sup>a</sup> 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.

<sup>b</sup> Includes 931,150 Wallowa stock eyed embryos that were euthanized because they were excess to program needs. Four hundred of these excess eyed embryos were transferred to Union and Wallowa County elementary schools (100 to Willow, 200 to Joseph, and 100 to Wallowa). Eyed embryos were inventoried on 4/22, 4/28-29, 5/6, 5/14, 5/21, 5/27, 6/4, 6/10, and 6/23.

Table 15. Timing of adult steelhead returns to LSRCP facilities in 2000 by location and origin.

Period	Week of the Year	Number of fish trapped <sup>a</sup>					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Jan 15-21	3			-	-		
Jan 22-28	4	-	-	0	0	-	-
Jan 29-Feb4	5	-	-	0	0	-	-
Feb 05-11	6	-	-	0	0	-	-
Feb 12-18	7	-	-	0	0	-	-
Feb 19-25	8	5	0	1	0	-	-
Feb 26-Mar 04	9	30	0	3	0	0	0
Mar 05-11	10	35	0	11	0	3	1
Mar 12-18	11	84	0	10	0	11	0
Mar 19-25	12	89	0	6	1	20	1
Mar 26-Apr 01	13	160	0	41	4	42	3
Apr 02-08	14	137	0	28	6	113	19
Apr 09-15	15	154	9	74	7	128	11
Apr 16-22	16	131	0	55	12	75	26
Apr 23-29	17	80	0	76	12	25	9
Apr 30-May 06	18	44	0	9	0	23	3
May 07-13	19	6	0	8	1	2	2
May 14-20	20	7	0	9	3	2	2
May 21-27	21	3	0	2	2	1	0
May 28-Jun 03	22	1	0	0	0	0	0
Jun 04-10	23	0	0	0	2	0	0
Jun 10-16	24	0	0	0	0	0	0
	Total	966	9	333	50	445	77

<sup>a</sup> Weirs installed January 20<sup>th</sup> at Big Canyon (Deer Cr.) and February 23<sup>rd</sup> at Little Sheep as well as ladder opened February 16<sup>th</sup> at Wallowa Fish Hatchery. Adult collections stopped June 16<sup>th</sup> at Big Canyon, June 5<sup>th</sup> at Little Sheep, and June 12<sup>th</sup> at Wallowa. Timing of natural fish to Wallowa is unknown so fish were allocated to the week when the most hatchery fish were trapped.

Table 16. Numbers and disposition of adult steelhead that returned to LSRCF facilities in 2000 by stock, origin, age (freshwater:saltwater), and sex. M indicates male and F indicates female.

Stock, Disposition <sup>a</sup>	Hatchery									Natural									Grand Total	
	1:1		1:2		1:3		2:1		Total	2:1		2:2		3:1		3:2		4:1		Total
	M	F	M	F	M	F	M	F			M	F	M	F	M	F	M	F	M	
<i>Wallowa Hatchery (Wallowa stock)</i>																				
Trapped	463	359	29	114	0	1	0	0	966	2	0	1	1	2	3	0	0	0	9	975
Passed	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
Kept	463	359	29	114	0	1	0	0	966	2	0	1	1	2	3	0	0	0	9	975
Mortality	2	3	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5
Spawned	376	304	24	110	0	1	0	0	815	2	0	1	1	2	3	0	0	0	9	824
Killed <sup>a</sup>	85	52	5	4	0	0	0	0	146	0	0	0	0	0	0	0	0	0	0	146
Fork Length (mm)	600	582	698	701	-	-	-	-		634	-	-	-	649	634	-	-	-		
Standard deviation	(25)	(24)	(57)	(28)	-	-	-	-		(6)	-	-	-	(1)	(25)	-	-	-		
<i>Big Canyon Facility (Wallowa stock)</i>																				
Trapped	117	123	15	78	0	0	0	0	333	6	4	1	5	17	6	4	6	1	50	383
Passed	0	0	0	0	0	0	0	0	0	6	4	1	5	17	6	4	6	1	50	50
Outplanted	21	26	4	20	0	0	0	0	71	0	0	0	0	0	0	0	0	0	0	71
Kept	96	97	11	58	0	0	0	0	262	0	0	0	0	0	0	0	0	0	0	262
Mortality	1	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killed	95	97	11	57	0	0	0	0	260	0	0	0	0	0	0	0	0	0	0	260
Fork Length (mm)	591	568	731	696	-	-	-	-		-	-	-	-	-	-	-	-	-		
Standard deviation	(30)	(24)	(33)	(32)	-	-	-	-		-	-	-	-	-	-	-	-	-		
<i>Little Sheep Creek Facility (Imnaha stock)</i>																				
Trapped	137	169	22	114	0	3	0	0	445	9	13	0	5	25	16	4	4	1	77	522
Passed	29	44	9	45	0	3	0	0	130	4	5	0	5	16	10	2	3	1	46	176
Outplanted	33	55	3	28	0	0	0	0	119	0	0	0	0	0	0	0	0	0	0	119
Kept	75	70	10	41	0	0	0	0	196	5	8	0	0	9	6	2	1	0	31	227
Mortality	1	2	0	0	0	0	0	0	3	0		0	0	0	1	0	0	0	1	4
Spawned <sup>b</sup>	72	66	10	40	0	0	0	0	188	5	8	0	0	9	5	2	1	0	30	218
Killed	2	2	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5
Fork Length (mm)	605	590	716	683	-	-	-	-		639	595	-	-	607	602	-	-	-		
Standard deviation	(26)	(27)	(17)	(34)	-	-	-	-		-	(20)	-	-	-	(7)	-	-	-		

<sup>a</sup> Includes six fish (six age 1:1 females) that were transferred and used in an egg viability test for the Kelt Reconditioning study, and five fish (two age 1:1 males and three age 1:1 females) that were transferred to the Life History Characterization study.

<sup>b</sup> Includes 13 wild males live spawned then passed above the weir and 11 hatchery males spawned, held as backup males, then passed above the weir. Also includes 19 hatchery males spawned, held as backup males, then outplanted to Big Sheep Creek

Table 17. Spawning summaries for summer steelhead at LSRCP facilities in 2000. The percent mortality is from green egg to eyed embryo after shocking.

Spawn date, Lot number	Parental origin <sup>a</sup>	Number of eggs	Eyed embryos <sup>b</sup>	% mortality
<i>Wallowa Hatchery (Wallowa stock)</i>				
3/22, wa360	Hatchery	117,100	98,300	16
3/29, wa361	Hatchery	371,100	338,700	9
4/05, wa362	Hatchery	355,530	301,700	15
4/12, wa363	Hatchery	438,600	408,300	7
4/19, wa364	Hatchery	347,900	315,800	9
4/26, wa365	Hatchery	226,200	196,900	13
5/03, wa366	Hatchery	106,800	91,300	15
5/10, wa367	Hatchery	56,100	45,400	19
5/17, wa368	Hatchery	14,700	13,800	6
5/23, wa369	Hatchery	12,500	11,900	5
Total		2,046,530	1,822,100	11
<i>Little Sheep Creek Facility (Imnaha stock)</i>				
3/28, li370	Hatchery	58,600	46,000	22
4/04, li371	Hatchery	59,274	53,710	30
4/04, li371	Mixed	16,936	-	-
4/11, li372	Hatchery	104,000	130,780	16
4/11, li372	Mixed	52,000	-	-
4/18, li373	Hatchery	96,233	100,980	13
4/18, li373	Mixed	19,247	-	-
4/25, li374	Hatchery	49,512	66,120	18
4/25, li374	Mixed	31,508	-	-
5/02, li375	Hatchery	44,942	60,210	14
5/02, li375	Mixed	24,968	-	-
5/10, li376	Hatchery	4,130	4,000	52
5/10, li376	Mixed	4,130	-	-
5/23, li377	Hatchery	3,020	2,930	3
Subtotal	Hatchery	419,711	-	-
Subtotal	Mixed	148,789	-	-
Total		568,500	464,730	21

<sup>a</sup> 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.

<sup>b</sup> Includes 342,300 Wallowa stock eyed embryos that were euthanized because they were excess to program needs. Three hundred of these excess eyed embryos were transferred to Wallowa County elementary schools. Eyed embryos were inventoried on 4/20, 4/24, 5/1, 5/8, 5/14, 5/21, 5/24, 5/29, and 6/8.

Table 18. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Willowa stock summer steelhead for the 1998-99 run year. All CWT fish were from releases of hatchery fish into either Deer Creek (at Big Canyon Acclimation facility) or Spring Creek (at Willowa Hatchery). Data was summarized as available through January 2003.

Brood year, release site	Experimental group <sup>a</sup>	CWT code	Recoveries at weirs <sup>b</sup>	Other in-basin recoveries <sup>c</sup>	Out-of-basin recoveries <sup>d</sup>	Total recoveries <sup>e</sup>
1994						
Deer Cr.	Acclimated	075825	2	0	0	2
1995						
Deer Cr.	Acclimated	071159	19	12	44	75
	Acclimated	071160	18	2	15	35
	Direct stream	071161	18	3	43	64
	Direct stream	071162	20	7	30	57
Spring Cr.	Forced	071163	13	0	35	48
	Volitional	071216	12	0	14	26
1996						
Deer Cr.	Forced, (fast/slow)	075330	20	7	21	48
	Forced, (slow/fast)	091825	22	2	37	61
	Volitional, (fast/slow)	091826	28	12	39	79
	Volitional, (slow/fast)	091827	28	30	31	89
Spring Cr.	Forced	091829	29	0	56	85
	Forced	091831	4	0	3	7
	Volitional	091828	23	2	43	68
	Volitional	091830	3	0	9	12
	Grand total of recoveries in 1999		259	77	420	756

<sup>a</sup> Experimental groups include the release (and rearing) strategy. Fast/slow and slow/fast indicates rate of growth experiment during rearing. All releases were targeted for five fish per pound.

<sup>b</sup> Actual number of CWT fish that were released into Spring Cr. and recovered at the Willowa Fish Hatchery weir or released into Deer Cr. 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.

<sup>c</sup> Actual number of CWT fish that were released into Spring Cr. and recovered at the Big Canyon Facility weir or released into Deer Cr. and recovered at the Willowa Fish Hatchery weir plus the estimated number (from creel surveys and harvest card returns) of CWT fish that were harvested in the Grande Ronde River basin fisheries.

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total 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 greater than 24 (because of a low sampling rate) unexpanded data were used.

<sup>e</sup> Estimated total by summing all recoveries.

Table 19. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1998-99 run year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through January 2003.

Brood year	Experimental group <sup>a</sup>	CWT code	Recoveries at weirs <sup>b</sup>	Other in-basin recoveries <sup>c</sup>	Out-of-basin recoveries <sup>d</sup>	Total recoveries <sup>e</sup>
1994	Direct stream	070919	1	0	0	1
1995	Acclimated	071217	3	0	26	29
	Acclimated	071218	8	8	11	27
	Direct stream	071219	2	3	2	7
1996	Direct stream	071220	2	0	0	2
	Slow/Fast growth	091832	17	3	27	47
	Fast/Slow growth	091833	33	7	9	49
Grand total of recoveries in 1999			66	21	75	162

<sup>a</sup> Experimental groups include the release strategy. All releases were targeted for five fish per pound.

<sup>b</sup> Actual number of CWT fish recovered at the L. Sheep Creek weir. The protocol was to collect all CWT fish at the weir for sampling at the hatchery during spawning.

<sup>c</sup> Estimated number (from creel surveys and harvest card returns) of total CWT fish that were harvested in the Imnaha River basin fishery.

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total 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 greater than 24 (because of a low sampling rate) unexpanded data were used.

<sup>e</sup> Estimated total by summing all recoveries.

Table 20. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Wallowa stock summer steelhead for the 1999-2000 run year. All CWT fish were from releases of hatchery fish into either Deer Creek (at Big Canyon Acclimation Facility) or Spring Creek (at Wallowa Hatchery). Data was summarized as available through February 2004.

Brood year, release site	Experimental group <sup>a</sup>	CWT code	Recoveries at weirs <sup>b</sup>	Other in-basin recoveries <sup>c</sup>	Out-of-basin recoveries <sup>d</sup>	Total recoveries <sup>e</sup>
1995						
Deer Cr.	Direct stream	071161	0	0	6	6
Spring Cr.	Forced	071163	1	0	0	1
1996						
Deer Cr.	Forced, (fast/slow)	075330	8	4	0	12
	Forced, (slow/fast)	091825	6	7	1	14
	Volitional, (fast/slow)	091826	12	5	18	35
	Volitional, (slow/fast)	091827	3	10	1	14
Spring Cr.	Forced	091829	2	0	0	2
	Forced	091831	3	0	1	4
	Volitional	091828	4	0	17	21
	Volitional	091830	2	0	0	2
1997						
Deer Cr.	Forced	092326	23	2	53	78
	Forced	092331	12	11	41	64
	Volitional	092327	19	14	35	68
	Volitional	092330	11	0	48	59
Spring Cr.	Lyons Ferry Hatchery	071247	10	0	48	58
	Forced	092325	16	4	48	68
	Forced	092328	25	0	18	43
	Volitional	092324	16	0	74	90
	Volitional	092329	23	0	67	90
Grand total of recoveries in 2000			196	57	476	729

<sup>a</sup> Experimental groups include the release strategy. All releases were targeted for 5 fish per pound.

<sup>b</sup> Actual number of CWT fish that were released into Spring Cr. and recovered at the Wallowa Fish Hatchery weir or released into Deer Cr. 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.

<sup>c</sup> Actual number of CWT fish that were released into Spring Cr. and recovered at the Big Canyon Facility weir or released into Deer Cr. and recovered at the Wallowa Fish Hatchery weir plus the estimated number (from creel surveys and harvest card returns) of CWT fish that were harvested in the Grande Ronde River basin fisheries.

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total 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 greater than 24 (because of a low sampling rate) unexpanded data were used.

<sup>e</sup> Estimated total by summing all recoveries.

Table 21. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1999-2000 run year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through February 2004.

Brood year	Experimental group <sup>a</sup>	CWT code	Recoveries at weirs <sup>b</sup>	Other in-basin recoveries <sup>c</sup>	Out-of-basin recoveries <sup>d</sup>	Total recoveries <sup>e</sup>
1996	Slow/Fast growth	091832	10	4	18	32
	Fast/Slow growth	091833	16	4	9	29
1997	1/4 standard density	074860	66	15	30	111
	1/4 standard density	075301	29	0	7	36
	1/2 standard density	092322	54	5	19	78
	1/2 standard density	092323	74	6	52	132
Grand total of recoveries in 2000			249	34	135	418

<sup>a</sup> Experimental groups include the release strategy. All releases were targeted for five fish per pound.

<sup>b</sup> Actual number of CWT fish recovered at the L. Sheep Creek weir. The protocol was to collect all CWT fish at the weir for sampling at the hatchery during spawning.

<sup>c</sup> Estimated number (from creel surveys and harvest card returns) of total CWT fish that were harvested in the Imnaha River basin fishery.

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total 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 greater than 24 (because of a low sampling rate) unexpanded data were used.

<sup>e</sup> Estimated total by summing all recoveries.



Table 22. Catch and escapement distribution of adult summer steelhead by recovery location for the 1998-99 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through January 2003.

Location	Wallowa Stock			Imnaha Stock		
	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean catch	0	0	0.0	0	0	0.0
Columbia River						
Treaty net	40	274	4.1	12	59	7.3
C and S	0	0	0.0	0	0	0.0
Sport	28	220	3.3	13	70	8.6
Test	0	0	0.0	0	0	0.0
Tributary sport	17	173	2.6	4	25	3.1
Deschutes River						
Sport	4	32	0.5	1	6	0.7
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. Basin	44	330	5.0	0	0	0.0
Within Snake R. Basin*	2	22	0.3	1	6	0.7
Snake River sport, tribs.*	285	2,265	34.0	44	246	30.3
Oregon tributaries* <sup>a</sup>	77	1,208	18.2	21	67	8.3
Other in-basin escapement* <sup>b</sup>	0	400	6.0	0	0	0.0
Hatchery weir* <sup>c</sup>	259	1,730	26.0	66	332	41.0
Total estimated return	756	6,654	100.0	162	811	100.0
Return to compensation area		5,625			651	
Percent of compensation goal		61.2			32.6	

\* 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.

<sup>a</sup> Total returns to Oregon tributaries are harvest estimates based on angler surveys and harvest card returns.

<sup>b</sup> 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.

<sup>c</sup> Total returns to the hatchery weir are actual numbers.

Table 23. Catch and escapement distribution of adult summer steelhead by recovery location for the 1999-2000 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through February 2004.

Location	Wallowa Stock			Imnaha Stock		
	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean catch	0	0	0.0	0	0	0.0
Columbia River						
Treaty net	25	160	3.1	28	82	9.5
C and S	0	0	0.0	0	0	0.0
Sport <sup>a</sup>	56	359	6.9	43	56	6.4
Test	0	0	0.0	0	0	0.0
Tributary sport	55	256	4.9	36	143	16.5
Deschutes River						
Sport	14	77	1.5	4	6	0.7
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. Basin	85	478	9.1	7	12	1.4
Within Snake R. Basin <sup>*</sup>	0	0	0.0	0	0	0.0
Snake River sport, tribs. <sup>*b</sup>	241	1,232	23.6	17	24	2.8
Oregon tributaries <sup>*c</sup>	57	1,094	21.0	34	98	11.3
Other in-basin escapement <sup>*d</sup>	0	262	5.0	0	0	0.0
Hatchery weir <sup>*e</sup>	196	1,299	24.9	249	445	51.4
Total estimated return	729	5,217	100.0	418	866	100.0
Return to compensation area		3,887			567	
Percent of compensation goal		42.3			28.4	

<sup>\*</sup> 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.

<sup>a</sup> No expansion was available for CWT recoveries from the Deschutes River sport fishery in 2000, so Columbia River harvest may be underestimated.

<sup>b</sup> No data was available for CWT returns to the Idaho portion of the Snake River fishery, therefore harvest in the Snake River is underestimated.

<sup>c</sup> Total returns to Oregon tributaries are harvest estimates based on angler surveys and harvest card returns.

<sup>d</sup> 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

<sup>e</sup> Total returns to the hatchery weir are actual numbers.

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