

LOWER SNAKE RIVER COMPENSATION PLAN:  
Oregon Summer Steelhead Evaluation Studies  
1997 and 1998 Bi-Annual Progress Report

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Fish Research and Development, NE Region



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## Preface

The purpose of this progress report is to provide summary information for Lower Snake River Compensation Plan (LSRCP) summer steelhead programs operated by ODFW in the Grande Ronde and Imnaha river basins during 1997 and 1998. These ongoing monitoring programs provide technical, logistical, and biological information to managers charged with maintaining viable salmon and steelhead populations and associated fisheries in Northeast Oregon.

This report summarizes fish culture monitoring data for LSRCP facilities for summer steelhead. These data serve as the basis for the analysis of trends in culture performance. Generally speaking, the data in this report were derived from hatchery inventories and standard databases (i.e., PSMFC, Coded-wire tag) or through standard measuring techniques. As such, specific protocols are usually not described. In cases where expansions of data or unique methodologies were used, protocols are described in more detail. Additional descriptions of protocols can be found in the 1997 and 1998 work statements (Carmichael *et al.* 1997, 1998). Coded-wire tag (CWT) data that were collected from 1997-1998 adult returns are used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 1997-1998, experimental treatments from which fish returned included acclimated vs. direct stream and forced vs. volitional release strategies. In 1997-1998, experimental treatments for which fish were released included density treatments, forced vs. volitional release, rearing site, and growth treatments. Analysis of specific survival studies will be completed once all brood years have returned and CWT data are complete for a given experiment. In addition, much of the data that we discuss in this report will be used in separate and specific evaluations of ongoing supplementation programs for steelhead in the Imnaha River basin. We began culture evaluations in 1983 and have dramatically improved many practices. Progress for work completed in previous years is presented in annual progress reports (Carmichael and Wagner, 1983; Carmichael and Messmer, 1985; Carmichael *et al.*, 1986a, 1987, 1988a, 1988b, 1989, 1990, 1999, and 2004; Messmer *et al.*, 1989, 1990, 1991, 1992, and 1993; Flesher *et al.*, 1991, 1992, 1993, 1994, 1995, and 1996; Whitesel *et al.*, 1993; and Jonasson *et al.*, 1994, 1995, and 1996), and United States v. Oregon production report (Carmichael *et al.*, 1986b). Progress of related work completed in 1997 and 1998 is presented in summer steelhead creel annual progress reports (Flesher *et al.*, 1997, and 1999), and in the steelhead life history, genetics, and kelt reconditioning 1997-2001 progress report (Ruzycki *et al.*, 2003).

This report is organized into sections on fish culture monitoring for juveniles, adults, CWT recoveries, and estimates for total escapement. During the period covered in this report, steelhead from the 1992-1995 broods returned to spawn, steelhead from the 1996 and 1997 broods were released as smolts, and adult steelhead that returned to spawn were used to create the 1997 and 1998 broods.

## **Acknowledgments**

We would like to thank Tim Whitesel for overseeing the collection of the data presented in this report as well as coordinating many of the experiments, and Chris Starr and Joe Krakker for reviewing the document. Greg Davis, Mike Gribble, and many other hatchery personnel exhibited great dedication and provided essential assistance. Numerous personnel from the U.S. Fish and Wildlife Service, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation provided enthusiastic support. This project was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, contract numbers 1448-14110-97-J039 and 1148-14110-98-J058, a cooperative agreement with the Oregon Department of Fish and Wildlife.

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## **EXECUTIVE SUMMARY**

### **Objectives**

1. Document summer steelhead rearing and release activities at all LSRCP facilities.
2. Determine optimum rearing and release strategies that will produce maximum survival to adulthood for hatchery-produced summer steelhead smolts.
3. Document summer steelhead adult returns by stock to each LSRCP broodstock collection facility.
4. Determine if the total production of summer steelhead adults meet mitigation goals and index annual smolt survival and adult returns to Lower Granite Dam for production groups.
5. Participate in planning activities associated with anadromous fish production and management in the Grande Ronde and Imnaha river basins and participate in ESA permitting, consultation, and rearing activities.
6. Monitor natural spawning of summer steelhead in selected areas within the Grande Ronde Basin.
7. Determine the number of summer steelhead harvested annually and angler effort in recreational fisheries on the Grande Ronde, Wallowa, and Imnaha rivers.

### **Accomplishments and Findings**

In 1997, we released 1,397,888 Wallowa stock steelhead smolts into the Grande Ronde Basin and 327,460 Imnaha stock smolts into the Imnaha River Basin. In 1998, we released 1,384,008 smolts into the Grande Ronde Basin and 117,096 into the Imnaha Basin. In addition in 1998, we released 5,015 presmolts and the Nez Perce Tribe released 426,585 unmarked fry into the Imnaha

Basin. In 1997, experimental groups were released at the Little Sheep Creek and Big Canyon facilities to evaluate growth rate during rearing. In both 1997 and 1998, we also released experimental groups to evaluate forced and volitional release strategies at Wallowa Fish Hatchery and Big Canyon Facility. In addition in 1998, we also released experimental groups at Little Sheep Creek to evaluate rearing densities.

In 1997, a total of 1,473 and 1,232 Wallowa stock steelhead returned to Wallowa Hatchery and Big Canyon, respectively. In addition, we trapped and released 44 natural steelhead at Big Canyon. At the Little Sheep Facility, we trapped 938 Imnaha stock hatchery and 28 naturally produced steelhead adults. Of these, we released 53 hatchery and 24 natural steelhead above the weir. In 1998, 1,371 and 1,190 hatchery steelhead returned to Wallowa Hatchery and Big Canyon respectively. We also trapped 46 and released 45 natural fish at Big Canyon. At Little

Sheep Creek, 685 hatchery and 33 natural steelhead returned. During spawning in the spring of 1997, we collected 2,786,600 Wallowa stock eggs and 860,100 Imnaha stock eggs. In 1998, we collected 2,883,300 Wallowa stock eggs and 1,690,529 Imnaha stock eggs.

We estimated that 7,063 Wallowa stock hatchery steelhead returned to the LSRCP compensation area in 1997 (76.9% of goal) and 9,519 returned in 1998 (103.6% of goal). The return of Imnaha steelhead to the compensation area was 1,648 (82.4% of goal) in 1997 and 1,359 (68.0% of goal) in 1998.

## INTRODUCTION

The main objectives of this report are to document fish culture practices, describe adult returns, and assess success towards meeting LSRCP goals for Grande Ronde and Imnaha steelhead. We report on juvenile steelhead rearing and release activities for the 1996 and 1997 brood years (BY) released in 1997 and 1998, respectively. Included are collection, spawning, and adult characteristics for the 1997 and 1998 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

## RESULTS AND DISCUSSION

### Juveniles

#### *1997*

Wallowa egg-to-embryo survival for the 1996 BY was 88.7%, higher than in the recent past (1993-1995 BY range of 71.8-86.2%), whereas embryo-to-smolt survival was 87.6%, lower than in the recent past (1993-1995 BY range of 91.6-100%). Imnaha egg-to-embryo survival for the 1996 BY was 76.7%, lower than in the past (1993-1995 BY range of 77.6-90.8%). Imnaha embryo-to-smolt survival was 88.3%, also lower than in the past (1993-1995 BY range of 94.4-100%; Table 1). We achieved our Wallowa stock production goal of 1,350,000 smolts and were slightly under the Imnaha stock production goal of 330,000 smolts in 1997. To evaluate different rearing and release strategies, we marked and released eight groups of Wallowa stock steelhead and two groups of Imnaha stock steelhead with adipose-left ventral clips and coded-wire-tags (AdLV and CWT) (Table 2). We marked 98.9% of Wallowa stock smolts and 99.0% of Imnaha stock smolts with an adipose fin clip, with the target being 100%, which was slightly below the range in recent years (1993-1995 BY range of 99.2-99.6%). Fin clip quality and tag retention for experimental groups averaged 99.3% for Wallowa and 99.0% for Imnaha stocks, which is in the program's range in recent years (1993-1995 BY range of 93.8-99.2%). Details of experimental and production releases for the 1996 BY are shown in Tables 3 and 4.

#### *1998*

Egg-to-embryo survival for Wallowa stock for the 1997 BY was 91.6%, higher than in the past (1993-1996 BY range 71.8-88.7%), and embryo-to-smolt survival was 91.5%, which is within the range in recent years (1993-1996 BY range of 87.6-100%). Imnaha egg-to-embryo and embryo-to-smolt survival of 88.7% and 93.9%, respectively, were within past ranges (1993-1996 BY ranges: egg-to-embryo 76.7-90.8%, embryo-to-smolt 88.3-100%; Table 5). We achieved our smolt production goal for Wallowa stock. For Imnaha stock, our smolt production goal was changed based on estimated wild adult returns. Criteria included a production cap of 330,000 smolts, a minimum of 5% wild fish in the broodstock, and removal of no more than 25% of the wild Little Sheep escapement for broodstock. Based on these criteria and a wild adult return of 28 fish, we did not reach our production cap, however, we removed only 14% of the wild escapement for broodstock, and achieved a percent of wild fish in the brood of 12% (by euthanizing embryos in excess of program needs). To evaluate the influence of volitional release, hatchery of rearing, and rearing density on smolt-to-adult survival and to monitor survival of major production releases, we marked (AdLV and CWT) nine groups of Wallowa stock and four

groups of Imnaha stock smolts (Table 6). We marked 99.2% of the smolts released in the Grande Ronde and 98.7% of the smolts released in the Imnaha basins with an adipose fin clip. Fin clip quality and tag retention of experimental groups averaged 96.4% for Wallowa stock and 95.8% for Imnaha stock, which is in the program's range in the recent past (1993-1996 BY range of 93.8-99.3%). Release information for production and experimental releases of 1997 BY are presented in Tables 7 and 8. Release information for 1998 BY fry and presmolts released in 1998 are presented in Table 9.

## Adults

### 1997

The weirs were installed on February 3<sup>rd</sup> at Big Canyon Facility, February 18<sup>th</sup> at Wallowa Fish Hatchery and February 26<sup>th</sup> at Little Sheep Creek (Table 10). Returns to Little Sheep Creek Facility were predominately hatchery fish and only 28 natural fish returned. Similar to Little Sheep Creek, most of the adults that returned to Big Canyon Facility were hatchery origin and only 44 natural fish returned. Run timing of hatchery fish was similar to natural fish at both Little Sheep Creek and Big Canyon. The majority of hatchery adults that returned to Wallowa Fish Hatchery, Big Canyon and Little Sheep Creek spent one year in the ocean (Table 11). Similarly, a majority of the natural fish that returned to Little Sheep Creek spent one year in the ocean. However, more natural two-ocean than one-ocean fish returned to the Big Canyon Facility.

The majority of hatchery adults that returned to Wallowa Fish Hatchery and almost 20% of Big Canyon hatchery returns in 1997 were retained for spawning (Table 11). We outplanted 655 hatchery adults to local ponds for harvest opportunity. At Big Canyon all natural fish and 5 hatchery fish were passed above the weir to spawn naturally. As in 1996, both hatchery and wild fish escaped above the weir at Big Canyon without being trapped or counted during high water in 1997. We estimated that an additional 79 hatchery steelhead escaped above the weir in 1997 and included these in our escapement estimate for the 1996-97 run year (*see* Table 20). We retained 38.8% of the hatchery fish and 14.3% of the natural fish for spawning at Little Sheep Creek. Natural fish not retained for spawning were released above the weir to spawn naturally. Hatchery fish comprised 68.8% of the fish released above the weir at Little Sheep Creek. Length-at-age data for Wallowa stock adults are presented in Figure 1 and Imnaha stock adult data are presented in Figure 2.

We exceeded our egg take goals for both Wallowa and Imnaha stocks in 1997. The percent mortality from green egg-to-eyed embryo ranged from 6-17% for Wallowa stock from nine weekly spawns, and from 5-19% for Imnaha stock from nine weekly spawns (Table 12). Over the last three brood years (1994-96 BY), the range of green egg-to-embryo mortality was 3-26% for Wallowa stock and 4-28% for Imnaha stock.

### 1998

Weirs were installed on February 17<sup>th</sup> at Wallowa Fish Hatchery and February 26<sup>th</sup> at Little Sheep Creek (Table 13). The weir was installed earlier than normal, on January 20<sup>th</sup>, at Big Canyon Facility. Hatchery fish comprised 95.4% of the returns to Little Sheep Creek with only 33 natural fish. Adults that returned to Big Canyon were 96.3% hatchery origin with only 46 natural fish. At Wallowa Fish Hatchery, hatchery fish comprised 99.8% of the returns with only 3 natural fish. In previous years, because so few natural adults returned to Wallowa Fish Hatchery, natural and hatchery returns were not separated. Typical of most years, the majority

of hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon were fish that spent one year in the ocean (Table 14). In contrast, similar numbers of one-ocean and two-ocean natural fish returned to Big Canyon. At Little Sheep Creek, a majority of the hatchery and natural adults spent one year in the ocean.

All adult returns to Wallowa Fish Hatchery in 1998 were retained for spawning (Table 14). Of the adult returns to Big Canyon, we outplanted 451 fish to local ponds for harvest opportunity. We passed all natural fish (except one spawned out male that was trapped late in the season) and 10 hatchery fish above the weir at Big Canyon for natural production. We retained a majority of the hatchery fish and 24.2% of the natural fish at Little Sheep Creek for spawning. Hatchery fish comprised 82.3% of the adults released above the weir to spawn naturally. Length-at-age data for Wallowa stock adults are presented in Figure 3, and Imnaha stock data are presented in Figure 4.

Egg take goals for both Wallowa and Imnaha stocks were exceeded in 1998. Over 654,000 of the 1.69 M fertilized eggs taken at Little Sheep Creek were transferred to the Nez Perce Tribe for rearing at a temporary site on the lower Imnaha River (Table 15). The percent mortality from green egg to eyed embryo ranged from 6-52% for Wallowa stock from eight weekly spawns and ranged from 4-26% for Imnaha stock from nine weekly spawns. Over the last four brood years (1994-97 BY), the range of green egg-to-embryo mortality was 4-24% for Wallowa stock and 5-26% for Imnaha stock.

### **Experimental group returns**

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

#### *1997*

Wallowa and Imnaha adults that returned in 1997 were from groups released to evaluate the survival benefits of acclimation. Adult returns from brood years 1992-1994 occurred in 1997. We had Wallowa stock recoveries from 11 CWT codes (Table 16) and Imnaha stock recoveries from seven CWT codes (Table 17).

#### *1998*

Wallowa and Imnaha stock adults that returned in 1998 were from releases to evaluate the benefits of acclimation, and from volitional releases for Wallowa stock only. Adult returns were from brood years 1993-1995. We had Wallowa stock recoveries from 12 CWT codes (Table 18) and Imnaha stock recoveries from seven CWT codes (Table 19).

## Compensation goals

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

### *1996-1997 run year*

For the Wallowa stock, we estimated that in the 1996-97 run year, 7,063 hatchery origin adults returned to the compensation area (Table 20). This represented 76.9% of the compensation goal. For the Imnaha stock, we estimated that 1,648 hatchery origin adults returned to the compensation area, or 82.4% of the compensation goal.

### *1997-1998 run year*

For the Wallowa stock, we estimated that in the 1997-98 run year, 9,519 hatchery origin adults returned to the compensation area, representing 103.6% of the compensation goal (Table 21). For the Imnaha stock, we estimated that 1,359 adults returned to the compensation area, accounting for 68.0% of the compensation goal.

There are three principle factors that influence success in meeting the compensation goal: number of smolts released for the brood years that produced the adults; smolt-to-adult survival; and capture of fish below the compensation area in fisheries and as strays. We met our compensation goal (103.6%) for the first time for the Grande Ronde program during the 1997-98 run year, however we have yet to reach our compensation goal for the Imnaha program. For both the Grande Ronde and Imnaha programs we have met our smolt production goals in most years. Returns in the 1996-1997 run year represented completed returns for the 1992 BY. Returns in the 1997-1998 run year represented the final returns of the 1993 BY. Total smolt-to-adult survival rates for the 1992 BY Wallowa and Imnaha stocks were 0.40% and 0.25%, respectively. For the 1993 BY, Wallowa and Imnaha stocks smolt-to-adult survival rates were 0.82% and 0.27%, respectively (Figure 5). Beginning with the 1987 BY, when we began meeting our smolt production goals, we have only met our SAR goal for Wallowa stock of 0.68% in three out of the last seven complete brood years, and only met our SAR goal for Imnaha stock of 0.61% in two of seven brood years, suggesting low smolt-to-adult survival may be the primary factor for rarely achieving our compensation goals. For the Wallowa stock, 34% of the recoveries for the 1996-1997 run year occurred downstream of the compensation area, and for the 1997-1998 run year, 29% occurred downstream (Tables 20 & 21). A smaller percentage of Imnaha stock were recovered downstream of the compensation area; 15% for the 1996-1997 run year and 14% for the 1997-1998 run year.

The Imnaha steelhead supplementation program allows us to evaluate and compare productivity (progeny produced per parent) of hatchery fish and naturally spawning fish. Progeny-per-parent ratios for naturally spawning fish have been below 1.0 for completed brood years 1987-1993 (Figure 6). Hatchery fish progeny-per-parent ratios (weir returns only) have been above 1.0 for all brood years except 1991 and 1992. Hatchery rates exceeded natural rates for all brood years except 1991. One purpose of the supplementation program is to enhance or stabilize natural fish abundance. Annual abundance of naturally-produced fish has been highly



variable; however, we have not observed an increasing trend in the abundance of natural fish as a result of supplementation (Figure 7).

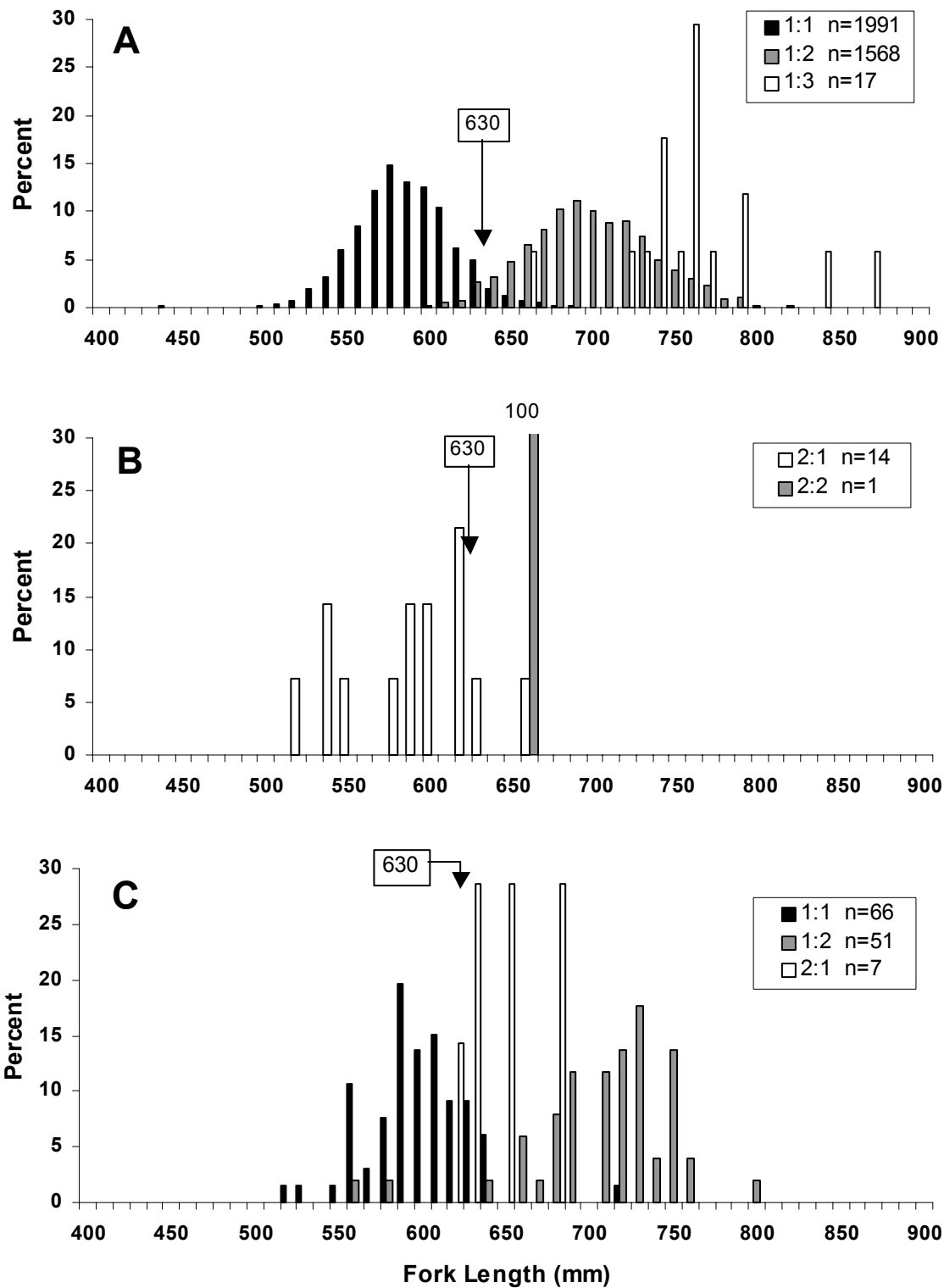


Figure 1. Length-at-age relationships based on scale analysis for Wallowa stock summer steelhead for A and B) 1991-1996 and C) 1997 adult returns. Numbers in boxes represent fish size at which one-ocean and two-ocean fish were distinguished during visual observations based on scale analysis from 1991-1996 adult returns. Number above bar represents percent for that bar.

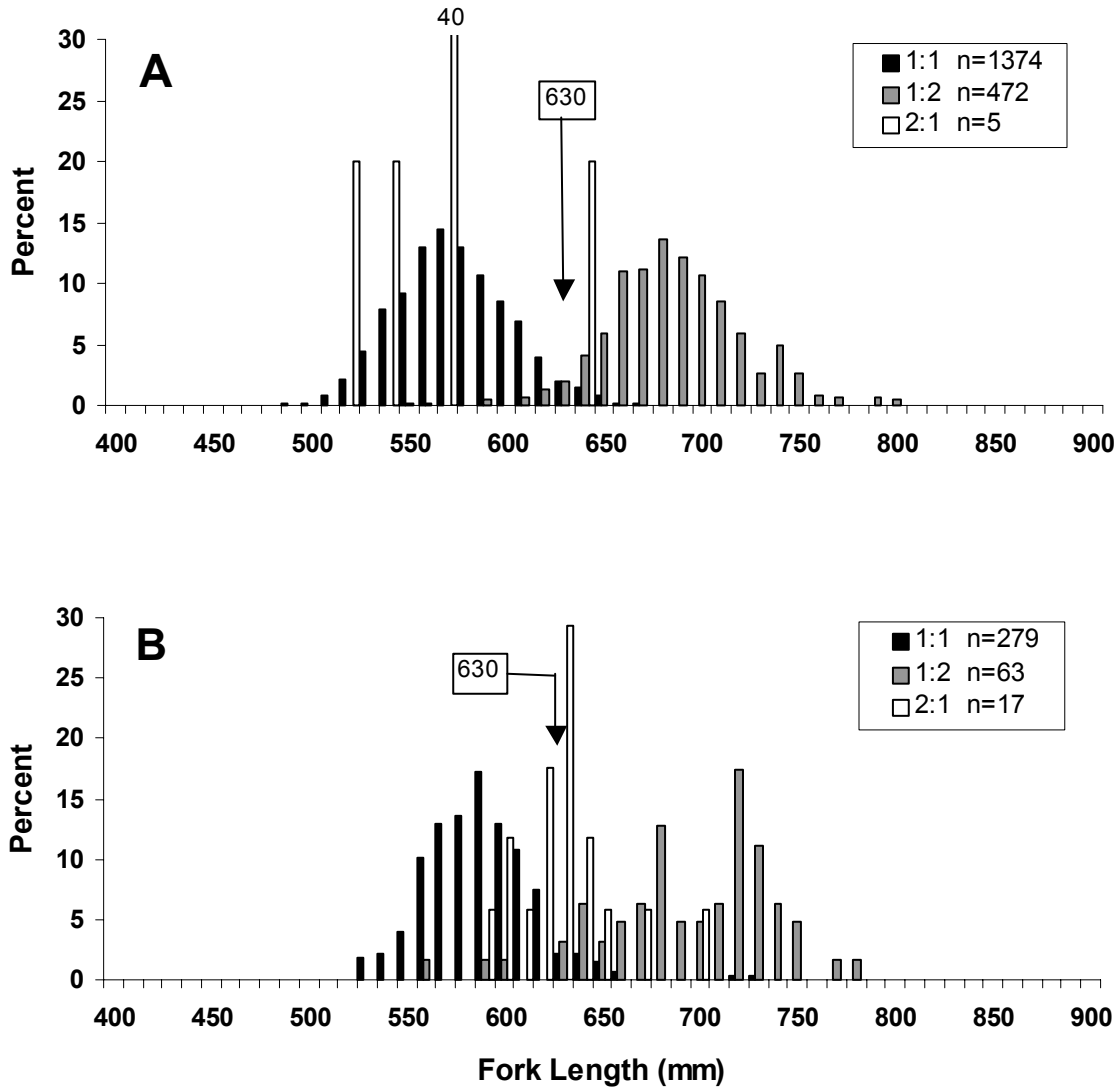


Figure 2. Length-at-age relationships based on scale analysis for Imnaha stock summer steelhead for A) 1991-1996 and B) 1997 adult returns. Numbers in boxes represent fish size at which one-ocean and two-ocean fish were distinguished during visual observations based on scale analysis from 1991-1996 adult returns. Number above bar represents percent for that bar.

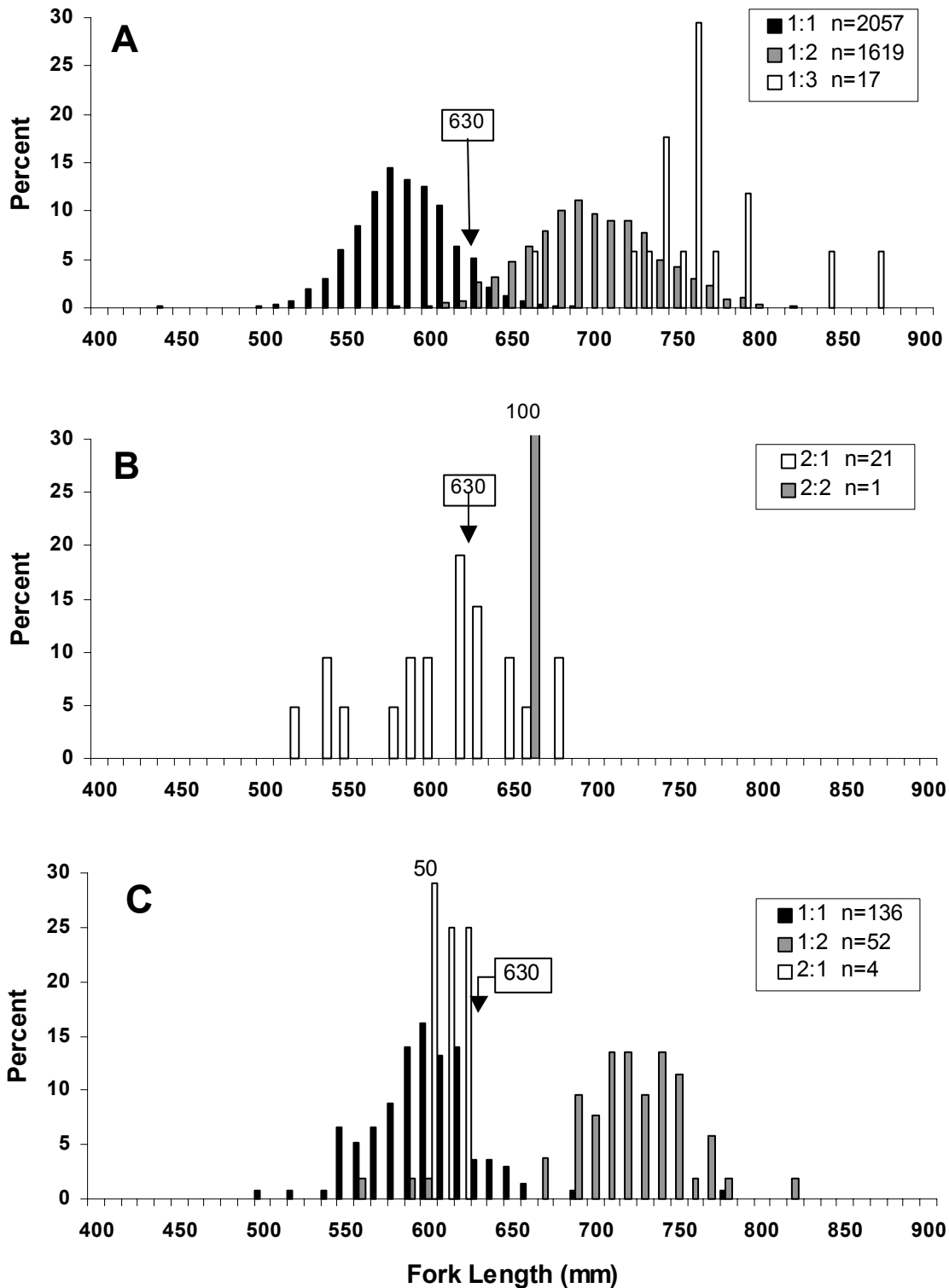


Figure 3. Length-at-age relationships for Wallowa stock summer steelhead for A and B) 1991-1997 and C) 1998 adult returns. Numbers in boxes represent fish size at which one-ocean and two-ocean fish were distinguished during visual observations based on scale analysis from 1991-1997 adult returns. Numbers above bars represent percent for those bars.

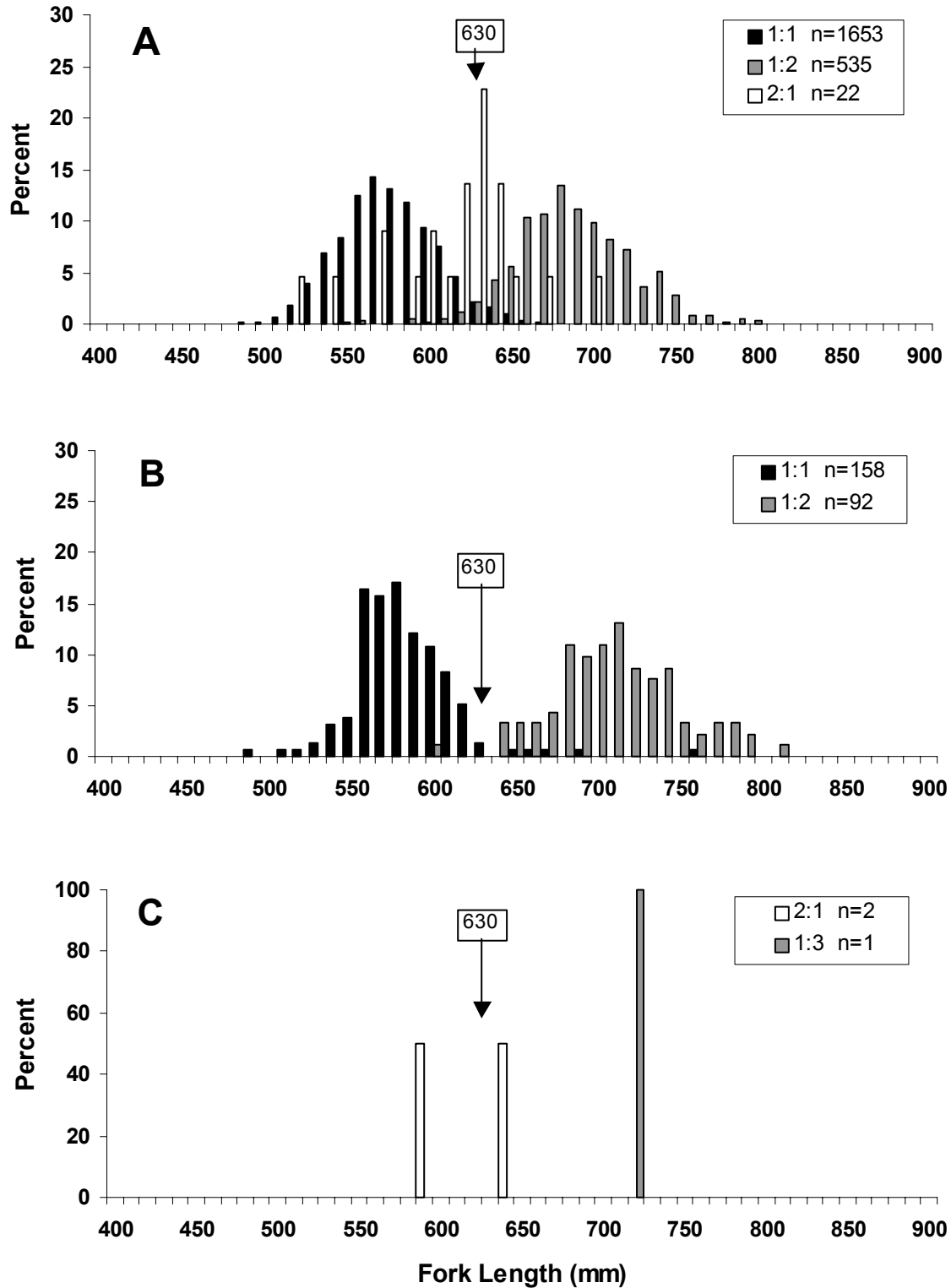


Figure 4. Length-at-age relationships for Imnaha stock summer steelhead for A) 1991-1997 and B and C) 1998 adult returns. Numbers in boxes represent fish size at which one-ocean and two-ocean fish were distinguished during visual observations based on scale analysis from 1991-1997 adult returns.

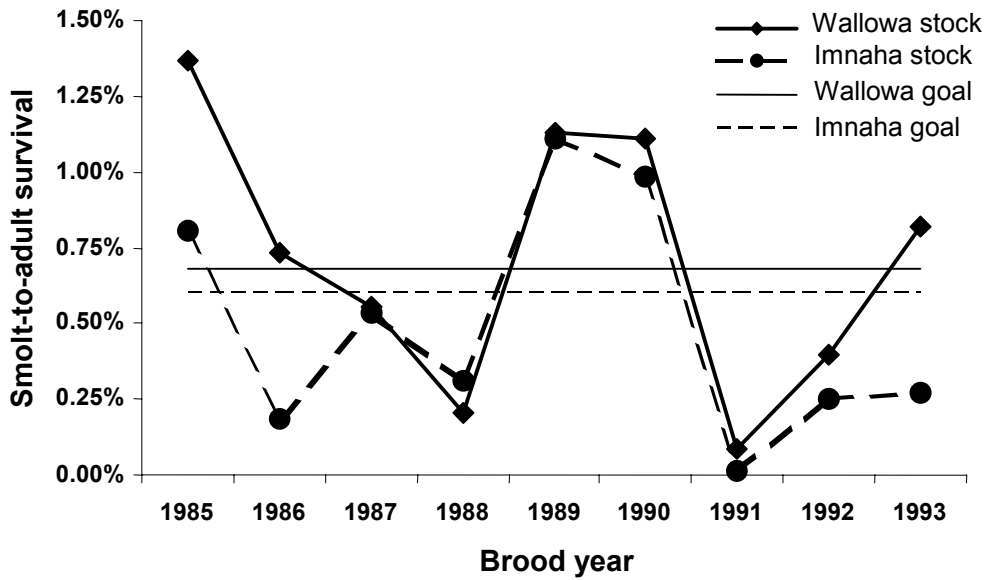


Figure 5. Smolt-to-adult survival for Wallowa and Imnaha stock summer steelhead, brood years 1985-1993. The Wallowa SAR goal is 0.68% and the Imnaha SAR goal is 0.61%.

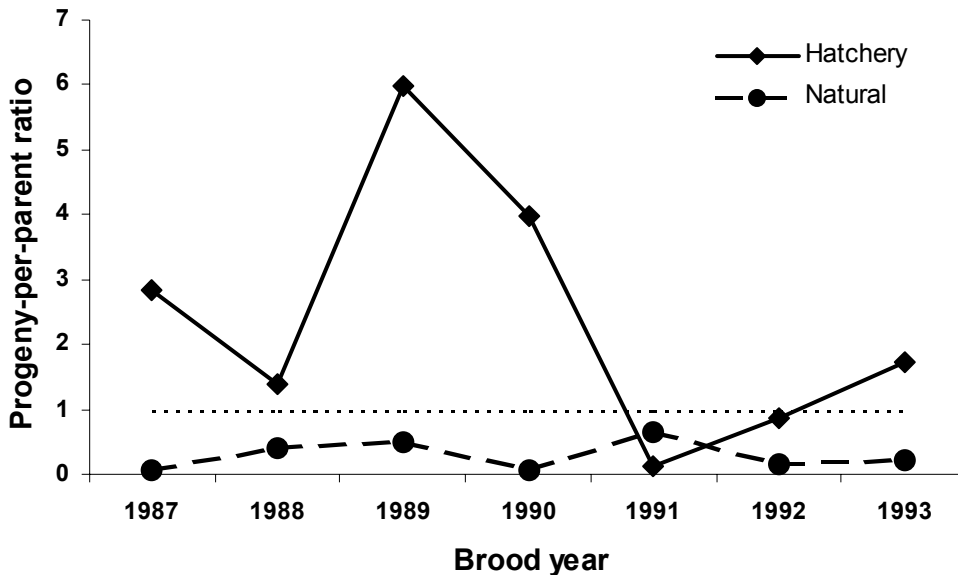


Figure 6. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, brood years 1987-1993. Dashed line indicates a progeny-to-parent ratio of one (replacement).

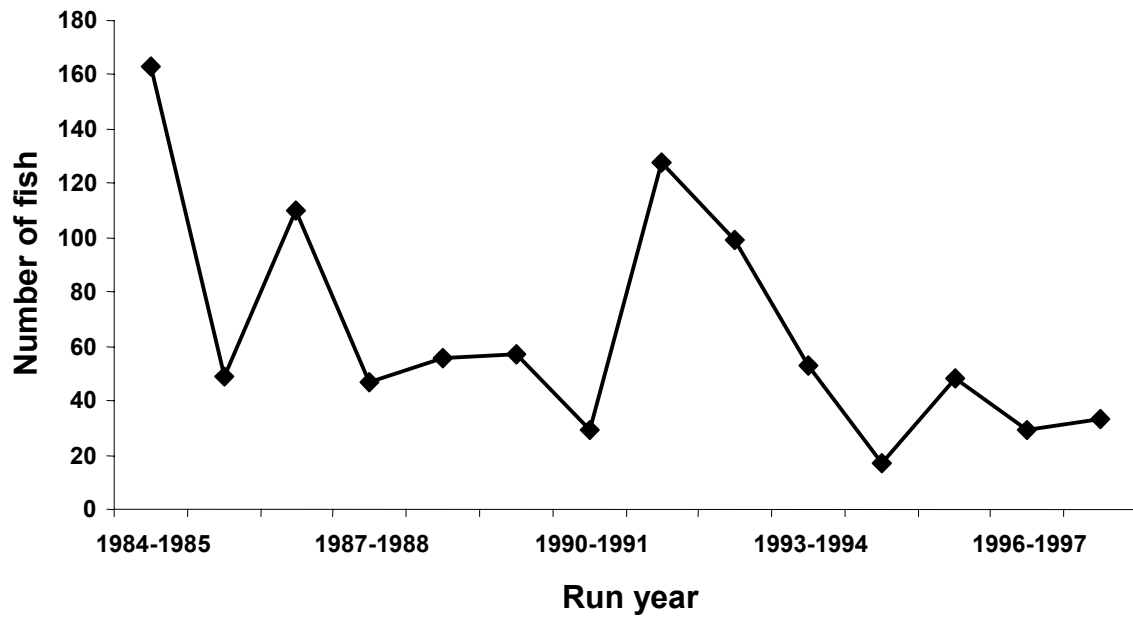


Figure 7. Returns of naturally produced summer steelhead to Little Sheep Creek, run years 1984-85 to 1997-98.

Table 1. Summary of egg collection and juvenile survival for 1996 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCF facilities in 1997. Eyed embryos are fertilized eggs with pigmented eyes visible through the egg shell.

| Stock   | Number of eggs taken | Eyed embryos           | Total fish at smolt stage | Estimated survival rate |                              |
|---------|----------------------|------------------------|---------------------------|-------------------------|------------------------------|
|         |                      |                        |                           | Egg-to-embryo           | Embryo-to-smolt <sup>a</sup> |
| Wallowa | 2,781,565            | 2,467,785 <sup>b</sup> | 1,402,919 <sup>c</sup>    | 88.7                    | 87.6                         |
| Imnaha  | 728,244              | 558,755 <sup>d</sup>   | 327,460                   | 76.7                    | 88.3                         |

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

<sup>b</sup> Includes 893,902 embryos that were euthanized as gradeouts or as excess to program needs.

<sup>c</sup> Includes 24,624 Wallowa stock smolts received from WDFW and released on the lower Grande Ronde River at the mouth of the Wenaha River, and 5,031 fish held back and reared as rainbow trout in Kinney Lake.

<sup>d</sup> Includes 187,845 embryos that, after hatching, were euthanized as gradeouts or as excess to program needs.

Table 2. Estimates of fin clip quality and coded-wire tag retention for 1996 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 1997. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose clipped and target size at release was 5 fish per pound. For experimental fish, targets for both stocks were 100% AdLV+CWT.

| Experimental group   | Tag code | Number checked | CWT +LV | CWT + no LV | No CWT + LV | Ad   | No Ad |
|----------------------|----------|----------------|---------|-------------|-------------|------|-------|
| <i>Wallowa stock</i> |          |                |         |             |             |      |       |
| Volitional, 3        | 091828   | 306            | 99.4    | 0.3         | 0.3         | 98.7 | 1.3   |
| Forced, 5            | 091829   | 304            | 100.0   | 0.0         | 0.0         | 99.7 | 0.3   |
| Volitional, 17       | 091830   | 305            | 99.0    | 0.3         | 0.7         | 98.2 | 1.8   |
| Forced, 19           | 091831   | 336            | 98.5    | 0.0         | 1.5         | 98.7 | 1.3   |
| Forced, fast/slow, 7 | 075330   | 327            | 99.4    | 0.3         | 0.3         | 98.5 | 1.5   |
| Vol., slow/fast, 8   | 091826   | 322            | 99.4    | 0.3         | 0.3         | 99.3 | 0.7   |
| Forced, slow/fast, 9 | 091825   | 308            | 99.4    | 0.6         | 0.0         | 98.5 | 1.5   |
| Vol., fast/slow, 10  | 091827   | 310            | 99.7    | 0.3         | 0.0         | 99.3 | 0.7   |
| Average              |          | 315            | 99.3    | 0.3         | 0.4         | 98.9 | 1.1   |
| <i>Imnaha stock</i>  |          |                |         |             |             |      |       |
| Slow/fast growth, 31 | 091832   | 335            | 98.8    | 0.6         | 0.6         | 99.0 | 1.0   |
| Fast/slow growth, 32 | 091833   | 336            | 99.1    | 0.3         | 0.6         | 99.0 | 1.0   |
| Average              |          | 336            | 99.0    | 0.4         | 0.6         | 99.0 | 1.0   |



Table 3. Details of experimental and production groups of 1996 brood year, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 1997. Experimental group indicates release strategy and rearing raceway number(s). All production, volitional, and forced groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

| Experimental group <sup>a</sup> | FPP | Release date      | Release location <sup>b</sup> | CWT code | Length mm    | Weight g     | Condition factor | Total fish released | Percent survival to LGD <sup>c</sup> |
|---------------------------------|-----|-------------------|-------------------------------|----------|--------------|--------------|------------------|---------------------|--------------------------------------|
| Direct Stream, 15,16, 22,24,    | 4.9 | April 7-8         | Gr. Ronde R.                  | -        | 198          | -            | -                | 199,969             | -                                    |
| Direct Stream, 26               | 5.0 | April 9           | Catherine Cr.                 | -        | 196          | -            | -                | 62,490              | -                                    |
| Direct Stream                   | 4.8 | April 24          | Wenaha R.                     | -        | -            | -            | -                | 24,624              | -                                    |
| Volitional, 3                   | 5.0 | April 2-18        | Spring Cr.                    | 091828   | 200 (19)     | 87.1 (26.5)  | 1.05 (0.06)      | 26,798              | 77.2                                 |
| Forced, 5                       | 5.2 | April 1           | Spring Cr.                    | 091829   | 203 (19)     | 87.4 (21.8)  | 1.02 (0.05)      | 26,360              | 73.9                                 |
| Production, 1-6, 11-14          | 5.0 | April 1-18        | Spring Cr.                    | -        | 204 (17)     | 90.0 (22.5)  | 1.04 (0.07)      | 463,732             | -                                    |
| Volitional, 17                  | 5.0 | May 16-30         | Spring Cr.                    | 091830   | 209 (17)     | 92.6 (22.8)  | 1.00 (0.07)      | 24,487              | 61.9                                 |
| Forced, 19                      | 5.1 | May 15            | Spring Cr.                    | 091831   | 206 (19)     | 87.7 (25.3)  | 0.99 (0.06)      | 26,588              | 68.5                                 |
| Production, 17,19,21            | 5.1 | May 15-30         | Spring Cr.                    |          | 207 (17)     | 88.9 (22.3)  | 0.98 (0.06)      | 112,517             | -                                    |
| Forced, fast/slow, 7            | 5.6 | April 8           | Deer Cr.                      | 075330   | 202 (15)     | 80.8 (18.6)  | 1.02 (0.06)      | 25,227              | 67.2                                 |
| Forced, slow/fast, 9            | 5.6 | April 8           | Deer Cr.                      | 091825   | <sup>d</sup> | <sup>d</sup> | <sup>d</sup>     | 26,766              | 60.2                                 |
| Vol., slow/fast, 8              | 5.2 | April 9-23        | Deer Cr.                      | 091826   | 207 (16)     | 92.5 (19.3)  | 1.03 (0.16)      | 26,571              | 61.6                                 |
| Vol., fast/slow, 10             | 5.2 | April 9-23        | Deer Cr.                      | 091827   | <sup>e</sup> | <sup>e</sup> | <sup>e</sup>     | 26,844              | 77.8                                 |
| Production, 7-10                | 5.3 | April 8-23        | Deer Cr.                      | -        | 201 (16)     | 83.4 (20.9)  | 0.98 (0.19)      | 111,726             | -                                    |
| Volitional, 18,20               | 4.9 | May 21-<br>June 4 | Deer Cr.                      | -        | 209 (16)     | 92.0 (22.1)  | 1.01 (0.07)      | 99,985              | 64.7                                 |
| Forced 23, 25                   | 4.9 | May 20            | Deer Cr.                      | -        | 210 (18)     | 93.4 (26.8)  | 0.99 (0.07)      | 113,204             | 63.3                                 |
| Total released <sup>f</sup>     |     |                   |                               |          |              |              |                  | 1,397,888           |                                      |

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW), except for Wenaha River releases reared at Lyon's Ferry Fish Hatchery (WDFW). Fast/slow growth experimental groups were fed at 95-100% of AGR (allowable growth rate, ODFW 1986 unpublished feed chart) which represents fast growth for the first 8-10 weeks of rearing, then at 70% AGR which represents slow growth for the last 10-12 weeks of rearing, or visa versa.

<sup>b</sup> Gr. Ronde R. indicates direct stream releases in the upper Grande Ronde River at river mile 156-159. Catherine Cr. indicates direct stream releases in Catherine Creek at river mile 17-18. Wenaha R. indicates direct stream releases in the lower Grande Ronde River at the mouth of the Wenaha River at river mile 45.

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

<sup>d</sup> CWT codes 075330 and 091825 were held in the same acclimation pond and were not distinguishable based on an external mark.

<sup>e</sup> CWT codes 091826 and 091827 were held in the same acclimation pond and were not distinguishable based on an external mark.

<sup>f</sup> Wallowa stock steelhead male releases were 1% precocial.

Table 4. Details of experimental and production groups of 1996 brood year, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 1997. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

| Experimental group <sup>a</sup> | FPP | Release date | Release location | CWT code | Length mm    | Weight g     | Condition factor | Total fish Released | Percent survival to LGD <sup>b</sup> |
|---------------------------------|-----|--------------|------------------|----------|--------------|--------------|------------------|---------------------|--------------------------------------|
| Slow/fast, 31                   | 5.3 | April 15     | L. Sheep Cr.     | 091832   | 209 (16)     | 96.1 (20.7)  | 1.04 (0.07)      | 26,175              | 63.6                                 |
| Fast/slow, 32                   | 5.3 | April 15     | L. Sheep Cr.     | 091833   | <sup>c</sup> | <sup>c</sup> | <sup>c</sup>     | 28,070              | 68.3                                 |
| Production, 29-32               | 5.3 | April 15     | L. Sheep Cr.     | -        | 193 (20)     | 74.5 (24.4)  | 1.04 (0.07)      | 154,691             | -                                    |
| Production, 27,28               | 5.0 | May 13       | L. Sheep Cr.     | -        | 207 (24)     | 93.6 (26.7)  | 1.01 (0.06)      | <u>118,524</u>      | -                                    |
| Total released                  |     |              |                  |          |              |              |                  | 327,460             |                                      |

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW). Fast/slow growth experimental groups were fed at 95-100% of AGR (allowable growth rate, ODFW 1986 unpublished feed chart) which represents fast growth for the first 8-10 weeks of rearing, then at 70 % AGR, which represents slow growth for the last 10-12 weeks of rearing, or visa versa.

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

<sup>c</sup> CWT codes 071832 and 071833 were held in the same acclimation pond and were not distinguishable based on an external mark.

Table 5. Summary of egg collection and juvenile survival for 1997 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCF facilities in 1998. Eyed embryos are fertilized eggs with pigmented eyes visible through the egg shell.

| Stock   | Number of eggs taken | Eyed embryos           | Total fish released    | Estimated survival rate |                              |
|---------|----------------------|------------------------|------------------------|-------------------------|------------------------------|
|         |                      |                        |                        | Egg-to-embryo           | Embryo-to-smolt <sup>a</sup> |
| Wallowa | 2,786,600            | 2,552,300 <sup>b</sup> | 1,388,446 <sup>c</sup> | 91.6                    | 91.5                         |
| Imnaha  | 860,100              | 762,700 <sup>d</sup>   | 117,096                | 88.7                    | 93.9                         |

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

<sup>b</sup> Includes 1,082,127 embryos that were euthanized as gradeouts or as excess to program needs.

<sup>c</sup> Includes 43,570 Wallowa stock smolts transferred from WDFW to the lower acclimation pond at Wallowa Hatchery on 9 March 1998, and 4,438 fish held back and reared as rainbow trout in Roulet pond (N = 2,188) and Kinney Lake (N = 2,250).

<sup>d</sup> Includes 638,018 embryos that were euthanized as gradeouts or as excess to program needs.

Table 6. Estimates of fin clip quality and coded-wire tag retention for 1997 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 1998. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose clipped and target size at release was 5 fish per pound. For experimental fish, targets for both stocks were 100% AdLV+CWT.

| Experimental group   | Tag code | Number checked | CWT +LV | CWT + no LV | No CWT + LV | Ad   | No Ad |
|----------------------|----------|----------------|---------|-------------|-------------|------|-------|
| <i>Wallowa stock</i> |          |                |         |             |             |      |       |
| Lyons Ferry, 2       | 071247   | 246            | 99.2    | 0.0         | 0.8         | -    | -     |
| Volitional, 3        | 092329   | 286            | 97.6    | 1.0         | 1.4         | 99.1 | 0.9   |
| Forced, 5            | 092328   | 259            | 97.3    | 0.4         | 2.3         | 98.9 | 1.1   |
| Volitional, 17       | 092324   | 238            | 96.6    | 2.1         | 1.3         | 99.4 | 0.6   |
| Forced, 19           | 092325   | 232            | 94.4    | 3.4         | 2.2         | 99.4 | 0.6   |
| Volitional, 7        | 092327   | 286            | 96.5    | 1.4         | 2.1         | 99.4 | 0.6   |
| Forced, 9            | 092326   | 276            | 94.9    | 0.0         | 5.1         | 98.9 | 1.1   |
| Volitional, 21       | 092330   | 280            | 93.9    | 0.7         | 5.4         | 99.1 | 0.9   |
| Forced, 23           | 092331   | 248            | 96.8    | 0.4         | 2.8         | 99.1 | 0.9   |
| Average              |          | 261            | 96.4    | 1.0         | 2.6         | 99.2 | 0.8   |
| <i>Imnaha stock</i>  |          |                |         |             |             |      |       |
| 1/2 std. density, 27 | 092323   | 291            | 96.6    | 3.1         | 0.3         | 98.7 | 1.3   |
| 1/4 std. density, 28 | 074860   | 290            | 99.0    | 0.0         | 1.0         | 98.7 | 1.3   |
| 1/2 std. density, 29 | 092322   | 297            | 92.9    | 0.0         | 7.1         | 98.7 | 1.3   |
| 1/4 std. density, 30 | 075301   | 275            | 94.6    | 0.7         | 4.7         | 98.7 | 1.3   |
| Average              |          | 288            | 95.8    | 0.9         | 3.3         | 98.7 | 1.3   |

Table 7. Details of experimental and production groups of 1997 brood year, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 1998. Experimental group indicates release strategy and rearing raceway number(s). All production, volitional, and forced released groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LFH indicates Lyons Ferry Fish Hatchery; LGD indicates Lower Granite Dam.

| Experimental group <sup>a</sup>   | FPP | Release date          | Release location <sup>b</sup> | CWT Code | Length mm | Weight g     | Condition Factor | Total fish released | Percent survival to LGD <sup>c</sup> |
|-----------------------------------|-----|-----------------------|-------------------------------|----------|-----------|--------------|------------------|---------------------|--------------------------------------|
| Direct Stream, 11,12, 14,16       | 4.7 | April 6-8             | Gr. Ronde R.                  | -        | 204 (18)  | -            | -                | 199,960             | -                                    |
| Direct Stream, 11,15              | 4.7 | April 8-9             | Catherine Cr.                 | -        | 205 (19)  | -            | -                | 62,505              | -                                    |
| Volitional, 3                     | 5.0 | March 25-<br>April 8  | Spring Cr.                    | 092329   | 201 (18)  | 90.1 (22.9)  | 1.06 (0.05)      | 26,245              | 66.6                                 |
| Forced, 5                         | 5.1 | March 24              | Spring Cr.                    | 092328   | 202 (16)  | 89.7 (20.8)  | 1.06 (0.05)      | 26,243              | 52.7                                 |
| Forced, 2 at LFH                  | 9.8 | March 24              | Spring Cr.                    | 071247   | 162 (22)  | 46.4 (19.1)  | 1.03 (0.08)      | 25,301              | 34.9                                 |
| Production, 1-6, 8, 2 at LFH      | 5.0 | March 24-<br>April 8  | Spring Cr.                    | -        | 203 (18)  | 91.1 (25.7)  | 1.04 (0.05)      | 285,167             | -                                    |
| Volitional, 17                    | 4.8 | May 2-20              | Spring Cr.                    | 092324   | 213 (17)  | 94.9 (23.1)  | 0.99 (0.09)      | 22,982              | 74.5                                 |
| Forced, 19                        | 5.1 | May 1                 | Spring Cr.                    | 092325   | 205 (19)  | 88.9 (22.6)  | 0.98 (0.06)      | 25,285              | 71.3                                 |
| Production, 13,17-<br>20,22,24,26 | 4.5 | May 1-20              | Spring Cr.                    | -        | 214 (18)  | 100.4 (24.6) | 1.00 (0.07)      | 348,179             | -                                    |
| Volitional, 7                     | 5.1 | April 1-15            | Deer Cr.                      | 092327   | 201 (18)  | 89.4 (25.2)  | 1.02 (0.05)      | 26,142              | 60.9                                 |
| Forced, 9                         | 5.6 | March 31              | Deer Cr.                      | 092326   | 197 (18)  | 80.6 (22.2)  | 1.02 (0.05)      | 24,970              | 47.5                                 |
| Production, 7-10                  | 5.1 | March 31-<br>April 15 | Deer Cr.                      | -        | 204 (21)  | 88.1 (24.6)  | 1.03 (0.07)      | 141,840             | -                                    |
| Volitional, 21                    | 5.0 | May 13-27             | Deer Cr.                      | 092330   | 211 (19)  | 91.6 (27.3)  | 0.94 (0.05)      | 26,096              | 64.2                                 |
| Forced, 23                        | 4.6 | May 12                | Deer Cr.                      | 092331   | 212 (21)  | 99.5 (31.8)  | 0.97 (0.08)      | 28,309              | 80.4                                 |
| Production, 21,23,<br>25, 26      | 4.9 | May 12-27             | Deer Cr.                      | -        | 209 (21)  | 93.5 (28.4)  | 0.97 (0.06)      | 114,784             | -                                    |
| Total released <sup>d</sup>       |     |                       |                               |          |           |              |                  | 1,384,008           |                                      |

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW), except the Spring Creek forced release group with CWT code 071247, and 18,269 Ad only fish included in the Spring Creek production group which were reared at Lyon's Ferry Fish Hatchery (Washington Department of Fish and Wildlife).

<sup>b</sup> Gr. Ronde R. indicates direct stream releases in the upper Grande Ronde River at river mile 164-170. Catherine Cr. indicates direct stream releases in Catherine Creek at river mile 18-19.

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

<sup>d</sup> Wallowa stock steelhead male releases were less than 1% precocial.

Table 8. Details of experimental and production groups of 1997 brood year, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 1998. Experimental group indicates release strategy and rearing raceway number(s). All groups were acclimated. Target size for all fish was 5 fish per pound (FPP). Standard deviations are shown in parentheses. LGD indicates Lower Granite Dam.

| Experimental group <sup>a</sup> | FPP | Release date | Release location | CWT code | Length mm    | Weight g     | Condition factor | Total fish released | Percent survival to LGD <sup>b</sup> |
|---------------------------------|-----|--------------|------------------|----------|--------------|--------------|------------------|---------------------|--------------------------------------|
| 1/2 Std. density, 27            | 5.1 | April 26     | L. Sheep Cr.     | 092323   | 201 (29)     | 89.4 (37.2)  | 1.08 (0.07)      | 26,467              | 63.6                                 |
| 1/4 Std. density, 28            | 5.1 | April 26     | L. Sheep Cr.     | 074860   | <sup>c</sup> | <sup>c</sup> | <sup>c</sup>     | 13,519              | 75.5                                 |
| 1/2 Std. density, 29            | 5.1 | April 26     | L. Sheep Cr.     | 092322   | <sup>c</sup> | <sup>c</sup> | <sup>c</sup>     | 25,399              | 52.6                                 |
| 1/4 Std. density, 30            | 5.1 | April 26     | L. Sheep Cr.     | 075301   | <sup>c</sup> | <sup>c</sup> | <sup>c</sup>     | 12,934              | 50.6                                 |
| Production, 27-30               | 5.3 | April 26     | L. Sheep Cr.     | -        | 199 (29)     | 86.2 (36.3)  | 1.08 (0.07)      | 8,103               | -                                    |
| Production, 31                  | 5.6 | May 19       | L. Sheep Cr.     | -        | 200 (29)     | 81.3 (33.6)  | 1.05 (0.12)      | 30,674              | -                                    |
| Total released                  |     |              |                  |          |              |              |                  | 117,096             |                                      |

<sup>a</sup> All fish were reared at Irrigon Fish Hatchery (ODFW). Standard rearing density (Std. density) at Irrigon Fish Hatchery is 1.5 lbs/cu.ft. (Number of fish/5 FPP/7,000 cu.ft. per raceway), therefore 1/2 and 1/4 standard density experimental groups were 0.7 and 0.4 lbs/cu.ft. at 5 FPP, respectively. Beginning with the 1998 brood, embryos that were in excess to program needs were outplanted as presmolts.

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

<sup>c</sup> CWT codes 092323, 074860, 092323, and 075301 were held in the same acclimation pond and were not distinguishable based on an external mark.

Table 9. Details of 1998 brood year, Imnaha stock hatchery summer steelhead released as fry or presmolts in the Imnaha River Basin in 1998 by the Nez Perce Tribe (NPT) and ODFW. The presmolts represent embryos that were reared and released, rather than being euthanized because they were in excess to program needs. Experimental group indicates life stage and release strategy. FPP indicates fish per pound.

| Agency, experimental group <sup>a</sup> | FPP  | Release date   | Release location | Fin clip | Total fish released |
|---|------|----------------|------------------|----------|---------------------|
| NPT, fry, direct stream                 | --   | May 30, June 2 | Imnaha R.        | None     | 139,074             |
| NPT, fry, direct stream                 | --   | July 10, 14    | B. Sheep Cr.     | None     | 287,511             |
| Total fry released                      |      |                |                  |          | 426,585             |
| ODFW, presmolt, direct stream           | 59.0 | November 4     | B. Sheep Cr.     | Ad       | 5,015               |
| Total fish released                     |      |                |                  |          | 431,600             |

<sup>a</sup> All fry were reared at a temporary site on the lower Imnaha River by the Nez Perce Tribe (NPT) and the presmolts were reared at Irrigon Fish Hatchery (ODFW)

Table 10. Timing of adult steelhead returns to LSRCP facilities in 1997 by location and origin. End-of-season adjustments in numbers trapped were distributed proportionally over the entire run.

| Period        | Week of the year | Number of fish trapped <sup>a</sup> |         |            |         |              |         |
|---------------|------------------|-------------------------------------|---------|------------|---------|--------------|---------|
|               |                  | Wallowa                             |         | Big Canyon |         | Little Sheep |         |
|               |                  | Hatchery                            | Natural | Hatchery   | Natural | Hatchery     | Natural |
| Feb 05-11     | 6                | -                                   | -       | 0          | 0       | -            | -       |
| Feb 12-18     | 7                | -                                   | -       | 3          | 0       | -            | -       |
| Feb 19-25     | 8                | 1                                   | 0       | 2          | 1       | -            | -       |
| Feb 26-Mar 04 | 9                | 6                                   | 0       | 0          | 0       | 0            | 0       |
| Mar 05-11     | 10               | 268                                 | 0       | 6          | 0       | 0            | 0       |
| Mar 12-18     | 11               | 334                                 | 0       | 110        | 1       | 8            | 0       |
| Mar 19-25     | 12               | 220                                 | 0       | 351        | 9       | 151          | 6       |
| Mar 26-Apr 01 | 13               | 190                                 | 0       | 207        | 1       | 136          | 5       |
| Apr 02-08     | 14               | 135                                 | 0       | 54         | 0       | 55           | 1       |
| Apr 09-15     | 15               | 124                                 | 0       | 28         | 1       | 53           | 2       |
| Apr 16-22     | 16               | 130                                 | 0       | 287        | 14      | 232          | 5       |
| Apr 23-29     | 17               | 32                                  | 0       | 59         | 10      | 139          | 1       |
| Apr 30-May 06 | 18               | 27                                  | 0       | 46         | 3       | 87           | 2       |
| May 07-13     | 19               | 5                                   | 0       | 53         | 2       | 51           | 2       |
| May 14-20     | 20               | 0                                   | 0       | 15         | 2       | 24           | 3       |
| May 21-27     | 21               | 1                                   | 0       | 8          | 0       | 0            | 1       |
| May 27-Jun 03 | 22               | 0                                   | 0       | 3          | 0       | 2            | 0       |
| Jun 04-10     | 23               | 0                                   | 0       | 0          | 0       | 0            | 0       |
| Total         |                  | 1,473                               | 0       | 1,232      | 44      | 938          | 28      |

<sup>a</sup> Weirs installed February 3<sup>rd</sup> at Big Canyon (Deer Cr.) and February 26<sup>th</sup> at Little Sheep, and ladder opened February 18<sup>th</sup> at Wallowa Fish Hatchery. Adult collections stopped June 13<sup>th</sup> at Big Canyon and Little Sheep, and June 11<sup>th</sup> at Wallowa. Big Canyon trap numbers for Apr 16-22 and Apr 23-29 were adjusted using the mean number of fish arriving per day at the weir to apportion arrivals between weeks to compensate for the fish ladder being blocked two days prior to the week of Apr 16-22.

Table 11. Numbers and disposition of adult steelhead that returned to LSRCF facilities in 1997 by stock, origin, age (freshwater:saltwater), and sex. M indicates male and F indicates female.

| Stock,<br>Disposition <sup>a</sup>                | Hatchery |      |      |      |     |      |      |      |       | Natural |     |     |     |     |     | Grand<br>Total |      |       |       |
|---|----------|------|------|------|-----|------|------|------|-------|---------|-----|-----|-----|-----|-----|----------------|------|-------|-------|
|   | 1:1      |      | 1:2  |      | 1:3 |      | 2:1  |      | Total | 2:1     |     | 2:2 |     | 3:1 |     |                | 3:2  |       | Total |
|   | M        | F    | M    | F    | M   | F    | M    | F    | Total | M       | F   | M   | F   | M   | F   | M              | F    | Total |       |
| <i>Wallowa Hatchery (Wallowa stock)</i>           |          |      |      |      |     |      |      |      |       |         |     |     |     |     |     |                |      |       |       |
| Trapped   | 719      | 311  | 83   | 337  | 0   | 2    | 10   | 11   | 1,473 | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 1,473 |
| Passed  | 0        | 0    | 0    | 0    | 0   | 0    | 0    | 0    | 0     | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 0     |
| Outplanted  | 186      | 33   | 22   | 35   | 0   | 0    | 3    | 1    | 280   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 280   |
| Kept  | 533      | 278  | 61   | 302  | 0   | 0    | 7    | 10   | 1,193 | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 1,192 |
| Mortality   | 18       | 0    | 3    | 2    | 0   | 0    | 0    | 0    | 23    | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 23    |
| Spawned   | 372      | 199  | 52   | 226  | 0   | 2    | 4    | 7    | 862   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 862   |
| Killed  | 143      | 79   | 6    | 74   | 0   | 0    | 3    | 3    | 308   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 308   |
| Fork Length (mm)                                  | 600      | 595  | 728  | 701  | -   | -    | 646  | 640  |       | -       | -   | -   | -   | -   | -   | -              | -    | -     |       |
| Standard deviation                                | (22)     | (43) | (36) | (45) | -   | -    | (27) | (27) |       | -       | -   | -   | -   | -   | -   | -              | -    | -     |       |
| <i>Big Canyon Facility (Wallowa stock)</i>        |          |      |      |      |     |      |      |      |       |         |     |     |     |     |     |                |      |       |       |
| Trapped   | 664      | 291  | 44   | 213  | 0   | 2    | 10   | 8    | 1,232 | 4       | 6   | 8   | 9   | 5   | 5   | 2              | 5    | 44    | 1,276 |
| Passed <sup>a</sup>                               | 4        | 0    | 1    | 0    | 0   | 0    | 0    | 0    | 5     | 4       | 6   | 8   | 9   | 5   | 5   | 2              | 5    | 44    | 49    |
| Outplanted  | 287      | 40   | 16   | 27   | 0   | 0    | 4    | 1    | 375   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 375   |
| Kept <sup>b</sup>                                 | 373      | 251  | 27   | 186  | 0   | 2    | 6    | 7    | 852   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 852   |
| Mortality   | 1        | 2    | 1    | 2    | 0   | 0    | 0    | 0    | 6     | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 6     |
| Spawned   | 97       | 65   | 4    | 43   | 0   | 1    | 1    | 1    | 212   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 212   |
| Killed  | 275      | 184  | 22   | 141  | 0   | 1    | 5    | 6    | 634   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 634   |
| Fork Length (mm)                                  | 596      | 574  | 736  | 701  | -   | -    | -    | -    |       | 594     | 581 | 820 | 660 | 556 | 675 | -              | 700  |       |       |
| Standard deviation                                | (30)     | (16) | (21) | (21) | -   | -    | -    | -    |       | -       | -   | -   | -   | -   | -   | -              | (42) |       |       |
| <i>Little Sheep Creek Facility (Imnaha stock)</i> |          |      |      |      |     |      |      |      |       |         |     |     |     |     |     |                |      |       |       |
| Trapped   | 465      | 286  | 42   | 113  | 0   | 3    | 9    | 20   | 938   | 3       | 6   | 2   | 3   | 3   | 7   | 3              | 1    | 28    | 966   |
| Passed  | 28       | 13   | 3    | 8    | 0   | 0    | 1    | 0    | 53    | 2       | 6   | 2   | 3   | 2   | 6   | 3              | 0    | 24    | 77    |
| Outplanted  | 0        | 0    | 0    | 0    | 0   | 0    | 0    | 0    | 0     | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 0     |
| Kept  | 437      | 273  | 39   | 105  | 0   | 3    | 8    | 20   | 885   | 1       | 0   | 0   | 0   | 1   | 1   | 0              | 1    | 4     | 889   |
| Mortality   | 2        | 11   | 0    | 1    | 0   | 0    | 0    | 0    | 14    | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 14    |
| Spawned <sup>c</sup>                              | 160      | 108  | 21   | 62   | 0   | 3    | 5    | 13   | 372   | 1       | 0   | 0   | 0   | 1   | 1   | 0              | 1    | 4     | 376   |
| Killed  | 275      | 154  | 18   | 42   | 0   | 0    | 3    | 7    | 499   | 0       | 0   | 0   | 0   | 0   | 0   | 0              | 0    | 0     | 499   |
| Fork Length (mm)                                  | 592      | 578  | 700  | 687  | -   | 729  | 632  | 622  |       | -       | -   | -   | -   | 720 | 530 | -              | -    |       |       |
| Standard deviation                                | (25)     | (28) | (43) | (44) | -   | (22) | (14) | (34) |       | -       | -   | -   | -   | -   | -   | -              | -    |       |       |

<sup>a</sup> Includes one wild female passed, then recaptured and released below the Deer Creek weir. An additional 79 hatchery fish escaped into Deer Creek above the weir without being trapped (using Chapman's modification of Petersen's mark-recapture estimate from spawned-out fish collected on the weir).

<sup>b</sup> Only 124 males and 162 females were transferred to Wallowa Hatchery for spawning.

<sup>c</sup> Includes four males and four females spawned for a temperature study at Irrigon Hatchery (not included in broodstock). Also includes five age 2:1 hatchery fish with scale growth patterns suggesting the time interval spent in freshwater intermediate of age 1:1 and 2:1 fish.

Table 12. Spawning summaries for summer steelhead at LSRCP facilities in 1997. The percent mortality is from green egg to eyed embryo after shocking.

| Spawn date, Lot number                            | Parental origin <sup>a</sup> | Number of eggs <sup>b</sup> | Eyed embryos <sup>c</sup> | % mortality |
|---|------------------------------|-----------------------------|---------------------------|-------------|
| <i>Wallowa Hatchery (Wallowa stock)</i>           |                              |                             |                           |             |
| 3/25, wa320                                       | Hatchery                     | 859,600                     | 810,700                   | 6           |
| 4/01, wa321                                       | Hatchery                     | 494,600                     | 459,800                   | 7           |
| 4/08, wa322                                       | Hatchery                     | 387,300                     | 347,200                   | 10          |
| 4/15, wa323                                       | Hatchery                     | 292,900                     | 259,900                   | 11          |
| 4/22, wa324                                       | Hatchery                     | 241,400                     | 224,000                   | 7           |
| 4/29, wa325                                       | Hatchery                     | 248,800                     | 222,800                   | 11          |
| 5/06, wa326                                       | Hatchery                     | 144,400                     | 130,000                   | 10          |
| 5/13, wa327                                       | Hatchery                     | 92,300                      | 76,400                    | 17          |
| 5/21, wa328                                       | Hatchery                     | 25,300                      | 21,500                    | 15          |
| Total   |                              | 2,786,600                   | 2,552,300                 | 8           |
| <i>Little Sheep Creek Facility (Imnaha stock)</i> |                              |                             |                           |             |
| 3/27, li330                                       | Hatchery                     | 131,156                     | 124,500                   | 9           |
| 3/27, li330                                       | Mixed                        | 5,044                       | -                         | -           |
| 4/03, li331                                       | Hatchery                     | 157,800                     | 128,300                   | 19          |
| 4/10, li332                                       | Hatchery                     | 171,500                     | 163,400                   | 5           |
| 4/17, li333                                       | Hatchery                     | 76,190                      | 70,900                    | 12          |
| 4/17, li333                                       | Mixed                        | 4,010                       | -                         | -           |
| 4/24, li334                                       | Hatchery                     | 103,800                     | 88,200                    | 15          |
| 5/01, li335                                       | Hatchery                     | 87,700                      | 79,400                    | 10          |
| 5/08, li336                                       | Hatchery                     | 52,158                      | 52,200                    | 8           |
| 5/08, li336                                       | Mixed                        | 4,742                       | -                         | -           |
| 5/15, li337                                       | Hatchery                     | 35,200                      | 32,300                    | 18          |
| 5/15, li337                                       | Mixed                        | 4,400                       | -                         | -           |
| 5/20, li338                                       | Hatchery                     | 26,400                      | 23,500                    | 11          |
| Subtotal  | Hatchery                     | 841,904                     | -                         | -           |
| Subtotal  | Mixed                        | 18,196                      | -                         | -           |
| Total   |                              | 860,100                     | 762,700                   | 11          |

<sup>a</sup> In general, family groups were one male x one female for Wallowa stock and were matrix spawned (three males x three females) for Imnaha stock. Mixed eggs include both natural and hatchery parents.

<sup>b</sup> Does not include eggs from two hatchery females from group li330 (n=9,349) and two hatchery females from group li331 (n=7,600) used for a temperature study at Irrigon Hatchery.

<sup>c</sup> Includes 344,400 Wallowa stock and 324,400 Imnaha stock eyed embryos that were euthanized because they were excess to program needs. Four hundred of these excess eyed embryos (Wallowa stock) were transferred to ODFW's Salmon and Trout Enhancement Program (STEP) biologist Patty Bowers. Eyed embryos were inventoried on 4/17, 4/24, 5/1, 5/8, 5/15, 5/22, 5/29, and 6/6.



Table 13. Timing of adult steelhead returns to LSRCP facilities in 1998 by location and origin.

| Period        | Week of the year | Number of fish trapped <sup>a</sup> |         |            |         |              |         |
|---------------|------------------|-------------------------------------|---------|------------|---------|--------------|---------|
|               |                  | Wallowa                             |         | Big Canyon |         | Little Sheep |         |
|               |                  | Hatchery                            | Natural | Hatchery   | Natural | Hatchery     | Natural |
| Jan 22-28     | 4                | -                                   | -       | 0          | 0       | -            | -       |
| Jan 29-Feb4   | 5                | -                                   | -       | 0          | 0       | -            | -       |
| Feb 05-11     | 6                | -                                   | -       | 0          | 0       | -            | -       |
| Feb 12-18     | 7                | -                                   | -       | 0          | 0       | -            | -       |
| Feb 19-25     | 8                | 12                                  | 0       | 2          | 0       | -            | -       |
| Feb 26-Mar 04 | 9                | 22                                  | 0       | 0          | 0       | 0            | 0       |
| Mar 05-11     | 10               | 9                                   | 0       | 3          | 0       | 0            | 0       |
| Mar 12-18     | 11               | 109                                 | 0       | 94         | 0       | 12           | 2       |
| Mar 19-25     | 12               | 222                                 | 0       | 201        | 1       | 32           | 2       |
| Mar 26-Apr 01 | 13               | 218                                 | 0       | 93         | 3       | 67           | 5       |
| Apr 02-08     | 14               | 267                                 | 3       | 38         | 0       | 121          | 1       |
| Apr 09-15     | 15               | 183                                 | 0       | 56         | 3       | 106          | 3       |
| Apr 16-22     | 16               | 124                                 | 0       | 221        | 14      | 58           | 3       |
| Apr 23-29     | 17               | 154                                 | 0       | 333        | 13      | 180          | 9       |
| Apr 30-May 06 | 18               | 35                                  | 0       | 125        | 8       | 97           | 6       |
| May 07-13     | 19               | 16                                  | 0       | 13         | 2       | 9            | 1       |
| May 14-20     | 20               | 0                                   | 0       | 7          | 0       | 3            | 1       |
| May 21-27     | 21               | 0                                   | 0       | 3          | 0       | 0            | 0       |
| May 28-Jun 03 | 22               | -                                   | -       | 1          | 1       | -            | -       |
| Jun 04-10     | 23               | -                                   | -       | 0          | 1       | -            | -       |
|               | Total            | 1,371                               | 3       | 1,190      | 46      | 685          | 33      |

<sup>a</sup> Weirs installed January 20<sup>th</sup> at Big Canyon (Deer Cr.) and February 26<sup>th</sup> at Little Sheep as well as ladder opened February 17<sup>th</sup> at Wallowa Fish Hatchery. Adult collections stopped June 26<sup>th</sup> at Big Canyon and May 26<sup>th</sup> at Little Sheep and Wallowa. Timing of natural fish to Wallowa is unknown so fish were allocated to the week when the most hatchery fish were trapped.

Table 14. Numbers and disposition of adult steelhead that returned to LSRCF facilities in 1998 by stock, origin, age (freshwater:saltwater), and sex. M indicates male and F indicates female.

| Stock,<br>Disposition <sup>a</sup>                | Hatchery |      |      |      |     |   |      |     |       | Natural |     |     |     |     |     |     |   |       | Grand<br>Total |
|---|----------|------|------|------|-----|---|------|-----|-------|---------|-----|-----|-----|-----|-----|-----|---|-------|----------------|
|   | 1:1      |      | 1:2  |      | 1:3 |   | 2:1  |     | Total | 2:1     |     | 2:2 |     | 3:1 |     | 3:2 |   | Total |                |
|   | M        | F    | M    | F    | M   | F | M    | F   |       | M       | F   | M   | F   | M   | F   | M   | F |       |                |
| <i>Wallowa Hatchery (Wallowa stock)</i>           |          |      |      |      |     |   |      |     |       |         |     |     |     |     |     |     |   |       |                |
| Trapped   | 607      | 325  | 128  | 258  | 0   | 0 | 30   | 23  | 1,371 | 1       | 0   | 1   | 0   | 0   | 1   | 0   | 0 | 3     | 1,374          |
| Passed  | 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              |
| Kept  | 607      | 325  | 128  | 258  | 0   | 0 | 30   | 23  | 1,371 | 1       | 0   | 1   | 0   | 0   | 1   | 0   | 0 | 3     | 1,374          |
| Mortality   | 38       | 2    | 1    | 2    | 0   | 0 | 2    | 1   | 46    | 0       | 0   | 0   | 0   | 0   | 0   | 0   | 0 | 0     | 46             |
| Spawned <sup>a</sup>                              | 450      | 311  | 113  | 248  | 0   | 0 | 23   | 22  | 1,167 | 1       | 0   | 0   | 0   | 0   | 1   | 0   | 0 | 2     | 1,169          |
| Killed <sup>b</sup>                               | 119      | 12   | 14   | 8    | 0   | 0 | 5    | 0   | 158   | 0       | 0   | 1   | 0   | 0   | 0   | 0   | 0 | 1     | 159            |
| Fork Length (mm)                                  | 600      | 585  | 747  | 702  | -   | - | 609  | 591 |       | 649     | -   | -   | -   | -   | -   | -   | - |       |                |
| Standard deviation                                | (35)     | (27) | (32) | (42) | -   | - | (10) | -   |       | -       | -   | -   | -   | -   | -   | -   | - |       |                |
| <i>Big Canyon Facility (Wallowa stock)</i>        |          |      |      |      |     |   |      |     |       |         |     |     |     |     |     |     |   |       |                |
| Trapped   | 382      | 445  | 69   | 256  | 0   | 0 | 16   | 22  | 1,190 | 6       | 5   | 10  | 8   | 6   | 6   | 3   | 2 | 46    | 1,236          |
| Passed  | 3        | 4    | 1    | 2    | 0   | 0 | 0    | 0   | 10    | 6       | 5   | 10  | 8   | 6   | 6   | 2   | 2 | 45    | 55             |
| Outplanted  | 139      | 27   | 54   | 200  | 0   | 0 | 13   | 18  | 451   | 0       | 0   | 0   | 0   | 0   | 0   | 0   | 0 | 0     | 451            |
| Kept  | 240      | 414  | 14   | 54   | 0   | 0 | 3    | 4   | 729   | 0       | 0   | 0   | 0   | 0   | 0   | 1   | 0 | 1     | 730            |
| Mortality   | 1        | 0    | 0    | 0    | 0   | 0 | 0    | 0   | 1     | 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              |
| Killed <sup>b</sup>                               | 239      | 414  | 14   | 54   | 0   | 0 | 3    | 4   | 728   | 0       | 0   | 0   | 0   | 0   | 0   | 1   | 0 | 1     | 729            |
| Fork Length (mm)                                  | 584      | 572  | 735  | 675  | -   | - | -    | 556 |       | 614     | -   | -   | 659 | 593 | 605 | 702 | - |       |                |
| Standard deviation                                | (26)     | (22) | (43) | (19) | -   | - | -    | -   |       | (9)     | -   | -   | -   | -   | -   | -   | - |       |                |
| <i>Little Sheep Creek Facility (Imnaha stock)</i> |          |      |      |      |     |   |      |     |       |         |     |     |     |     |     |     |   |       |                |
| Trapped   | 202      | 226  | 50   | 178  | 1   | 6 | 7    | 15  | 685   | 3       | 7   | 2   | 8   | 3   | 7   | 1   | 2 | 33    | 718            |
| Passed  | 36       | 35   | 7    | 29   | 0   | 2 | 1    | 6   | 116   | 2       | 6   | 2   | 4   | 2   | 7   | 1   | 1 | 25    | 141            |
| Outplanted  | 0        | 0    | 0    | 0    | 0   | 0 | 0    | 0   | 0     | 0       | 0   | 0   | 0   | 0   | 0   | 0   | 0 | 0     | 0              |
| Kept  | 166      | 191  | 43   | 149  | 1   | 4 | 6    | 9   | 569   | 1       | 1   | 0   | 4   | 1   | 0   | 0   | 1 | 8     | 577            |
| Mortality   | 4        | 0    | 3    | 1    | 0   | 0 | 0    | 0   | 8     | 0       | 0   | 0   | 0   | 0   | 0   | 0   | 0 | 0     | 8              |
| Spawned <sup>c</sup>                              | 158      | 185  | 40   | 146  | 1   | 4 | 6    | 9   | 549   | 1       | 1   | 0   | 4   | 1   | 0   | 0   | 1 | 8     | 557            |
| Killed  | 4        | 6    | 0    | 2    | 0   | 0 | 0    | 0   | 12    | 0       | 0   | 0   | 0   | 0   | 0   | 0   | 0 | 0     | 12             |
| Fork Length (mm)                                  | 582      | 575  | 735  | 700  | 715 | - | 611  | -   |       | -       | 574 | -   | -   | -   | -   | -   | - |       |                |
| Standard deviation                                | (28)     | (33) | (52) | (33) | -   | - | (29) | -   |       | -       | -   | -   | -   | -   | -   | -   | - |       |                |

<sup>a</sup> Includes six live spawned fish (three males and three females) that were transferred to the Kelt Reconditioning study.

<sup>b</sup> Includes five fish (two males and three females) from Wallowa Hatchery and two males from Big Canyon Facility that were transferred to the Life History Characterization study.

<sup>c</sup> Includes 17 live spawned fish (two male and five female wild fish and six male and four female hatchery fish) that were transferred to the Kelt Reconditioning study.

Table 15. Spawning summaries for summer steelhead at LSRCF facilities in 1998. The percent mortality is from green egg to eyed embryo after shocking.

| Spawn date, Lot number                            | Parental origin <sup>a</sup> | Number of eggs <sup>b</sup> | Eyed embryos <sup>c</sup> | % mortality |
|---|------------------------------|-----------------------------|---------------------------|-------------|
| <i>Wallowa Hatchery (Wallowa stock)</i>           |                              |                             |                           |             |
| 3/24, wa330                                       | Hatchery                     | 458,300                     | 432,800                   | 6           |
| 3/31, wa331                                       | Hatchery                     | 474,900                     | 431,400                   | 9           |
| 4/07, wa332                                       | Hatchery                     | 475,000                     | 427,500                   | 10          |
| 4/14, wa333                                       | Hatchery                     | 541,100                     | 490,700                   | 9           |
| 4/21, wa334                                       | Hatchery                     | 410,400                     | 381,600                   | 7           |
| 4/24, wa335                                       | Hatchery                     | 330,000                     | 295,300                   | 11          |
| 5/05, wa336                                       | Hatchery                     | 169,200                     | 127,200                   | 25          |
| 5/12, wa337                                       | Hatchery                     | 24,400                      | 11,600                    | 52          |
| Total   |                              | 2,883,300                   | 2,598,100                 | 10          |
| <i>Little Sheep Creek Facility (Imnaha stock)</i> |                              |                             |                           |             |
| 3/30, li340                                       | Hatchery                     | 74,171                      | 76,860                    | 9           |
| 3/30, li340                                       | Mixed                        | 9,889                       | -                         | -           |
| 4/06, li341                                       | Hatchery                     | 199,100                     | 172,800                   | 13          |
| 4/13, li342                                       | Hatchery                     | 180,380 (86,580)            | 79,200                    | 16          |
| 4/20, li343                                       | Hatchery                     | 207,539 (106,139)           | 93,800                    | 7           |
| 4/27, li344                                       | Hatchery                     | 327,347 (145,619)           | 157,000                   | 18          |
| 4/27, li344                                       | Mixed                        | 9,772                       | -                         | -           |
| 5/04, li345                                       | Hatchery                     | 604,038 (285,884)           | 239,400                   | 26          |
| 5/04, li345                                       | Mixed                        | 4,646                       | -                         | -           |
| 5/11, li346                                       | Hatchery                     | 58,007 (29,967)             | 26,340                    | 6           |
| 5/18, li347                                       | Mixed                        | 12,330                      | 11,870                    | 4           |
| 5/26, li348                                       | Mixed                        | 3,310                       | 2,970                     | 10          |
| Subtotal  | Hatchery                     | 1,650,582                   | -                         | -           |
| Subtotal  | Mixed                        | 39,947                      | -                         | -           |
| Total   |                              | 1,690,529 (654,189)         | 860,240                   | 17          |

<sup>a</sup> In general, family groups were one male x one female for Wallowa stock and were matrix spawned (three males x three females) for Imnaha stock. Mixed eggs include both natural and hatchery parents.

<sup>b</sup> Includes 654,189 Imnaha stock fertilized eggs (in parenthesis) transferred to Nez Perce Tribe for off-site rearing on the lower Imnaha River.

<sup>c</sup> Includes 710,100 Wallowa stock eyed embryos that were euthanized because they were excess to program needs. Two hundred of these excess eyed embryos were transferred to ODFW's Salmon and Trout Enhancement Program (STEP) biologist Patty Bowers. Also includes 468,090 Imnaha stock eyed embryos transferred to Nez Perce Tribe for off-site rearing on the lower Imnaha River. Eyed embryos were inventoried on 4/23-24, 4/30, 5/14-15, 6/2, and 6/11..

Table 16. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Wallowa stock summer steelhead for the 1996-97 run year. All CWT fish were from releases of hatchery fish into either Deer Creek (at Big Canyon Acclimation Facility) or Spring Creek (at Wallowa Hatchery). Data was summarized as available through January 2003.

| Brood year,<br>release site          | Experimental group <sup>a</sup> | CWT<br>code | Recoveries<br>at weirs <sup>b</sup> | Other in-basin<br>recoveries <sup>c</sup> | Out-of-basin<br>recoveries <sup>d</sup> | Total<br>recoveries <sup>e</sup> |
|--------------------------------------|---------------------------------|-------------|-------------------------------------|---|---|----------------------------------|
| 1993                                 |                                 |             |                                     |   |   |                                  |
| Deer Cr.                             | Acclimated                      | 070325      | 41                                  | 0   | 71                                      | 112                              |
|                                      | Acclimated                      | 070326      | 30                                  | 21  | 60                                      | 111                              |
|                                      | Direct stream                   | 070327      | 14                                  | 0   | 75                                      | 89                               |
|                                      | Direct stream                   | 070328      | 10                                  | 7   | 34                                      | 51                               |
| Spring Cr.                           | Production                      | 070329      | 18                                  | 2   | 57                                      | 77                               |
|                                      | Production                      | 070330      | 23                                  | 5   | 42                                      | 70                               |
| 1994                                 |                                 |             |                                     |   |   |                                  |
| Deer Cr.                             | Acclimated                      | 075824      | 47                                  | 21  | 40                                      | 108                              |
|                                      | Acclimated                      | 075825      | 67                                  | 26  | 75                                      | 168                              |
|                                      | Direct stream                   | 070920      | 68                                  | 48  | 132                                     | 248                              |
| Spring Cr.                           | Production                      | 075822      | 39                                  | 0   | 66                                      | 105                              |
|                                      | Production                      | 075823      | 27                                  | 10  | 46                                      | 83                               |
| Grand total of<br>recoveries in 1997 |                                 |             | 384                                 | 140                                       | 698                                     | 1,222                            |

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

<sup>b</sup> Actual number of CWT fish that were released into Spring Cr. and recovered at the Wallowa Fish Hatchery weir or released into Deer Cr. and recovered at the Big Canyon Facility weir. The protocol was to collect all CWT fish at the weirs for sampling at the hatchery during spawning.

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

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Grande Ronde River basin.

<sup>e</sup> Estimated total by summing all recoveries. When CWT expansion factors were greater than 24 (because of a low sampling rate) unexpanded data were used.

Table 17. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1996-97 run year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through January 2003.

| Brood year                        | Experimental group <sup>a</sup> | CWT code | Recoveries at weirs <sup>b</sup> | Other in-basin recoveries <sup>c</sup> | Out-of-basin recoveries <sup>d</sup> | Total recoveries <sup>e</sup> |
|-----------------------------------|---------------------------------|----------|----------------------------------|--|--------------------------------------|-------------------------------|
| 1993                              | Acclimated                      | 070321   | 12                               | 0                                      | 21                                   | 33                            |
|                                   | Acclimated                      | 070322   | 11                               | 10                                     | 8                                    | 29                            |
|                                   | Direct stream                   | 070323   | 5                                | 0                                      | 3                                    | 8                             |
|                                   | Direct stream                   | 070324   | 5                                | 0                                      | 5                                    | 10                            |
| 1994                              | Acclimated                      | 075820   | 73                               | 5                                      | 11                                   | 89                            |
|                                   | Acclimated                      | 075821   | 81                               | 15                                     | 50                                   | 146                           |
|                                   | Direct stream                   | 070919   | 67                               | 5                                      | 53                                   | 125                           |
| Grand total of recoveries in 1997 |                                 |          | 254                              | 35                                     | 151                                  | 440                           |

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

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

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

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Imnaha River basin. When CWT expansion factors were greater than 24 (because of a low sampling rate) unexpanded data were used.

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

Table 18. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Wallowa stock summer steelhead for the 1997-98 run year. All CWT fish were from releases of hatchery fish into either Deer Creek (at Big Canyon Acclimation Facility) or Spring Creek (at Wallowa Hatchery). Data was summarized as available through January 2003.

| Brood year,<br>release site | Experimental group <sup>a</sup>      | CWT<br>code | Recoveries<br>at weirs <sup>b</sup> | Other in-basin<br>recoveries <sup>c</sup> | Out-of-basin<br>recoveries <sup>d</sup> | Total<br>recoveries <sup>e</sup> |
|-----------------------------|--------------------------------------|-------------|-------------------------------------|---|---|----------------------------------|
| 1993                        |                                      |             |                                     |   |   |                                  |
| Spring Cr.                  | Production                           | 070329      | 0                                   | 0   | 1                                       | 1                                |
| 1994                        |                                      |             |                                     |   |   |                                  |
| Deer Cr.                    | Acclimated                           | 075824      | 10                                  | 11  | 51                                      | 72                               |
|                             | Acclimated                           | 075825      | 18                                  | 14  | 34                                      | 66                               |
|                             | Direct stream, 5 fpp                 | 070920      | 14                                  | 34  | 59                                      | 107                              |
| Spring Cr.                  | Production, 5 fpp                    | 075822      | 12                                  | 0   | 32                                      | 44                               |
|                             | Production, 5 fpp                    | 075823      | 6                                   | 0   | 23                                      | 29                               |
| 1995                        |                                      |             |                                     |   |   |                                  |
| Deer Cr.                    | Acclimated, 5 fpp                    | 071159      | 42                                  | 57  | 74                                      | 173                              |
|                             | Acclimated, 5 fpp                    | 071160      | 40                                  | 52  | 158                                     | 250                              |
|                             | Direct stream, 5 fpp                 | 071161      | 34                                  | 10  | 55                                      | 99                               |
|                             | Direct stream, 5 fpp                 | 071162      | 26                                  | 40  | 87                                      | 153                              |
| Spring Cr.                  | Forced, 5 fpp                        | 071163      | 38                                  | 17  | 83                                      | 138                              |
|                             | Volitional, 5 fpp                    | 071216      | 22                                  | 21  | 120                                     | 163                              |
|                             | Grand total of<br>recoveries in 1998 |             | 262                                 | 256                                       | 777                                     | 1,295                            |

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

<sup>b</sup> Actual number of CWT fish that were released into Spring Cr. and recovered at the Wallowa Fish Hatchery weir or released into Deer Cr. and recovered at the Big Canyon Facility weir. The protocol was to collect all CWT fish at the weirs for sampling at the hatchery during spawning.

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

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Grande Ronde River basin. When CWT expansion factors were greater than 24 (because of a low sampling rate) unexpanded data were used.

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

Table 19. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1997-98 run year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through January 2003.

| Brood year                        | Experimental group <sup>a</sup> | CWT code | Recoveries at weirs <sup>b</sup> | Other in-basin recoveries <sup>c</sup> | Out-of-basin recoveries <sup>d</sup> | Total recoveries <sup>e</sup> |
|-----------------------------------|---------------------------------|----------|----------------------------------|--|--------------------------------------|-------------------------------|
| 1994                              | Acclimated                      | 075820   | 21                               | 0                                      | 12                                   | 33                            |
|                                   | Acclimated                      | 075821   | 19                               | 0                                      | 32                                   | 51                            |
|                                   | Direct stream                   | 070919   | 20                               | 0                                      | 13                                   | 33                            |
| 1995                              | Acclimated                      | 071217   | 46                               | 21                                     | 15                                   | 82                            |
|                                   | Acclimated                      | 071218   | 63                               | 0                                      | 36                                   | 99                            |
|                                   | Direct stream                   | 071219   | 14                               | 0                                      | 16                                   | 30                            |
|                                   | Direct stream                   | 071220   | 15                               | 0                                      | 6                                    | 21                            |
| Grand total of recoveries in 1998 |                                 |          | 198                              | 21                                     | 130                                  | 349                           |

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

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

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

<sup>d</sup> Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Imnaha River basin. When CWT expansion factors were greater than 24 (because of a low sampling rate) unexpanded data were used.

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

Table 20. Catch and escapement distribution of adult summer steelhead by recovery location for the 1996-97 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through January 2003.

| Location                                | Wallowa Stock            |              |                         | Imnaha Stock             |              |                         |
|---|--------------------------|--------------|-------------------------|--------------------------|--------------|-------------------------|
|   | Estimated CWT recoveries | Total return | Percent of total return | Estimated CWT recoveries | Total return | Percent of total return |
| Ocean catch                             | 0                        | 0            | 0.0                     | 0                        | 0            | 0.0                     |
| Columbia River                          |                          |              |                         |                          |              |                         |
| Treaty net                              | 131                      | 1,130        | 10.7                    | 47                       | 141          | 7.3                     |
| C and S                                 | 0                        | 0            | 0.0                     | 0                        | 0            |                         |
| Sport                                   | 42                       | 387          | 3.7                     | 11                       | 40           | 2.1                     |
| Test                                    | 0                        | 0            | 0.0                     | 0                        | 0            |                         |
| Tributary sport                         | 38                       | 378          | 3.6                     | 12                       | 24           | 1.2                     |
| Deschutes River                         |                          |              |                         |                          |              |                         |
| Sport                                   | 59                       | 469          | 4.4                     | 13                       | 33           | 1.7                     |
| C and S                                 | 0                        | 0            |                         | 0                        | 0            |                         |
| Strays                                  |                          |              |                         |                          |              |                         |
| Outside Snake R. Basin                  | 132                      | 1,182        | 11.1                    | 16                       | 56           | 2.9                     |
| Within Snake R. Basin*                  | 0                        | 0            | 0.0                     | 4                        | 16           | 0.8                     |
| Snake River sport, tribs.*              | 296                      | 2,044        | 19.3                    | 48                       | 224          | 11.5                    |
| Oregon tributaries* <sup>a</sup>        | 140                      | 1,648        | 15.5                    | 35                       | 397          | 20.4                    |
| Other in-basin escapement* <sup>b</sup> | 0                        | 587          | 5.5                     | 0                        | 73           | 3.8                     |
| Hatchery weir* <sup>c</sup>             | 384                      | 2,784        | 26.2                    | 254                      | 938          | 48.3                    |
| Total estimated return                  | 1,222                    | 10,609       | 100.0                   | 440                      | 1,942        | 100.0                   |
| Return to compensation area             |                          | 7,063        |                         |                          | 1,648        |                         |
| Percent of compensation goal            |                          | 76.9         |                         |                          | 82.4         |                         |

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

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

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

<sup>c</sup> Total returns to the hatchery weir are actual numbers and for Wallowa Stock includes an estimated 79 hatchery fish that escaped above the weir without being trapped at Big Canyon Facility.



Table 21. Catch and escapement distribution of adult summer steelhead by recovery location for the 1997-98 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through January 2003.

| Location                                | Wallowa Stock            |              |                         | Imnaha Stock             |              |                         |
|---|--------------------------|--------------|-------------------------|--------------------------|--------------|-------------------------|
|   | Estimated CWT recoveries | Total return | Percent of total return | Estimated CWT recoveries | Total return | Percent of total return |
| Ocean catch                             | 1                        | 12           | 0.1                     | 0                        | 0            | 0.0                     |
| Columbia River                          |                          |              |                         |                          |              |                         |
| Treaty net                              | 142                      | 1,255        | 9.4                     | 45                       | 171          | 10.8                    |
| C and S                                 | 0                        | 0            | 0.0                     | 0                        | 0            | 0.0                     |
| Sport                                   | 113                      | 998          | 7.5                     | 11                       | 15           | 1.0                     |
| Test                                    | 0                        | 0            | 0.0                     | 0                        | 0            | 0.0                     |
| Tributary sport                         | 4                        | 28           | 0.2                     | 0                        | 0            | 0.0                     |
| Deschutes River                         |                          |              |                         |                          |              |                         |
| Sport                                   | 20                       | 189          | 1.4                     | 5                        | 16           | 1.0                     |
| C and S                                 | 1                        | 7            | 0.1                     | 0                        | 0            | 0.0                     |
| Strays                                  |                          |              |                         |                          |              |                         |
| Outside Snake R. Basin                  | 158                      | 1,365        | 10.2                    | 11                       | 22           | 1.4                     |
| Within Snake R. Basin*                  | 2                        | 19           | 0.1                     | 4                        | 16           | 1.0                     |
| Snake River sport, tribs.*              | 336                      | 2,849        | 21.3                    | 54                       | 254          | 16.0                    |
| Oregon tributaries* <sup>a</sup>        | 256                      | 3,670        | 27.4                    | 21                       | 386          | 24.4                    |
| Other in-basin escapement* <sup>b</sup> | 0                        | 418          | 3.1                     | 0                        | 18           | 1.1                     |
| Hatchery weir* <sup>c</sup>             | 262                      | 2,563        | 19.2                    | 198                      | 685          | 43.3                    |
| Total estimated return                  | 1,295                    | 13,373       | 100.0                   | 349                      | 1,583        | 100.0                   |
| Return to compensation area             |                          | 9,519        |                         |                          | 1,359        |                         |
| Percent of compensation goal            |                          | 103.6        |                         |                          | 68.0         |                         |

\* 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.

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

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

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

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