LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Summer Steelhead Evaluation Studies
2006 Annual Progress Report

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OREGON
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LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

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Front cover photo of Troy, OR elementary students during fall broodstock collection on the Lower Grande River. Photo taken by Mike Flesher, 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 2006. 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 2001-2003 broods returned to spawn, and steelhead from the 2005 brood were released as smolts. Adult steelhead that returned to spawn were used to create the 2006 brood.

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

Objectives

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

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

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

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

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

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

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

Accomplishments and Findings

We accomplished each of our objectives for 2006. 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. 2008b).

The production goal of 870,000 Wallowa stock smolts was not achieved in 2006, with 859,648 smolts released. The Imnaha stock production goal of 330,000 smolts was also not achieved in 2006, with 279,904 smolts released. In 2006, we released a group of 78,960 unclipped, untagged smolts into Big Sheep Creek.

In 2006, 2,958 and 1,986 Wallowa stock hatchery steelhead returned to Wallowa Fish Hatchery and the Big Canyon Facility, respectively. In addition, we trapped 11 natural steelhead at Wallowa Fish Hatchery and 85 natural steelhead at the Big Canyon Facility, which were released to spawn naturally. At the Little Sheep Creek Facility, we trapped 2,354 Imnaha stock hatchery and 115 natural steelhead adults. Of these, we released 250 hatchery and 102 natural steelhead above the weir, and outplanted 1,934 hatchery steelhead to Big Sheep Creek. We

continued the Wallowa stock fall-collected broodstock experiment by collecting 115 adult steelhead in October 2005. During spawning in the spring of 2006, we collected 1,086,450 Wallowa stock eggs, 236,530 Wallowa Fall Broodstock eggs, and 408,230 Imnaha stock eggs.

In the 2005-06 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 five times in our program history, and the Imnaha stock goal six times. We estimate that 15,258 Wallowa stock hatchery steelhead (166.1% of goal), and 4,432 Imnaha stock hatchery steelhead (221.6% of goal) returned to the LSRCP compensation area in 2006.

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 2005 brood year (BY) released in 2006. Included are collection, spawning, and adult characteristics for the 2006 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 et al. 2005c, Carmichael et al. 2006). Coded-wire tag (CWT) data that were collected from 2006 adult returns were used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 2006, experimental treatments from which fish returned included forced vs. volitional release, unclipped, blank-wire tagged release, and off-station direct-stream release strategies. In 2006, experimental fish were released at Wallowa Hatchery to evaluate progeny from early returning (fall-collected) broodstock vs. production broodstock. We also released unclipped, blank-wire tagged smolts from Little Sheep Creek, and two groups (marked and unmarked/untagged) of off-station direct stream release smolts into Big Sheep Creek 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; Flesher et al. 2005a; 2009; 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; 2005b; 2007; 2008a), 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 2006 is presented in the summer steelhead creel annual progress report (Flesher et al. 2008b).

RESULTS AND DISCUSSION

Juveniles

Wallowa stock egg-to-eyed embryo survival for the 2005 brood year (BY) was 91.7%, slightly above the range of recent brood years (1993-2004 BY range = 71.8-91.6%), and embryo-to-smolt survival was 84.7%, below the range of recent brood years (1993-2004 BY range = 86.5-98.3%; Table 1). Imnaha stock egg-to-embryo survival for the 2005 BY was 90.5%, within the range of recent brood years (1993-2004 BY range = 76.7-92.1%), and embryo-to-smolt survival was 79.5%, below the range of past years (1993-2004 BY range = 87.8-98.5%; Table 1). We released 859,648 Wallowa stock smolts in 2006, less than our production goal of 870,000 smolts. For the Imnaha stock, we released 279,904 Imnaha stock smolts, also less than our production goal of 330,000 smolts (Tables 1 and 3). A higher than normal loss of 2005 brood year juveniles was primarily due to bacterial coldwater disease, caused by *Flavobacterium psychrophilum* (S. Onjukka, May/June 2005 Monthly Activity Report for Fish Health Services). Hatchery managers attempt to meet production goals every year; however variation in mortality at various stages of rearing, from fertilized eggs to acclimated smolts, results in fewer or more fish being released in any given year. Managers periodically adjust the number of eggs collected based on recent hatchery performance.

To evaluate different rearing and release strategies, we marked and released six groups of Wallowa stock steelhead and one group of Imnaha stock steelhead smolts with adipose-left ventral clips and coded-wire-tags (AdLV and CWT), and six groups of Wallowa stock Fall Brood steelhead with adipose-right ventral clips and coded-wire tags (AdRV and CWT; Table 2). We marked 95.6% of Wallowa stock smolts and 97.3% of Imnaha stock smolts with an adipose fin clip, which was below the range of recent brood years for Wallowa stock (1993-2004 BY range = 97.8-99.6%) and within the range of recent brood years for Imnaha stock (1993-2004 BY range = 96.1-99.8%). Fin clip quality and tag retention for experimental groups averaged 96.9% for Wallowa, within the range of recent years (1993-2004 BY range = 89.1-99.3%) and 97.0% for Imnaha stocks, also within the range of recent years (1993-2004 BY range = 84.7-99.0%). We also released 78,960 unmarked (unclipped and untagged) Imnaha stock smolts into Big Sheep Creek. Details of experimental and production releases for the 2005 BY are shown in Table 3.

Densities of residual hatchery steelhead were similar to those of wild *O. mykiss* at index sites in the Grande Ronde Basin in 2006 (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, 83% of residual hatchery steelhead were males, similar to the gender ratio observed in previous years.

Adults

Weirs were installed to capture adult steelhead on 24 January at Big Canyon Facility, 8 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 115 (4.7%) natural steelhead. Similar to Little Sheep Creek, most of the adults that returned to the Big Canyon Facility were of hatchery origin, with only 85 (4.1%) natural steelhead. In addition, 11 (0.4%) 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). Forty-three percent (50 of 115), 33% (28 of 85), and 18% (2 of 11) 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 2006 were spawned or killed (Table 6). In 2006, 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 116 adult hatchery steelhead from Wallowa Fish Hatchery, and 111 hatchery adults from Big Canyon Facility to local ponds for harvest opportunities. In addition, 130 fish captured at Big Canyon Facility were returned to the Wallowa River for further angling opportunities. Sixty-six of these fish returned to the weir a second time and were euthanized. At the Big Canyon Facility, 85 natural fish and four hatchery fish were passed above the weir to spawn naturally. One hundred fifteen hatchery steelhead —presumably of Wallowa stock— were captured by hook and line on the lower Grande Ronde River in mid-October 2005 (Table 6), to be held and spawned as fall broodstock the following spring. Adult steelhead collection information for the fall broodstock program from years 2003 through 2006 is shown in Appendix Table 1. Of the 115 fall broodstock returning in 2006, all were transferred to the Wallowa Fish Hatchery where 79 were spawned. We retained 7% of the hatchery fish and 10% of the natural fish for spawning at Little Sheep Creek Facility, and outplanted 1,934 hatchery adults to Big Sheep Creek to spawn naturally. Seven hundred three of the 1,934 outplanted fish (36%) were recaptured at least once at the Little Sheep Creek Facility in 2006. One hundred two natural and 250 hatchery adults were released above the weir in Little Sheep Creek to spawn naturally. In addition, 4 natural males were spawned and then passed above the weir, resulting in 70% of fish above the weir being of hatchery origin. Of the 352 fish passed into Little Sheep Creek, 53 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.

In 2006, we collected a large number of scale samples from natural fish at both the Big Canyon Facility and Little Sheep Creek Facility. This large sample size allowed us to estimate the age composition of natural fish using only data from fish returning in 2006 (Table 6). Previously, historical data was compiled in order to reach a large enough sample size. From scale reading, it was determined that four out of 48 fish sampled (8%) at Big Canyon and five out of 61 fish sampled (8%) at Little Sheep Creek were unmarked hatchery origin fish, originally identified as natural fish and passed above the weir.

We conducted multiple spawning redd surveys of steelhead that were passed above the Big Canyon Facility weir into Deer Creek using protocols described in Gee et al. (2008). In 2006, a

total of 96 steelhead were passed above the weir, of which 55 were females (Table 8). Fifty-eight redds were counted, which was 105% of the total number of redds constructed, assuming that each female constructs one redd.

In 2006, we accomplished our egg take goal for the Wallowa stock with 1,322,980 green eggs collected. Of these, 1,086,450 were for production and 236,530 were for the Fall broodstock evaluation. We collected 408,230 green Imnaha stock eggs, which exceeded our goal of 366,000 eggs. Mortality from green egg-to-eyed embryo ranged from 5-31% for Wallowa production stock from seven weekly spawns, 5-48% for Fall broodstock during seven weekly spawns, and from 4-15% for Imnaha stock from eight weekly spawns (Table 9). Over the last twelve brood years (1993-2004 BY), the range of green egg-to-eyed embryo mortality was 0-52% 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 2001-2003 occurred in the 2005-06 run year. Wallowa and Imnaha stock adults that returned in 2006 came from the following evaluation groups: forced versus volitional release groups at Wallowa Fish Hatchery and Big Canyon Facility (Wallowa Basin) for BY 2001, monitoring of the BY 2001-2003 Big Sheep Creek (Imnaha Basin) marked and unclipped direct stream release groups, unclipped and blank-wire-tagged releases at the Little Sheep Creek Facility for BY 2001-2003, and major production release groups. We had Wallowa stock recoveries from 14 CWT codes (Table 10) and Imnaha stock recoveries from nine 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 2005-06 run year, 15,258 hatchery origin adults returned to the compensation area, representing 166.1% of the compensation goal (Table 12). For the Imnaha stock, we estimate that 4,432 adults returned to the compensation area, accounting for 221.6% of the compensation goal. Age composition of returning adults is shown in Table 13.

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 five times (1997-98, 2001-02, 2003-04, 2004-05, and 2005-06 run years) for the Wallowa program, and six times for the Imnaha program (1992-93, 2001-02, 2002-03, 2003-04, 2004-05, and 2005-06 run years). For both the Grande Ronde and Imnaha programs, we have met our smolt production goals in most years. Returns in the 2005-06 run year represent the final returns of the 2001 BY. For the 2001 BY, SAS for the Wallowa and Imnaha stocks were 1.485% and 1.402%, respectively (Figure 3). Smolt-to-adult return to the compensation area above Lower Granite Dam has reached our goal in only three of the last 17 brood years for both Wallowa and Imnaha stocks (Figure 4). This suggests that low SAS rates may be the primary factor for rarely achieving our compensation goals. However, our SAR goal has been reached in each of the last three years for Imnaha stock and in two of the last three years for Wallowa Stock. For Wallowa stock, 10.8% of the recoveries in the 2005-06 run year occurred downstream of the compensation area (Table 12). For Imnaha stock, 12.9% of the recoveries in the 2005-06 run year occurred downstream of the compensation area. Development of the compensation plan goals assumed that twice as many adult steelhead would be harvested in downriver fisheries as return to the compensation area (USACOE 1975), however that harvest level was not reached for either stock.

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 were below 1.0 for completed brood years 1987 to 1994 and 1998, and above 1.0 for completed brood years 1995 to 1997, 1999, and 2000 (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 for the 1991 and 1997 broods. One purpose of the supplementation program is to enhance or stabilize natural fish abundance. Annual abundance of naturally-produced fish has been highly variable; however recent years of data suggest an increasing trend in natural returns (Figure 6).

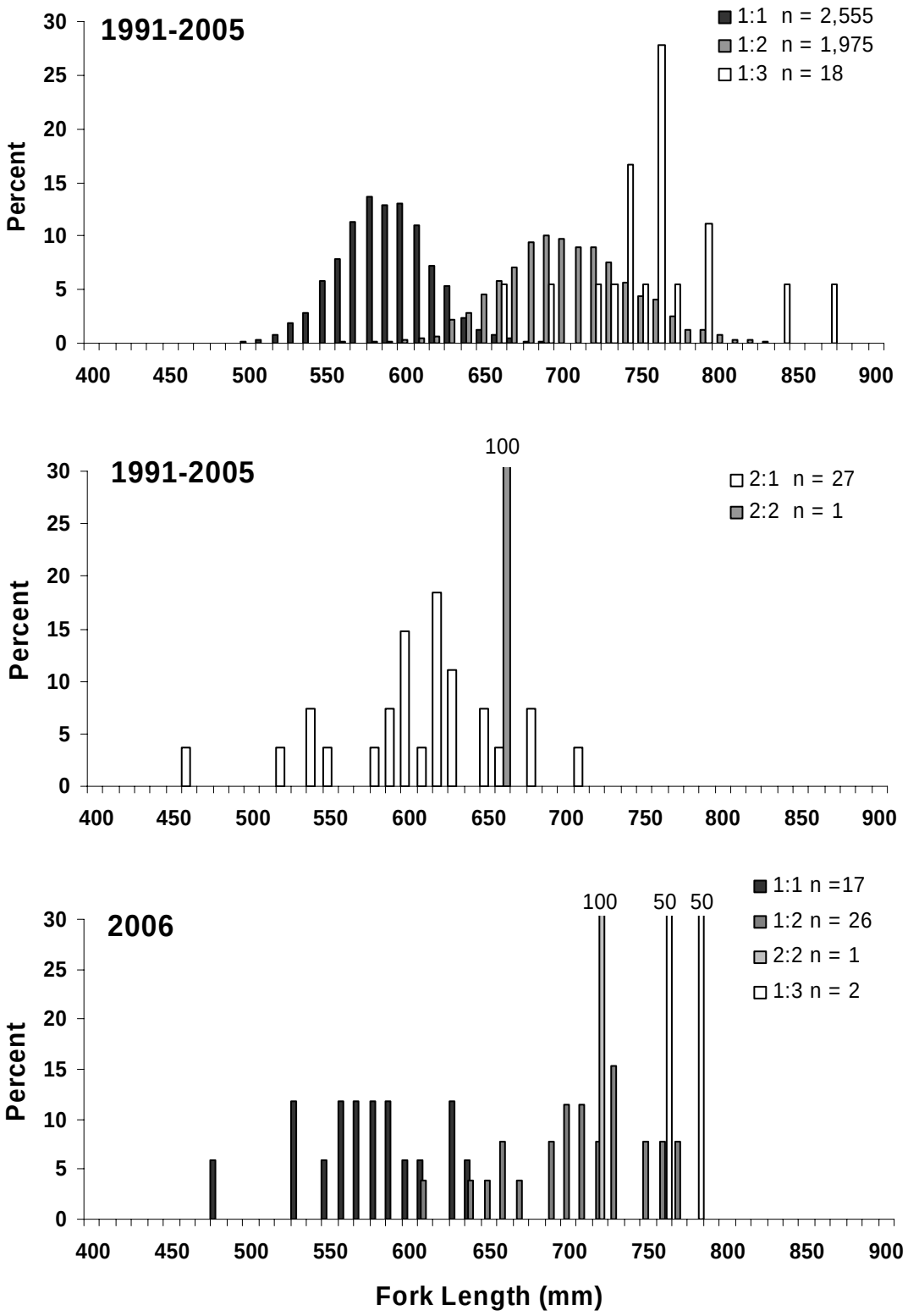

Figure 1. Length-at-age relationships based on scale analysis for adult returns of one freshwater age (top) and two freshwater age (middle) Wallowa stock summer steelhead from 1991 to 2005 and in 2006 (bottom).

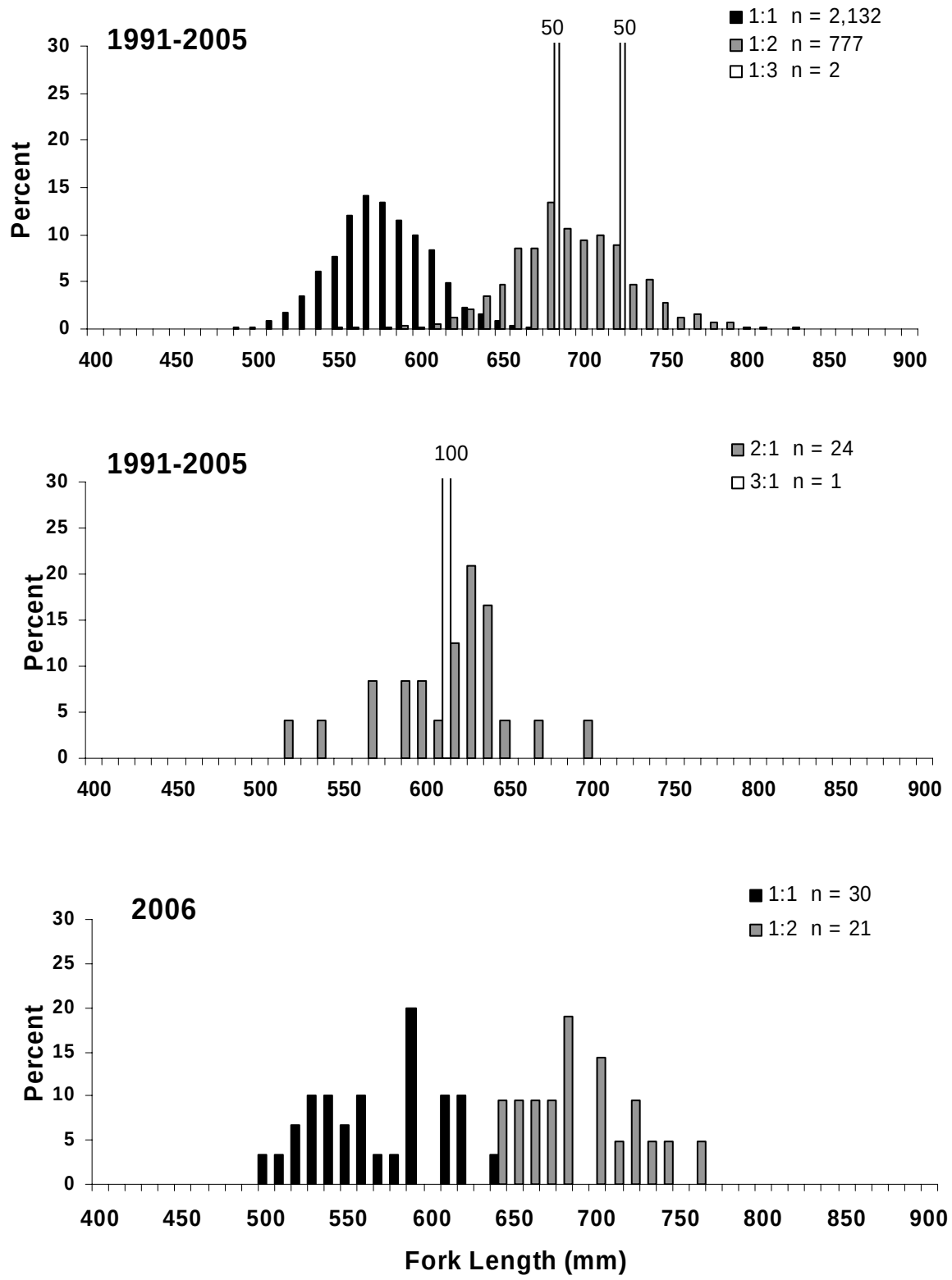

Figure 2. Length-at-age relationships based on scale analysis for adult returns of one freshwater age (top), and two and three freshwater age (middle) Imnaha stock summer steelhead from 1991 to 2005 and in 2006 (bottom).

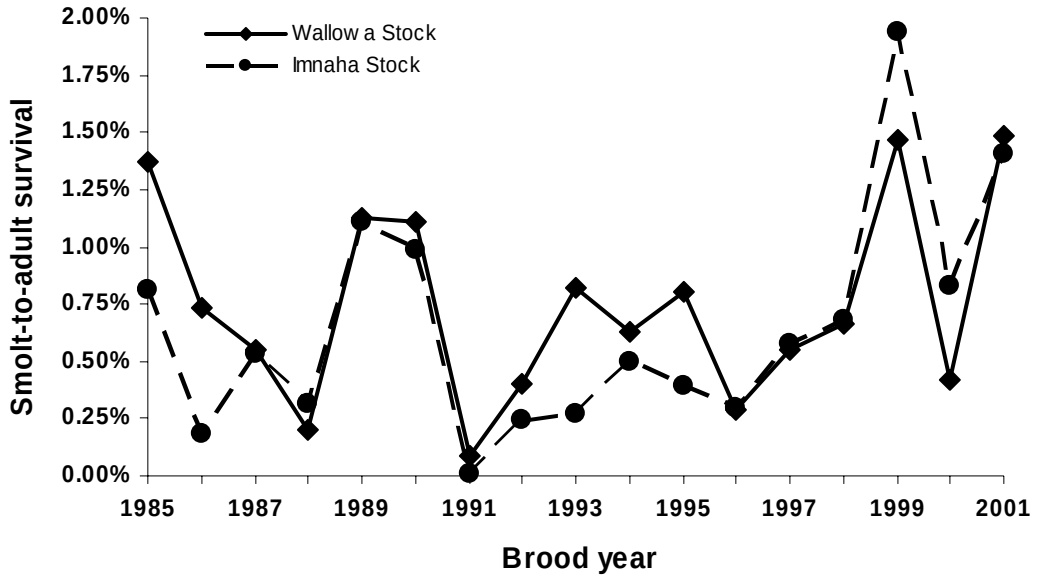

Figure 3. Overall smolt-to-adult survival (SAS) for Wallowa and Imnaha stock summer steelhead, 1985-2001 brood years. Data is based on CWT recoveries.

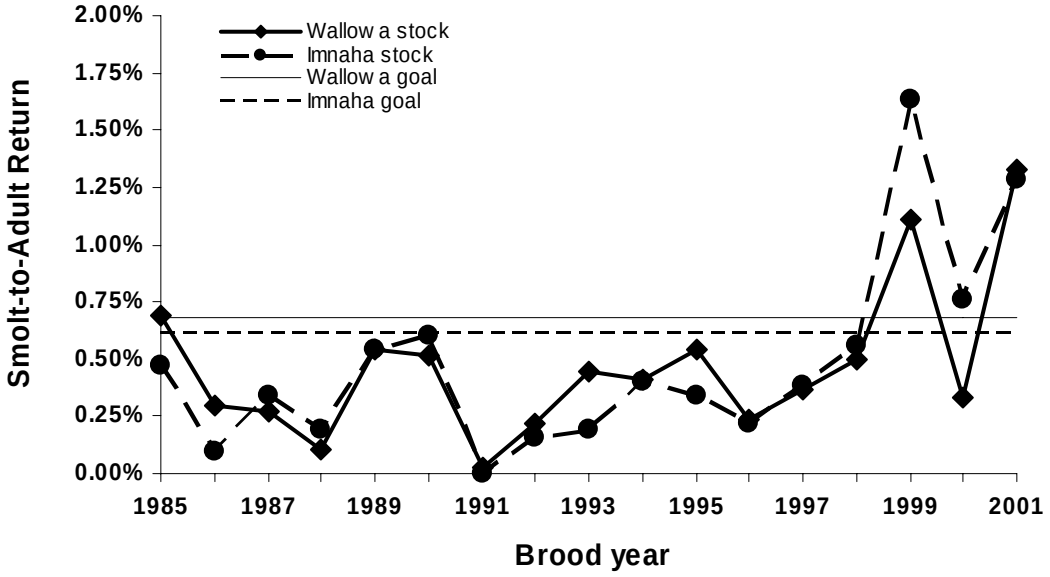

Figure 4. Smolt-to-adult return rates to the compensation area above Lower Granite Dam for Wallowa and Imnaha stock summer steelhead, 1985-2001 brood years. The Wallowa stock goal is 0.68% and the Imnaha stock goal is 0.61%. Data is based on CWT recoveries.

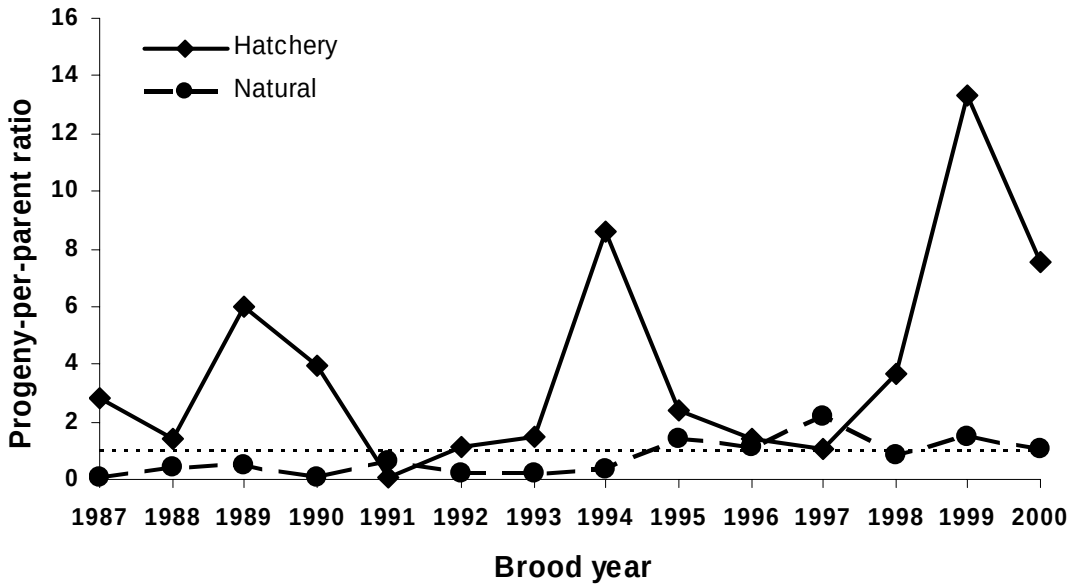

Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, 1987-2000 brood years. Dotted line represents replacement (P:P ratio =1).

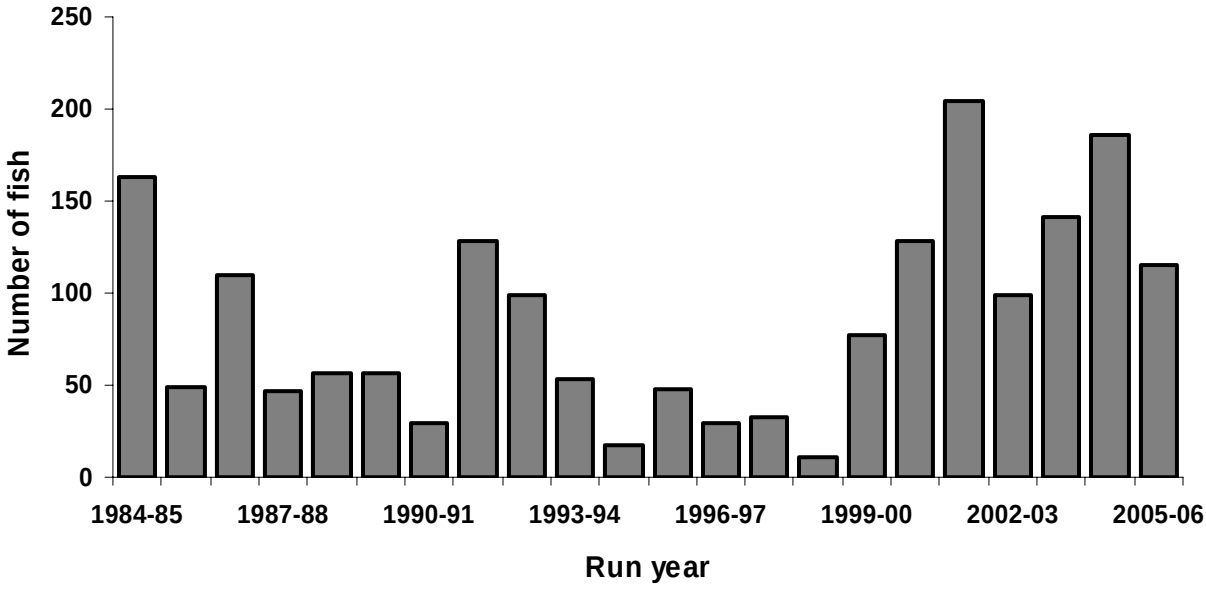

Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek for the 1984-85 to 2005-06 run years.

Table 1. Summary of egg collection and juvenile survival for 2005 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 2006.

Stock	Number of eggs taken	Eyed embryos	Total smolts released	Estimated survival rate	
				Egg-to-embryo	Embryo-to-smolt[a]
Wallowa	1,310,600	1,202,300[b]	872,860[c]	91.7	84.7
Imnaha	439,275	397,400[d]	289,091[e]	90.5	79.5

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

[b] *Includes 1,800 embryos that were transferred to the Salmon and Trout Enhancement Program (STEP) Coordinator. Also includes 47,600 embryos that were culled because they were excess to program needs, 4,000 embryos that were culled due to physical deformities, and 118,923 embryos that were overestimated in the inventory.*

[c] *Includes a total of 13,212 fish outplanted as rainbow trout. This includes 3,670 fish to Kinney Lake, 1,028 fish to Wallowa Wildlife Pond, 2,010 fish to Willow Creek Reservoir, 3,501 fish to Phillips Reservoir, 1,002 fish to South Fork Burnt River, and 2,001 fish to Hardy Murray Reservoir.*

[d] *Includes 33,640 embryos that were overestimated in the inventory.*

[e] *Includes 9,187 fish outplanted to Kinney Lake as rainbow trout.*

Table 2. Estimates of fin clip quality and coded-wire tag retention for 2005 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 2006. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose fin-clipped. Targets for tagged production groups were 100% AdLV+CWT and for tagged fall brood (progeny of broodstock collected in early fall) were 100% AdRV+CWT. 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	074131	474	-	92.8	7.2	0.0	ND	-	-
Production, 3	074132	503	-	93.4	6.4[b]	0.2	ND	-	-
Production, 5	074133	533	-	95.3	4.3	0.4	ND	-	-
Production , 14	074134	503	-	92.4	6.0	1.6	ND	-	-
Fall Brood, 9	074135	535	-	99.2	0.4[c]	0.4	0.0	-	-
Fall Brood, 13	091705	99	-	100.0	0.0	0.0	0.0	-	-
Fall Brood, 13	092645	495	-	99.2	0.6	0.2	0.0	-	-
Fall Brood, 11	092608	531	-	98.9	0.2	0.7	0.2	-	-
Fall Brood, 11	092644	99	-	99.0	0.0	1.0	0.0	-	-
Fall Brood, 15	094301	539	-	99.4	0.2	0.4	0.0	-	-
Production, 17	093402	522	-	96.2	3.8	0.0	ND		
Production, 16	094303	508	-	96.5	2.8	0.8	ND		
Average	-	445.1	246.0	96.9	2.6	0.5	ND	95.6	4.4
				Imnaha Stock					
Production, 23	074130	500	-	97.0	2.8	0.2	ND	-	-
Average	-	500.0	242.0	97.0	2.8	0.2	ND	97.3	2.7
Overall average		472.6	244.0	96.9	2.7	0.4	ND	96.1	3.9

[a] *Adipose fin (Ad) clip quality checks were conducted on 224, 266, 337, 212, 208, 246 and 231 fish in seven Wallowa stock raceways, and on 233, 269 and 224 fish in the production Imnaha stock raceways prior to tagging and final ponding.*

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

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

Table 3. Details of experimental and production groups of 2005 brood year summer steelhead released in the Grande Ronde (Wallowa stock) and Imnaha (Imnaha stock) river basins in 2006. 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; percent migration includes ±95% confidence intervals.

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 9-10	Spring Cr.	074131	213 (18)	101.9 (28.7)	1.09 (0.09)	25,037	77.4 ± 7.8
Production, 3	April 9-10	Spring Cr.	074132	[c]	[c]	[c]	23,872	71.6 ± 6.0
Production, 5	April 9-10	Spring Cr.	074133	[c]	[c]	[c]	25,200	73.6 ± 6.0
Production, 1-7	April 9-11	Spring Cr.	-	206 (19)	101.6 (25.5)	1.11 (0.07)	242,421	-
Fall Broodstock, 9	April 10-11	Spring Cr.	074135	208 (23)	102.6 (26.8)	1.09 (0.10)	25,932	72.8 ± 5.8
Fall Broodstock, 11	April 10-11	Spring Cr.	092644	[d]	[d]	[d]	21,488	73.7 ± 3.8
Fall Broodstock, 11	April 10-11	Spring Cr.	092608	[d]	[d]	[d]	5,107	-
Fall Broodstock, 13	April 10-11	Spring Cr.	092645	[d]	[d]	[d]	21,777	71.4 ± 6.3
Fall Broodstock, 13	April 10-11	Spring Cr.	091705	[d]	[d]	[d]	2,756	-
Fall Broodstock, 9, 11, 13	April 10-11	Spring Cr.	-	[d]	[d]	[d]	14,851	-
Fall Broodstock, 9, 11, 13[e]	April 10-11	Spring Cr.	-	[f]	[f]	[f]	12,104	-
Production, 14	April 12-14	Deer Cr.	074134	211 (19)	110.5 (29.2)	1.14 (0.08)	23,985	81.3 ± 10.0
Production, 8, 10, 12, 14	April 12-14	Deer Cr.	-	206 (19)	100.2 (22.3)	1.11 (0.09)	163,772	-
Production, 16	April 29-May 6	Spring Cr.	094303	204 (17)	95.2 (24.5)	1.08 (0.11)	26,732	106.4 ± 58.2[i]
Production, 16, 18-20	April 29-May 6	Spring Cr.	-	202 (18)	90.3 (23.7)	1.08 (0.10)	104,493	-
Fall Broodstock, 15	April 29-May 6	Spring Cr.	094301	210 (19)	100.2 (26.7)	1.00 (0.09)	27,052	97.8 ± 29.9
Fall Broodstock, 15	April 29-May 6	Spring Cr.	-	[g]	[g]	[g]	2,951	-
Fall Broodstock, 15[e]	April 29-May 6	Spring Cr.	-	[h]	[h]	[h]	4,035	-
Production, 17	May 2-12	Deer Cr.	094302	197 (19)	79.0 (19.0)	1.00 (0.10)	24,925	68.0 ± 7.3
Production, 17, 19	May 2-12	Deer Cr.	-	200 (21)	86.4 (27.4)	1.00 (0.09)	61,158	-
Total released							859,648	
			Imnaha stock					
Production, 23	April 11-May 2	L. Sheep Cr.	074130	207 (26)	100.1 (33.9)	1.02 (0.15)	25,495	70.5 ± 8.7
Production, 21-24	April 11-May 2	L. Sheep Cr.	-	201 (28)	94.4 (38.2)	1.11 (0.09)	126,365	-
Production, 26,28	April 10-11	B. Sheep Cr.	-	218 (28)	-	-	49,084	84.1 ± 6.5
No fin clip, 25-28	April 10-11	B. Sheep Cr.	-	217 (27)	-	-	78,960	-
Total released							279,904	

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

[b] *The percent of PIT tag release groups that migrated to Lower Granite Dam are Cormack-Jolly-Seber estimates of survival probabilities calculated using PITPro 4 (Westhagen and Skalski 2009).*

[c] *CWT codes 074131, 32, and 33 were in the same acclimation pond and were not distinguishable based on an external mark.*

[d] *CWT codes 074135, 092644, 092608, 092645, 091705, and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[e] *A total of 16,139 fall broodstock steelhead released were incorrectly marked with an AdLV fin clip instead of an AdRV fin clip. These misclips occurred prior to coded-wire tagging, and no coded-wire tags were implanted into the misclipped fish.*

[f] *No length or weight data available.*

[g] *CWT code 094301 and AdRV-only marked fish were in the same acclimation pond and were not distinguishable based on external mark.*

[h] *CWT code 094303 and misclipped fall broodstock fish were in the same acclimation pond and were not distinguishable based on an external mark.*

[i] *Survival probabilities exceeding 100% occur when true survival is close to 100% and/or when PIT tag detection variability is high (Smith et al. 2000).*

Table 4. Density (±95% confidence interval) and mean fork length (standard deviation in parentheses) of residual hatchery steelhead and wild rainbow trout/juvenile steelhead from index sites on Deer (Grande Ronde Basin) and Little Sheep (Imnaha Basin) creeks in 2006. Hatchery steelhead were classified as residuals after 20 June. HSTS indicates residual hatchery steelhead and WSTS indicates wild rainbow trout/juvenile steelhead for ages one and older.

			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.	2 Aug	HSTS	251.4	17	163.9 (36.8)	103-232	1	100	6.8 ± 0.3
Deer Cr.	2 Aug	WSTS	152.6[d]	20	101.2 (18.5)	70-144	-	-	7.8 ± 9.1
					Imnaha Basin				
L. Sheep	1 Aug	HSTS	368.2	44	146.6 (27.7)	98-245	6	83	14.7 ± 4.7
L. Sheep	1 Aug	WSTS	368.2	11	105.7 (16.9)	83-142	-	-	3.4 ± 1.5

[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.*

[d] *Includes only the lower index site.*

Table 5. Timing of adult steelhead returns to LSRCP facilities in 2006 by location and origin.

Period	Week of the year	Number of fish trapped[a]					
		Wallowa[b]		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Jan 22-28	4	-	-	-	-	-	-
Jan 29-Feb 04	5	-	-	10	0	-	-
Feb 05-11	6	14	0	0	0	-	-
Feb 12-18	7	19	0	0	0	-	-
Feb 19-25	8	7	0	0	0	-	-
Feb 26-Mar 04	9	182	0	38	2	0	0
Mar 05-11	10	150	0	34	1	23	1
Mar 12-18	11	170	0	6	0	22	0
Mar 19-25	12	227	3	75	5	92	8
Mar 26-Apr 01	13	437	2	546	15	396	19
Apr 02-08	14	352	2	387	11	548	25
Apr 09-15	15	410	2	327	15	581	23
Apr 16-22	16	361	0	229	12	368	18
Apr 23-29	17	329	1	136	6	189	9
Apr 30-May 06	18	158	0	140	7	76	6
May 07-13	19	129	1	23	4	36	3
May 14-20	20	13	0	20	4	21	1
May 21-27	21	0	0	9	2	2	2
May 28-Jun 03	22	-	-	2	0	0	0
Jun 04-10	23	-	-	4	1	-	-
Jun 11-17	24	-	-	0	0	-	-
Total		2,958	11	1,986	85	2,354	115

[a] *Weirs installed 24 January at Big Canyon Facility (Deer Creek), 24 February at Little Sheep Creek Facility, and the ladder was opened on 8 February at Wallowa Fish Hatchery. Adult collections stopped 15 June at Big Canyon Facility, 5 June at Little Sheep Creek Facility, and 27 May at Wallowa Fish Hatchery.*

[b] *Between 10/11/05 and 10/21/05, 55 hatchery males and 60 hatchery females were collected between Wildcat Creek in Oregon and Boggan's Oasis in Washington and taken to Wallowa Fish Hatchery for the Fall broodstock. As these fish were caught by hook and line and did not return of their own volition, they are not included in the run timing.*

Table 6. Number, disposition, and mean fork length (mm) of adult steelhead that returned to LSRCP facilities in 2006 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		2:2		1:3			2:1		2:2		2:3		3:1		3:2			
	M	F	M	F	M	F	M	F	Total	M	F	M	F	M	F	M	F	M	F	Total	
Wallowa Fish Hatchery (Wallowa stock)																					
Trapped	1,315	723	243	654	13	0	5	5	2,958	1	1	2	5	0	0	0	0	0	2	11	2,969
Passed	0	0	0	0	0	0	0	0	0	1	1	2	5	0	0	0	0	0	2	11	11
Outplanted	53	38	20	0	4	0	0	1	116	0	0	0	0	0	0	0	0	0	0	0	116
Kept	1,262	685	223	654	9	0	5	4	2,842	0	0	0	0	0	0	0	0	0	0	0	2,842
Mortality	7	4	4	5	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	20
Spawned	99	34	73	156	3	0	3	2	370	0	0	0	0	0	0	0	0	0	0	0	370
Killed[c]	1,156	647	146	493	6	0	2	2	2,452	0	0	0	0	0	0	0	0	0	0	0	2,452
Fork length (mm)	576	555	718	694	729	-	774	754		-	-	-	-	-	-	-	-	-	-		
Standard deviation	44	26	32	46	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	13	4	11	15	1		1	1													
Wallowa Fish Hatchery (Wallowa Stock-Fall Broodstock)																					
Transferred to WFH	30	20	24	40	0	0	1	0	115	0	0	0	0	0	0	0	0	0	0	0	115
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	30	20	24	40	0	0	0	0	115	0	0	0	0	0	0	0	0	0	0	0	115
Mortality	7	10	6	4	0	0	1	0	28	0	0	0	0	0	0	0	0	0	0	0	28
Spawned	21	6	17	35	0	0	0	0	79	0	0	0	0	0	0	0	0	0	0	0	79
Killed[c]	2	4	1	1	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	8
Fork length (mm)	601	555	687	681	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Standard deviation	32	10	42	22	-	-	-	-		-	-	-	-	-	-	-	-	-	-		
Sample size	2	2	11	4																	
Big Canyon Facility (Wallowa stock)																					
Trapped	544	504	243	673	12	0	8	2	1,986	12	9	18	27	1	0	5	2	0	11	85	2,071
Passed[d]	0	0	2	2	0	0	0	0	4	12	9	18	27	1	0	5	2	0	11	85	89
Outplanted	22	8	22	57	1	0	1	0	111	0	0	0	0	0	0	0	0	0	0	0	111
Returned to river[e]	28	2	14	19	0	0	1	0	64	0	0	0	0	0	0	0	0	0	0	0	64
Kept	494	494	205	595	11	0	6	2	1,807	0	0	0	0	0	0	0	0	0	0	0	1,807
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]	494	494	205	595	11	0	6	2	1,807	0	0	0	0	0	0	0	0	0	0	0	1,807
Fork length (mm)	-	-	-	-	-	-	-	-		614	588	722	692	805	-	608	600	-	692		
Standard deviation	-	-	-	-	-	-	-	-		46	44	50	45	-	-	39	-	-	32		
Sample size										6	5	8	15	1		2	1		6		

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 2:3 M	Natural 2:3 F	Natural 3:1 M	Natural 3:1 F	Natural 3:2 M	Natural 3:2 F	Natural Total	Grand total
Little Sheep Creek Facility (Imnaha stock)																					
Trapped	876	462	213	803	0	0	0	0	2,354	14	22	12	36	0	0	10	4	1	16	115	2,469
Passed[f]	94	47	26	83	0	0	0	0	250	13	21	10	31	0	0	9	4	0	14	102	352
Outplanted[g]	707	391	166	670	0	0	0	0	1,934	0	0	0	0	0	0	0	0	0	0	0	1,934
Kept	74	25	21	50	0	0	0	0	170	1	1	2	5	0	0	1	0	1	2	13	183
Mortality	8	0	5	0	0	0	0	0	13	1	0	0	1	0	0	0	0	0	0	2	15
Spawned[h]	63	25	15	49	0	0	0	0	152	0	1	2	4	0	0	1	0	1	2	11	163
Killed	3	0	1	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	5
Fork Length (mm)	573	552	708	675	-	-	-	-		620	565	728	664	-	-	552	580	-	693		
Standard deviation	35	39	34	29	-	-	-	-		17	42	30	34	-	-	25	14	-	29		
Sample size	18	12	6	15						4	13	5	20	-	-	3	2		9		

[a] *Wallowa stock ages apportioned using 79 scale samples collected in 2006; Imnaha stock ages apportioned using 53 scale samples from 2005 and 50 scale samples from 2006 in order to increase sample size. Lengths are from fish with 2006 scale samples.*

[b] *Wallowa and Big Canyon ages apportioned using 2006 data (44 samples); at Little Sheep Creek Facility ages were apportioned using 2006 data (56 samples).*

[c] *For Wallowa stock, 1,459 fish that returned to Wallowa Fish Hatchery and 1,140 fish that returned to Big Canyon were euthanized and donated to local food banks. In addition, 71 fish from Wallowa Hatchery and 81 fish from Big Canyon were euthanized and donated to local schools for educational purposes.*

[d] *Includes two males and two females originally identified as natural origin fish (due to the absence of any external marks) and passed above the weir. However, scale reading determined them to be of hatchery origin.*

[e] *One hundred thirty fish were returned to the river fishery. Of these, 51 males and 15 females returned to the weir a second time and were euthanized. These 66 fish are included in the "killed" category.*

[f] *Includes five females originally identified as natural origin fish (due to the absence of any external marks) and passed above the weir. However, scale reading determined them to be of hatchery origin.*

[g] *Includes one hatchery male that was outplanted, recaptured and spawned .*

[h] *Includes four 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, run years 1999 to 2006.

	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	109	7.0	461	37	8.0
2006	1,934	703	36.3	352	53	15.1
Mean	-	-	21.7	-	-	11.1

[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.*

Table 8. Summary of summer steelhead spawning surveys in Deer Creek above the Big Canyon Facility weir, 2002-2006.

Year	Females passed	Males passed	Total passed	Redds counted	Fish/ redd	Females/ redd	% Redds counted[a]	Redds/ mile[b]	Redd visibility[c]
2002	120	89	209	84	2.49	1.43	70	8.4	19.8
2003	92	48	140	64	2.19	1.44	70	6.4	20.5
2004	47	20	67	46	1.46	1.02	98	4.6	29.8
2005	42	35	77	35	2.20	1.20	83	3.5	16.7
2006[d]	55	41	96	58	1.66	0.95	105	5.8	28.2

[a] *Calculated as number of redds counted ÷ number of females passed x 100. Assume 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.*
[d] *Includes an estimated seven additional steelhead (4 females and 3 males) that escaped above the weir prior to weir installation, based on marked and unmarked fallbacks at weir.*

Table 9. Spawning summaries for summer steelhead at LSRCP facilities in 2006. 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)		
3/15, WA430	Production	102,000	70,000	31.4
	Fall Broodstock	11,980	6,200	48.2
3/22, WA431	Production	191,900	161,400	15.9
	Fall Broodstock	0	0	NA
3/29, WA432	Production	183,100	171,800	6.2
	Fall Broodstock	30,850	23,300	24.5
4/05, WA433	Production	170,100	156,700	7.9
	Fall Broodstock	51,300	43,200	15.8
4/12, WA434	Production	182,600	174,400	4.5
	Fall Broodstock	49,400	47,000	4.9
4/19, WA435	Production	101,800	94,300	7.4
	Fall Broodstock	75,750	60,500	20.1
4/26, WA436	Production	154,950	133,250	14.0
	Fall Broodstock	17,250	16,100	6.7
Subtotal	Production	1,086,450	961,850	11.5
	Fall Broodstock	236,530	196,300	17.0
Total		1,322,980	1,158,150	12.5
		Little Sheep Creek Facility (Imnaha stock)		
3/27, LI530	Hatchery	26,250	22,400	14.7
4/04, LI531	Hatchery	95,100	89,200	6.2
4/11, LI532	Hatchery	96,164	95,400	9.8
	Mixed	9,616		
4/18, LI533	Hatchery	53,808	54,350	7.4
	Mixed	4,892		
4/25, LI534	Hatchery	56,100	48,250	14.0
5/02, LI535	Hatchery	25,200	41,600	10.0
	Mixed	21,000		
5/08, LI536	Hatchery	4,733	13,400	5.6
	Mixed	9,467		
5/15, LI537	Mixed	5,900	5,650	4.2
Subtotal	Hatchery	357,355	370,250	9.3
	Mixed	50,875		
Total		408,230	370,250	9.3

[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 1,200 Wallowa production stock eyed embryos that were transferred to the Salmon and Trout Enhancement Program (STEP), 138,650 Wallowa production stock eyed embryos that were euthanized because they were excess to program needs, and 19,260 Imnaha 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) Wallowa stock summer steelhead for the 2005-06 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 April 2009.

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]
2001						
Deer Cr.	Production, April	093407	0	0	0	0
	Forced, May	093408	2	0	0	2
	Volitional, May	093409	0	0	0	0
Spring Cr.	Production, April	093404	0	0	8	8
	Forced, May	093405	0	0	0	0
	Volitional, May	093406	0	0	0	0
2002						
Deer Cr.	Production, April	093631	58	78	78	214
	Production, May	093633	43	48	147	238
Spring Cr.	Production, April	093630	36	32	71	139
	Production, May	093632	26	36	74	136
2003						
Deer Cr.	Production, April	093915	114	68	160	342
	Production, May	093917	36	33	49	118
Spring Cr.	Production, April	093914	76	31	145	252
	Production, May	093916	17	4	57	78
	Total recoveries		408	330	789	1,527

[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 2005-06 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 April 2009.

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]
2001						
Big Sheep	Production, April	090125	0	0	0	0
Little Sheep	Production, April	093402	0	0	0	0
Little Sheep	Production, May	093403	0	0	8	8
2002						
Big Sheep	Production, April	093636	0	17	91	108
Little Sheep	Production, April	093634	53	2	76	131
Little Sheep	Production, May	093635	60	8	97	165
2003						
Big Sheep	Production, April	093911	13	24	169	206
Little Sheep	Production, April	093912	95	20	90	205
Little Sheep	Production, May	093913	86	5	26	117
	Total recoveries		307	76	557	940

[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 2005-06 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 April 2009. "-" 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	0	0	0.0	1	3	0.1
Columbia River harvest						
Treaty net	46	432	2.5	30	86	1.7
C and S	0	0	0.0	0	0	0.0
Sport	52	361	2.1	92	292	5.7
Test	0	0	0.0	0	0	0.0
Tributary sport	108	936	5.5	74	215	4.2
Deschutes River harvest						
Sport	1	6	0.0	8	26	0.5
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. Basin	15	111	0.7	18	33	0.6
Within Snake R. Basin*	4	25	0.1	2	6	0.1
Snake River sport, tribs. harvest*	567	5,138	30.0	332	939	18.5
Oregon tributary harvest* [a]	326	5,151	30.1	76	412	8.1
Other in-basin escapement* [b]	-	0	0.0	-	721	14.2
Hatchery weir* [c]	408	4,944	29.0	307	2,354	46.3
Total estimated return	1,527	17,104	100	940	5,087	100
Return to compensation area		15,258			4,432	
Percent of compensation goal		166.1			221.6	

** 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.*

[a] *Harvest in Oregon tributaries are estimates based on angler surveys and harvest card returns.*

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

[c] *Total returns to the hatchery weir are actual numbers, except 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.*

Table 13. Catch and escapement distribution of adult summer steelhead by age and recovery location for the 2005-06 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 April 2009. "-" indicates not sampled or undefined.

	Total returns by age							
	Wallowa Stock				Imnaha Stock			
Location	Age 3	Age 4	Age 5	Total	Age 3	Age 4	Age 5	Total
Ocean catch	0	0	0	0	3	0	0	3
Columbia River								
Treaty net	111	321	0	432	15	71	0	86
C and S	0	0	0	0	0	0	0	0
Sport	145	216	0	361	57	235	0	292
Test	0	0	0	0	0	0	0	0
Tributary sport	497	439	0	936	89	126	0	215
Deschutes River								
Sport	6	0	0	6	13	13	0	26
C and S	0	0	0	0	0	0	0	
Strays								
Outside Snake R. Basin	84	27	0	111	19	14	0	33
Within Snake R. Basin*	12	13	0	25	3	3	0	6
Snake River sport, tribs.*	3,050	1,967	121	5,138	358	553	28	939
Oregon tributaries* [a]	1,687	3,345	119	5,151	169	243	0	412
Other in-basin escapement* [b]	-	-	-	-	410	311	0	721
Hatchery weir* [c]	3,086	1,814	44	4,944	1,338	1,016	0	2,354
Total estimated return	8,678	8,142	284	17,104	2,474	2,585	28	5,087

** 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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APPENDIX TABLES

Appendix Table A-1. Date of collection, gender, length, and disposition of hatchery summer steelhead caught by hook and line on the Lower Grande Ronde River and collected for fall broodstock from 2003 to 2006. KNS indicates 'killed not spawned'.

Date of Collection	Gender	Length (mm)	Disposition
2003			
October 13-16	F	566	Spawned
	M	587	Spawned
	M	595	Spawned
	F	556	Spawned
	F	586	Spawned
	F	--	Mortality
	M	541	Spawned
	F	561	Spawned
	M	599	Spawned
	F	574	Spawned
	M	598	KNS
	M	582	KNS
	F	566	Spawned
	M	587	Spawned
	M	595	Spawned
	F	556	Spawned
	F	586	Spawned
	M	580	Mortality
	M	582	Mortality
	M	554	Spawned
	F	569	Spawned
	M	629	Spawned
	F	544	KNS
	M	531	Spawned
	M	619	Mortality
	F	--	Mortality
	F	591	Spawned
	F	525	Spawned
	F	518	Spawned
	M	560	Spawned
	F	571	Spawned
	F	--	Mortality[a]
	M	--	Spawned
	M	563	Mortality
	F	550	Spawned
	M	590	Mortality
	M	580	Mortality
	F	584	Spawned
	M	560	Mortality
	M	596	Spawned

[a] *These fish were collection mortalities that died prior to transport to Wallowa Hatchery.*

[b] *All collected fish were marked with PIT tags for identification. These fish either lost their tag or were implanted with an unreadable tag. Therefore, we were unable to determine which day they were collected.*

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 13-16 (cont)	F	688	Spawned
	F	713	Spawned
	M	595	Mortality
	F	654	Spawned
	F	564	KNS
	F	566	Spawned
	M	592	Spawned
	M	581	Spawned
	F	543	Spawned
	F	579	Spawned
	F	603	Spawned
	F	578	Spawned
	M	573	Mortality
	F	--	Mortality
	F	568	Spawned
	F	550	Spawned
	M	566	KNS
	M	610	Spawned
	M	563	Spawned
	M	600	Spawned
	M	617	Spawned
	M	590	Spawned
	M	605	Spawned
	M	688	Spawned
	M	621	Mortality
	F	689	Spawned
	F	577	Spawned
	F	600	Spawned
	M	570	Spawned
	M	529	Spawned
	F	581	Spawned
	M	592	Spawned
	F	569	Spawned
	M	595	Spawned
	M	617	Spawned
	M	591	Spawned
	F	--	Mortality[a]
	M	585	Spawned
	M	590	Spawned
	F	638	Spawned
	M	591	Spawned
	F	514	Spawned
	M	623	Mortality
	M	607	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 13-16 (cont)	M	613	Spawned
	M	595	KNS
	F	590	Spawned
	M	751	Spawned
	M	523	Spawned
	F	654	Spawned
October 20-24	F	--	Mortality[a]
	--	--	Mortality[a]
	F	590	Spawned
	F	526	Spawned
	F	576	Spawned
	M	605	Spawned
	M	568	Mortality
	M	526	Spawned
	F	700	Spawned
	M	546	Spawned
	M	615	Spawned
	F	686	Spawned
	F	560	Spawned
	F	577	Spawned
	M	597	Spawned
	F	566	Spawned
	F	590	Spawned
	M	560	Spawned
	M	565	Spawned
	F	531	Spawned
	F	556	Spawned
	M	575	Spawned
	F	587	KNS
	F	530	Spawned
	M	593	Mortality
2004			
October 11-15	F	718	Spawned
	M	603	Spawned
	M	588	KNS
	F	700	Spawned
	F	570	Spawned
	M	735	Spawned
	F	637	Spawned
	M	681	Spawned
	F	685	Spawned
	F	--	Mortality
	M	605	Spawned
	M	571	Mortality
	M	627	Spawned
	M	< 630	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 11-15 (cont)	M	637	Spawned
	M	559	Spawned
	F	690	Spawned
	F	649	Spawned
	M	524	Spawned
	F	574	Spawned
	M	598	Spawned
	F	--	Mortality
	F	564	Spawned
	F	663	Spawned
	M	605	KNS
	M	548	Spawned
	F	676	Spawned
	F	650	Spawned
	M	585	Spawned
	F	547	Spawned
	M	555	KNS
	F	696	Spawned
	F	578	Spawned
	F	571	KNS
	F	667	Spawned
	M	588	Mortality
	M	--	Mortality
	M	607	Mortality
	M	726	Spawned
	F	641	Spawned
	M	566	Mortality
	M	572	Spawned
	F	710	Spawned
	F	696	Spawned
	F	534	Spawned
	M	565	Spawned
	M	722	Spawned
	F	660	Spawned
	M	583	Spawned
	M	620	Spawned
	M	615	Spawned
	F	537	Spawned
	M	580	Spawned
	M	583	Spawned
	M	601	Spawned
	F	565	Spawned
	F	703	Spawned
	M	572	Spawned
	M	558	Spawned
	M	576	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
	M	573	Spawned
October 18-22	F	711	Spawned
	M	595	Spawned
	M	548	Spawned
	F	549	Spawned
	F	565	Spawned
	M	549	Spawned
	M	546	Spawned
	M	523	Spawned
	M	615	Spawned
	M	560	Spawned
	F	709	Spawned
	F	698	Spawned
	F	668	Spawned
	M	621	Mortality
	M	570	KNS
	F	586	Spawned
	F	630	Spawned
	M	608	Spawned
	F	650	Spawned
	F	547	Spawned
	F	634	Spawned
	F	696	Spawned
	M	582	Spawned
	M	627	Spawned
	M	554	KNS
	M	559	Mortality
	F	567	Spawned
	M	574	Spawned
	M	537	Spawned
	M	685	Spawned
	F	557	Spawned
	F	620	KNS
	--	--	Mortality[a]
	F	590	Spawned
	M	589	Spawned
	M	725	Mortality
	M	527	Spawned
	F	561	Spawned
	F	551	Spawned
Unknown[b]	M	535	Spawned
Unknown[b]	M	576	KNS
Unknown[b]	M	615	KNS
Unknown[b]	M	--	KNS
Unknown[b]	M	533	Spawned
Unknown[b]	M	585	KNS

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
Unknown[b]	M	540	KNS
Unknown[b]	M	575	Spawned
Unknown[b]	F	616	Spawned
Unknown[b]	M	--	Mortality
2005			
October 10-14	F	645	Spawned
	F	718	Spawned
	F	--	Mortality
	F	632	Spawned
	F	< 640	Mortality
	F	760	Spawned
	F	670	Spawned
	F	728	Mortality
	F	705	Spawned
	M	565	Spawned
	F	710	Spawned
	M	< 640	Mortality
	F	548	Spawned
	M	< 640	Mortality
	M	598	Spawned
	M	--	Mortality
	F	546	KNS
	M	711	Spawned
	F	713	Spawned
	M	615	Spawned
	F	619	Spawned
	M	< 640	Mortality
	M	676	Spawned
	F	680	Mortality
	F	700	Spawned
	M	623	Spawned
	F	675	Spawned
	M	690	Spawned
	F	664	Spawned
	F	682	Spawned
	F	667	KNS
	F	565	KNS
	M	> 640	Mortality
	M	666	Spawned
	M	658	KNS
	M	567	Spawned
	F	644	Spawned
	M	751	Spawned
	M	689	Spawned
	M	--	Mortality
	M	575	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 10-14 (cont)	F	734	Spawned
	M	660	Spawned
	M	661	Spawned
	F	711	Spawned
	F	661	Spawned
	M	--	Mortality
	F	663	Spawned
October 16-21	F	650	Spawned
	M	578	Spawned
	F	--	Mortality
	F	520	KNS
	F	--	Mortality
	F	610	Spawned
	M	575	Spawned
	M	670	Spawned
	F	672	Spawned
	M	> 640	Mortality
	F	685	Spawned
	M	708	Spawned
	F	701	Spawned
	F	730	Spawned
	F	727	Spawned
	F	660	Spawned
	F	< 640	Mortality
	F	661	Spawned
	M	584	Spawned
	M	--	Spawned
	F	--	Mortality
	F	580	Spawned
	F	692	Spawned
	M	666	Spawned
	M	573	Mortality
	M	557	Spawned
	F	--	Mortality
	M	552	Spawned
	M	556	Spawned
	F	674	Spawned
	M	--	Mortality
	M	735	Mortality
	F	--	Mortality
	M	--	Mortality
	F	680	Spawned
	F	565	Spawned
	M	578	Spawned
	F	< 640	Mortality
	M	746	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 16-21 (cont)	M	708	Spawned
	F	640	Spawned
	F	< 640	Mortality
	F	562	Spawned
	M	565	Spawned
	M	671	Spawned
	F	703	Spawned
	M	725	Spawned
	M	585	Spawned
	M	< 640	Mortality
	M	584	KNS
	F	670	Spawned
	F	600	Spawned
	M	--	Mortality
	F	580	Spawned
	M	600	Spawned
	M	637	KNS
	M	570	Spawned
	F	654	Spawned
	M	660	Spawned
	M	670	Spawned
	M	642	Spawned
	M	606	Spawned
	F	545	KNS
	F	--	Mortality
	F	--	Mortality
	F	647	Spawned
	M	635	Spawned
2006			
October 8-14	F	570	Spawned
	M	529	Spawned
	F	595	Spawned
	F	558	Spawned
	M	592	Spawned
	M	581	KNS
	F	598	Spawned
	M	585	Spawned
	F	543	KNS
	M	595	Spawned
	M	646	KNS
	M	575	Spawned
	F	651	Spawned
	M	576	Spawned
	F	< 640	KNS
	F	540	KNS
	F	555	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 8-14 (cont)	F	570	Spawned
	M	< 640	KNS
	M	--	Spawned
	M	564	Spawned
	F	571	Spawned
	F	585	Spawned
	M	578	Spawned
	M	564	Spawned
	M	578	KNS
	M	560	Spawned
	M	597	KNS
	M	551	Spawned
	F	574	Spawned
	M	561	Spawned
	M	530	Spawned
	F	580	Spawned
	F	557	Spawned
	M	570	KNS
	F	557	Spawned
	M	565	Spawned
	M	--	Mortality
	F	554	Spawned
	M	524	Spawned
	F	611	Spawned
October 15-20	M	555	Spawned
	M	595	Spawned
	F	675	Spawned
	M	555	Mortality
	F	591	Spawned
	M	579	Spawned
	F	603	Spawned
	M	605	Spawned
	F	620	Spawned
	F	560	Spawned
	F	642	Spawned
	M	600	Spawned
	F	553	Spawned
	F	575	Spawned
	F	725	Spawned
	M	535	Spawned
	F	520	Spawned
	M	569	Spawned
	M	--	Mortality
	F	< 640	KNS
	M	520	Spawned
	F	564	Spawned

Appendix Table A-1. (continued)

Date of Collection	Gender	Length (mm)	Disposition
October 15-20 (cont)	M	615	Spawned
	M	572	KNS
	M	568	KNS
	M	590	Spawned
	M	--	Spawned
	F	518	Spawned
	M	550	Spawned
	F	588	Spawned
	M	--	Spawned
	M	572	Spawned
	F	539	Spawned
	M	609	Mortality
	M	627	Spawned
	F	528	Spawned
	M	615	Spawned