LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2005 Annual Progress Report

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OREGON
Fish & Wildlife

LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

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Front cover photo of steelhead anglers on the lower Grande Ronde River in September 2007 by Jared Sisemore.

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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 2005. 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 2000-2002 broods returned to spawn, and steelhead from the 2004 brood were released as smolts. Adult steelhead that returned to spawn were used to create the 2005 brood.

ACKNOWLEDGMENTS

We would like to thank hatchery managers Greg Davis and Mike Gribble, as well as many other hatchery personnel who exhibited great dedication and provided essential assistance. Numerous personnel from the Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife Service, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation provided enthusiastic support. We also thank Gerold Grant, project leader for the 2004-2005 run year, and Chris Starr and Joe Krakker, who provided administrative support. This project was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, contract numbers 14110-4-J071, 14110-5-J055, and 14110-6-J011, a cooperative agreement with the Oregon Department of Fish and Wildlife.

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EXECUTIVE SUMMARY

Objectives

1. Document summer steelhead rearing and release activities at all LSRCP facilities.

2. Determine optimum rearing and release strategies that will produce maximum survival to adulthood for hatchery-produced summer steelhead smolts.

3. Document summer steelhead adult returns by stock to each LSRCP broodstock collection facility.

4. Determine if the total production of summer steelhead adults meets mitigation goals, and index annual smolt survival and adult returns to Lower Granite Dam for production groups.

5. Participate in planning activities associated with anadromous fish production and management in the Grande Ronde and Imnaha river basins, and participate in ESA permitting, consultation, and rearing activities.

6. Monitor natural spawning of summer steelhead in selected areas within the Grande Ronde Basin.

7. Determine the number of summer steelhead harvested annually and angler effort in recreational fisheries on the Grande Ronde, Wallowa, and Imnaha rivers.

Accomplishments and Findings

We accomplished all of our objectives for 2005. 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 (e.g., Flesher et al. 2008).

The production goal of 870,000 Wallowa stock smolts was not achieved in 2005, with 712,890 smolts released. The Imnaha stock production goal of 330,000 smolts was also not achieved in 2005, with 292,444 smolts released. In 2005, we released unclipped, blank-wire tagged smolts in Little Sheep Creek, and a group of unclipped, untagged smolts in Big Sheep Creek.

In 2005, 2,360 and 1,069 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped five natural steelhead at Wallowa Fish Hatchery and 77 natural steelhead at the Big Canyon Facility, which were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 2,025 Imnaha stock hatchery and 188 natural steelhead adults. Of these, we released 282 hatchery and 179

natural steelhead above the weir, and outplanted 1,555 hatchery steelhead to Big Sheep Creek. We continued the Wallowa stock fall-collected broodstock experiment by collecting 108 adult steelhead in October 2004. During spawning in the spring of 2005, we collected 1,117,400 Wallowa stock eggs, 193,200 Wallowa Fall Broodstock eggs, and 439,275 Imnaha stock eggs.

In the 2004-05 run year, the compensation goals of 9,184 Wallowa stock and 2,000 Imnaha stock adult steelhead above Lower Granite Dam were exceeded. We have met the Wallowa stock goal four times in our program history, and this is the fourth consecutive year we have met the Imnaha stock goal. We estimate that 12,151 Wallowa stock hatchery steelhead (132.3% of goal), and 3,539 Imnaha stock hatchery steelhead (177.0% of goal) returned to the LSRCP compensation area in 2005.

INTRODUCTION

The objectives of this report are to document fish culture practices, describe adult returns, and assess progress toward meeting LSRCP goals for Grande Ronde and Imnaha steelhead. We report on juvenile steelhead rearing and release activities for the 2004 brood year (BY) released in 2005. Included are collection, spawning, and adult characteristics for the 2005 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

In general, the data in this report were derived from hatchery inventories and standard databases (e.g., Pacific States Marine Fisheries Commission Regional Mark Information System (RMIS), ODFW mark recovery) or through standard measuring techniques. As such, specific protocols are usually not described. In cases where expansions of data or unique methodologies were used, protocols are described in more detail. Additional descriptions of protocols can be found in our work statements (Carmichael and Hoffnagle 2004, Carmichael et al. 2005c, Carmichael et al. 2005d). Coded-wire tag (CWT) data that were collected from 2005 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2005, experimental treatments from which fish returned included forced vs. volitional release, a pre-smolt release, non-clipped, blank-wire tagged release, and off-station direct-stream release strategies. In 2005, experimental fish were released to evaluate progeny from early returning (fall-collected) broodstock vs. production broodstock. We also released non-clipped, blank-wire tagged smolts, and two groups (marked and unmarked/untagged) of off-station direct stream release smolts, to compare to production releases. Analysis of specific survival studies will be completed and published in separate reports once all brood years have returned and CWT data are complete for 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; 1999; 2004; 2005a; 2005b; Gee et al. 2007; 2008; 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, 2005,

2007), a United States vs. Oregon production report (Carmichael et al. 1986b), and a five-year study plan (Carmichael 1989). Progress on related work completed in 2005 is presented in the summer steelhead creel annual progress report (Flesher et al. 2008).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed embryo survival for the 2004 brood year (BY) was 87.9%, within the range of recent brood years (1993-2003 BY range = 71.8-91.6%), and embryo-to-smolt survival was 87.9%, also within the range of recent brood years (1993-2003 BY range = 86.5-98.3%; Table 1). Imnaha stock egg-to-embryo survival for the 2004 BY was 92.1%, above the range of recent brood years (1993-2003 BY range = 76.7-90.8%), and embryo-to-smolt survival was 93.5%, within the range of past years (1993-2003 BY range = 87.8-98.5%; Table 1). We released 712,890 Wallowa stock smolts in 2005, less than our production goal of 870,000 smolts. For the Imnaha stock, we released 292,444 Imnaha stock smolts, also less than our production goal of 330,000 smolts (Tables 1 and 3). Hatchery managers attempt to meet production goals every year, however variation in mortality at various stages of rearing, from fertilized eggs to acclimated smolts, results in fewer or more fish being released in any given year. Managers periodically adjust the number of eggs collected based on recent hatchery performance.

To evaluate different rearing and release strategies, we marked and released ten groups of Wallowa stock steelhead and two 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 and not fin-clipped (No fin clip and Blank tag, Table 2). We marked 99.6% of Wallowa stock smolts and 99.8% of Imnaha stock smolts with an adipose fin clip, which was the highest observed for Wallowa stock and the highest achieved for Imnaha stock thus far in the range of recent years (1993-2003 BY range = 96.1-99.6%). Fin clip quality and tag retention for experimental groups averaged 94.3% for Wallowa, within the range of recent years (1993-2003 BY range = 89.1-99.3%) and 91.3% for Imnaha stocks, also within the range of recent years (1993-2003 BY range = 84.7-99.0%). We also released 45,398 unmarked (no fin clip and no tag) Imnaha stock smolts into Big Sheep Creek. Details of experimental and production releases for the 2004 BY are shown in Table 3.

Densities of residual hatchery steelhead were lower than those of wild *O. mykiss* at index sites in the Grande Ronde Basin in 2005 for the fourth 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, 100.0% of residual hatchery steelhead were males, similar to the gender ratio observed in previous years.

Adults

Weirs were installed to capture adult steelhead on 25 January at Big Canyon Facility, 8 February at Wallowa Fish Hatchery, and 25 February at Little Sheep Creek Facility (Table 5). Returns to the Little Sheep Creek Facility were predominantly hatchery fish, with only 188 (8.5%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 77 (6.7%) natural steelhead. In addition, 5 (0.2%) natural steelhead returned to Wallowa Fish Hatchery. The majority of hatchery adults that returned to Wallowa Fish Hatchery, Big Canyon Facility and Little Sheep Creek Facility spent one year in the ocean (Table 6). Sixty- two percent (117 of 188), 71% (55 of 77), and 40% (2 of 5) of natural fish returning to the Little Sheep Creek Facility, Big Canyon Facility, and Wallowa Fish Hatchery, respectively, spent one year in saltwater before returning.

The majority of hatchery adults that returned to Wallowa Fish Hatchery in 2005 were spawned or killed (Table 6). In 2005, 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 73 adult hatchery steelhead from Wallowa Fish Hatchery, and 167 hatchery adults from Big Canyon Facility to local ponds for harvest opportunities. In addition, 36 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Eighteen of these fish returned to the weir a second time and were euthanized. At the Big Canyon Facility, all 77 natural fish and no hatchery fish were passed above the weir to spawn naturally. One hundred nine hatchery steelhead ―presumably of Wallowa stock― were captured by hook and line on the lower Grande Ronde River in mid-October 2004 (Table 6), to be held and spawned as fall broodstock the following spring. Of the 109 fall broodstock collected, one fish died, 108 were transferred to the Wallowa Fish Hatchery, where 86 were spawned. We retained 9% of the hatchery fish and 10% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 1,555 hatchery adults to Big Sheep Creek to spawn naturally. One hundred nine of the 1,555 outplanted fish (7%) were recaptured at least once at the Little Sheep Creek Facility in 2005. One hundred seventy natural and 282 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally. In addition, 9 natural males were spawned and passed above the weir, and seven hatchery fish (one male and six females) were outplanted, recaptured, and passed above the weir, resulting in 62% of fish above the weir being of hatchery origin. Of the 468 fish passed into Little Sheep Creek, 37 fell back and were recaptured at the weir (Table 7). Length-at-age data for Wallowa and Imnaha stock adults are presented in Figures 1 and 2, respectively.

We conducted spawning redd surveys of natural origin steelhead that were passed above the Big Canyon Facility weir into Deer Creek using protocols described in Gee et al. (2008). In 2005, a total of 77 steelhead were passed above the weir, of which 42 were females (Table 8). Thirty-five redds were counted, which was 83% of the total number of redds constructed, assuming that each female constructs one redd.

In 2005, we accomplished our egg take goal for the Wallowa stock with 1,310,600 green eggs collected. Of these, 1,117,400 were for production and 193,200 were for the Fall broodstock evaluation. We collected 439,275 green Imnaha stock eggs, short of our goal of 448,000. Mortality from green egg-to-eyed embryo ranged from 4-11% for Wallowa production

stock from eight weekly spawns, 0-42% for Fall broodstock during eight weekly spawns, and from 5-21% for Imnaha stock from eight weekly spawns (Table 9). Over the last eleven brood years (1993-2003 BY), the range of green egg-to-eyed embryo mortality was 1-52% for Wallowa stock and 1-57% for Imnaha stock.

Experimental Group Returns

The number of coded-wire tagged (CWT) and adipose-clipped adults that were harvested or returned to collection sites are used to estimate various performance parameters. These numbers allow us to monitor our success toward meeting the LSRCP goals, to estimate stray rates, and to determine the contribution to recreational, tribal, and commercial fisheries. They also provide the basis for evaluating the success of experimental rearing and release strategies. Recoveries for each CWT code were summarized from the CWT recovery database maintained by PSMFC, ODFW's mark recovery database, and from data reported by the Washington Department of Fish and Wildlife and Idaho Department of Fish and Game. Our protocol was to collect and enumerate all fish marked with a CWT when they were spawned, dispatched, or died. A summary of these data is provided in this report. Final analyses, results, and discussion of production and release strategies will be presented in special reports once all adults have returned from the experimental groups.

Adult returns from BY 1999-2002 occurred in the 2004-05 run year. Wallowa and Imnaha stock adults that returned in 2005 came from the following evaluation groups: a pre-smolt direct stream release strategy in Little Sheep Creek (Imnaha Basin) for BY 1999, forced versus volitional release groups at Wallowa Fish Hatchery and Big Canyon Facility (Wallowa Basin) for BY 2000-2001, monitoring of the BY 2000-2002 Big Sheep Creek (Imnaha Basin) marked and unclipped direct stream release groups (BY 2000 unclipped releases were marked with red colored visual implant elastomer (VIE) tags behind the left eye), unclipped and blank-wire-tagged releases at the Little Sheep Creek Facility for BY 2000-2002, and major production release groups. We had Wallowa stock recoveries from 16 CWT codes (Table 10) and Imnaha stock recoveries from eight CWT codes (Table 11).

Compensation Goals

Goals for smolt-to-adult return (SAR) rates and the number of adults produced to the compensation area are 0.68% and 9,184 for the Grande Ronde Basin (Wallowa stock) and 0.61% and 2,000 for the Imnaha Basin (Imnaha stock). The compensation area is defined as the watershed above Lower Granite Dam. To provide a cumulative summary of disposition for all adults that returned to the compensation area, we expanded CWT recoveries to account for the non-CWT fish that returned.

For the Wallowa stock, we estimate that in the 2004-05 run year, 12,151 hatchery origin adults returned to the compensation area, representing 132.3% of the compensation goal (Table 12). For the Imnaha stock, we estimate that 3,539 adults returned to the compensation area, accounting for 177.0% of the compensation goal.

There are three principal factors that influence success in meeting the compensation goals: number of smolts released for the brood years that produced the adults; smolt-to-adult survival (SAS) rates to the mouth of the Columbia River; and capture of fish below the compensation area in fisheries and as out-of-basin strays. Over the history of the LSRCP project, we have now reached our adult production compensation goal four times (1997-98, 2001-02, 2003-04, and 2004-05 run years) for the Wallowa program, and for four consecutive years for the Imnaha program (2001-02, 2002-03, 2003-04, and 2004-05 run years). For both the Grande Ronde and Imnaha programs, we have met our smolt production goals in most years. Returns in the 2004-05 run year represent the final returns of the 2000 BY. For the 2000 BY, SAS for the Wallowa and Imnaha stocks were 0.416% and 0.832%, respectively (Figure 3). Smolt-to-adult return to the compensation area above Lower Granite Dam has reached our goal for both Wallowa and Imnaha stocks in only two of the last 16 brood years (Figure 4). This suggests that low SAS rates may be the primary factor for rarely achieving our compensation goals. However, our SAR goal has been reached in both of the last two years for the Imnaha stock. For the Wallowa stock, 5.5% of the recoveries for the 2004-05 run year occurred downstream of the compensation area (Table 12). For the Imnaha stock, 5.7% of the recoveries for the 2004-05 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 through 1994 and 1998, and above 1.0 for completed brood years 1995 to 1997 and 1999 (Figure 5). Hatchery fish progeny-per-parent ratios (weir returns only) have been above 1.0 for all brood years except 1991. Hatchery ratios exceeded natural ratios 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; however the most recent five years of data suggest an increasing trend in natural returns (Figure 6).

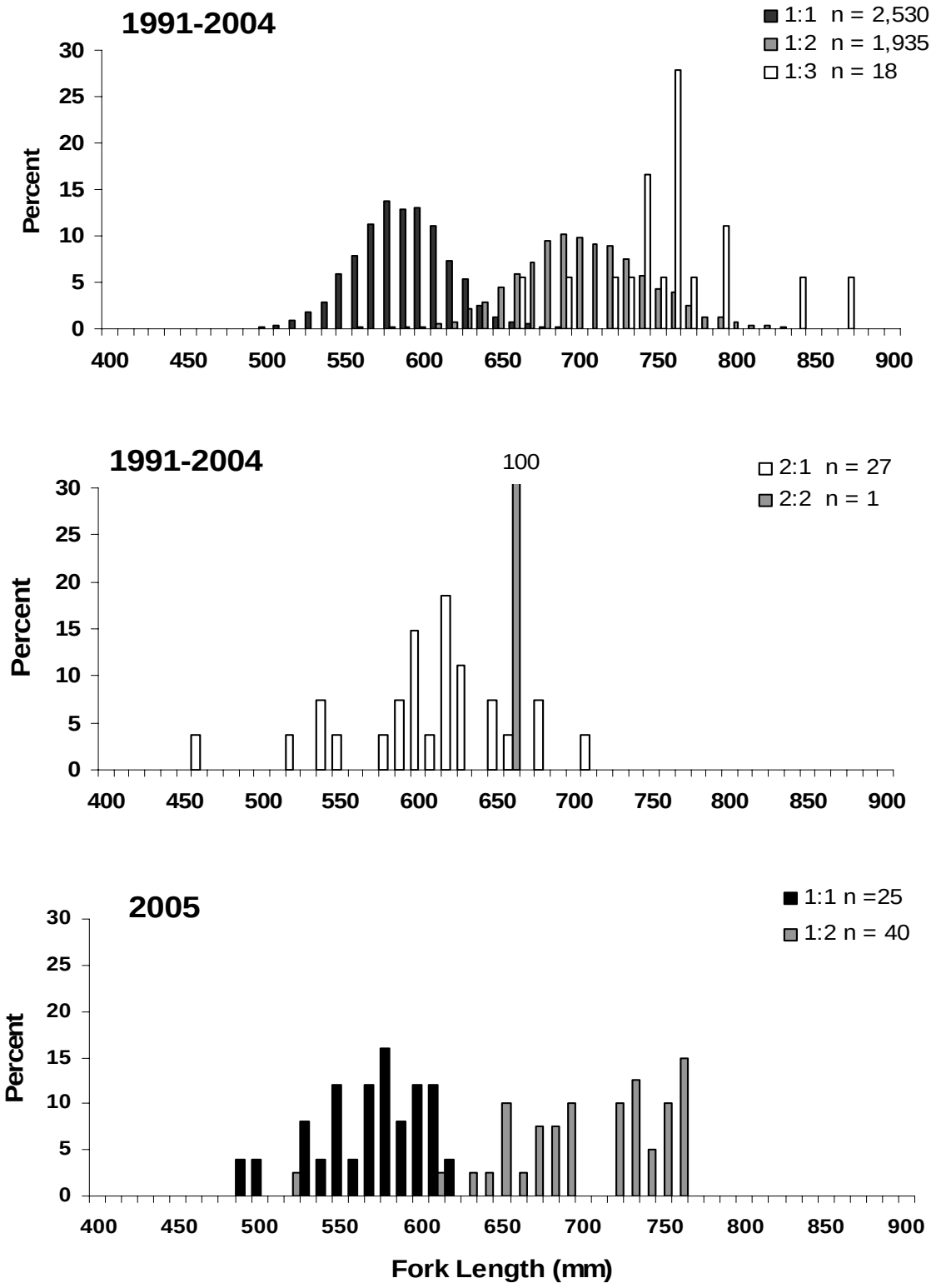

Figure 1. Length-at-age relationships based on scale analysis for adult returns of one freshwater age (top) and two freshwater age (middle) Wallowa stock summer steelhead from 1991 to 2004 and in 2005 (bottom).

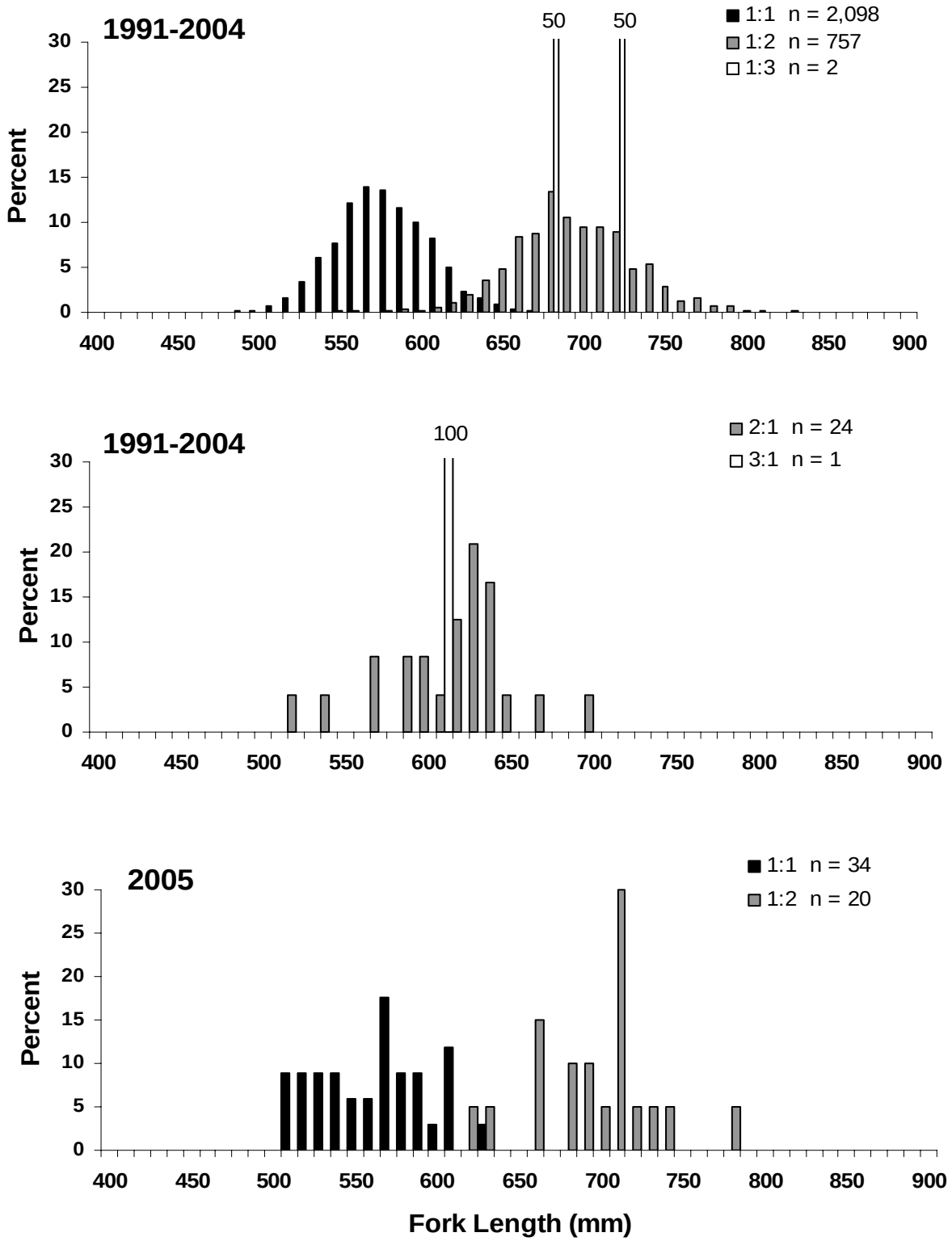

Figure 2. Length-at-age relationships based on scale analysis for adult returns of one freshwater age (top), and two and three freshwater age (middle) Imnaha stock summer steelhead from 1991 to 2004 and in 2005 (bottom).

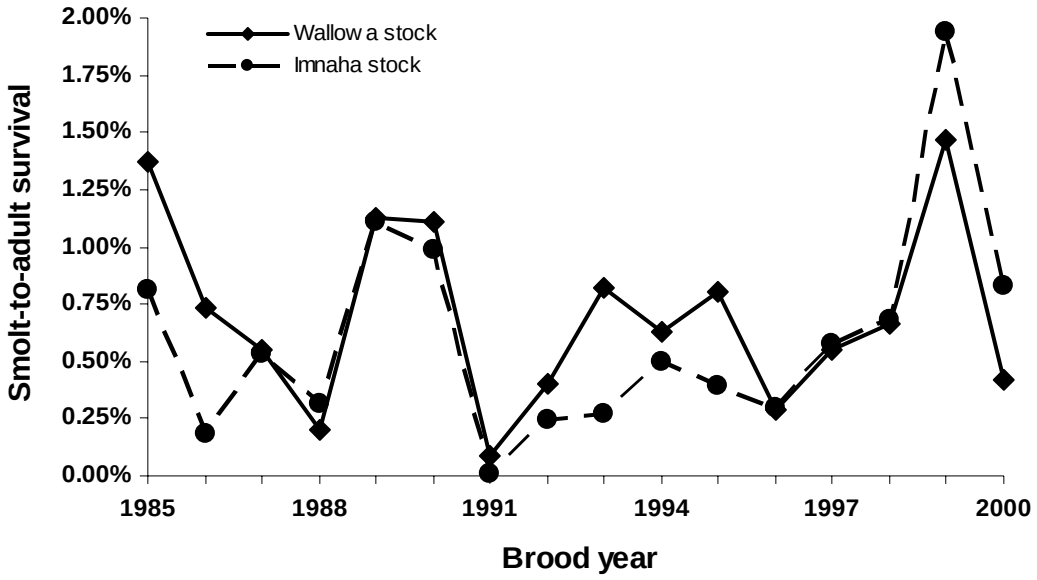

Figure 3. Smolt-to-adult survival rates for Wallowa and Imnaha stock summer steelhead, 1985-2000 brood years. Data is based on CWT recoveries.

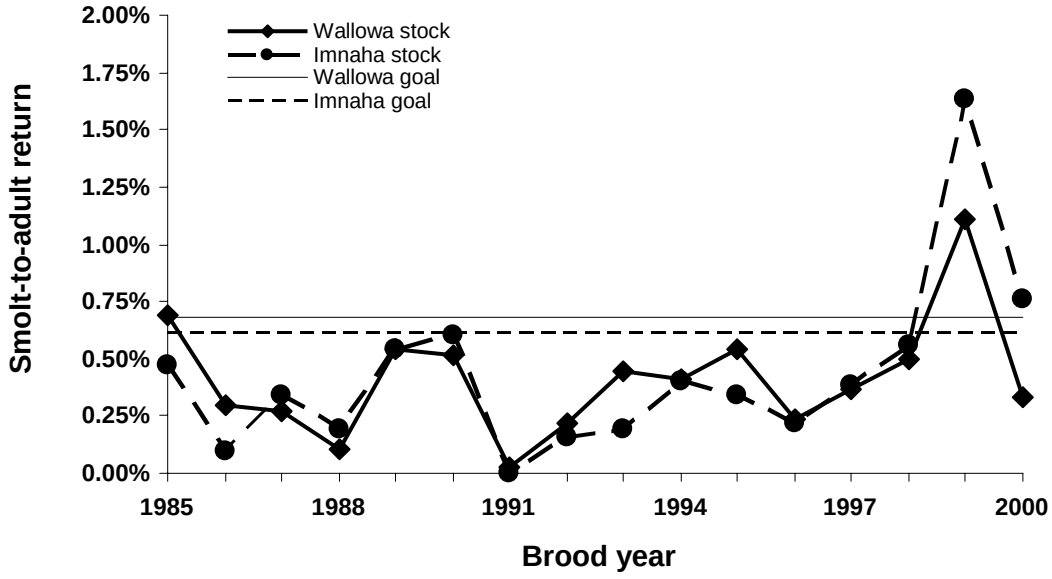

Figure 4. Smolt-to-adult return rates to the compensation area above Lower Granite Dam for Wallowa and Imnaha stock summer steelhead, 1985-2000 brood years. The Wallowa stock goal is 0.68% and the Imnaha stock goal is 0.61%. Data is based on CWT recoveries.

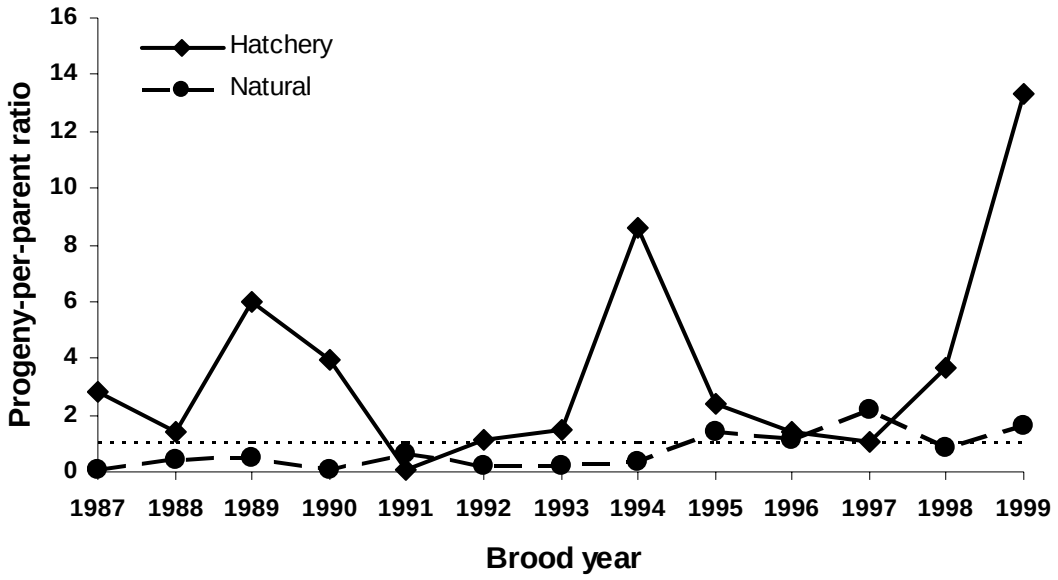

Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-1999 brood years. Dotted line represents replacement (P:P ratio =1).

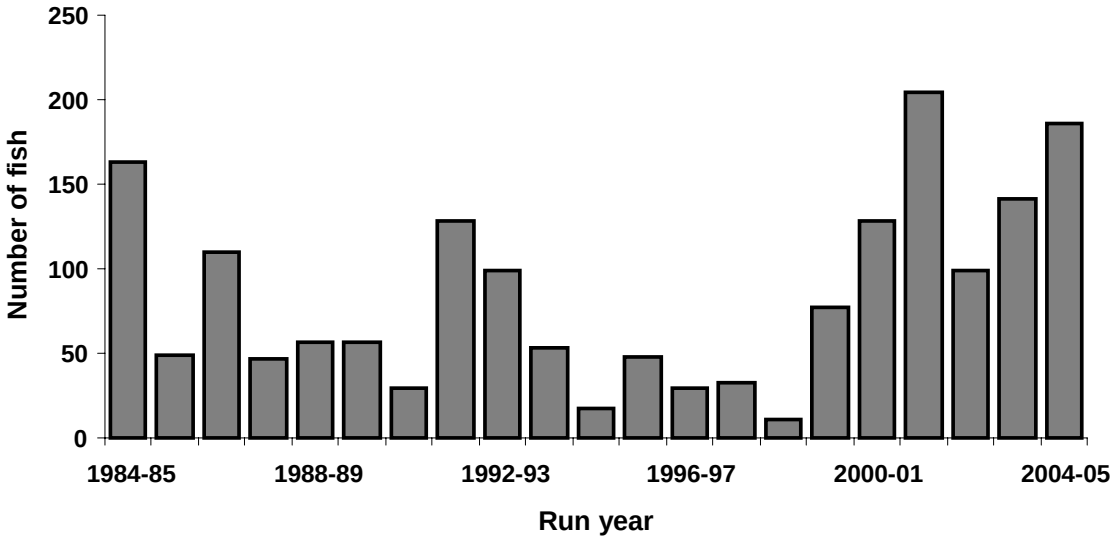

Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 2004-05.

Table 1. Summary of egg collection and juvenile survival for 2004 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2005.

Stock	Number of eggs taken	Eyed embryos	Total smolts released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt[a]
Wallowa	1,133,750	996,000[b]	712,890	87.9	87.9
Imnaha	432,180	398,120[c]	300,914[d]	92.1	93.5

[a] *Embryos that were culled from or not part of production were subtracted from the calculation of embryo-to-smolt survival.*
[b] *Includes 1,400 embryos that were transferred to the Salmon and Trout Enhancement Program (STEP) Coordinator. Also includes 183,241 embryos that were overestimated in the inventory.*
[c] *Includes 76,311 embryos that were overestimated in the inventory.*
[d] *Includes 8,470 fish outplanted to Kinney Lake as rainbow trout.*

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2004 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2005. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose fin-clipped, except for Imnaha stock blank-wire tagged fish which were not fin-clipped. Targets for tagged production groups were 100% AdLV+CWT and for tagged fall brood (brood collected in early fall) were 100% AdRV+CWT. ND indicates not determined because tag retention checks were conducted in outside rearing raceways containing both tagged and un-tagged fish.

Experimental group	Tag code	Number checked[a]		Percent					
		CWT	Ad	CWT+ clip	CWT+ no clip	No CWT + clip	No CWT + no clip	Ad	No Ad
				Wallowa Stock					
Production, 1	094104	523	-	91.4	5.5	3.1	ND	-	-
Production, 3	094105	547	-	94.3	3.7	2.0	ND	-	-
Production, 5	094106	514	-	93.2	5.1	1.8	ND	-	-
Production , 14	094107	510	-	90.8	8.6[b]	0.6	ND	-	-
Fall Brood, 9	094108	536	-	93.7	5.4	0.9	0.0	-	-
Fall Brood, 11	094109	529	-	96.0	3.0	0.9	0.0	-	-
Fall Brood, 13	094110	546	-	98.5	0.5	0.9	0.0	-	-
Fall Brood, 15	094111	531	-	98.3	1.3	0.4	0.0	-	-
Production, 7	094112	504	-	94.0	3.2	2.8	ND	-	-
Production, 16	094113	540	-	92.8	5.9	1.3	ND	-	-
Average	-	528.0	214.0	94.3	4.2	1.5	ND	99.6	0.4
				Imnaha Stock					
Production, 23	094103	507	-	91.5	4.1	4.3	ND	-	-
Production, 28	094020	520	-	91.2	4.0	4.8	ND	-	-
No fin clip, 25[c]	Blank tag	500	-	0.0	96.2	0.0	3.8	-	-
Average (23, 28)[d]	-	513.5	216.0	91.3	4.1	4.6	ND	99.8	0.2
Overall average[d]		525.6	214.7	93.8	4.2	2.0	ND	99.7	0.3

[a] *Adipose fin (Ad) clip quality checks were conducted on 221, 201, 208, and 226 fish in the four Wallowa stock raceways, and on 230 and 202 fish in the production Imnaha stock raceways prior to tagging and final ponding.*
[b] *This percentage includes 0.4% that were inadverently marked RV instead of LV.*
[c] *To equalize rearing densities, 20% of the fish from raceway 25 were reared in raceway 23.*
[d] *Averages includes CWT fish only.*

Table 3. Details of experimental and production groups of 2004 brood year summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2005. 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]
			Wallowa stock					
Production, 1	April 11-13	Spring Cr.	094104	216 (14)	107.8 (21.7)	1.05 (0.07)	24,463	81.3
Production, 3	April 11-13	Spring Cr.	094105	[c]	[c]	[c]	25,385	74.8
Production, 5	April 11-13	Spring Cr.	094106	[c]	[c]	[c]	25,026	73.0
Production 1-6, 8	April 11-13	Spring Cr.	-	218 (18)	113.7 (30.3)	1.07 (0.08)	234,877	-
Fall Broodstock, 9	April 11-13	Spring Cr.	094108	220 (18)	118.5 (30.2)	1.07 (0.07)	25,232	71.7
Fall Broodstock, 11	April 11-13	Spring Cr.	094109	[d]	[d]	[d]	25,915	76.6
Fall Broodstock, 13	April 11-13	Spring Cr.	094110	[d]	[d]	[d]	26,571	84.1
Fall Broodstock , 9, 11, 13	April 11-13	Spring Cr.	-	[d]	[d]	[d]	9,474	-
Production, 7	April 13-15	Deer Cr.	094112	209 (15)	100.5 (24.0)	1.08 (0.09)	25,672	69.5
Production, 7, 10	April 13-15	Deer Cr.	-	215 (20)	103.2 (29.2)	1.08 (0.08)	62,252	-
Production, 14	April 30-May 12	Spring Cr.	094107	223 (18)	117.9 (33.7)	1.01 (0.06)	24,308	73.7
Production, 12, 14, 18	April 30-May 12	Spring Cr.	-	214 (22)	103.8 (31.2)	1.02 (0.05)	93,939	-
Fall Broodstock, 15	April 30-May 12	Spring Cr.	094111	215 (19)	102.9 (27.7)	1.01 (0.06)	26,202	77.3
Fall Broodstock, 15	April 30-May 12	Spring Cr.	-	[e]	[e]	[e]	1,369	-
Production, 16	May 3-13	Deer Cr.	094113	218 (17)	103.1 (20.7)	1.01 (0.07)	24,993	78.9
Production, 16, 17	May 3-13	Deer Cr.	-	213 (18)	103.1 (22.5)	1.00 (0.05)	57,212	-
Total released							712,890	
			Imnaha stock					
Production, 23	April 11-May 5	L. Sheep Cr.	094103	199 (26)	94.0 (38.7)	1.08 (0.09)	23,203	58.7
No fin clip, 25[f]	April 11-May 5	L. Sheep Cr.	Blank tag	202 (25)	94.6 (37.2)	1.08 (0.09)	44,322	-
No fin clip, 25[f]	April 11-May 5	L. Sheep Cr.	-	[g]	[g]	[g]	1,750	
Production, 21, 23, 25, 27	April 11-May 5	L. Sheep Cr.	-	209 (28)	102.9 (37.2)	1.09 (0.08)	82,773	-
No fin clip, 24	April 11-13	B. Sheep Cr.	-	209 (21)	-	-	45,398	
Production, 28	April 11-13	B. Sheep Cr.	094020	201 (19)	-	-	47,789	66.8
Production, 26, 27	April 11-13	B. Sheep Cr.	-	209 (26)	-	-	47,209	-
Total released							292,444	

[a] *All fish were reared at Irrigon Fish Hatchery.*

[b] *The percent of PIT tag release groups that migrated to Lower Granite Dam are Cormack-Jolly-Seber estimates of survival probabilities from the SURPH.2 program (Lady et al. 2001).*

[c] *CWT codes 094104, 05, and 06 were in the same acclimation pond and were not distinguishable based on an external mark.*

[d] *CWT codes 094108, 09, and 10, and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[e] *CWT codes 094111 and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[f] *To equalize rearing densities, 20% of the 50 K "No fin clip+blank wire" tagged fish from raceway 25 were reared in raceway 23.*

[g] *Blank-tag+no fin clip fish and those that had shed their blank tags were in the same acclimation pond and were not distinguishable based on an external mark.*

Table 4. Density (±95% confidence interval) and mean fork length (standard deviation in parentheses) of residual hatchery steelhead, wild rainbow trout/juvenile steelhead, and juvenile chinook salmon from index sites on Deer (Grande Ronde) and Little Sheep (Imnaha) creeks in 2005. Hatchery steelhead were classified as residuals after 20 June. HSTS indicates residual hatchery steelhead, WSTS indicates wild rainbow trout/juvenile steelhead for ages one and older, and CHS indicates young-of-the-year chinook salmon.

			Area	Size of fish (mm)			Gender[b]		Density[c]
Location[a]	Date	Species	(m^2)	N	Fork length	Range	N	% males	(fish/100m^2)
					Grande Ronde Basin				
Deer Cr.	27 July	HSTS	257.3	14	171.1 (38.3)	119-253	3	100	5.6 ± 0.5
Deer Cr.	27 July	WSTS	164.2	35	106.7 (17.0)	78-153	-	-	15.6 ± 5.7
Deer Cr.	27 July	CHS	257.3	4	-	-	-	-	1.7 ± 1.9
					Imnaha Basin				
L. Sheep	28 July	HSTS	513.4	63	151.4 (32.9)	81-242	13	100	13.8 ± 1.5
L. Sheep	28 July	WSTS	513.4	27	112.1 (22.5)	74-180	-	-	5.3 ± 0.4

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

[b] *These fish were AdLV+CWT marked residual steelhead that were euthanized and used for CWT recovery.*

[c] *Density (±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 LSRCP facilities in 2005 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	-	-	-	-	-	-
Jan 29-Feb 04	5	-	-	0	0	-	-
Feb 05-11	6	-	-	0	0	-	-
Feb 12-18	7	0	0	0	0	-	-
Feb 19-25	8	5	0	0	0	-	-
Feb 26-Mar 04	9	42	0	3	1	0	0
Mar 05-11	10	149	0	70	4	47	1
Mar 12-18	11	638	0	9	0	164	16
Mar 19-25	12	312	0	28	1	149	14
Mar 26-Apr 01	13	264	0	280	5	89	8
Apr 02-08	14	342	1	283	11	513	39
Apr 09-15	15	213	0	113	6	349	36
Apr 16-22	16	221	2	172	26	301	27
Apr 23-29	17	116	2	96	17	329	37
Apr 30-May 06	18	44	0	7	1	53	6
May 07-13	19	13	0	8	4	25	3
May 14-20	20	1	0	0	0	6	1
May 21-27	21	0	0	0	1	0	0
May 28-Jun 03	22	-	-	-	-	-	-
Total		2,360	5	1,069	77[b]	2,025	188

[a] *Weirs installed on 25th January at Big Canyon Facility (Deer Cr.) and 25th February at Little Sheep Creek Facility, and the ladder opened on 8th February at Wallowa Fish Hatchery. Adult collections stopped on 23rd May at Big Canyon Facility, and 26th May at both Little Sheep Creek Facility and Wallowa Fish Hatchery.*

[b] *Includes one wild female observed in the ladder below the trap while it was being dewatered on 23 May 2005. The fish was sampled and passed above the weir.*

Table 6. Number, disposition, and mean fork length (mm) of adult steelhead that returned to LSRCP facilities in 2005 by stock, origin, estimated age (freshwater:saltwater), and gender. Fall broodstock were captured in the lower Grande Ronde River and transported to the hatchery. M indicates male and F indicates female. WFH indicates Wallowa Fish Hatchery.

Facility, stock, disposition	Hatchery[a]									Natural[b]											Grand total
	1:1		1:2		2:1		3:1			2:1		2:2		3:1		3:2		4:1			
	M	F	M	F	M	F	M	F	Total	M	F	M	F	M	F	M	F	M	F	Total	
Wallowa Fish Hatchery (Wallowa stock)																					
Trapped	890	354	386	730	0	0	0	0	2,360	0	0	0	1	0	2	1	1	0	0	5	2,365
Passed	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	1	0	0	5	5
Outplanted	36	9	13	15	0	0	0	0	73	0	0	0	0	0	0	0	0	0	0	0	73
Kept	854	345	373	715	0	0	0	0	2,287	0	0	0	0	0	0	0	0	0	0	0	2,287
Mortality	21	1	5	3	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	30
Spawned[c]	156	52	82	190	0	0	0	0	480	0	0	0	0	0	0	0	0	0	0	0	480
Killed[d]	677	292	286	522	0	0	0	0	1,777	0	0	0	0	0	0	0	0	0	0	0	1,777
Fork length (mm)	570	558	702	694	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Standard deviation	37	25	48	53	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	16	9	12	28	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Wallowa Fish Hatchery (Wallowa Stock-Fall Broodstock)[j]																					
Transferred to WFH	51	18	11	28	0	0	0	0	108	0	0	0	0	0	0	0	0	0	0	0	108
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	51	18	11	28	0	0	0	0	108	0	0	0	0	0	0	0	0	0	0	0	108
Mortality	8	1	1	1	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	11
Spawned	35	16	9	26	0	0	0	0	86	0	0	0	0	0	0	0	0	0	0	0	86
Killed[d]	8	1	1	1	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	11
Fork length (mm)	558	559	-	615	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Standard deviation	31	23	-	47	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	6	4	-	4	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Big Canyon Facility (Wallowa stock)																					
Trapped[e]	390	205	104	370	0	0	0	0	1,069	9	12	1	11	20	12	4	6	1	1	77	1,146
Passed	0	0	0	0	0	0	0	0	0	9	12	1	11	20	12	4	6	1	1	77	77
Outplanted	83	30	9	45	0	0	0	0	167	0	0	0	0	0	0	0	0	0	0	0	167
Returned to river[f]	7	1	1	9	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	18
Kept	530	486	70	137	0	9	1	1	1,216	0	0	0	0	0	0	0	0	0	0	0	1,216
Mortality	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killed[d,f]	299	174	94	316	0	0	0	0	883	0	0	0	0	0	0	0	0	0	0	0	883
Fork length (mm)	-	-	-	-	-	-	-	-		598	555	-	684	645	-	-	-	-	-		
Standard deviation	-	-	-	-	-	-	-	-		4	14	-	46	-	-	-	-	-	-		
Sample size	-	-	-	-	-	-	-	-		2	6	-	5	1	-	-	-	-	-		

Table 6. Continued

Facility, stock, Disposition	Hatchery 1:1 M	Hatchery 1:1 F	Hatchery 1:2 M	Hatchery 1:2 F	Hatchery 2:1 M	Hatchery 2:1 F	Hatchery 3:1 M	Hatchery 3:1 F	Hatchery Total	Natural 2:1 M	Natural 2:1 F	Natural 2:2 M	Natural 2:2 F	Natural 3:1 M	Natural 3:1 F	Natural 3:2 M	Natural 3:2 F	Natural 4:1 M	Natural 4:1 F	Natural Total	Grand total
Little Sheep Creek Facility (Imnaha stock)																					
Trapped	886	616	102	421	0	0	0	0	2,025	36	33	10	40	32	16	2	19	0	0	188	2,213
Passed	139	80	19	44	0	0	0	0	282	33	32	7	35	28	15	2	18	0	0	170	452
Outplanted[g]	652	493	78	332	0	0	0	0	1,555	0	0	0	0	0	0	0	0	0	0	0	1,555
Kept	95	43	5	45	0	0	0	0	188	3	1	3	5	4	1	0	1	0	0	18	206
Mortality	8	1	0	0	0	0	0	0	9	0	0	0	0	1	0	0	0	0	0	1	10
Spawned[h]	82	40	5	45	0	0	0	0	172	3	1	3	5	3	1	0	1	0	0	17	189
Killed	5	2	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	7
Fork Length (mm)	559	557	681	693	-	-	-	-		-	520	-	672	-	582	-	652	-	-		
Standard deviation	36	31	44	37	-	-	-	-		-	-	-	21	-	-	-	-	-	-		
Sample size	21	13	5	15	-	-	-	-		-	1	-	3	-	1	-	1	-	-		

[a] *Wallowa stock ages apportioned using 79 scale samples collected in 2005; Imnaha stock ages apportioned using 49 scale samples from 2004 and 53 scale samples from 2005 in order to increase sample size. Lengths are from fish with 2005 scale samples.*

[b] *Wallowa and Big Canyon ages apportioned using historical data (128 samples) and 2005 data (16 samples); at Little Sheep Creek Facility historical data (70 samples), 2005 data (6 samples), 2006 data (56 samples), and 2007 data (42 samples) were used to increase sample size.*

[c] *Includes 80 fish (40 males and 40 females) that were spawned and embryos were transferred to Washington Department of Fish and Wildlife (WDFW).*

[d] *For Wallowa stock, 1,095 fish that returned to Wallowa Fish Hatchery and 545 fish that returned to Big Canyon were euthanized and donated to local food banks. In addition, 72 fish from Wallowa Hatchery and 78 fish from Big Canyon were euthanized and donated to local schools for educational purposes.*

[e] *Includes one wild female observed in the ladder below the trap while it was being dewatered on 23 May 2005. The fish was sampled and passed above the weir.*

[f] *Thirty-six fish were returned to the river fishery. Of these, nine males and nine females returned to the weir a second time and were euthanized. These 18 fish are included in the "killed" category.*

[g] *Includes one male and six females outplanted, recaptured and passed above the weir. Also includes two females outplanted, recaptured and spawned.*

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

Table 7. Number of adult summer steelhead trapped at the Little Sheep Creek Facility weir that were either outplanted to Big Sheep Creek or passed above the weir, and were subsequently recaptured, 1999-2005.

	Big Sheep Creek			Little Sheep Creek		
	Number of fish		%	Number of fish		%
Year	Outplanted	Recaptured[a]	Recaptured[b]	Passed	Recaptured[a]	Recaptured[b]
1999	42	6	14.3	80	1	1.3
2000	138	17	12.3	200	9	4.5
2001	354	48	13.6	784	89	11.4
2002	2,030	907	44.7	1198	269	22.5
2003	1,403	439	31.3	387	36	9.3
2004	1,719	244	14.1	823	138	16.8
2005	1,555[c]	109	7.0	461	37	8.0
Average	-	-	19.6	-	-	10.5

[a] *Total number of recaptures, including second and third time recaptures. For 1999-2002, recaptures were opercle punched at the weir and second and third time recaptures recorded.*
[b] *Total recaptured divided by total outplanted.*
[c] *Includes seven hatchery fish (one male and six females) outplanted, recaptured, and passed above the weir.*

Table 8. Summary of summer steelhead spawning surveys in Deer Creek above the Big Canyon Facility weir, 2002-2005.

Year	Females passed	Males passed	Total passed	Redds counted	Fish/ redd	Females/ redd	% Redds counted[a]	Redds/ mile[b]	Redd visibility[c]
2002	120	89	209	84	2.49	1.43	70	8.4	19.8
2003	92	48	140	64	2.19	1.44	70	6.4	20.5
2004	47	20	67	46	1.46	1.02	98	4.6	29.8
2005	42	35	77	35	2.20	1.20	83	3.5	16.7

[a] *Calculated as number of redds counted ÷ number of females passed x 100. The assumption is that each female passed constructs one redd.*
[b] *Twelve miles of stream were surveyed in 2002 and 2003. Ten miles of stream were surveyed in 2004 and 2005. Redds/mile were based on the lower ten miles, since redds have not been observed between RM 10-12.*
[c] *Indicates the average length of time (in days) each redd was clearly or moderately visible.*

Table 9. Spawning summaries for summer steelhead at LSRCP facilities in 2005. 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
		Wallowa Hatchery (Wallowa stock)		
3/16, wa420	Production	105,300	98,000	6.9
	Fall Broodstock	14,400	8,400	41.7
3/23, wa421	Production	164,400	158,000	3.9
	Fall Broodstock	40,400	38,200	5.4
3/30, wa422	Production	238,800	212,800	10.9
	Fall Broodstock	13,600	13,100	3.7
4/06, wa423	Production	229,400	207,800	9.4
	Fall Broodstock	13,450	13,000	3.3
4/13, wa424	Production	164,100	149,200	9.1
	Fall Broodstock	54,800	48,500	11.5
4/20, wa425	Production	132,400	121,600	8.2
	Fall Broodstock	41,600	41,600	0
4/27, wa426	Production	83,000	78,000	6.0
	Fall Broodstock	8,700	8,500	2.3
5/03, wa427	Production	0	0	-
	Fall Broodstock	6,250	5,600	10.4
Subtotal	Production	1,117,400	1,025,400	8.2
	Fall Broodstock	193,200	176,900	8.4
Total		1,310,600	1,202,300	8.3
		Little Sheep Creek Facility (Imnaha stock)		
3/22, li520	Hatchery	19,075	17,300	9.3
3/29, li521	Hatchery	30,712	31,500	10.3
	Mixed	4,388		
4/05, li522	Hatchery	40,700	36,000	11.5
4/12, li523	Hatchery	119,000	131,400	8.0
	Mixed	23,800		
4/19, li524	Hatchery	53,093	69,000	4.7
	Mixed	19,307		
4/25, li525	Hatchery	46,818	45,100	12.4
	Mixed	4,682		
5/03, li526	Hatchery	25,500	26,800	21.2
	Mixed	8,500		
5/10, li527	Hatchery	30,590	40,300	7.8
	Mixed	13,110		
Subtotal	Hatchery	365,488	397,400	9.5
	Mixed	73,787		
Total		439,275	397,400	9.5

[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 1,800 Wallowa production stock eyed embryos that were transferred to the Salmon and Trout Enhancement Program (STEP), 47,600 Wallowa production stock eyed embryos that were euthanized because they were excess to program needs, and 4,000 Wallowa fall broodstock eyed embryos that were euthanized due to physical deformities.*

Table 10. Summary of anadromous adult recoveries of coded-wire tagged (CWT) Wallowa stock summer steelhead for the 2004-05 run year. All CWT fish were hatchery origin fish released into either Deer Creek (at Big Canyon Facility) or Spring Creek (at Wallowa Fish Hatchery). Data were summarized as available through December 2008.

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]
2000						
Deer Cr.	Production, April	093215	0	0	0	0
	Forced, May	093216	0	0	0	0
	Volitional, May	093217	0	0	0	0
Spring Cr.	Production, April	093212	0	0	0	0
	Forced, May	093213	0	0	0	0
	Volitional, May	093214	0	0	0	0
2001						
Deer Cr.	Production, April	093407	21	57	91	169
	Forced, May	093408	32	30	26	88
	Volitional, May	093409	22	36	78	136
Spring Cr.	Production, April	093404	24	31	54	106
	Forced, May	093405	22	56	26	104
	Volitional, May	093406	20	24	23	67
2002						
Deer Cr.	Production, April	093631	45	67	156	268
	Production, May	093633	36	19	95	150
Spring Cr.	Production, April	093630	46	24	73	143
	Production, May	093632	30	36	21	87
	Total recoveries		298	380	643	1,321

[a] *Experimental groups include the release strategy. All releases were targeted for five fish per pound (90.7g/fish). All fish were acclimated. April releases were forced (over a 24-hour period) and May releases were volitional (1-3 weeks) unless otherwise noted.*

[b] *Actual number of CWT fish that were released into Spring 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.*

[c] *Estimated number (from creel surveys and harvest card returns) of CWT fish that were harvested in the Grande Ronde River Basin fisheries.*

[d] *Estimated number (from PSMFC and ODFW databases) of 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 2004-05 run year. All CWT fish were hatchery origin fish either released into Little Sheep Creek at Little Sheep Creek Facility or into Big Sheep Creek. Data were summarized as available through December 2008.

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]
2000						
Little Sheep	Production, April	093210	0	0	0	0
	Production, May	093211	0	0	0	0
2001						
Big Sheep	Production, April	090125	0	27	23	50
Little Sheep	Production, April	093402	46	4	22	72
	Production, May	093403	39	16	27	82
2002						
Big Sheep	Production, April	093636	15	38	71	124
Little Sheep	Production, April	093634	114	17	84	215
Little Sheep	Production, May	09 3435	84	10	24	118
	Total recoveries		298	112	251	661

[a] *Experimental groups include the release strategy. All releases were targeted for five fish per pound (90.7 g/fish). All fish were acclimated, except for Big Sheep which were direct stream releases. All Little Sheep releases were forced (over a 24-hour period).*

[b] *Estimated number of CWT fish recovered at the Little Sheep Creek Facility weir based on actual number recovered at the weir and estimated number either passed above the weir to Little Sheep Creek or outplanted to Big Sheep Creek to spawn naturally.*

[c] *Estimated number (from creel surveys and harvest card returns) of 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. Harvest and escapement distribution of adult summer steelhead by recovery location for the 2004-05 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 December 2008. "-" indicates not sampled or undefined.

	Wallowa Stock			Imnaha Stock		
Location	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean harvest	1	2	0.0	0	0	0.0
Columbia River Harvest						
Treaty net	25	177	1.4	14	38	1.0
C and S	0	0	0.0	0	0	0.0
Sport	36	312	2.4	41	108	2.9
Test	0	0	0.0	0	0	0.0
Tributary sport	0	0	0.0	0	0	0.0
Deschutes River Harvest						
Sport	9	45	0.3	11	35	0.9
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. Basin[a]	22	175	1.4	8	32	0.9
Within Snake R. Basin*	5	28	0.2	0	0	0.0
Snake River sport, tribs.*	545	3,874	30.1	177	514	13.7
Oregon tributary harvest* [b]	380	4,820	37.5	112	278	7.4
Other in-basin escapement* [c]	-	0	0.0	-	720	19.2
Hatchery weir* [d]	298	3,429	26.7	298	2,027	54.0
Total estimated return	1,321	12,862	100	661	3,752	100
Return to compensation area		12,151			3,539	
Percent of compensation goal		132.3			177.0	

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

[a] *Due to lost snouts (N = 10) at Warm Springs National Fish Hatchery for the 2004-05 run year (David Hand, personal communication, 1/8/09), no CWT data was available for this recovery area. Therefore, total returns in areas outside of the Snake River Basin may be underestimated.*

[b] *Harvest estimates based on angler surveys and harvest card returns.*

[c] *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.*

[d] *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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