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Prepared By: Richard W. Carmichael
Debra L. Eddy
Michael W. Flesher
MaryLouise Keefe
Patrick J. Keniry
Steven J. Parker
Timothy A. Whitesel

Oregon Department of Fish and Wildlife
2501 S.W. First Avenue
P.O. Box 59
Portland, OR 97207

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Preface

The purpose of this progress report is to provide summary information for spring chinook salmon and summer steelhead Lower Snake River Compensation Plan (LSRCP) programs operated by ODFW in the Grande Ronde and Imnaha river basins during 1994. 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 collected at Lower Snake River Compensation Plan (LSRCP) facilities for each species. These data should 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 1994 work statement (Carmichael *et al.*, 1994). Coded-wire tag (CWT) data that were collected from 1994 adult returns will be used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 1994, experimental treatments from which fish returned included acclimated vs. direct stream for steelhead and size-at-release for both steelhead and chinook. In 1994, experimental treatments for which fish were released included size-at-release, and low density treatments for chinook as well as acclimated vs. direct stream for both steelhead and chinook. 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 both steelhead and chinook 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, 1987a, 1988, 1989), and United States vs Oregon Production Reports (Carmichael *et al.*, 1986b, 1986c; 1987b, 1987c; Messmer *et al.*, 1990, 1992; Flesher *et al.*, 1991, 1994; Whitesel *et al.*, 1994). Progress for related work completed during 1994 is presented in the summer steelhead creel (Flesher *et al.*, 1994), and the residual steelhead (Jonasson *et al.*, 1995) annual progress reports.

To facilitate the location of information, this report is divided into a section for spring chinook salmon, and a section for summer steelhead. Within each section, data are organized into fish culture monitoring for juveniles, adults, CWT recoveries, and estimates for total escapement. During the period covered in this report, chinook from the 1989, 1990 and 1991 broods returned to spawn, chinook from the 1992 brood were released as smolts, chinook from the 1993 brood were either reared at a hatchery or released as presmolts, and adult chinook that returned to spawn were used to create the 1994 brood. During the period covered in

this report, steelhead from the 1990 and 1991 broods returned to spawn, steelhead from the 1992 brood entered freshwater in preparation for spawning in 1995, steelhead from the 1993 brood were released as smolts, and adult steelhead that returned to spawn were used to create the 1994 brood.

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EXECUTIVE SUMMARY

Objectives

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

2. Document chinook salmon and summer steelhead adult returns by stock to each LSRCP broodstock collection facility.

3. Determine if the total production of spring chinook and summer steelhead adults meet mitigation goals and index annual smolt survival and adult returns to Lower Granite Dam for production groups.

4. Coordinate spring chinook broodstock marking programs for Lookingglass Fish Hatchery.

5. Conduct extensive and supplemental spring chinook salmon spawning ground surveys in selected streams in Northeast Oregon.

6. Identify hatchery and wild origin for carcasses collected on spawning ground surveys in the Grande Ronde Basin.

Accomplishments and Findings

Spring Chinook Salmon

In 1994 we released 438,617 Imnaha stock smolts plus 283,047 Imnaha stock presmolts (1993 BY) into the Imnaha River Basin and 849,273 Rapid River stock chinook salmon smolts into the Grande Ronde River Basin. The 1992 brood year (BY) juveniles were used to test the effects of different rearing densities, target sizes at release, and acclimation on smolt-to-adult survival rates. A total of 163 Imnaha stock, 221 Rapid River stock and 153 Carson stock chinook adults were trapped at LSRCP facilities. We collected 111,794 eggs from Imnaha stock, and 171,958 eggs from Rapid River stock adults. We also collected 137,343 eggs from Carson stock returns, which were transferred to the Umatilla Fish Hatchery program. Estimated adult hatchery-origin returns to the compensation area were 124 Imnaha (4% of compensation goal) and 352 Grande Ronde River Basin (15% of the compensation goal). Data from spawning ground surveys were used to estimate spawning escapements of 998 chinook in the Grande Ronde River Basin and 258 chinook in the Imnaha River Basin. Relatively large numbers of stray hatchery adults were present in non-supplemented streams in the Grande Ronde River Basin.

Summer Steelhead

In 1994 we released 1,174,598 Wallowa stock summer steelhead into the Grande Ronde River Basin. We also released 350,541 smolts into the Imnaha River Basin. Experimental groups were designed to evaluate the effects of acclimation prior to release on smolt-to-adult survival. A total of 598 adult steelhead were trapped at the Wallowa Fish Hatchery collection site and 444 fish were trapped at the Big Canyon Facility. At the Little Sheep Creek Facility, we trapped 141 hatchery fish and 53 naturally produced fish for a total of 194 adult returns. During spawning in the spring of 1994, we collected 2,996,460 Wallowa stock eggs and 454,140 Imnaha stock eggs. We estimated that 8,641 hatchery Wallowa stock steelhead returned to the compensation area (43% of goal), and that 484 Imnaha stock hatchery steelhead returned to the compensation area (9% of the compensation goal).

Management Recommendations

1. Continue to mark Rapid River stock releases with adipose and right ventral fin clips (AdRV) plus a coded-wire tag (CWT) to enable returning adults to be trapped at Lower Granite Dam. Evaluate the effectiveness of this strategy in reducing strays beginning with 1995 returns.
2. Hatchery production is able to meet smolt production goals given the appropriate numbers of broodstock. Fertilization and egg-to-smolt survival rates are high. Culture efforts should be focused on improving smolt migration success and maximizing smolt-to-adult survival.
3. Efforts should be made to install weirs for broodstock collection as early as possible to enable collection of adults from throughout the entire returning population.
4. Managers should consider adopting a locally-adapted stock for steelhead production in the Grande Ronde Basin. This could help reduce the potential impacts of unharvested or residual hatchery adults spawning with native fish.
5. The quality of fin clips (especially ventral clips) must be improved to enable visual identification of Rapid River stock chinook or of steelhead containing CWTs.
6. Investigations should be made to increase the egg-to-fry survival for steelhead.
7. If managers want to reduce the potential impacts of artificial selection, embryos from the Wallowa steelhead program should not be given to Washington programs from a specific segment of the run. Rather, embryos to be transferred should be taken in proportion to the numbers of fish that were spawned in a given week.
8. A large proportion of returning adult steelhead are harvested in sport and treaty net fisheries outside of the compensation area. Changes in their

exploitation rates in these fisheries could dramatically increase our ability to meet compensation goals.

9. Develop methods to utilize adult summer steelhead at LSRCP facilities that are excess to program needs.

SECTION I

SPRING CHINOOK SALMON

The main objective of this report section is to document fish culture performance for spring chinook salmon at LSRCP facilities. These data are then used to evaluate and design culture practices to optimize the egg-to-smolt survival rate, smolt quality, and the smolt-to-adult survival rate (SAR). This section of the report is concerned with rearing and release operations for the 1992 and 1993 BYs of juvenile chinook; the collection, spawning and adult characteristics for the 1994 returns of adult chinook salmon (encompassing production from the 1989, 1990, and 1991 BYs); and the collection of 1994 BY eggs.

Juveniles

Green egg to eyed embryo survival, measured by inventory when eyed embryos were shocked and picked, and eyed embryo-to-smolt survival for the 1992 BY was within the range of recently observed rates for each stock of fish (Table 1). Recent green egg-to-eyed embryo survival rates have been approximately 85%, with an additional 5% loss by the smolt stage. The eyed embryo survival rate of 96.4% for Rapid River stock was exceptional. The LSRCP production goal for the Imnaha Program was 420,000 smolts to the Imnaha River and an additional 70,000 smolts for Big Sheep or Lick Creek if broodstock was available. The production goal for Rapid River stock was 900,000 smolts. Smolt production exceeded the goal for the Imnaha River but no smolts were released into Big Sheep or Lick creeks. Smolt releases were only 5% short of the goal for the Rapid River stock program.

Presmolts from the 1993 BY of Imnaha stock (hatchery-origin parents) were also released in 1994. These releases occurred during July in Big Sheep, Little Sheep and Freezeout creeks as well as into the Imnaha River, and totaled 283,047 fish. These releases may have had some impact on natural chinook. At river kilometer 53, for example, prior to the release of the hatchery fish the natural juveniles had an abundance of 3.58/100m^2 (see Jonasson *et al.*, 1995). After the release of the hatchery fish the abundance of natural juveniles was 1.40/100m^2 while the abundance of hatchery juveniles was 314.70/100m^2. Furthermore, as late as October 13, we found hatchery fish as abundant as 145.20/100m^2 in Big Sheep Creek.

To evaluate different rearing strategies for maximizing SAR, juveniles from each stock were divided into a number of experimental groups for rearing and release. All the fish in each experimental group received a raceway-unique CWT to

track adult returns for each treatment. In addition to receiving a CWT, all Imnaha stock parr were marked externally with an adipose clip (Table 2). Rapid River stock juveniles were marked with adipose and right ventral fin clips (designated AdRV). We observed poor quality of right ventral clips on fish in some raceways. Returning adults with no adipose clip will not be sampled to retrieve a CWT, so fish with unrecognizable adipose marks are subtracted from the original experimental release groups and are included as non-experimental releases with unrecognizable marks (Tables 3a and 3b).

The 1992 Imnaha stock juveniles were divided into six groups (Table 3a). Experimental treatments were size-at-release (15 versus 25 fish/lb.), and release type (≥21 day acclimation versus direct stream release). Rearing density at transfer to the acclimation facility was 13.4 g/l (15/lb. treatments) and 12.8 g/l (25/lb. treatments). Standard density at release is 16.0 g/l. Smolts were within 1.1 fish/lb. of their target size at release (Table 3a). Smolts were transferred to the Imnaha Acclimation Facility on March 3rd. All 1992 BY smolts were released on April 11, 1994 at the Imnaha Acclimation facility. The release protocol was to crowd the fish out of the acclimation pond over a two-hour period in late afternoon. Direct stream releases were transported to the release site and released through the acclimation pond on the same day that acclimated fish were released.

Rapid River stock salmon were reared to a target size of 20 fish/lb. (Table 3b). Experimental groups were two raceways at standard density 16.0 g/l, two raceways at 13.7 g/l and two raceways at 6.8 g/l. Smolts were released directly into Lookingglass Creek, except for fish from one raceway, which were released in the Snake River below Hell's Canyon Dam. Most fish were released in April, but fish in raceways 2 and 4 were released in May. The release for fish in raceways 2 and 4 was delayed to accommodate treatment for Erythrocytic Inclusion Body Syndrome. The release protocol was to crowd the fish out of a raceway in a single afternoon.

Smolt quality was monitored after release by measuring the percentage of each PIT-tagged group detected at mainstem dams during their seaward migration (Tables 3a and 3b). Detection rates were high in 1994 compared to previous years for both Imnaha and Rapid River stocks. However, detection rates of Rapid River releases were higher than detection rates of Imnaha releases. Detections among treatment groups within a stock were not different, likely due to the variability among the 25 fish/lb. replicates for the Imnaha stock. The overall detection rates in 1994 and in previous migration years has been poor (*i.e.*, less than 60% reaching Lower Granite Dam).

Adults

The Imnaha weir was installed close to the target date of June 15th and no fish were trapped during the first week of operation, suggesting the majority of returning adults had not yet reached the weir (Table 4) and few probably escaped before the weir was installed. The mark-recapture population estimate above the weir indicated that approximately 7% of the run was not trapped (Table 4). Run timing of marked and unmarked fish at the Imnaha weir appeared similar.

Because not all hatchery releases were marked with an adipose clip and a CWT, some of the unmarked fish that returned to the weir were likely of hatchery origin. Given this information, we adjusted the allocation of unmarked fish trapped at the Imnaha weir based on the percentage marked for each returning age class. This resulted in fewer natural fish and more hatchery fish being trapped than initially thought (Table 5). Age composition was based on CWT age, scale age (Figure 1) and length-at-age if necessary. These distributions are used to estimate age for allocation of individuals at adult collection sites. No adult salmon were transplanted from the Imnaha River to other streams in 1994 and only 112 fish were released above the Imnaha weir (69% of the trapped fish). Pre-spawning mortality for those fish held at Lookingglass Fish Hatchery was 14%. One unmarked fish and one marked fish were killed-not-spawned (KNS). Hatchery-origin Imnaha returns had a higher percentage of three year old males and five year old females than unmarked fish, although five year old fish made up over 50% of both the hatchery and natural returns. A total of 22 females were spawned with 20 males, placing production estimates at only 17% of a full program. The broodstock spawned consisted of 36% natural fish.

A large number of both Rapid River and Carson stock adults were trapped at the Lookingglass Creek weir during the first week of operation, indicating that the weir was installed well after fish had begun to return (Table 4). This was also the first year that AdRV, Rapid River fish returned (age 3 fish) and could have been trapped at Lower Granite Dam and hauled to Lookingglass Fish Hatchery. However, we predicted that very few AdRV jacks would return, particularly to streams other than Lookingglass Creek. As a result, AdRV fish were allowed to swim upstream rather than being trapped at Lower Granite Dam and hauled to Lookingglass Fish Hatchery. Some of the Rapid River stock adults were passed above the Lookingglass weir in 1994 (N = 112). Population estimates conducted by CTUIR (1995) estimated that 121 ± 9 adults were above the weir. No Carson stock adults were released above the Lookingglass Creek weir in 1994 (Table 5). There was no tribal fishery on Lookingglass Creek in 1994. Pre-spawning mortality for Rapid River stock was average at 6%. The majority of the 1994 return were four years old reflecting the relatively large smolt releases from the 1990 BY. We spawned 49 females, resulting in production at just 19% of a full program. The Carson stock returns were the five-year-old component of the last propagated brood year of this stock (1989 BY). Pre-spawning mortality for the Carson stock was high (16%) for unknown reasons. Eggs from those surviving to spawn (24 females and 24 males) were fertilized and the embryos were shipped to the Umatilla Fish Hatchery on the day of spawning (Tables 5 and 6).

The distribution of spawn timing of Imnaha stock was within the normal range of what we had observed previously for hatchery and natural populations (Table 6). Spawning was conducted using matrices to increase the number of pairs that mated, and to incorporate naturally produced fish into as many family groups as possible. No family group consisted solely of naturally produced fish, although there were a substantial number of hatchery-only family groups. Mortality to

shocking at the eyed-embryo stage was normal for Imnaha Stock at 15.4%. Spawn timing for Rapid River stock extended later than in past brood years. The number of males involved in each family group was not recorded, but a total of 49 males were spawned. At 10.9% the mortality to shocking inventory was low for Rapid River stock compared to previous years.

Experimental group returns

The numbers of returning adults from each stock of chinook are used for multiple purposes. They allow us to evaluate LSRCP goals by estimating the total return of hatchery-origin chinook to each basin. They also provide the basis for the evaluation of the success of experimental rearing and release strategies for each stock.

The Imnaha returns in 1994 contained hatchery-origin fish spanning four brood years. The numbers of recoveries of each CWT code were summarized from the CWT recovery database maintained by the Pacific State Marine Fisheries Commission or directly through ODFW's CWT recovery database. No precocial, two-year-old males from the 1992 brood year were recovered in 1994. In the Imnaha River supplementation program, we routinely release hatchery fish to spawn above the weir, and additional hatchery chinook are known to spawn below the weir. Some of these fish are recovered during spawning ground surveys so CWT codes can be determined, but many are not. The numbers and proportions of hatchery fish (tagged and not tagged) released above the weir vary annually as well as by the age and sex of the fish. Hence, to quantify the total number of fish returning from a given CWT group in a particular brood year we begin by evaluating the distribution of tag codes in fish that were trapped at the weir and kept for hatchery broodstock. This distribution is expanded by the proportion of fish that were kept (by sex and age) to calculate the distribution (by sex, age and code) of CWT fish that were trapped. We assumed that the distribution of codes in trapped fish reflected the distribution of codes throughout the river for the entire return. We applied this distribution to the estimated number of fish that passed the weir site before the weir was functioning (based on a mark-recapture estimate above the weir) as well as to the estimated number of fish that spawned below the weir (based on multiplying the number of redds below the weir by the fish/redd above the weir). This allowed us to estimate the total number of CWT fish (by sex, age and code) that returned to the river (Table 7a). The expanded number of CWT recoveries from 1994 were variable, even within replicate treatment groups. Other recoveries of adult salmon from the ocean, Deschutes or Columbia river fisheries, or from strays were also counted as adult returns, though recoveries outside of the Snake River basin were not applied towards the compensation goal.

Returns of CWT groups for Rapid River stock were also expanded to account for fish that returned to the river but were not sampled. The method was similar to that described for the Inmaha River. Of the 112 adults trapped and released above the weir, 16 were adipose-clipped (and were assumed to have had a CWT) while 96 fish were not adipose-clipped. In the hatchery there were 43 adipose-clipped fish with known tag codes and 66 fish that were not tagged. Using mark-recapture

techniques we estimated that three fish with a CWT escaped before the weir was installed. Using redd counts and fish/redd calculations, we also estimated that there were eight CWT fish that spawned below the weir. We applied the distribution of codes that we found in fish sampled at the hatchery to the unsampled fish in the river. This allowed us to estimate the total number of CWT fish (by sex, age and code) that returned to the river (Table 7b). We estimated a total of 70 tagged returns to the river (43 in the hatchery, 19 above the weir and eight below the weir) and 184 returns that were not tagged (66 in the hatchery, 102 above the weir and 16 below the weir). The returns for Carson stock were calculated as the total number of fish marked LV-only returning to Lookingglass Fish Hatchery in 1994. Carson stock releases in 1989 were not coded-wire tagged. Other recoveries of adult salmon from the ocean, Deschutes or Columbia river fisheries, or from strays were also counted as adult returns, though recoveries outside of the Snake River basin were not applied towards the compensation goal.

The possibility exists for the incorporation of stray hatchery fish into the broodstock because, in general, hatchery fish do not have stock-specific fin marks and some hatchery fish do not receive the appropriate fin marks prior to release. In 1994, we did not find any stray hatchery fish (using CWT codes) in the hatchery populations for the Imnaha or Rapid River stocks. However, 21.4% of the Imnaha brood and 60.4% of the Rapid River brood were marked fish of unknown origin because no CWT was found.

Compensation goals

The total number of hatchery-origin recoveries for each stock may be divided into recovery groups of ocean catch, Columbia River fisheries, escapement to a given river, and strays either within or outside of the Snake River Basin. To calculate the return to the compensation area (Snake River Basin), we summed all estimated recoveries for the 1994 return year that occurred above Ice Harbor Dam. To provide an overall summary of disposition for adults returning, CWT recoveries were expanded to account for the non-CWT fish that were released. Almost all of the CWT recoveries for Imnaha and Rapid River stock chinook occur at LSRCP collection facilities (Table 8). We did not attain our compensation goal in 1994 for either stock. Our escapement estimates to the compensation area indicate that the hatchery return was only 4% of the goal for the Imnaha River Basin and 15% of the goal for the Grande Ronde Basin. However, due to management constraints and the desire to maintain a high percentage of naturally produced fish in the hatchery broodstock, we were well below the original program production goal for the 1989-1991 brood Imnaha stock and also well below production capability for the Rapid River program. This decrease in production is compounded by a much lower SAR for the hatchery program than the original projection of 0.65%. Neither the Imnaha nor the Rapid River programs approached half of their target compensation return rate of 0.65%. Given that culture practices in the rearing phase are extremely efficient, effort must be directed at producing fish that have smolt-to-adult survival rates similar to or better than naturally produced fish.

The Imnaha supplementation program allows us to evaluate the relative replacement rates of hatchery and natural populations. The hatchery component progeny-to-parent ratio for the 1989 brood year was 3.8, compared to the natural population's 0.5. The natural population has been below replacement but fairly stable through time at approximately 0.5 while the hatchery population has been much more variable, ranging from 1.3 to 12.6 (Figure 2). One purpose of this supplementation program was to stabilize or enhance the size of the natural population. Unfortunately the size of natural population has exhibited a decreasing trend since 1985 (Figure 3). However, without similar information from a population that could serve as a proper control, it is difficult to assess whether this trend in population size is better or worse than it would have been without a supplementation program.

Natural Escapement Monitoring

Stream surveys to enumerate chinook salmon redds and to sample salmon carcasses were conducted as in previous years (see Keefe *et al.*, 1994 for methodology). During the surveys conducted in 1994, we observed 113 redds and sampled 72 carcasses in the Grande Ronde River Basin. In the Imnaha River Basin, we observed 105 redds and sampled 54 carcasses. To estimate escapement, we expanded the observed redd counts to account for spawning that occurred after our surveys in sections where surveys were not repeated. The expanded redd count in the Grande Ronde River Basin was 306 and was 154 in the Imnaha River Basin. These expanded redd counts are multiplied by a fish per redd conversion ratio to generate a total escapement estimate. In the Grande Ronde River Basin, we used the average of three years of ratios (3.26) generated by mark-recapture estimates in Lookingglass Creek (Lofy and McLean, 1995). The resulting Grande Ronde River Basin escapement was 998. In the Imnaha River Basin in 1994, we used a fish-per-redd ratio of 1.68 based on mark-recapture data above the Imnaha weir. The resulting escapement estimate for natural spawners in the Imnaha River Basin was 255 (Figure 3). In the Imnaha, an additional 51 fish were retained for hatchery broodstock, so the total escapement estimate was 306 (Figure 3).

During spawning ground surveys, we recovered 50 carcasses with fin clips, however, fish with only RV and LV fin clips did not receive CWTs, so snouts were not sampled on those fish (Table 9). Snouts from adipose-clipped fish were removed and any CWTs were recovered and decoded. The origins of the fish in the Imnaha River were Imnaha stock releases from the 1989 and 1990 brood years. Origins of marked fish in the Grande Ronde Basin were all Lookingglass Fish Hatchery, Rapid River stock releases from the 1989 and 1990 brood years (Table 9). The percentage of marked carcasses in non-supplemented streams was relatively high (25% in the Minam and 50% in the Wenaha), although these numbers are based on fairly low sample sizes (Table 10). In the Lostine River, six percent (1 of 17 carcasses) were marked, but no CWT was recovered. Some of the adults returning in 1994 were from brood years when not all hatchery releases were marked with a fin clip and given a CWT. To distinguish between unmarked hatchery fish and unmarked

natural fish on the spawning grounds, Lofy and Carmichael (1998) used a discriminant analysis on the scales collected from carcasses during spawning ground surveys. This analysis indicated that in the Lostine River, 25% of the fish spawning in nature were of hatchery origin. The percentage of hatchery fish on the spawning grounds was 50% in the Minam River, 33% in the Wenaha River, and 50% in Catherine Creek. The confidence intervals around these percentages are large, so these data should be treated with caution. However, combining data from both marked carcass recoveries and the discriminant analysis of scales, it is clear that there was a significant percentage of hatchery-origin fish present in natural populations in non-supplemented streams. The size and age structure of fish recovered on the spawning grounds was similar to those in the hatchery broodstocks (Tables 5 and 11), with the exception of fewer jacks being recovered during spawning ground surveys.

SECTION II

SUMMER STEELHEAD

The main objective of this report section was to document fish culture performance for summer steelhead at LSRCP facilities. These data are then used to evaluate and design culture practices to optimize egg-to-smolt survival, smolt quality, and smolt-to-adult survival (SAR). This section of the report is concerned with steelhead juvenile rearing and release operations for the 1993 brood year, and the collection, spawning and adult characteristics for the 1994 returns of summer steelhead.

Juveniles

Green egg-to-eyed embryo survival (measured when eyed embryos were shocked and picked), and eyed embryo-to-smolt survival for the 1993 BY was within the range of recently observed rates for each stock of fish (Table 12). Average survival rates to the eyed embryo stage are approximately 70-80%, with an additional 5-10% loss by the smolt stage. The eyed embryo survival rates for both stocks of steelhead were average for the 1993 brood. The production goal for the Grande Ronde River Basin was 1,350,000 steelhead smolts at five fish per pound. An additional 330,000 Imnaha stock smolts at five fish per pound is the production goal for the Imnaha River Basin. Total releases were 87 and 106 percent, respectively, of the target smolt releases.

To evaluate different rearing strategies for maximizing SAR, juveniles from each stock were divided into a number of experimental groups for rearing and release. A portion of the fish in each experimental group received a CWT to track adult returns for each treatment. In some cases more than one tag code was used in a single raceway. All fish were marked externally with an adipose clip to identify them as a hatchery fish (Table 13). In addition to an adipose clip, all fish that were given a CWT were also marked externally with a left ventral clip (designated

AdLV). Fin clip quality was good in most raceways, although three of the 10 raceways had approximately 10% of the fish with no CWT. Returning adults with no left ventral clip were not sampled to retrieve a CWT, so fish with unrecognizable left ventral marks were subtracted from the original experimental release group and are included as normal, non-experimental production releases (Tables 14a and 14b).

The 1993 BY juveniles were divided into a number of experimental groups. However, the CWT allocations were also split among different release locations and times to permit the estimation of return rates for unmarked fish from each release group. The experimental groups for the 1993 BY were acclimated versus direct stream releases. We evaluated smolt quality using the relative detections of PIT-tagged smolts at Lower Granite Dam. Within a stock and release location, PIT tag detection rates were similar among all groups (Tables 14a and 14b). The exception to this pattern was a relatively low detection rate for the Imnaha direct stream release group. The trend of lower PIT tag detection rates with time may be a result of a lower sampling rate of migrants because of increased spill over mainstem dams. We also compared the use of brands versus PIT tags as an index of smolt migration. Expanded brand detection rates at the dams were always much lower (2-3 fold) than PIT tag detection rates.

Adults

Weirs for adult steelhead collection were installed early enough in Deer Creek (Big Canyon Facility) and Little Sheep Creek to trap most of the run (Table 15). The ladder at Wallowa Fish Hatchery may have been opened after fish arrived at the weir site. Run timing was similar between hatchery and wild fish in Little Sheep Creek but not in Deer Creek. In Deer Creek, we began trapping hatchery fish in the early part of March, but natural fish did not show up until the middle of April. Interestingly, the Big Canyon facility used to be operated so that natural fish were not passed above the weir until April 15th, coincident with the end of the fishing season. Given that run timing has been shown to be a partly heritable trait, previous operating protocols at the Big Canyon Facility may have influenced this characteristic of the natural steelhead population in Deer Creek. Overall, the majority of the hatchery-origin adult returns spent two winters at sea (Table 16). The majority of the natural fish trapped in the Wallowa River basin also spent two winters at sea. However, the naturally produced adults trapped at the Little Sheep Creek Facility consisted mostly of 1-ocean fish. This trend appears stable through time and is not an artifact of higher natural production in the 1990 BY compared to the 1989 BY. Age composition was based on CWT age, scale age and length-at-age if necessary (Figure 4). These distributions are used to estimate age for allocation of individuals at adult collection sites based on age. There were no outplants from any steelhead collections in 1994 (Table 16). At the Big Canyon Facility, 34 hatchery fish and all of the natural fish trapped at the weir were passed above the weir to spawn naturally. At the Little Sheep Creek Facility, 36 of the 141 trapped hatchery fish were released above the weir to spawn naturally along with 41 of the 53 natural returns. Twenty-three percent of the natural return to Little Sheep

Creek was kept for hatchery broodstock, resulting in a hatchery broodstock consisting of 10% natural fish. Natural parents were used in 60% of the family groups for the Little Sheep hatchery program. Pre-spawning mortality was less than three percent for all stocks.

Spawn timing in the hatchery was similar to past years (Table 17). Egg take goals were achieved for Wallowa stock steelhead. Embryos from the first spawning of Wallowa stock steelhead were shipped to Lyons Ferry Fish Hatchery (Washington) for rearing. Excluding these fish, an additional 531,300 Wallowa stock fry were excess to program needs and therefore euthanized. Survival to the fry stage was variable and ranged from 70 to 92%. Egg take goals were not achieved for Imnaha stock steelhead, where only 88% of the desired number of eggs were taken. The numbers of natural fish returning to the Little Sheep Creek weir along with the guidelines of the Wild Fish Management Policy often limit the production capacity of the program. Survival to the fry stage was variable and ranged from 69 to 97%.

Experimental group returns

The numbers of returning adults from each stock of steelhead are used for multiple purposes. They allow us to evaluate LSRCP compensation goals by estimating the total return of hatchery-origin steelhead to the compensation and other areas. They also provide the basis for the evaluation of the success of experimental rearing and release strategies for each stock. The returns in 1994 contained hatchery-origin fish spanning three brood years. The numbers of recoveries of each CWT code were summarized from the CWT recovery database maintained by the Pacific State Marine Fisheries Commission or directly through ODFW's CWT recovery database. Residual hatchery fish, from releases in 1992 and 1993, were also recovered at collection facilities in 1994. Since these fish were not anadromous they were not counted as experimental returns or as returns towards the compensation goal. We enumerated the actual number of CWTed fish that returned to the hatchery facilities. Our protocol was to collect all fish marked with a left ventral clip and sampled them for a CWT when they were spawned or died (Tables 18a and 18b). Some hatchery steelhead escape and spawn below the weirs. We did not expand for CWT fish spawning below the weirs. We conducted creel surveys in the Imnaha and Grande Ronde river basins. During creel surveys we collected and sampled snouts from fish that were missing their left ventral fin for a CWT. The number of CWT recoveries from creel surveys was expanded to estimate the total number of CWT fish that were harvested in the fisheries. In addition, we tabulated all CWT recoveries reported to the PSMFC or ODFW databases for each stock. Returning adults in 1994 were components of experiments examining the relative survival rates of acclimated versus direct stream releases, and four versus five fish-per-pound target size at release treatment groups.

Compensation goals

The compensation goal for the Grande Ronde Basin (Wallowa stock) is 9,184 adults, and 2,000 adults to the Imnaha Basin (Imnaha stock) to the compensation

area. The compensation area is defined as the watershed above Ice Harbor Dam. To provide an overall summary of disposition for adults returning, CWT recoveries were expanded to account for the non-CWT fish that were released (Table 19). For the Wallowa stock, we estimated that in the 1993-1994 run year, 3,953 adult hatchery-origin summer steelhead returned to the compensation area. This is 43.0% of the compensation goal (Table 19). For the Imnaha stock, only 173 hatchery-origin adults returned to the compensation area, or 8.7% of the compensation goal. In both cases, a large proportion of the total adult return was harvested outside the compensation area by either Columbia River treaty net or sport fisheries (Table 19).

We have not yet attained our compensation goal with the Wallowa stock steelhead program. The Imnaha stock steelhead program has only achieved its compensation goal in the 92-93 run year. In both programs we have generally been able to achieve our juvenile production goals. This suggests that a low SAR is the primary impediment to us reaching the compensation goals. The adult steelhead returns of hatchery fish in 1994 are likely to represent the last fish which will return from the 1989 brood year. The smolt-to-adult survival rate for the 1989 brood year was 0.56% for Imnaha stock and 0.55% for Wallowa stock steelhead. These return rates are the highest observed in each program, though still less than the projected goals of 0.61% and 0.68%, respectively, for each program.

The Imnaha supplementation program allows us to evaluate the relative replacement rates of hatchery and natural populations. The progeny-to-parent rates for naturally reproducing Imnaha stock steelhead have been consistently below replacement (1.0) (Figure 5). The hatchery component progeny-to-parent ratio for the 1989 brood year (which was completed in 1994) exceeded 5.0, compared to the natural population's rate of much less than 1.0. The natural population has been below replacement but fairly stable through time, while the hatchery population is much more variable, ranging from approximately 1.0 to greater than 5.0. One purpose of this supplementation program was to stabilize or enhance the size of the natural population. The annual numbers of naturally produced steelhead trapped at the Little Sheep Creek Facility has been somewhat variable but low, ranging from 30 to 160 fish over the last decade (Figure 6). However, without similar information from a population that could serve as a proper control, it is difficult to assess whether this trend in population size is better or worse than it would have been without a supplementation program.

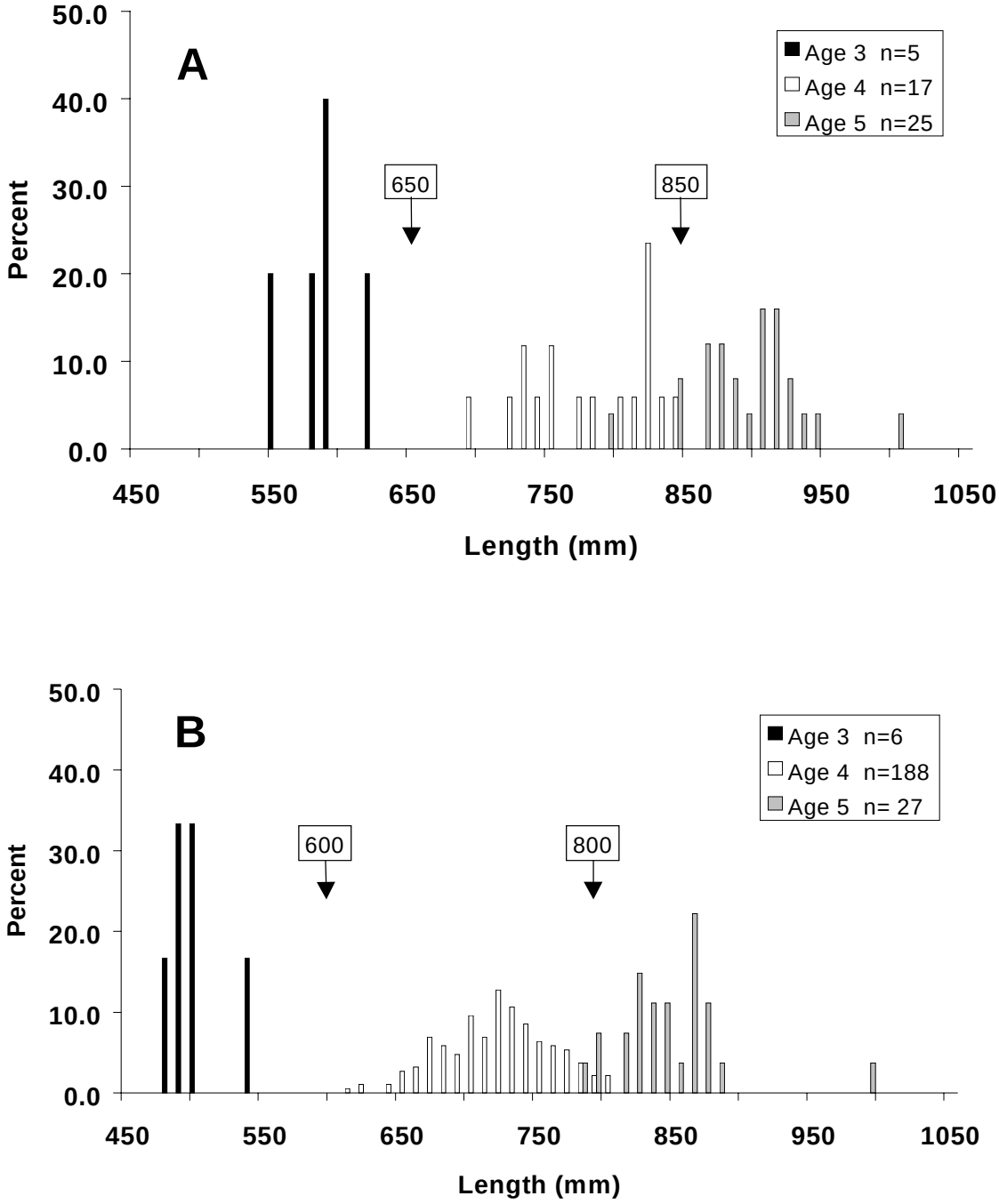

Figure 1. Length-at-age relationship for A) Imnaha and B) Rapid River stock chinook salmon adults used as hatchery broodstock in 1994. Guidelines that were developed from 1990-93 broodstock and used as visual indications of age are presented in boxes.

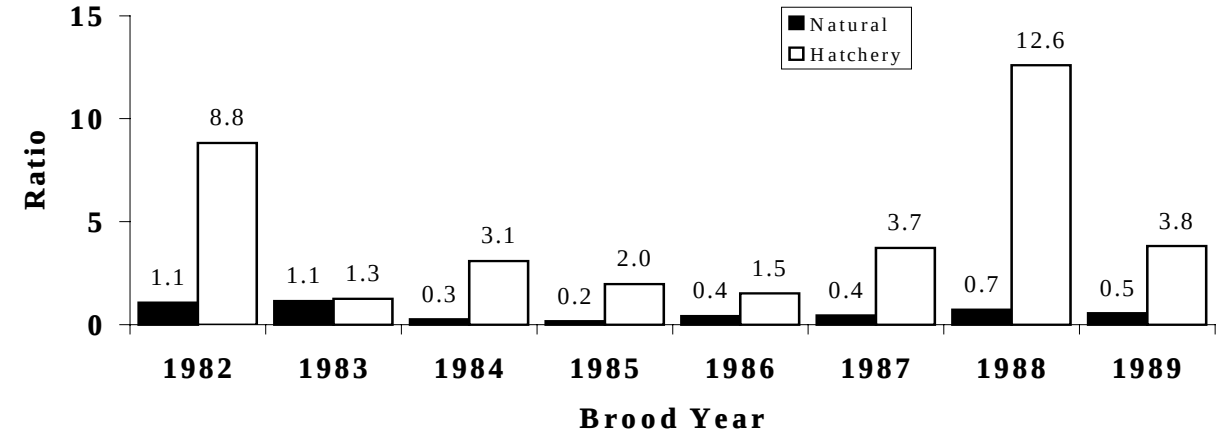

Figure 2. Progeny-to-parent ratios for completed brood years (1982-89) of Imnaha River chinook salmon.

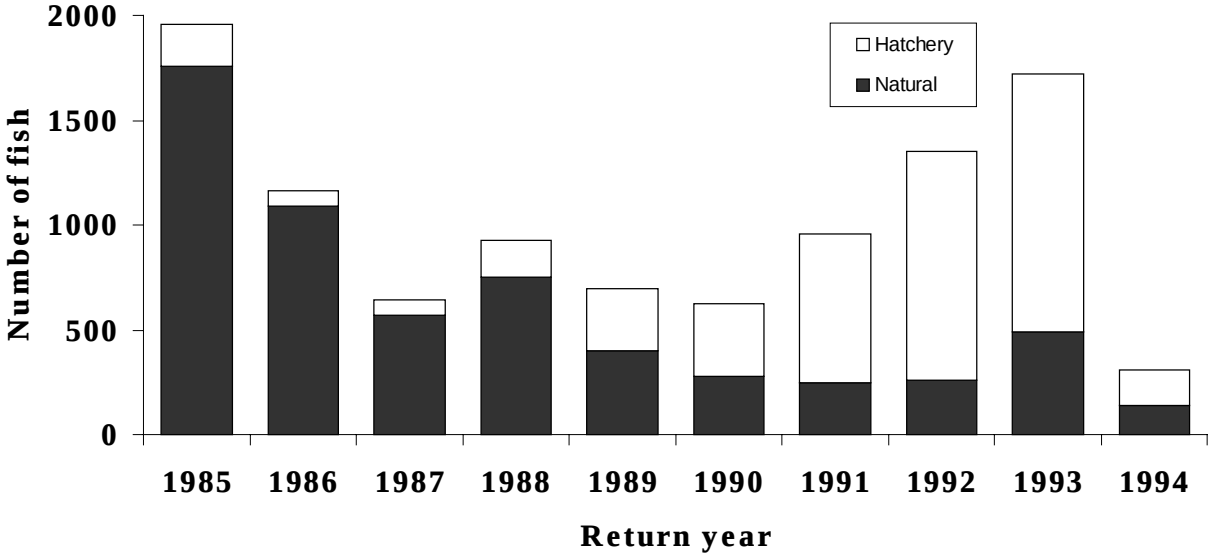

Figure 3. Estimates of natural- and hatchery-origin chinook salmon spawning in the Imnaha River, 1985-94.

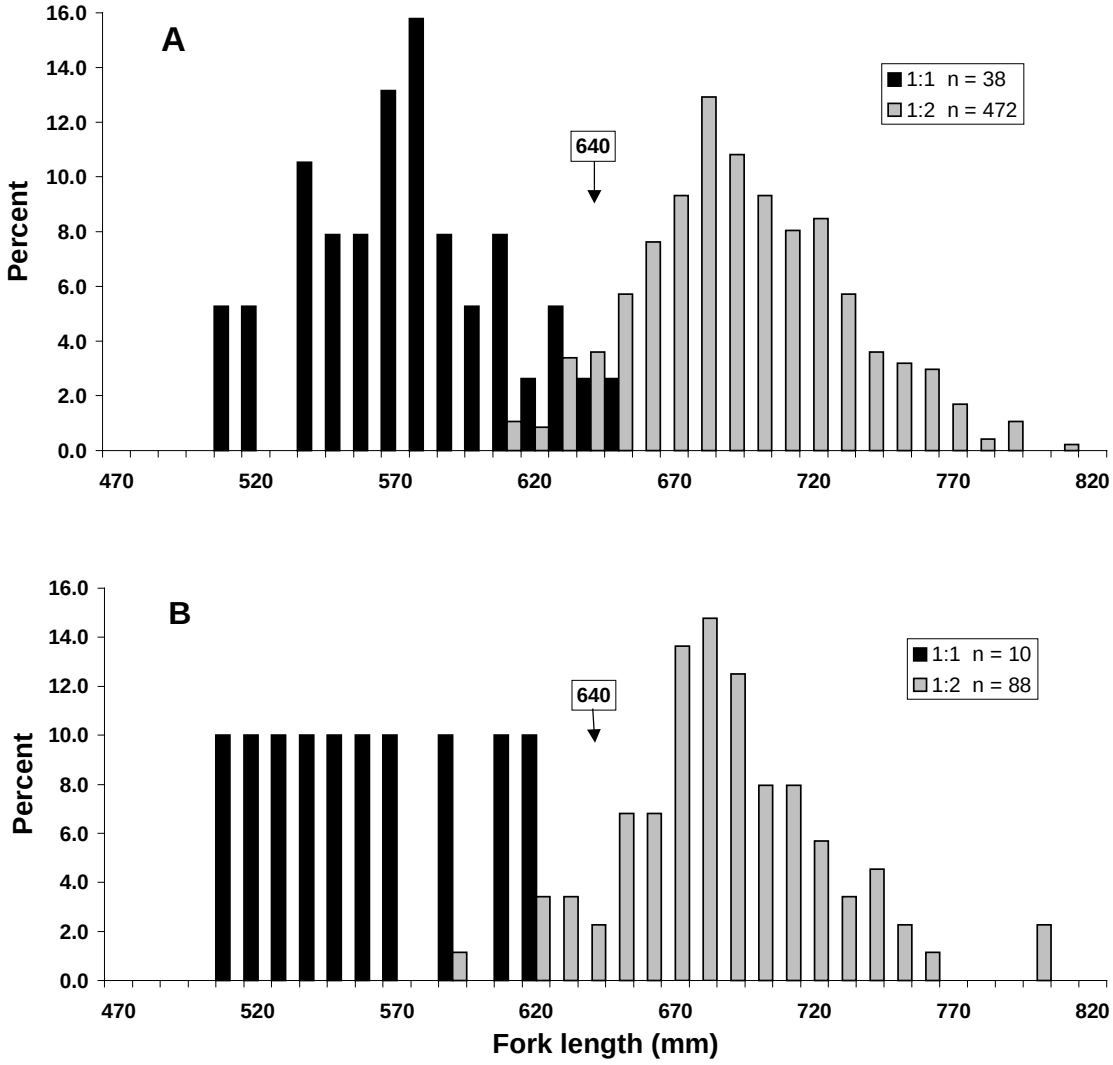

Figure 4. Length-at-age relationships for A) Wallowa and B) Imnaha stock summer steelhead used as hatchery broodstock in 1994. Guidelines that were developed from 1990-93 broodstock and used as visual indications of age are presented in boxes.

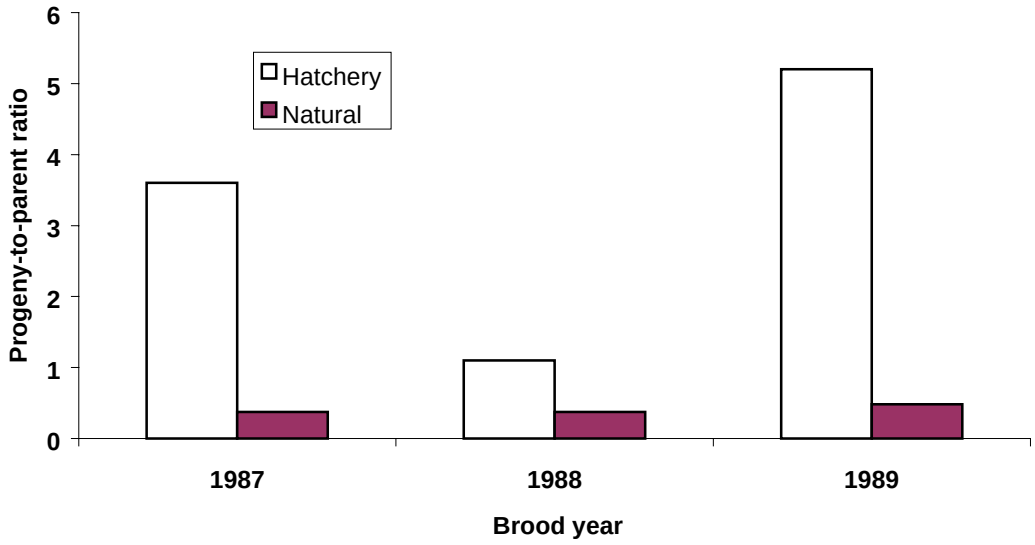

Figure 5. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, brood years 1987-89.

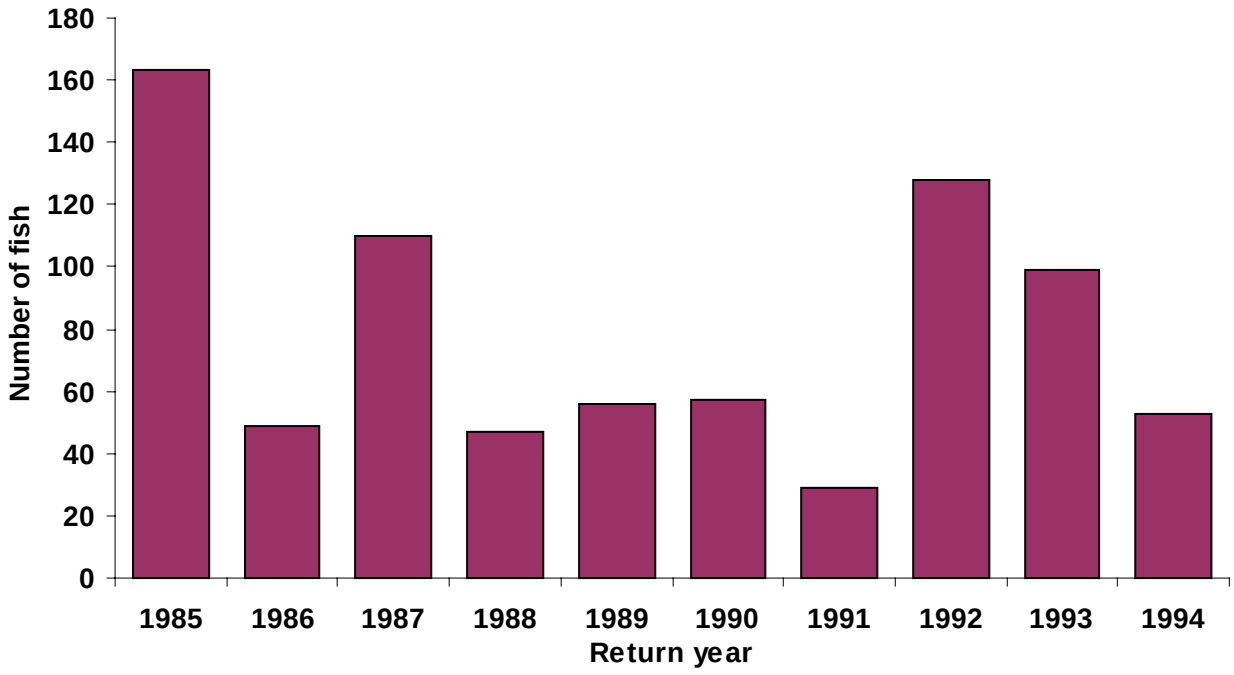

Figure 6. Returns of naturally produced summer steelhead to Little Sheep Creek, 1985-94.

Table 1. Rearing summaries for juvenile spring chinook salmon from the 1992 brood year released in the Grande Ronde and Imnaha river basins in 1994.

Stock	Number of eggs taken	Eyed Embryos	Percent Survival		Total fish released[b]
			Egg to embryo	Embryo to smolt	
Imnaha	542,005	469,050	86.5%	93.5%	438,617[c]
Rapid River	934,849[a]	901,250	96.4%	97.6%	849,273

[a] *Does not include 308,000 viable eggs and 109,950 eyed embryos shipped to Rapid River Hatchery.*
[b] *Includes all fish released (adipose clipped and coded-wire tagged plus unrecognizable marks, target 100% see Table 2).*
[c] *Does not include 283,047 93 BY pre-smolts released in 1994.*

Table 2. Estimates of percent fin clip and coded-wire tag application success for 1992 brood year spring chinook salmon reared at Lookingglass Fish Hatchery and released in 1994. Release group indicates rearing density, experimental treatment and raceway number. Imnaha stock target was 100% AD with CWT, Rapid River stock target was 100% ADRV with CWT.

Release group	Number checked	Ad clip with CWT	Ad clip No CWT	No Ad clip with CWT	No Ad clip No CWT	RV Clip	No RV Clip
Imnaha stock							
13.4 g/l, Acclimated, 13	519	96.7	1.9	1.4	0	-	-
13.0 g/l, Acclimated, 14	500	95.0	4.6	0.4	0	-	-
13.0 g/l, Acclimated, 15	500	97.6	2.2	0.2	0	-	-
13.4 g/l, Acclimated, 16	504	95.8	2.8	1.4	0	-	-
13.0 g/l, Direct stream, 17	513	94.5	4.1	1.4	0	-	-
13.0 g/l, Direct stream, 18	520	97.1	1.5	1.4	0	-	-
Average	509	96.1	2.9	1.0	0	-	-
Rapid River stock							
16.0 g/l,20/lb,01	471	97.0	1.3	1.7	0	98.3	1.7
16.0 g/l,20/lb,02	407	97.8	2.0	0.2	0	90.4	9.6
16.0 g/l,20/lb,03	418	98.1	0.7	1.2	0	90.0	10.0
16.0 g/l,20/lb,04	444	96.4	0.7	2.9	0	85.6	14.4
16.0 g/l,20/lb,05	484	98.0	1.2	0.8	0	87.5	12.5
16.0 g/l,20/lb,06	456	95.2	2.8	2.0	0	96.9	3.1
16.0 g/l,20/lb,07	468	94.4	2.6	1.3	1.7	80.0	20.0
16.0 g/l,20/lb,08	400	95.8	1.7	2.2	0.3	88.6	11.4
13.7 g/l,20/lb,09	453	96.2	1.5	1.6	0.7	97.2	2.8
13.7 g/l,20/lb,10	458	96.9	0.7	2.2	0.2	97.6	2.4
6.8 g/l,20/lb,11	465	95.9	0.9	2.8	0.4	97.6	2.4
6.8 g/l,20/lb,12	482	93.2	0.4	6.0	0.4	95.1	4.9
Average	451	96.2	1.4	2.1	0.3	92.1	7.9

Table 3a. Details of experimental groups of 1992 brood year, Imnaha River stock spring chinook salmon released in the Imnaha River basin in 1994. Experimental group indicates rearing density, experimental treatment, and rearing raceway number. Standard density is 16.071 grams per liter (gpl) at release (equal to 80,000 fish at 20 fish per pound). Sample size for length was approximately 300, and 100 for weight and condition factor (except n=25 weights for ponds 6-9,11,12). FPP = Fish per pound.

Experimental group	FPP	Release Date	Release Location	CWT Code	Fork length mm (S.D.)	Weight g (S.D.)	Condition Factor (S.D.)	Total fish released[a]	Number PIT tagged	Percent PIT tags detected[b]
				1992 Brood						
13.4 gpl, Acclimated, 13	14.9	Apr 11 94	Imnaha Weir	070119	129 (14)	30.5 (13.0)	1.29 (0.08)	49,682	500	33.2
13.4 gpl, Acclimated, 14	15.2	Apr 11 94	Imnaha Weir	070118	129 (12)	29.8 (8.5)	1.36 (0.15)	49,471	500	31.4
12.8 gpl, Acclimated, 15	25.8	Apr 11 94	Imnaha Weir	076362	112 (6)	17.6 (2.7)	1.25 (0.09)	81,997	499	20.2
12.8 gpl, Acclimated, 16	24.0	Apr 11 94	Imnaha Weir	076363	113 (6)	18.9 (3.4)	1.30 (0.11)	80,404	500	27.2
12.8 gpl, Direct stream, 17	23.9	Apr 11 94	Imnaha Weir	070116	114 (7)	19.0 (3.2)	1.24 (0.08)	78,785	501	24.0
12.8 gpl, Direct stream, 18	24.9	Apr 11 94	Imnaha Weir	070117	110 (6)	18.2 (3.0)	1.30 (0.08)	81,508	500	23.4
Unrecognizable marks[c]		Apr 11 94	Imnaha Weir	-	-	-	-	16,770	-	-
							Subtotal	438,617		
				1993 Brood						
13.0 gpl, HxH[d], presmolt, 9	90.9	Jul 19 94	Imnaha Basin[e]	-	72 (3.5)	5.0 (0.8)	1.31 (0.18)	283,047	-	-
Total released								721,664	3,000	

[a] *Equals total number released in Table 1 by stock. Total released includes all fish with adipose clip and CWT (target 100%) plus an additional 30,713 Rapid River stock and 16,770 Imnaha stock fish were released without recognizable marks.*

[b] *Includes unique detections at all dams in the Snake and Columbia Rivers.*

[c] *Unrecognizable marks represent fish that did not receive fin clips. Based on visual inspection, these fish would not be recognized as originating from the hatchery. The total number was calculated by expanding the proportion of unmarked fish observed during prerelease sampling. This group pools unmarked fish from all release groups.*

[d] *HxH indicates both parents were known hatchery origin. These pre-smolt releases were from 1993 brood year and marked Ad–no CWT and were not considered part of the normal supplementation program.*

[e] *Locations include Big Sheep Creek (rkm 35,39,44,55,56), Little Sheep Creek (rkm3-21), Freezeout Creek (rkm 1), and the Imnaha River (rkm 6,8,18,54,58).*

Table 3b. Details of experimental groups of 1992 brood year, Rapid River stock spring chinook salmon released in the Grande Ronde River basin in 1994. Experimental group indicates rearing density, experimental treatment, and rearing raceway number. All fish were targeted for release at a size of 20 fish per pound (FPP). Standard density is 16.071 grams per liter (gpl) at release (equal to 80,000 fish at 20 fish per pound). Sample size for length was approximately 300, and 100 for weight and condition factor (except n=25 weights for ponds 6-9,11,12)

Experimental group	FPP	Release Date	Release location	CWT code	Fork length mm (S.D.)	Weight g (S.D.)	Condition Factor (S.D.)	Total fish released[a]	Number PIT tagged	Percent PIT tags detected[b]
16.0 gpl, 1	20.4	10 Apr 94	Lookingglass Cr.	070441	116 (6)	19.5 (2.9)	1.25 (0.08)	74,132	0	-
16.0 gpl, 2	16.7	6 May 94	Lookingglass Cr.	070440	118 (6)	21.5 (3.7)	1.27 (0.07)	67,540	0	-
16.0 gpl, 3	19.8	10 Apr 94	Lookingglass Cr.	070439	119 (5)	20.9 (2.7)	1.23 (0.06)	79,827	0	-
16.0 gpl, 4	15.9	6 May 94	Lookingglass Cr.	070438	122 (5)	23.0 (3.6)	1.25 (0.08)	77,722	0	-
16.0 gpl, 5	18.9	10 Apr 94	Lookingglass Cr.	070437	120 (7)	22.1 (4.1)	1.27 (0.12)	79,481	0	-
16.0 gpl, 6	19.2	10 Apr 94	Lookingglass Cr.	070436	120 (7)	21.6 (3.7)	1.21 (0.06)	77,160	0	-
16.0 gpl, 7	19.4	12 Apr 94	Snake River[c]	070435	119 (6)	21.9 (3.4)	1.24 (0.07)	79,380	0	-
16.0 gpl, 8	20.2	10 Apr 94	Lookingglass Cr.	070434	124 (6)	22.9 (4.1)	1.20 (0.07)	80,275	0	-
13.7 gpl, 9	20.2	10 Apr 94	Lookingglass Cr.	075308	118 (6)	20.6 (3.2)	1.27 (0.08)	68,693	496	57.3
13.7 gpl, 10	20.5	10 Apr 94	Lookingglass Cr.	075307	118 (6)	20.3 (3.2)	1.24 (0.07)	68,959	500	55.4
6.8 gpl, 11	18.5	10 Apr 94	Lookingglass Cr.	070448	121 (6)	22.7 (3.8)	1.25 (0.07)	33,231	497	56.7
6.8 gpl, 12	18.6	10 Apr 94	Lookingglass Cr.	070447	121 (7)	22.3 (3.3)	1.23 (0.07)	32,160	500	58.4
Unrecognizable marks [d]								30,713		
Total released								849,273	1,993	

[a] *Equals total number released in Table 1 by stock. Total released includes all fish with adipose clip and CWT (target 100%) plus an additional 30,713 Rapid River stock and 16,770 Imnaha stock fish were released without recognizable marks.*

[b] *Includes unique detections at all dams in the Snake and Columbia Rivers.*

[c] *Rkm 395, below Hell's Canyon Dam.*

[d] *Unrecognizable marks represent fish that did not receive fin clips. Based on visual inspection, these fish would not be recognized as originating from the hatchery. The total number was calculated by expanding the proportion of unmarked fish observed during prerelease sampling. This group pools unmarked fish from all release groups.*

Table 4. Timing of adult spring chinook salmon returns to LSRCP facilities in 1994 by origin.

Period	Week of year	Number of fish trapped[a]				
		Imnaha		Rapid River		Carson
		Marked	Unmarked	Marked	Unmarked	Marked[b]
Apr 09-15	15	-	-	-	-	-
Apr 16-22	16	-	-	-	-	-
Apr 23-29	17	-	-	-	-	-
Apr 30-May 06	18	-	-	-	-	-
May 07-13	19	-	-	-	-	-
May 14-20	20	-	-	-	-	-
May 21-27	21	-	-	-	-	-
May 28-Jun 03	22	-	-	100	17	78
Jun 04-10	23	-	-	32	6	25
Jun 11-17	24	-	-	26	3	24
Jun 18-24	25	0	0	10	2	11
Jun 25-Jul 01	26	17	23	3	5	8
Jul 02-08	27	25	30	4	0	2
Jul 09-15	28	6	7	2	0	4
Jul 16-22	29	17	8	0	1	0
Jul 23-29	30	4	4	0	0	1
Jul 30-Aug 05	31	1	1	0	0	0
Aug 06-12	32	1	1	1	0	0
Aug 13-19	33	0	0	1	0	0
Aug 20-26	34	1	2	2	1	2
Aug 27-Sep 02	35	3	4	2	1	0
Sep 03-09	36	3	3	0	3	0
Sep 10-16	37	1	1	0	0	0
Sep 17-23	38	0	0	0	0	0
Sep 24-30	39	-	-	-	-	-
Sep 31-Oct 07	40	-	-	-	-	-
	Total	79	84	183	39	155

[a] *The Imnaha River weir was operational from June 16th through September 21st, the Lookingglass Creek weir was operational from May 24st to September 21st.*

[b] *All Rapid River stock fish were trapped at the Lookingglass Creek weir. Unmarked fish were likely 5 year old unmarked hatchery fish. After 1995, all hatchery fish returning to Lookingglass Creek should be marked AdRV. Carson stock adults were identified visually by an LV only fin mark.*

Table 5. Numbers of adult spring chinook salmon returning to LSRCP facilities in 1994 by origin, age, and sex. M=Male, F=Female.

Stock,	Hatchery							Natural							Grand
	3		4		5			3		4		5			
Disposition	M	F	**M**	F	M	F	Total	M	F	M	F	M	F	Total	Total
Imnaha River							*Imnaha River Weir*								
Trapped	6	0	19	14	15	37	91[a]	1	0	20	14	18	19	72	163
Passed	2	0	10	11	11	26	60	0	0	15	9	16	12	52	112[b]
Outplants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	4	0	9	3	4	11	31	1	0	5	5	2	7	20	51
Actual spawned	3	0	8	2	3	11	27	0	0	5	3	1	6	15	42
Killed, not spawned	0	0	1	0	0	0	1	0	0	0	0	1	0	1	2
Pre-spawn mortality	1	0	0	1	1	0	3	1	0	0	2	0	1	4	7
Mean length (mm)[c]	591	-	753	825	903	876		550	-	783	798	913	899		
Standard Deviation (mm)	17	-	38	14	11	19		-	-	74	36	81	25		
Age composition (%)	6.6	0.0	20.9	15.4	16.5	40.6	100%	1.4	0.0	27.8	19.4	25.0	26.4	100%	
Rapid River and Carson							*Lookingglass Fish Hatchery*								
			Rapid River Stock							*Carson Stock*					
Total Trapped	6	0	85	103	9	18	221	0	0	0	0	74	79	153	
Trapped at LG Dam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trapped at Lookingglass	6	0	85	103	9	18	221	0	0	0	0	74	79	153	
Passed	3	0	37	54	6	12	112[d]	0	0	0	0	0	0	0	
Outplants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Kept	3	0	48	49	3	6	109	0	0	0	0	74	79	153	
Actual spawned	2	0	44	45	3	4	98	0	0	0	0	24	24	48	
Killed-not spawned	0	0	0	0	0	0	0	0	0	0	0	37	44	81[d]	
Pre-spawn mortality	0	0	4	0	0	2	6	0	0	0	0	13	11	24	
Mean length (mm)[c]	497	-	725	709	864	827		-	-	-	-	-	-		
Standard Deviation (mm)	22	-	40	37	47	29		-	-	-	-	-	-		
Age composition (%)	2.7	0.0	38.5	46.6	4.1	8.1	100%	0.0	0.0	0.0	0.0	48.4	51.6	100%	

[a] *Numbers have been adjusted to include unmarked hatchery fish that were counted as natural when collected.*

[b] *Of the 112 passed fish, 16 had CWT, leaving 96 non-CWT fish. Of these, 39 had no external marks (8M,9F- 4 year old; 9M,13F-5 years old), and 56 were RV only.*

[c] *Mean length per age class determined from known age fish based on either CWT or scale data.*

[d] *These fish were killed and frozen on 6/02/94 and given away on 7/20/94. The remaining Carson stock fish were spawned at Wallowa Fish Hatchery and viable eggs were shipped to Umatilla hatchery on the spawn day.*

Table 6. Timing of spawning and spawning summaries for 1994 brood spring chinook salmon at LSRCP facilities.

Date	Hatchery spawn code	Origin of parents in matrices[a]	Number of parents F, M	Number of eggs taken	Percent mortality to shocking[b]
		Imnaha stock at Lookingglass Fish Hatchery			
August 24, 1994	181	Hatchery	2, 4	11,356	8.5
		Natural	0	-	-
		Mixed	5, 10	27,965	31.9
August 31, 1994	182	Hatchery	1, 1	5754	1.6
		Natural	0	-	-
		Mixed	3, 5	15,869	8.5
September 08, 1994	183	Hatchery	4, 4	23,191	2.9
		Natural	0	-	-
		Mixed	7, 12	28,279	19.8
Total			22 Family groups	111,794	Avg. 15.4
		Rapid River stock at Lookingglass Fish Hatchery			
August 24, 1994	403	Hatchery	2	9,840	26.3
August 31, 1994	404	Hatchery	4	13,937	13.8
September 08, 1994	405	Hatchery	11	39,693	3.0
September 14, 1994	406	Hatchery	31	107,363	12.1
September 21, 1994	407	Hatchery	1	1,125	5.3
Total			49 Family groups	171,958	Avg. 10.9
		Carson stock at Wallowa Fish Hatchery[c]			
August 23, 1994	104	Hatchery	12	69,713	NA
August 30, 1994	105	Hatchery	10	57,388	NA
September 06, 1994	106	Hatchery	2	10,242	NA
Total			24 Family groups	137,343	NA

[a] *Rapid River and Carson stock were spawned in a 2X2 matrix, however, the number of males used in each matrix was not tracked. Therefore, only the total number of family groups is reported.*

[b] *Embryos were shocked on October 14, 1994.*

[c] *Carson stock salmon were spawned at Wallowa Fish Hatchery and viable eggs were shipped to Umatilla hatchery on the spawn day.*

Table 7a. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha River stock, spring chinook for the 1994 return year. All but two groups (denoted by *) of CWT fish were from releases of acclimated hatchery fish into the Imnaha River. Data was summarized as available through August, 1998. (fpp = fish per pound; gpl = grams per liter).

Brood year	Experimental group[a]	CWT code	Recoveries at weir[b]	Other in-basin recoveries[c]	Out-of-basin recoveries[d]	Total recoveries[e]
1988	12 fpp, 14.0 gpl	074729	0	0	1	1
	12 fpp, 14.0 gpl	074730	0	0	1	1
1989	15 fpp, 10.6 gpl	075040	2	11	0	13
	15 fpp, 10.6 gpl	075043	1	6	0	7
	20 fpp, 8.6 gpl	075045	3	17	1	21
	20 fpp, 8.6 gpl	075046	1	6	0	7
1990	25 fpp, 8.0 gpl	075844	0	0	0	0
	25 fpp, 8.0 gpl	075845	0	0	3	3
	15 fpp, 14.0 gpl	075846	5	20	0	25
	15 fpp, 14.0 gpl	075847	3	9	2	14
	*20 fpp, 8.0 gpl	075848	0	0	0	0
	*20 fpp, 8.0 gpl	075849	0	0	0	0
1991	15 fpp, 8.0 gpl	071538	4	7	0	11
	15 fpp, 8.0 gpl	071539	0	0	0	0
	25 fpp, 8.0 gpl	071540	0	0	0	0
	25 fpp, 8.0 gpl	071541	0	0	0	0
	Grand total of recoveries in 1994		19	76	8	103

[a] *Experimental groups include the release strategy and the target release size (fpp = fish per pound).*

[b] *Actual numbers of CWT fish recovered at the Imnaha River weir. Fish were collected for broodstock and sampled in the hatchery.*

[c] *Estimated number (the estimated spawning population above the weir, the number of redds above the weir, the fish/redd estimate from above the weir, the number of redds below the weir and the proportion of fish sampled from the hatchery with these tag codes) of total CWT fish that spawned naturally in the Imnaha River. We estimated that 31 CWT fish were passed above the weir. We estimated that three CWT fish escaped before the weir was operating. We estimated that 42 CWT fish spawned below the weir.*

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

[e] *Estimated total by summing all recoveries.*

Table 7b. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Rapid River spring chinook for the 1994 return year. All CWT fish were from releases of hatchery fish into Lookingglass Creek. Data was summarized as available through August, 1998.

Brood year	Experimental group[a]	CWT code	Recoveries at weir[b]	Other in-basin recoveries[c]	Out-of-basin recoveries[d]	Total recoveries[e]
1989	12 fpp, 14.0 gpl	075048	1	1	1	3
	12 fpp, 14.0 gpl	075051	0	0	0	0
	20 fpp, 8.6 gpl	075053	3	2	0	5
	20 fpp, 8.6 gpl	075054	3	2	0	5
1990	12 fpp, 16.0 gpl	074746	4	2	2	8
	12 fpp, 16.0 gpl	075055	13	8	0	21
	20 fpp, 8.6 gpl	075305	12	7	6	25
	20 fpp, 8.6 gpl	075306	4	2	1	7
1991	20 fpp, 16.0 gpl	071546	0	0	0	0
	20 fpp, 16.0 gpl	071547	0	0	0	0
	20 fpp, 8.0 gpl	071548	0	0	0	0
	20 fpp, 8.0 gpl	071549	1	1	0	2
	20 fpp, 16.0 gpl	071550	0	0	0	0
	20 fpp, 16.0 gpl	071551	0	0	0	0
	20 fpp, 8.0 gpl	071552	0	0	0	0
	20 fpp, 8.0 gpl	071553	0	0	0	0
	20 fpp, 8.0 gpl	071554	1	1	0	2
	20 fpp, 8.0 gpl	071555	1	1	0	2
	20 fpp, 8.0 gpl	071556	0	0	0	0
	20 fpp, 8.0 gpl	071557	0	0	0	0
	20 fpp, 8.0 gpl	071558	0	0	0	0
	Grand total of recoveries in 1994		43	27	10	80

[a] *Experimental groups include the target release size (fpp = fish per pound) and the target density (gpl = grams per liter) at release. All fish were reared in and released as acclimated from raceways at Lookingglass Fish Hatchery and acclimated to Lookingglass Creek water.*

[b] *Actual numbers of CWT fish recovered at the Lookingglass Creek weir. Fish were collected for broodstock and sampled in the hatchery.*

[c] *Estimated number (based on fish passed above the weir and spawning ground survey data) of CWT fish that spawned naturally in the Lookingglass Creek. Sixteen CWT fish were passed above the weir. We estimated that three CWT fish escaped before the weir was operating. We estimated that eight CWT fish spawned below the weir.*

[d] *Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake river fisheries, or in tributaries outside the Lookingglass Creek. When CWT expansion factors were greater than 24 (because of a low sampling rate) unexpanded data were used.*

[e] *Estimated total by summing all recoveries.*

Table 8. Catch and escapement distribution of hatchery adult spring chinook salmon by recovery location in 1994. (Data summarized through August 1998 from the PSMFC and ODFW CWT recovery databases).

Location	Imnaha Stock		Rapid River Stock		Carson Stock[a]	
	Percent of total	Expanded adults	Percent of total	Expanded adults	Percent of total	Expanded Adults
Ocean catch	0.0	0	0.0	0	-	-
Columbia River						
Treaty net	0.8	1	0.0	0	-	
Non-treaty net	0.0	0	1.3	3	-	-
Sport	0.0	0	2.2	5	-	-
Deschutes River						
Trap	3.0	4	2.2	5		
Sport	0.0	0	0.0	0	-	-
C and S[b]	0.0	0	0.0	0	-	-
Strays						
Outside Snake R. Basin	3.0	4	5.8	13	-	-
Within Snake R. Basin*	0.0	0	0.4	1	-	-
Recruitment to river*	93.2	124	88.0	198	100.0	153
Total estimated return		133		225		153
Return to compensation area		124[c]		199		153
Percent of compensation goal		3.9		15.3		-[d]

** indicates areas defining the compensation area. The compensation goal for Rapid River/Carson stock is 2,300 adults and the goal for Imnaha stock is 3,210 adults. Expanded adults returning for each stock in 1994 is calculated in Tables 7a and 7b.*

[a] *No Carson stock fish were tagged.*

[b] *C and S indicates ceremonial and subsistence tribal fisheries.*

[c] *We estimate an additional 11 unmarked hatchery fish returned to the Imnaha River.*

[d] *Included in 17.7% as calculated for Rapid River stock (Grande Ronde Basin).*

Table 9. Summary of adipose-clipped chinook salmon carcass recoveries during spawning ground surveys in 1994. The multiple tag recoveries in each group are shown in parentheses next to the location. An additional 28 marked fish were recovered (2 Minam, 3 Wenaha, 16 LGC, 7 Imnaha) but had no adipose clip (ventral clips only) and therefore were hatchery fish with no CWT.

Location (number)	CWT code	Release site
Imnaha River (5)	075045	Imnaha Acclimation Pond (1989 Brood)
Imnaha River (2)	075043	Imnaha Acclimation Pond (1989 Brood)
Imnaha River (2)	075848	Imnaha Acclimation Pond (1990 Brood)
Imnaha River (2)	075846	Imnaha Acclimation Pond (1990 Brood)
Imnaha River (1)	075849	Imnaha Acclimation Pond (1990 Brood)
Imnaha River (2)	075845	Imnaha Acclimation Pond (1990 Brood)
Imnaha River (1)	075046	Imnaha Acclimation Pond (1990 Brood)
Imnaha River (2)	No Tag	Unknown Origin
Lostine River (1)	No Tag	Unknown Origin
Minam River (1)	075048	Lookingglass Fish Hatchery (1989 Brood)
Lookingglass Cr (1)	075055	Lookingglass Fish Hatchery (1990 Brood)
Lookingglass Cr (1)	075306	Lookingglass Fish Hatchery (1990 Brood)
Lookingglass Cr (1)	075053	Lookingglass Fish Hatchery (1989 Brood)

Table 10. Summary of marked and unmarked spring chinook salmon carcass recoveries by stream during spawning ground surveys in 1994. These recoveries do not distinguish between unmarked hatchery and natural fish recovered on the spawning grounds. Some of the unmarked fish are of hatchery origin because a large percentage of the 1989 and 1990 brood years were not marked.

Stream	Marked	Unmarked	Percent marked
	Grande Ronde River Basin		
Bear Creek	0	0	0
Hurricane Creek	0	0	0
Lostine River	1	17	6
Wallowa River	0	0	0
Grande Ronde River	0	0	0
Catherine Creek	0	5	0
Lookingglass Creek	19	12	61
Minam River	3	9	25
Wenaha River	3	3	50
	Imnaha River Basin		
Big Sheep Creek	0	0	0
Imnaha River	24	30	54
Lick Creek	0	0	0

Table 11. Age composition of chinook salmon carcasses recovered in 1994 during surveys in the Imnaha and Grande Ronde river basins. M=male, F=female.

	Age 3		Age 4		Age 5	
Statistic	M	F	M	F	M	F
			Grande Ronde River Basin			
Number[a]	1	0	9	26	16	17
Percent of total	1	0	13	38	23	25
Mean length (mm)	-	-	735	712	931	848
Standard deviation	-	-	56	46	70	61
			Imnaha River Basin			
Number	0	0	9	7	10	28
Percent of total	0	0	17	13	19	51
Mean length (mm)	-	-	813	742	924	883
Standard deviation	-	-	57	62	87	36

[a] *Sex could not be determined for an additional two, five year olds in the Grande Ronde Basin.*

Table 12. Summary of egg collection and juvenile survival for 1993 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 1994.

Stock	Number of eggs taken	Eyed embryos	Percent survival[a]		Total fish released
			Egg-to-embryo	Embryo-to-smolt	
Wallowa	1,943,646[b]	1,395,000[c]	71.8	91.6	1,125,090[d]
Imnaha	647,272[e]	482,550[f]	79.5	94.4	350,541

[a] *Eggs that were culled from production and not fertilized and incubated at Wallowa Fish Hatchery were subtracted from the calculation of egg-to-embryo survival. 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.*

[b] *Does not include 315,200 eggs taken for the Washington Department of Fish and Wildlife (WDFW).*

[c] *Does not include 272,000 eyed embryos shipped to Lyons Ferry Fish Hatchery (WDFW). Does include 166,208 embryos that, after hatching, were euthanized as gradeouts or as excess to program needs.*

[d] *Does not include 49,508 Wallowa stock smolts received from WDFW and released on the lower Grande Ronde River at Wildcat Creek.*

[e] *Includes 40,200 eggs that were euthanized because they were excess to program needs.*

[f] *Includes 111,288 embryos that, after hatching, were euthanized as gradeouts or as excess to program needs.*

Table 13. Estimates of fin clip quality and coded-wire tag retention for 1993 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 1994. Experimental group indicates treatment and rearing raceway number. Targets for both Wallowa and Imnaha stocks were 100% adipose clipped and releases of a size of 5 fish per pound (FPP). 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
			Wallowa stock				
Acclimated, 3	070329	508	99.2	0.8	0.0	-	-
Acclimated, 5	070330	507	99.6	0.2	0.2	-	-
Direct stream, 18	070327	297	91.9	0.0	8.1	99.7	0.3
Direct stream, 18	070328	258	88.4	0.0	11.6	98.8	1.2
Acclimated, 9	070325	500	99.2	0.0	0.8	-	-
Acclimated, 11	070326	502	98.8	0.0	1.2	-	-
Average		429	96.2	0.1	3.7	99.3	0.7
			Imnaha stock				
Acclimated, 30	070321	509	90.8	1.0	8.2	-	-
Acclimated, 29	070322	509	88.0	0.6	11.4	-	-
Direct stream, 27	070323	302	98.3	0.0	1.7	99.7	0.3
Direct stream, 27	070324	300	98.0	0.0	2.0	98.7	1.3
Average		405	93.8	0.4	5.8	99.2	0.8

Table 14a. Details of experimental and production groups of 1993 brood, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 1994. Experimental group indicates release strategy and rearing raceway number. All fish were reared to a target size of 5 fish per pound (FPP). Standard deviation is shown in parentheses.

Experimental group[a]	FPP	Release date	Release location[b]	CWT code	Length mm	Weight g	Condition factor	Total fish released	Percent detected	
									Brand[c]	PIT[d]
Direct stream, 19-22	5.0	Apr 13-15	Gr. Ronde R.	-	198 (17)	-	-	200,806	-	-
Direct stream, 17-19	4.7	Apr 18	Catherine Cr.	-	204 (19)	-	-	62,556	-	-
Direct stream	4.1	Apr 26-27	Wildcat Cr.	-				49,508	-	-
Acclimated, 3	3.6	Apr 18	Spring Cr.	070329	227 (19)	125 (33)	1.05 (0.06)	27,187	27.1	61.7
Acclimated, 5	3.9	Apr 18	Spring Cr.	070330	221 (20)	115 (31)	1.03 (0.06)	27,694	31.4	57.7
Acclimated, 1-8,10-12	3.9	Apr 18	Spring Cr.	-	219 (20)	115 (35)	1.04 (0.06)	439,461	-	-
Direct stream, 18	4.2	Apr 22	Deer Cr.	070327	212 (21)	107 (31)	1.11 (0.06)	23,287	-	57.5
Direct stream, 18	4.2	Apr 22	Deer Cr.	070328	[e]	[e]	[e]	21,981	-	[e]
Direct stream, 18	4.2	Apr 22	Deer Cr.	-	[e]	[e]	[e]	4,936	-	[e]
Acclimated, 9	4.0	Apr 22	Deer Cr.	070325	218 (18)	113 (29)	1.07 (0.06)	26,858		42.5
Acclimated, 11	4.0	Apr 22	Deer Cr.	070326	[f]	[f]	[f]	26,960	-	53.9
Acclimated, 9,11	4.0	Apr 22	Deer Cr.	-	[f]	[f]	[f]	51,729	-	-
Acclimated, 13-16	4.8	May 2	Spring Cr.	-	211 (21)	95 (25)	1.00 (0.07)	211,635	-	-
Total released[g]								1,174,598		

[a] *All fish were reared at Irrigon Fish Hatchery (ODFW) except for Wildcat Cr. releases reared at Lyons Ferry Fish Hatchery (WDFW).*

[b] *Grande Ronde River releases were at river mile 156-160. Catherine Creek releases were at river mile 17-18. Wildcat Creek releases were in the Lower Grande Ronde River at river mile 53.*

[c] *Brand detections are expanded detections at Lower Granite Dam. Fish branded LA-A-1, RA-A-1 represent tag codes 070329 and 070330.*

[d] *Percent PIT tag detections are unique detections at all mainstem Columbia and lower Snake river dams.*

[e] *CWT codes 070327 and 070328 were held in the same raceway.*

[f] *CWT codes 070325 and 070326 were held in the same acclimation pond and were not distinguishable based on an external mark.*

[g] *Wallowa stock steelhead male releases were 1% precocial.*

Table 14b. Details of experimental and production groups of 1993 brood, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 1994. Experimental group indicates release strategy and rearing raceway number. All fish were reared to a target size of 5 fish per pound (FPP). Standard deviation is shown in parentheses.

Experimental group[a]	FPP	Release date	Release location[b]	CWT code	Length mm	Weight g	Condition factor	Total fish released	Percent detected	
									Brand[c]	PIT[d]
Acclimated, 30	4.7	Apr 25	L. Sheep Cr.	070321	207 (18)	96 (27)	1.05 (0.08)	24,658	12.0	47.1
Acclimated, 29	5.7	Apr 25	L. Sheep Cr.	070322	194 (18)	79 (23)	1.05 (0.07)	23,876	6.9	38.5
Acclimated, 29-32	5.0	Apr 25	L. Sheep Cr.	-	201 (22)	90 (32)	1.06 (0.08)	204,275	-	-
Direct stream, 27	5.1	Apr 25	L. Sheep Cr.	070323	199 (20)	89 (28)	1.09 (0.05)	22,900	9.5	25.3
Direct stream, 27	5.1	Apr 25	L. Sheep Cr.	070324	[e]	[e]	[e]	24,187	7.4	[e]
Direct stream, 27	5.1	Apr 25	L. Sheep Cr.	-	[e]	[e]	[e]	878	-	-
Direct stream, 25	5.3	Apr 26	Imnaha R.	-	193 (19)	-	-	49,767	-	-
Total released[f]								350,541		

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

[b] *Imnaha River releases were near Fence Cr. at river mile 15.*

[c] *Brand detections are expanded detections at Lower Granite Dam. Fish branded RA-A-2, and LA-A-2 represent tag codes 070321, and 070322. Fish branded RA-A-4 and LA-A-4 could have either tag code 070323 or 070324.*

[d] *Percent PIT tag detections are unique detections at all mainstem Columbia and lower Snake river dams.*

[e] *CWT codes 070323 and 070324 were held in the same raceway.*

[f] *Imnaha stock steelhead male releases were 2% precocial.*

Table 15. Timing of adult steelhead returns to LSRCP facilities in 1994 by location and origin.

Period	Week of the year	Number of fish trapped[a]					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Feb 05-11	6	-	-	-	-	-	-
Feb 12-18	7	-	-	-	-	-	-
Feb 19-25	8	-	-	-	-	-	-
Feb 26-Mar 04	9	4	0	0	0	-	-
Mar 05-11	10	5	0	6	0	0	0
Mar 12-18	11	44	0	57	1	6	2
Mar 19-25	12	79	0	19	1	7	2
Mar 26-Apr 01	13	124	5	26	0	5	10
Apr 02-08	14	117	0	80	9	14	10
Apr 09-15	15	110	0	49	7	17	8
Apr 16-22	16	53	0	78	9	59	11
Apr 23-29	17	27	0	55	15	25	7
Apr 30-May 06	18	19	0	11	0	5	1
May 07-13	19	8	0	13	4	3	2
May 14-20	20	3	0	2	2	0	0
May 21-27	21	0	0	0	0	0	0
May 27-Jun 03	22	-	-	0	0	0	0
Jun 04-10	23	-	-	-	-	-	-
	Total	593	5	396	48	141	53

[a] *Weirs installed February 22nd at Big Canyon (Deer Cr.), and March 1st at Little Sheep as well as ladder opened February 22nd at Wallowa Fish Hatchery. Adult collections stopped May 26th, 31st and June 1st at Wallowa, Big Canyon, and Little Sheep, respectively. Timing of natural fish to Wallowa is unknown so fish were allocated to the week when the most hatchery fish were trapped.*

Table 16. Numbers and disposition of adult steelhead that returned to LSRCP facilities in 1994 by stock origin, age (FW:SW), and sex. M=Male, F=Female.

Stock,	Hatchery									Natural					Grand
	1:1		1:2		1:3		2:1			2:1		2:2			
Disposition	M	F	M	F	M	F	M	F	Total	M	F	M	F	Total	Total
Wallowa Hatchery (Wallowa Stock)															
Trapped	28	19[a]	168	377	0	0	0	1	593	1	0	1	3	5	598
Passed	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
Kept	28	19	168	377	0	0	0	1	593	1	0	1	3	5	598
Mortality	2	1	9	7	0	0	0	0	19	0	0	0	0	0	19
Spawned	25	18	153	366	0	0	0	1	563	1	0	1	3	5	568
Killed	1	0	6	4	0	0	0	0	11	0	0	0	0	0	11
Fork Length (mm)	572	542	710	680	-	-	-	587		520	-	745	670		
Standard deviation	36	40	35	33	-	-	-	-		-	-	-	34		
Big Canyon Facility (Wallowa stock)															
Trapped	12	35	78	270	0	0	0	1	396	3	7	9	29	48	444
Passed	2	1	22	9	0	0	0	0	34	3	7	9	29	48	82
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	10	34	56	261	0	0	0	1	362	0	0	0	0	0	362
Mortality	1	1	0	1	0	0	0	0	3	0	0	0	0	0	3
Spawned	8	33	52	258	0	0	0	1	352	0	0	0	0	0	352
Killed	1	0	4	2	0	0	0	0	7	0	0	0	0	0	7
Fork Length (mm)	580	565	712	679	-	-	-	-		-	-	-	-		
Standard deviation	32	39	44	31	-	-	-	-		-	-	-	-		
Little Sheep Creek Facility (Imnaha stock)															
Trapped	9	14	21	97	0	0	0	0	141	16	20	9	8	53	194
Passed	8	4	11	13	0	0	0	0	36	14	14	7	6	41	77
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	1	10	10	84	0	0	0	0	105	2	6	2	2	12	117
Mortality	0	0	1	0	0	0	0	0	1	1	0	0	0	1	2
Spawned	1	10	9	84	0	0	0	0	104	1	6	2	2	11	115
Killed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fork Length (mm)	585	552	724	679	-	-	-	-		598	577	728	701		
Standard deviation	-	37	42	34	-	-	-	-		60	25	11	6		

[a] *Includes one spawned age 4:0 rainbow trout female at Wallowa Fish Hatchery.*

Table 17. Spawning summaries for summer steelhead at LSRCP facilities in 1994.

Spawn date, Lot number	Parental origin[a]	Number of eggs	Eyed embryos[b]	Excess fry	Ponded fry	% egg-to-fry survival[c]
		Wallowa Hatchery (Wallowa stock)				
3/22, wa286	Hatchery	303,880	277,000	0	[d]	[d]
3/29, wa287	Hatchery	585,100	468,000	0	460,753	56.6
4/05, wa288	Hatchery	558,000	440,000	120,000	315,705	86.6
4/12, wa289	Hatchery	698,500	611,300	251,300	353,881	69.5
4/19, wa290	Hatchery	566,000	399,300	80,000	313,182	82.4
4/26, wa291	Hatchery	334,200	278,400	80,000	195,399	71.2
5/03, wa292	Hatchery	167,700	121,600	0	119,457	83.0
5/10, wa293	Hatchery	81,400	68,800	0	67,558	91.8
5/17, wa294	Hatchery	5,560	5,200	0	5,102	61.1
Total		2,996,460	2,392,600	531,300[e]	1,831,037	78.8
		Little Sheep Creek Facility (Imnaha stock)				
3/31, li296	Hatchery	19,400				
	Mixed	19,400				
	Total	38,800	32,500	0	32,091	82.7
4/07, li297	Hatchery	25,500				
	Mixed	5,100				
	Total	30,600	24,000	0	23,691	77.4
4/14, li298	Hatchery	22,987				
	Mixed	14,367				
	Natural	5,746				
	Total	43,100	29,900	0	29,601	68.7
4/21, li299	Hatchery	163,216				
	Mixed	4,664				
	Total	167,880	128,780	0	126,543	75.4
4/28, li300	Hatchery	91,963				
	Mixed	47,058				
	Natural	2,139				
	Total	141,160	106,670	0	104,864	74.3
5/03, li301	Mixed	10,100	10,000	0	9,818	97.2
5/10, li302	Hatchery	6,486				
	Mixed	8,085				
	Natural	1,617				
	Total	16,170	14,400		14,164	87.6
5/17, li303	Mixed	6,330	6,170	0	6,108	96.5
Subtotal	Hatchery	329,534				
Subtotal	Mixed	115,104				
Subtotal	Natural	9,502				
Total		454,140	352,420	0	346,880	76.4

[a] *In general, family groups were pooled (two males x three females) for Wallowa stock and were matrix spawned (three males x three females) for Imnaha stock. Mixed eggs include both natural and hatchery parents.*

[b] *Eyed embryos were inventoried on 4/7,4/29, 5/9, 5/12, 5/23, 5/25 and 6/1/94.*

[c] *Survival to fry stage was measured on 6/17, 6/19,6/21, and 6/29/94.*

[d] *This egg take was transferred to Lyons Ferry Fish Hatchery in Washington. Egg numbers were not included in total.*

[e] *Fry were euthanized because they were excess to program needs.*

Table 18a. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Wallowa stock summer steelhead for the 1993-94 return year. All CWT fish were from releases of hatchery fish into either Deer or Spring creek. Data was summarized as available through February, 1998.

Brood year, Release site	Experimental group[a]	CWT code	Recoveries at weirs[b]	Other in-basin recoveries[c]	Out-of-basin recoveries[d]	Total recoveries[e]
1989						
Spring Cr.	Acclimated, 4 fpp	075120	0	0	20	20
1990						
Deer Cr.	Acclimated, 5 fpp	075351	28	40	72	140
	Acclimated, 5 fpp	075352	33	57	145	235
	Direct stream, 5 fpp	075353	20	13	180	213
	Direct stream, 5 fpp	075354	19	0	107	126
Spring Cr.	Acclimated, 4 fpp	075359	16	18	123	157
	Acclimated, 4 fpp	075360	25	20	189	234
	Acclimated, 5 fpp	075443	18	27	128	173
	Acclimated, 5 fpp	075444	28	7	93	128
1991						
Deer Cr.	Acclimated, 5 fpp	075855	2	0	5	7
	Acclimated, 5 fpp	075856	1	0	7	8
	Direct stream, 5 fpp	075857	0	0	4	4
	Direct stream, 5 fpp	075858	0	0	9	9
Spring Cr.	Production, 5 fpp	075853	2	0	6	8
	Production, 5 fpp	075854	2	0	6	8
	Grand total of recoveries in 1994		194	182	1,094	1,470

[a] *Experimental groups include the release strategy and the target release size (fpp = fish per pound).*

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

[c] *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) of CWT fish that were harvested in the Grande Ronde River basin fisheries.*

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

[e] *Estimated total by summing all recoveries.*

Table 18b. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1993-94 return year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through February, 1998.

Brood year	Experimental group[a]	CWT code	Recoveries at weirs[b]	Other in-basin recoveries[c]	Out-of-basin recoveries[d]	Total recoveries[e]
1990	Acclimated	075357	12	0	15	27
	Acclimated	075358	14	0	26	40
	Direct stream	075355	4	0	31	35
	Direct stream	075356	3	0	16	19
1991	Acclimated	075859	2	0	3	5
	Acclimated	075862	0	0	0	0
	Direct stream	075860	0	0	0	0
	Direct stream	075861	1	0	1	2
	Grand total of recoveries in 1994		36	0	92	128

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

[b] *Actual numbers 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.*

[c] *Estimated number (from creel surveys) of total CWT fish that were harvested in the Imnaha River basin fishery.*

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

[e] *Estimated total by summing all recoveries.*

Table 19. Catch and escapement distribution of adult summer steelhead by recovery location for the 1993-94 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through February, 1998.

	Wallowa Stock			Imnaha Stock		
Location	Estimated CWT recoveries	Total return	Percent of total return	Estimated CWT recoveries	Total return	Percent of total return
Ocean catch	0	0	0.0	1	4	0.8
Columbia River						
Treaty net	468	2,766	32.0	53	183	37.8
C and S	0	0	0.0	0	0	0.0
Sport	188	1,122	13.0	30	101	20.9
Test	4	29	0.3	0	0	0.0
Tributary sport	1	10	0.1	0	0	0.0
Deschutes River						
Sport	62	417	4.8	6	20	4.1
C and S	0	0	0.0	0	0	0.0
Strays						
Outside Snake R. Basin	54	344	4.0	1	3	0.6
Within Snake R. Basin*	5	13	0.2	0	0	0.0
Snake River sport, tribs.*	312	2,133	24.7	1	3	0.6
Oregon tributaries*	182	818	9.5	0	29	6.0
Hatchery weir*	194	989	11.4	36	141	29.2
Total estimated return	1,470	8,641	100.0	128	484	100.0
Return to compensation area	693	3,953		37	173	
Percent of compensation goal		43.0			8.7	

** 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. Total returns to the hatchery weir and harvest in Oregon tributaries are actual numbers.*

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