

LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2003 Annual Progress Report

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



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LOWER SNAKE RIVER
COMPENSATION PLAN

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Front cover photo of lower Grande Ronde River near Troy by Jeff Yanke in October, 2006.

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Preface

The purpose of this progress report is to provide summary information for Lower Snake River Compensation Plan (LSRCP) summer steelhead (*Oncorhynchus mykiss*) programs operated by ODFW in the Grande Ronde and Imnaha river basins during 2003. 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 1998-2000 broods returned to spawn, steelhead from the 2002 brood were released as smolts, and adult steelhead that returned to spawn were used to create the 2003 brood.

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CONTENTS

Preface.....	i
Acknowledgements.....	i
Table of Contents.....	ii
List of Figures.....	ii
List of Tables.....	iii
EXECUTIVE SUMMARY.....	1
Objectives.....	1
Accomplishments and Findings.....	1
INTRODUCTION.....	3
RESULTS AND DISCUSSION.....	3
Juveniles.....	3
Adults.....	4
Experimental group returns.....	5
Compensation goals.....	5
REFERENCES.....	20

List of Figures

<u>Figure</u>		<u>Page</u>
1	Length-at-age relationships based on scale analysis for adult returns of 1 fresh and 2 fresh Wallowa stock summer steelhead of the 1991-2002 run years and the 2002-2003 run year	7
2	Length-at-age relationships based on scale analysis for adult returns of 1 fresh and 2 fresh Imnaha stock summer steelhead of the 1991-2002 run years and the 2002-2003 run year	8
3	Overall smolt-to-adult survival for Wallowa and Imnaha stock summer steelhead, 1985-1998 brood years.....	9
4	Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-1997 brood years	9
5	Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2002-2003	10

List of Tables

<u>Table</u>	<u>Page</u>
1. Summary of egg collection and juvenile survival for 2002 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2003	11
2. Estimates of fin clip quality and coded-wire tag retention for 2002 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2003	11
3. Details of experimental and production groups of 2002 brood year hatchery summer steelhead released in the Grande Ronde and Imnaha river basins in 2003	12
4. Density and average fork length of residual steelhead from index sites during the summer in the Grande Ronde and Imnaha basins in 2003.....	13
5. Timing of adult steelhead returns to LSRCP facilities in 2003 by location and origin	13
6. Number and disposition of adult steelhead that returned to LSRCP facilities in 2003 by stock, origin, age, and sex.....	14
7. Number of hatchery adult summer steelhead at the Little Sheep Creek Facility weir that were outplanted into Big Sheep Creek and subsequently recaptured at the weir, 1999-2003.	15
8. Summary of summer steelhead spawning ground surveys in Deer Creek above the Big Canyon Facility weir	15
9. Spawning summary for summer steelhead at LSRCP facilities in 2003	16
10. Summary of anadromous adult recoveries of coded-wire tagged, Wallowa stock summer steelhead for the 2002-2003 run year	17
11. Summary of anadromous adult recoveries of coded-wire tagged, Imnaha stock summer steelhead for the 2002-2003 run year	18
12. Catch and escapement distribution of adult summer steelhead by recovery location for the 2002-2003 run year using PSMFC and ODFW mark recovery databases.....	19

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 all of our objectives for 2003. In this report, we present data and results for objectives 1, 2, 3, 4, and 6. More complete analyses, results, and discussion of rearing and release strategies for objective 2 are presented in separate special reports (e.g., Ruzycki et al. 2003). To accomplish objective 5, project staff participated in planning and coordination with co-managers and development and writing of the annual operation plan. Data and results for objective 7 are published in separate annual creel survey reports (Flesher et al. 2005).

The production goal of 870,000 Wallowa stock smolts was not achieved in 2003, with 816,509 smolts released. The Imnaha stock production goal of 330,000 smolts was achieved in 2003, with 373,452 smolts released. In 2003, we released unclipped, blank-wire tagged smolts in Little Sheep Creek, and a group of unclipped, untagged smolts in Big Sheep Creek.

In 2003, 2,090 and 1,369 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped 10 natural steelhead at Wallowa Fish Hatchery and 140 natural steelhead at the Big Canyon Facility. These adults were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 1,907 Imnaha stock hatchery and 97 natural steelhead adults. Of these, we released 320 hatchery and 90 natural steelhead above the weir, and outplanted 1,403 hatchery steelhead to Big Sheep Creek.

During spawning in the spring of 2003, we collected 1,206,310 Wallowa stock eggs and 467,350 Imnaha stock eggs.

For the 2002-2003 run year, the compensation goal of 9,184 Wallowa stock above Lower Granite Dam was not met, while the compensation goal of 2,000 Imnaha stock adults above Lower Granite Dam was exceeded. We have met the Wallowa stock goal twice in our program history, and this is the second consecutive year we have met the Imnaha stock goal. We estimated that 7,852 Wallowa stock hatchery steelhead (85.5% of goal), and 3,182 Imnaha stock hatchery steelhead (159.1% of goal) returned to the LSRCP compensation area in 2003.

INTRODUCTION

The objectives of this report are to document fish culture practices, describe adult returns, and assess success toward meeting LSRCF goals for Grande Ronde and Imnaha steelhead. We report on juvenile steelhead rearing and release activities for the 2002 brood year (BY) released in 2003. Included are collection, spawning, and adult characteristics for the 2003 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

In general, the data in this report were derived from hatchery inventories and standard databases (i.e., 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 the 2003 work statement (Carmichael et al. 2003). Coded-wire tag (CWT) data that were collected from 2003 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2003, experimental treatments from which fish returned included forced vs. volitional release, and a pre-smolt release strategy. In 2003, the experimental fish were released to evaluate acclimated vs. direct stream release strategies. We also released non-clipped, blank-wire tagged, and unmarked, untagged steelhead. Analysis of specific survival studies will be completed once all brood years have returned and CWT data are complete for a given experiment, which will be published in special reports. 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; Messmer et al. 1989; 1990; 1991; 1992; 1993; Jonasson et al. 1994; 1995; 1996; Ruzycki et al. 2003; 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), a United States v. Oregon production report (Carmichael et al. 1986b), and a five-year study plan (Carmichael 1989). Progress of related work completed in 2003 is presented in summer steelhead creel annual progress reports (Flesher et al. 2005).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed-embryo survival for the 2002 brood year (BY) was 90.6%, within the range of recent brood years (1993-2001 BY range: 71.8-91.6%), and embryo-to-smolt survival was 94.9%, also within the range of recent brood years (1993-2001 BY range: 89.4-97.5%; Table 1). Imnaha egg-to-embryo survival for the 2002 BY was 82.7%, within the range of recent brood years (1993-2001 BY range: 76.7-90.8%), and Imnaha embryo-to-smolt survival was 100.0%, above the range of past years (1993-2001 BY range: 85.6-94.9%; Table 1). The reported Imnaha stock embryo-to-smolt survival of 100% is greater than the actual value. The error is a result of variance in the life stage specific inventories. Mortality during the egg-to-

embryo stage varies annually due to natural variability in egg fertility, sperm viability, and hatchery conditions (e.g., water temperature, presence of fungus), while mortality during the embryo-to-smolt stage occurs during an extended rearing and release phase and has multiple causes. At Irrigon Fish Hatchery, some loss occurs due to cold water disease when fry are held in indoor tanks supplied with well water. Other mortality occurs during transportation of eggs from Wallowa Fish Hatchery to Irrigon Fish Hatchery and the return trip of smolts to acclimation and release sites, and during acclimation, when fish are held in concrete raceways. We released 816,509 Wallowa stock smolts in 2003, less than our production goal of 870,000 smolts, but exceeded our Imnaha stock production goal of 330,000 smolts by releasing 373,452 smolts (Table 1). Hatchery managers attempt to meet production goals every year; however, variation in mortality at various stages of rearing, from fertilizing eggs to acclimating 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 four groups of Wallowa stock steelhead and three groups of Imnaha stock steelhead smolts with adipose-left ventral clips and coded-wire-tags (AdLV and CWT), while a third group of Imnaha stock smolts were blank-wire-tagged but not adipose clipped (No Ad and BWT, Table 2). We marked 98.8% of Wallowa stock smolts and 96.1% of Imnaha stock smolts with an adipose fin clip, which was within the range of recent years (1993-2001 BY range: 98.4-99.6%). Fin clip quality and tag retention for experimental groups averaged 89.7% for Wallowa, within the range of recent years (1993-2001 BY range: 86.5-99.3%) and 84.7% for Imnaha stocks, which is below the range in recent years (1993-2001 BY range: 86.5-99.3%). We also released 73,306 unclipped and untagged Imnaha stock smolts into Big Sheep Creek. Details of experimental and production releases for the 2002 BY are shown in Table 3.

The density of residual hatchery steelhead was lower than the density of wild *O. mykiss* at index sites in the Grande Ronde Basin in 2003 for the second time since sampling began in 1996 (Table 4). In the Imnaha Basin, residual hatchery steelhead had a higher density than wild *O. mykiss*, the same pattern that we have observed since sampling for residual hatchery steelhead began in 1996. For the Imnaha Basin, 85.7% of these residual hatchery steelhead were males, similar to the sex ratio observed in previous years.

Adults

The weirs were installed to capture adult steelhead on 21 January at Big Canyon Facility, 18 February at Wallowa Fish Hatchery, and 24 February at Little Sheep Creek Facility (Table 5). Returns to the Little Sheep Creek Facility were predominantly hatchery fish, with only 97 (4.8%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 140 (9.3%) natural steelhead. In addition, 10 (0.5%) natural steelhead returned to Wallowa Fish Hatchery. Natural steelhead returned over the same time period as hatchery steelhead, but scarce natural adult returns make run timing comparisons difficult. The majority of hatchery adults that returned to Wallowa Fish Hatchery, Big Canyon Facility and Little Sheep Creek Facility spent one year in the ocean (Table 6). Sixty-five percent (63 of 97), 52% (73 of 140), and 50% (5 of 10) of natural fish returning to the Little Sheep Creek Facility, Big Canyon Facility, and Wallowa Fish Hatchery, respectively, were one ocean fish.

The majority of hatchery adults that returned to Wallowa Fish Hatchery in 2003 were spawned or killed (Table 6). In 2003, Big Canyon 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 81 adult hatchery steelhead from Wallowa Fish Hatchery, and 89 hatchery adults from Big Canyon Facility to local ponds for harvest opportunities. In addition, 200 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Fifty-five of these fish returned to the weir a second time and were euthanized. At Big Canyon Facility, all 140 natural fish and no hatchery fish were passed above the weir to spawn naturally. We retained 9% of the hatchery fish and 7% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 1,403 adults to Big Sheep Creek to spawn naturally. Four hundred thirty-nine of the 1,403 outplanted fish (31%) were recaptured at least once at the Little Sheep Creek Facility in 2003 (Table 7). Ninety natural and 320 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally, resulting in 78% of fish above the weir being of hatchery origin. Length-at-age data for Wallowa and Imnaha stock adults are presented in Figures 1 and 2, respectively.

We exceeded our egg take goals for both Wallowa and Imnaha stocks in 2003. Mortality from green egg-to-eyed embryo ranged from 5-19% for Wallowa stock from seven weekly spawns, and from 6-29% for Imnaha stock from eight weekly spawns (Table 9). Over the last nine brood years (1994-2002 BY), the range of green egg-to-eyed 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 or returned to collection sites were 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 the evaluation of 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 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 the 1998-2000 brood years occurred in the 2002-2003 run year. Wallowa and Imnaha stock adults that returned in 2003 were from groups released to evaluate the benefits of forced versus volitional release (Wallowa and Big Canyon 1998, 1999, & 2000 BY) and pre-smolt release strategies (Imnaha 1999 BY). We had Wallowa stock recoveries from 14 CWT codes (Table 10) and Imnaha stock recoveries from seven CWT codes (Table 11).

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.

For the Wallowa stock, we estimated that in the 2002-2003 run year, 7,852 hatchery origin adults returned to the compensation area, representing 85.5% of the compensation goal (Table 12). For the Imnaha stock, we estimated that 3,182 adults returned to the compensation area, accounting for 159.1% 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 (SAR); 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 reached our compensation goal twice (1997-1998 and 2001-2002 run years) for the Wallowa program, and before this year have only once reached our compensation goal for the Imnaha program (2001-02 run year). For both the Grande Ronde and Imnaha programs, we have met our smolt production goals in most years. Returns in the 2002-2003 run year represented the final returns of the 1998 BY. For the 1998 BY, smolt-to-adult survival rates for the Wallowa and Imnaha stocks were 0.66% and 0.60%, respectively (Figure 3). Beginning with the 1987 BY, when we started meeting our smolt production goals, overall smolt-to-adult survival has only reached our SAR goal for Wallowa stock (0.68%) in four of the last 12 complete brood years, and our SAR goal for Imnaha stock (0.61%) in two of the last 12 brood years. This suggests that low smolt-to-adult survival may be the primary factor for rarely achieving our compensation goals. For the Wallowa stock, 13.5% of the recoveries for the 2002-2003 run year occurred downstream of the compensation area (Table 12). For the Imnaha stock, 15.2% of the recoveries for the 2002-2003 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. Progeny-per-parent ratios for naturally spawning fish have been below 1.0 for completed brood years 1987-1994 and above 1.0 for completed brood years 1995-1997 (Figure 4). Hatchery fish progeny-per-parent ratios (weir returns only) have been above 1.0 for all brood years except 1991. Hatchery rates exceeded natural rates for all brood years except 1991 and 1997. 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 a large natural return in 2001-2002, we have not observed an increasing trend in the abundance of natural fish as a result of supplementation (Figure 5).

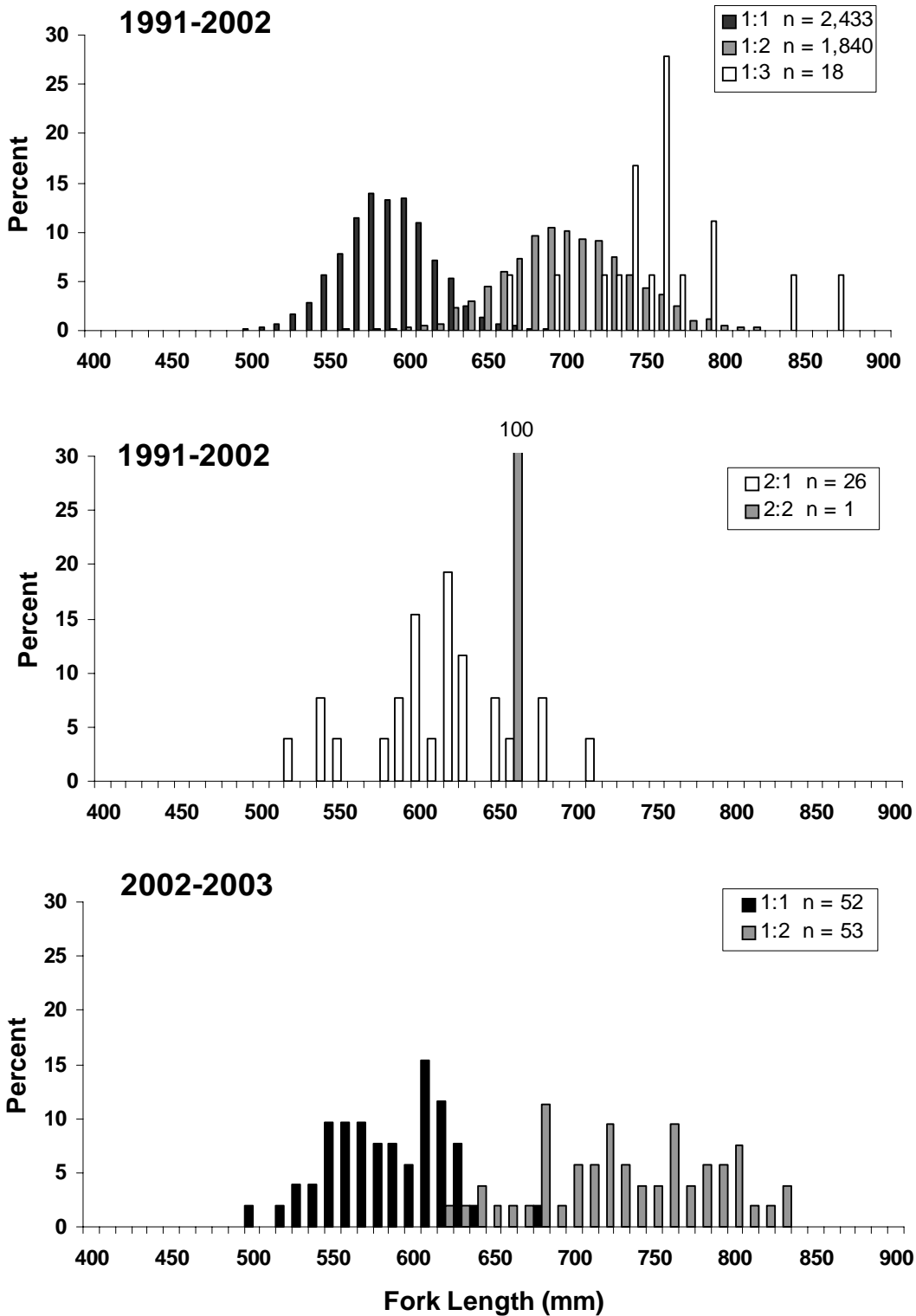


Figure 1. Length-at-age relationships based on scale analysis for adult returns of 1 fresh (top) and 2 fresh (middle) Wallowa stock summer steelhead of the 1991-2002 run years and the 2002-2003 run year (bottom)

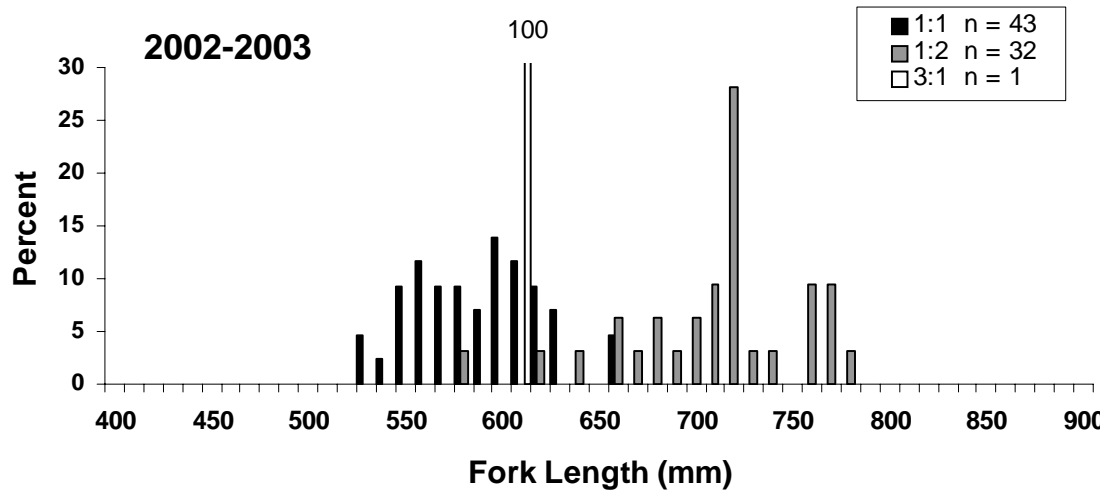
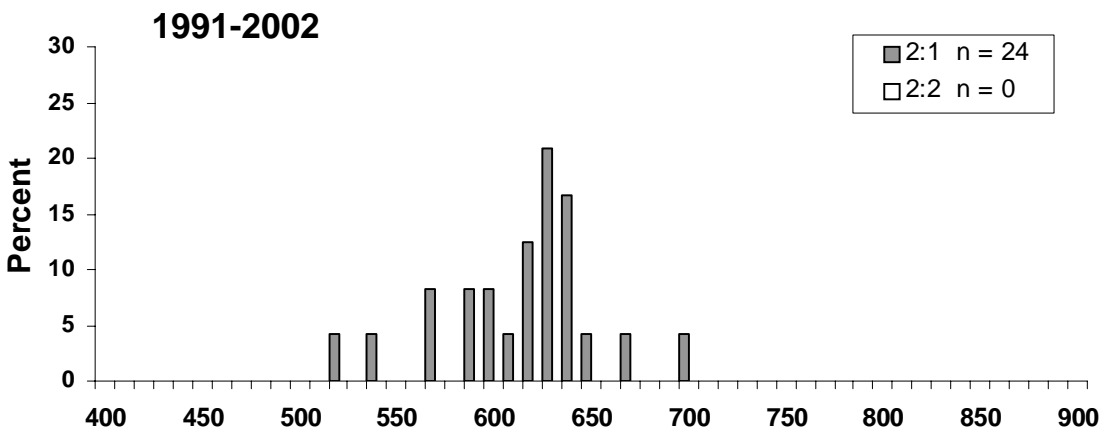
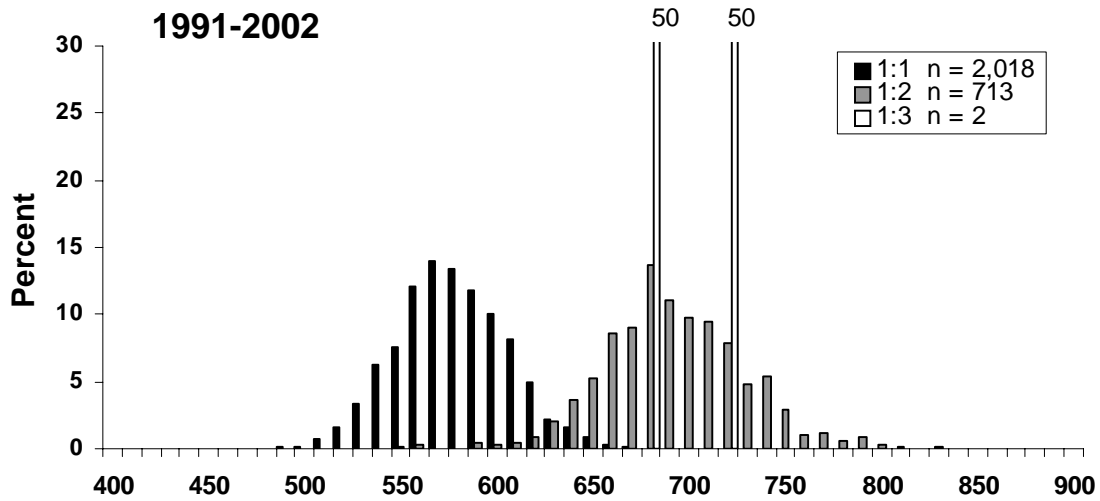


Figure 2. Length-at-age relationships based on scale analysis for adult returns of 1 fresh (top) and 2 fresh (middle) Imnaha stock summer steelhead of the 1991-2002 run years and the 2002-2003 run year (bottom).

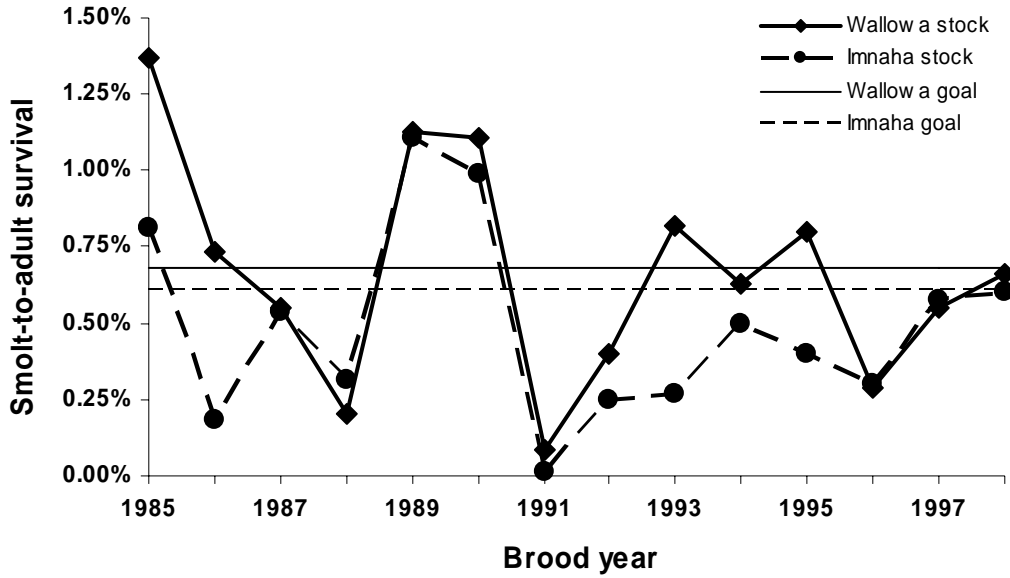


Figure 3. Overall smolt-to-adult survival for Wallowa and Imnaha stock summer steelhead, 1985-1998 brood years. The Wallowa SAR goal is 0.68% and the Imnaha SAR goal is 0.61%.

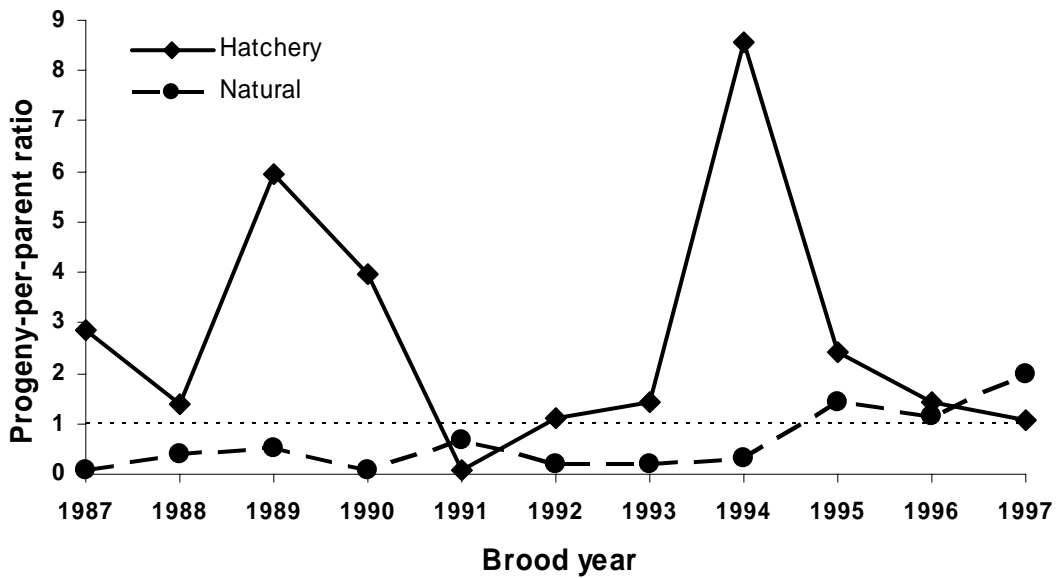


Figure 4. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-1997 brood years. Dotted line represents replacement (P:P ratio =1).

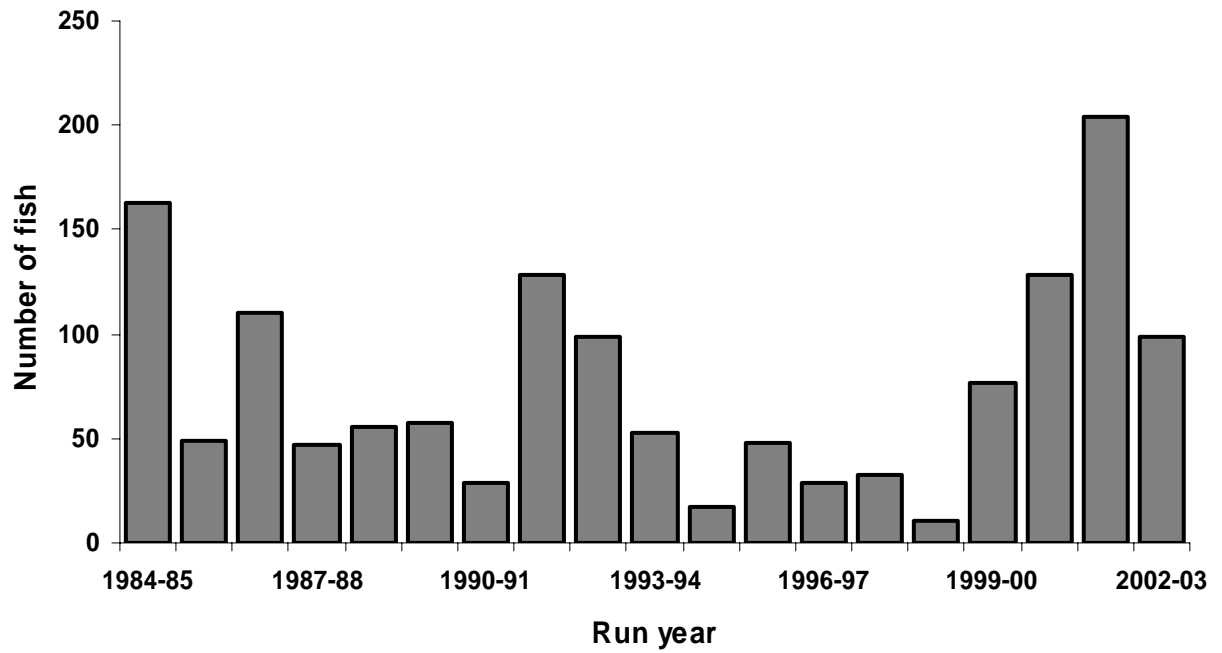


Figure 5. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2002-2003.

Table 1. Summary of egg collection and juvenile survival for 2002 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCF facilities in 2003.

Stock	Number of eggs taken	Eyed embryos	Total fish released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt ^a
Wallowa	1,331,551	1,206,728 ^b	827,403 ^c	90.6	94.9
Imnaha	514,670	425,475 ^d	373,452	82.7	98.5

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

^b Includes 226,728 embryos that were euthanized as grade-outs or as excess to program needs. Also includes 108,356 embryos that were overestimated in the inventory.

^c Includes 8,880 fish held back and reared as rainbow trout in Kinney Lake and 2,014 fish reared as rainbow trout for Morgan Lake.

^d Includes 62,844 embryos that were overestimated in the inventory.

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2002 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2003. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose clipped and release at mean weight of 91g. For experimental fish, targets for both stocks were 100% AdLV+CWT. Percentages for Ad and No Ad clips were not divided into experimental groups, just averaged for stock groups.

Experimental group	Tag code	Number checked		CWT + LV	CWT+ no LV	No CWT + LV	No CWT + no LV	Ad	No Ad
		Tag	Ad						
Volitional, 7	093630	503	-	91.8	6.0	2.2	0.0	-	-
Volitional, 13	093632	504	-	93.5	3.4	3.1	0.0	-	-
Volitional, 9	093631	408	-	90.4	5.4	4.2	0.0	-	-
Volitional, 17	093633	511	-	83.0	13.3	3.7	0.0	-	-
Average		482	205 ^a	89.7	7.0	3.3	0.0	98.8	1.2
Forced, 23	093634	509	-	86.6	8.3	5.1	0.0	-	-
Forced, 25	Blank	426	-	0.0	100.0	0.0	0.0	-	-
Forced, 24	093635	523	-	81.1	15.9	3.0	0.0	-	-
Direct Stream, 28	093636	518	-	86.5	7.1	6.4	0.0	-	-
Average (23,24,28)		517	273 ^b	84.7	10.4	4.8	0.0	96.1	4.0

^a Four ponds were sampled with 206, 205, 204, and 204 fish, respectively. Sampling was not done by experimental group.

^b One pond was sampled with 273 fish.

Table 3. Details of experimental and production groups of 2002 brood year hatchery summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2003. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated, except for Big Sheep Creek groups that were direct stream released. Target size for all fish was 91g. Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

Experimental group ^a	Release date	Release location	Tag code	Fork length (mm)	Weight (g)	Condition factor	Total fish released	Percent migration to LGD ^b
<i>Wallowa stock</i>								
Volitional, 7	April 11-15	Spring Cr.	093630	211 (23)	105.7 (26.7)	1.06 (0.32)	24,650	69.9
Production, 1-8	April 11-15	Spring Cr.	-	217 (18)	111.2 (28.0)	1.04 (0.07)	306,772	-
Volitional, 13	May 7-15	Spring Cr.	093632	220 (22)	109.7 (29.2)	1.02 (0.08)	22,753	71.8
Production, 11,13-16,19	May 7-15	Spring Cr.	-	225 (20)	116.5 (28.8)	1.02 (0.07)	170,213	-
Volitional, 9	April 14-16	Deer Cr.	093631	213 (22)	100.7 (25.9)	1.15 (0.58)	25,070	66.2
Production, 8-12	April 14-16	Deer Cr.	-	218 (18)	107.6 (25.2)	1.06 (0.12)	140,192	-
Volitional, 17	May 8-16	Deer Cr.	093633	224 (23)	114.0 (26.8)	1.05 (0.10)	21,390	57.5
Production, 17-20	May 8-16	Deer Cr.	-	220 (22)	115.7 (32.8)	1.05 (0.06)	105,469	-
Total released ^c							816,509	
<i>Imnaha stock</i>								
Forced, 23	April 8-9	L. Sheep Cr.	093634	210 (26)	99.4 (35.0)	1.04 (0.04)	22,913	87.0
Forced, 25	April 8-9	L. Sheep Cr.	Blank	211 (23)	103.8 (35.1)	1.04 (0.06)	46,707	65.5
Production, 21,23,25	April 8-9	L. Sheep Cr.	-	212 (24)	100.2 (37.2)	1.04 (0.06)	53,646	-
Forced, 24	May 6	L. Sheep Cr.	093635	210 (23)	102.7 (28.6)	1.03 (0.10)	21,548	79.0
Production, 22,24,26	May 6	L. Sheep Cr.	-	215 (21)	102.9 (33.1)	1.00 (0.08)	114,528	-
Direct Stream, 28	April 14-5	B. Sheep Cr.	093636	212 (21)	97.8 (25.7)	1.03 (0.05)	40,804	85.8
Direct Stream, 27,28	April 14-15	B. Sheep Cr.	-	182 (29)	67.0 (25.2)	1.01 (0.08)	73,306	-
Total released ^c							373,452	

^a All fish were reared at Irrigon Fish Hatchery.

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

^c Both Wallowa and Imnaha stock steelhead male releases were less than 1% precocious.

Table 4. Density ($\pm 95\%$ confidence interval) and average fork length (and standard deviation) of residual steelhead from index sites during the summer in the Grande Ronde and Imnaha basins in 2003. Hatchery steelhead smolts released in the spring (April-May) were classified as residuals after 20 June. HSTS indicates hatchery (adipose clipped) residual summer steelhead, WSTS indicates all wild *Oncorhynchus mykiss* except young-of-the-year (<70 mm).

Location ^a	Date	Species	Area (m ²)	Fork length (mm)			Sex ratio ^b		Density ^c (#/100m ²)
				N	Length	Range	N	% males	
<i>Grande Ronde Basin</i>									
Deer Cr.	6 Aug	HSTS	290.0	20	197 (35)	142-244	-	-	7.0 \pm 0.6
Deer Cr.	6 Aug	WSTS	116.7	27	100 (21)	71-167	-	-	16.1 \pm 4.6
<i>Imnaha Basin</i>									
L. Sheep	30 July	HSTS	501.4	113	171 (36)	97-266	14	85.7	23.1 \pm 0.7
L. Sheep	30 July	WSTS	501.4	82	100 (19)	79-207	-	-	16.8 \pm 0.6

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

^b These fish were AdLV+CWT marked residual steelhead used for CWT recovery. Sex ratio data was not collected for Deer Creek.

^c Density ($\pm 95\%$ confidence interval) was determined using a multiple pass removal method (Zippen 1958) with a backpack electrofisher (Smith-Root Model 12 or Model 12A) and block seines.

Table 5. Timing of adult steelhead returns to LSRCF facilities in 2003 by location and origin.

Period	Week of the year	Number of fish trapped ^a					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Jan 22-28	4	-	-	0	0	-	-
Jan 29-Feb 4	5	-	-	35	1	-	-
Feb 05-11	6	-	-	4	0	-	-
Feb 12-18	7	-	-	0	0	-	-
Feb 19-25	8	154	0	0	0	-	-
Feb 26-Mar 04	9	160	0	0	0	0	0
Mar 05-11	10	252	0	0	0	6	0
Mar 12-18	11	462	0	486	9	369	21
Mar 19-25	12	385	6	162	8	383	22
Mar 26-Apr 01	13	209	0	72	1	311	11
Apr 02-08	14	119	2	267	30	275	10
Apr 09-15	15	190	1	146	37	240	13
Apr 16-22	16	54	1	54	14	163	8
Apr 23-29	17	49	0	66	16	112	7
Apr 30-May 06	18	20	0	31	8	31	2
May 07-13	19	8	0	20	8	9	2
May 14-20	20	11	0	16	7	5	0
May 21-27	21	16	0	6	0	2	0
May 28-Jun 03	22	1	0	4	1	1	1
Jun 04-10	23	0	0	0	0	0	0
Total		2,090	10	1,369	140	1,907	97

^a Weirs installed January 21st at Big Canyon Facility (Deer Cr.), and February 24th at Little Sheep Creek Facility as well as ladder opened February 18th at Wallowa Fish Hatchery. Adult collections stopped June 12th at Big Canyon Facility, June 6th at Little Sheep Creek Facility, and June 12th at Wallowa Fish Hatchery.

Table 6. Number and disposition of adult steelhead that returned to LSRCP facilities in 2003 by stock, origin, age (freshwater:saltwater), and sex.

Stock, Disposition	Hatchery ^a									Natural ^b									Grand total		
	1:1		1:2		1:3		3:1		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			F
<i>Wallowa Fish Hatchery (Wallowa stock)</i>																					
Trapped	694	445	241	710	0	0	0	0	2,090	1	1	0	2	1	2	1	2	0	0	10	2,100
Passed	0	0	0	0	0	0	0	0	0	1	1	0	2	1	2	1	2	0	0	10	10
Outplanted	4	22	2	53	0	0	0	0	81	0	0	0	0	0	0	0	0	0	0	0	81
Kept	690	423	239	657	0	0	0	0	2,009	0	0	0	0	0	0	0	0	0	0	0	2,009
Mortality	2	2	4	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	8
Spawned	187	94	39	128	0	0	0	0	448	0	0	0	0	0	0	0	0	0	0	0	448
Killed ^c	501	327	196	529	0	0	0	0	1,553	0	0	0	0	0	0	0	0	0	0	0	1,553
Fork Length (mm)	589	574	746	720	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	
Standard deviation	39	31	61	49	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	
<i>Big Canyon Facility (Wallowa stock)</i>																					
Trapped	312	255	233	569	0	0	0	0	1,369	7	12	8	17	23	28	8	34	2	1	140	1,509
Passed	0	0	0	0	0	0	0	0	0	7	12	8	17	23	28	8	34	2	1	140	140
Outplanted	16	15	12	46	0	0	0	0	89	0	0	0	0	0	0	0	0	0	0	0	89
Returned to River ^d	24	24	25	72	0	0	0	0	145	0	0	0	0	0	0	0	0	0	0	0	145
Kept	272	216	196	451	0	0	0	0	1,135	0	0	0	0	0	0	0	0	0	0	0	1,135
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,e}	272	216	196	451	0	0	0	0	1,135	0	0	0	0	0	0	0	0	0	0	0	1,135
Fork Length (mm)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	
Standard deviation	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	
<i>Little Sheep Creek Facility (Imnaha stock)</i>																					
Trapped	714	559	111	506	0	1	0	16	1,907	16	18	7	15	23	6	1	11	0	0	97	2,004
Passed	140	82	23	72	0	0	0	3	320	15	17	6	14	22	6	1	9	0	0	90	410
Outplanted	497	444	71	379	0	0	0	12	1,403	0	0	0	0	0	0	0	0	0	0	0	1,403
Kept	77	33	17	55	0	1	0	1	184	1	1	1	1	1	0	0	2	0	0	7	191
Mortality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spawned ^f	71	27	16	51	0	1	0	1	167	1	1	1	1	1	0	0	2	0	0	7	174
Killed	6	6	1	4	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	17
Fork Length (mm)	587	581	727	701	-	-	-	610		-	529	-	670	-	-	-	627	-	-	-	
Standard deviation	33	31	35	48	-	-	-	-		-	-	-	-	-	-	-	38	-	-	-	

^a Wallowa stock ages apportioned using 105 scale samples collected in 2003; Imnaha stock ages apportioned using 71 scale samples from 2002 and 76 scale samples from 2003 in order to increase sample size. Lengths are from fish with 2003 scale samples.

^b Ages apportioned using historical data, except at Little Sheep Facility where historical data and 2006 data were used to get a larger sample size.

^c For the Wallowa stock, 1379 fish that returned to Wallowa Fish Hatchery and 539 fish that returned to Big Canyon were euthanized and donated to food banks.

^d Two hundred fish were returned to the river fishery, of these, 27 males and 28 females returned to the weir a second time and were dispatched. These 55 fish are included in the KNS category.

^e Includes 28 fish given to Gene Shippentower for his "Progeny Marker for Salmonids" study sponsored by CTUIR and ODFW. Also includes one age 1:2 CWT stray (63-13-09) released from Washington Department of Fish and Wildlife's Cottonwood Acclimation Pond in April 2000.

^f Includes three natural males that were live spawned and then passed above the weir.

Table 7. Number of hatchery adult summer steelhead at the Little Sheep Creek Facility weir that were outplanted into Big Sheep Creek and subsequently recaptured at the weir, 1999-2003.

Year	Number of fish						% ^b
	Outplanted			Recaptured ^a			
	M	F	Total	M	F	Total	
1999	25	17	42	5	1	6	14.3
2000	55	83	138	6	11	17	12.3
2001	170	184	354	34	14	48	13.6
2002	775	1,255	2,030	456	451	907	44.7
2003 ^b	568	835	1,403	-	-	439	31.3
Mean	-	-	-	-	-	-	23.2

^a Total number of recaptures, including second and third time recaptures.

^b Total recaptured divided by total outplanted.

^c In 2003, recaptures were not identified by sex

Table 8. Summary of summer steelhead spawning ground surveys in Deer Creek above the Big Canyon Facility weir.

Year	Females passed	Males passed	Total passed	Total redds	Fish/redd	Females/redd	% redds observed ^a	Redds/mile ^b
2002	120	89	209	87	2.40	1.38	73	7.25
2003	92	48	140	64	2.19	1.44	70	5.33

^a Percent of redds observed assume that each female passed constructs one redd.

^b Twelve miles of stream were surveyed.

Table 9. Spawning summary for summer steelhead at LSRCP facilities in 2003. The percent mortality is from green egg to eyed embryo after shocking.

Spawn date, Lot number	Parental origin ^a	Number of eggs	Eyed embryos ^b	% mortality
<i>Wallowa Hatchery (Wallowa stock)</i>				
3/19 wa400	Hatchery	111,700	99,400	11.0
3/26 wa401	Hatchery	169,150	144,600	14.5
4/02 wa402	Hatchery	222,400	200,200	10.0
4/09 wa403	Hatchery	230,460	219,800	4.6
4/16 wa404	Hatchery	228,800	184,800	19.2
4/23 wa405	Hatchery	152,700	143,800	5.8
4/30 wa406	Hatchery	<u>91,100</u>	<u>82,800</u>	<u>9.1</u>
Total		1,206,310	1,075,400	10.9
<i>Little Sheep Creek Facility (Imnaha stock)</i>				
3/25 li500	Mixed	85,350	60,650	28.9
4/01 li501	Mixed	70,290	65,390	7.0
4/08 li502	Hatchery	55,540	49,010	11.8
4/15 li503	Mixed	100,560	89,320	11.2
4/22 li504	Mixed	60,010	54,350	9.4
4/29 li505	Mixed	38,760	36,600	5.6
5/06 li506	Mixed	28,960	26,780	7.5
5/12 li507	Hatchery	<u>27,880</u>	<u>26,220</u>	<u>6.0</u>
Subtotal	Hatchery	83,420	-	-
Subtotal	Mixed	<u>383,930</u>	-	-
Total		467,350	408,320	12.6

^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 Includes 98,400 Wallowa stock eyed embryos that were euthanized because they were excess to program needs.

Table 10. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Willowa stock summer steelhead for the 2002-2003 run year. All CWT fish were hatchery fish released into either Deer Creek (at Big Canyon Facility) or Spring Creek (at Willowa Fish Hatchery). Data were summarized as available through January 2007.

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
1999						
Deer Cr.	Production	092934	34	38	32	104
	Production	092935	37	26	28	91
	Volitional	092936	19	24	40	83
	Forced	092937	29	6	28	63
Spring Cr.	Production	092930	27	16	50	93
	Production	092931	32	22	46	100
	Volitional	092932	27	9	40	76
	Forced	092933	19	10	102	131
2000						
Deer Cr.	Production	093215	21	3	20	44
	Forced	093216	32	15	39	86
	Volitional	093217	30	6	14	50
Spring Cr.	Production	093212	30	17	47	94
	Forced	093213	30	11	42	83
	Volitional	093214	22	2	18	42
Total recoveries			389	205	546	1140

^a Experimental groups include the release (and rearing) strategy. All releases were targeted for five fish per pound.

^b 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.

^c 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.

^d 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.

^e Estimated total by summing all recoveries.

Table 11. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Imnaha stock summer steelhead for the 2002-2003 run year. All CWT fish were hatchery fish released into Little Sheep Creek at Little Sheep Creek Facility. Data were summarized as available through January 2007.

Brood year	Experimental group ^a	CWT code	Recoveries at weirs ^b	Other in-basin recoveries ^c	Out-of-basin recoveries ^d	Total recoveries ^e
1998	Production	092561	3	0	0	3
1999	Pre-smolts	092706	2	0	0	2
	Production	092927	65	14	23	102
	Production	092928	53	6	41	100
	Production	092929	51	12	13	76
2000	Production	093210	117	13	76	206
	Production	093211	61	2	69	132
Total recoveries			352	47	222	621

^a Experimental groups include the release strategy. All releases were targeted for five fish per pound.

^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 total CWT fish that were harvested in the Imnaha River Basin fishery.

^d 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.

^e Estimated total by summing all recoveries.

Table 12. Catch and escapement distribution of adult summer steelhead by recovery location for the 2002-2003 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 January 2007. "-" indicates not sampled or undefined.

Location	Wallowa Stock			Imnaha Stock		
	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean catch	3	19	0.2	0	0	0.0
Columbia River						
Treaty net	61	283	3.1	12	56	1.5
C and S	0	0	0.0	0	0	0.0
Sport	65	256	2.8	84	430	11.4
Test	0	0	0.0	0	0	0.0
Tributary sport	2	12	0.1	0	0	0.0
Deschutes River						
Sport	50	207	2.3	16	88	2.3
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. Basin	86	451	5.0	0	0	0.0
Within Snake R. Basin*	0	0	0.0	1	5	0.1
Snake River sport, tribs.*	279	1,752	19.3	109	521	13.9
Oregon tributaries* ^a	205	2,642	29.1	47	239	6.4
Other in-basin escapement* ^b	-	0	0.0	-	510	13.6
Hatchery weir* ^c	389	3,458	38.1	352	1,907	50.8
Total estimated return	1,140	9,080	100.0	621	3,756	100.0
Return to compensation area		7,852			3,182	
Percent of compensation goal		85.5			159.1	

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

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

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

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

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