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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 1995 and 1996. 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 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 1995 and 1996 work statements (Carmichael 1995, 1996). Coded-wire tag (CWT) data that were collected from 1995-1996 adult returns is used to evaluate smolt-to-adult survival rates in experimental rearing and release groups. In 1995-1996, experimental treatments from which fish returned included acclimated vs. direct stream for steelhead and size-at-release for both steelhead and Chinook. In 1995-1996, experimental treatments for which fish were released included size-at-release, exercise, acclimation, and low density treatments for Chinook, acclimated vs. direct stream for both steelhead and Chinook, and forced vs. volitional release for steelhead. 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, 1987, 1988a, 1988b, 1989; Messmer *et al.*, 1989, 1990, 1991, 1992, 1993; Flesher *et al.*, 1991, 1992, 1993, 1994; Whitesel *et al.*, 1993; and Jonasson *et al.*, 1994), and United States v. Oregon production report (Carmichael *et al.*, 1986b). Progress for related work completed during 1995-1996 is presented in the summer steelhead creel (Flesher *et al.*, 1995, 1996), and the residual steelhead (Jonasson *et al.*, 1995, 1996) 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 1990-1993 brood years returned to spawn, Chinook from the 1993-1994 brood were released as smolts, and adult Chinook that returned to spawn were used to create the 1995 and 1996 broods. During the period covered in this report, steelhead from the 1991-1993 broods returned to spawn, steelhead from the 1994 and 1995 broods were released as smolts, and adult steelhead that returned to spawn were used to create the 1995 and 1996 broods.

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EXECUTIVE SUMMARY

Objectives

1. Document spring Chinook salmon and 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 spring Chinook and summer steelhead smolts.
3. Document Chinook salmon and summer steelhead adult returns by stock to each LSRCP broodstock collection facility.
4. 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.
5. Coordinate spring Chinook broodstock marking programs for Lookingglass Fish Hatchery.
6. 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.
7. Conduct index, extensive, and supplemental spring Chinook salmon spawning ground surveys in selected streams in Northeast Oregon.
8. Identify hatchery and wild origin for carcasses collected on spawning ground surveys in the Grande Ronde Basin.
9. Monitor natural spawning of summer steelhead in selected areas within the Grande Ronde Basin.
10. 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

Spring Chinook Salmon

In 1995 and 1996 we released 590,118 1993 brood and 91,240 1994 brood into the Imnaha river. The 1993 brood Imnaha Chinook releases included groups for evaluation

of acclimation, direct stream, and size-at-release. The 1994 brood Imnaha releases included groups for evaluation of rearing density. In 1995, 99.7% of the releases were recognizably marked with ad-clips and in 1996, 99.9% were recognizably marked. In the Grande Ronde Basin we released 658,250 Rapid River stock smolts in 1995, and 139,112 smolts in 1996. In 1995, 99.9% were recognizably marked and in 1996, 99.6% were ad-clipped. The 1993 and 1994 brood Rapid River releases included groups for evaluation of exercise and density.

In 1995, we trapped 30 hatchery and 38 naturally produced Chinook on the Imnaha River and in 1996 we trapped 84 hatchery and 145 naturally produced fish. In 1995, we began trapping Rapid River stock adults destined for Lookingglass Fish Hatchery at Lower Granite Dam. This trapping effort was initiated to reduce the number of stray hatchery fish on the spawning grounds in the Grande Ronde Basin.

In 1995, we trapped 138 Rapid River stock Chinook at Lower Granite Dam and 39 at Lookingglass Fish Hatchery. In addition, 34 natural fish were trapped at Lookingglass Fish Hatchery. In 1996, we trapped 572 Rapid River stock fish at Lower Granite Dam and 49 at Lookingglass Fish Hatchery. We also trapped 50 natural fish at Lookingglass Fish Hatchery. We estimated that 183 and 187 hatchery Chinook salmon returned to the LSRCP compensation area in 1995 as a result of hatchery releases in the Grande Ronde and Imnaha basins. These returns achieved only 5.7% and 9.1% of the adult compensation goals, respectively. In 1996, we estimated that LSRCP hatchery releases in the Grande Ronde Basin produced a return of 587 Chinook to the compensation area (25.5% of goal). The return of Imnaha hatchery Chinook was 188 achieving 5.9% of the goal. Few carcasses were recovered on spawning ground surveys in 1995, and we found only one hatchery stray in the Wenaha river. In 1996, we recovered 144 carcasses in the Grande Ronde Basin and found six hatchery strays (4.2%).

Summer Steelhead

In 1995, we released 1,402,994 Wallowa stock steelhead smolts into the Grande Ronde Basin and 338,512 Imnaha stock smolts into the Imnaha River Basin. In 1996, we released 1,356,344 smolts into the Grande Ronde Basin and 322,103 into the Imnaha Basin. In 1995 and 1996, experimental groups were released at the Little Sheep Creek and Big Canyon facilities for evaluation of acclimated and direct stream releases. In addition in 1996, we released experimental groups to evaluate forced and volitional release strategies at Wallowa Fish Hatchery. A total of 318 and 349 Wallowa stock steelhead returned to Wallowa Hatchery and Big Canyon respectively in 1995. In addition, we trapped and released 31 natural steelhead at Big Canyon. At the Little Sheep Facility, we trapped 278 hatchery and 17 naturally produced fish. Of these, we released 34 hatchery and 12 natural steelhead above the weir.

In 1996, 988 and 498 hatchery fish returned to Wallowa Hatchery and Big Canyon respectively. We also trapped and released 29 natural fish at Big Canyon. At Little Sheep Creek 442 hatchery fish and 47 natural fish returned. During spawning in the

spring of 1995, we collected 1,602,367 Wallowa stock eggs and 341,925 Imnaha stock eggs. In 1996, we collected 2,781,565 Wallowa stock eggs and 728,244 Imnaha stock eggs. We estimated that 2,232 Wallowa stock hatchery steelhead returned to the LSRCPC compensation area in 1995 (24.3% of goal) and 3,976 returned in 1996 (43.3% of goal). The return of Imnaha steelhead was 320 (16.0% of goal) in 1995 and 626 (31.3% of goal) in 1996.

SECTION I

SPRING CHINOOK SALMON

The main objective of this report section is to document fish culture performance for spring Chinook salmon at LSRCPC 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 1993 and 1994 brood years (BY) of juvenile Chinook; the collection, spawning and adult characteristics for the 1995 and 1996 returns of adult Chinook salmon, and the collection of 1995 and 1996 BY eggs.

Juveniles

1995

Egg to smolt survival rates for 1993 BY Imnaha and Rapid River stock Chinook was within the normal range observed in past years (Table 1). The smolt production goal for 1993 BY Rapid River stock was set below the mitigation goal of 900k to provide rearing space for Imnaha Chinook. The release of 658,230 smolts was well below the goal. The release of 590,118 1993 BY Imnaha stock smolts was the largest since the program began. This production level far exceeded the mitigation goal of 490,000. This production level was a result of a large number of hatchery returns that were surplus to that needed to pass above the weir to spawn naturally. The decision to not sacrifice any hatchery fish resulted in a greater number of fish being spawned than originally planned. We implemented a complex marking program for 1993 brood Chinook (Table 2). We attempted to mark 100% of the 1993 BY Imnaha Chinook with an adipose clip and the hatchery-hatchery crosses also received a left ventral clip. We attempted to mark 100% of the 1993 BY Rapid River stock smolts with Ad-RV+CWT. This mark was applied to allow for trapping, identification, and removal of Lookingglass produced Rapid River stock adults at Lower Granite Dam. We achieved a mark rate of 96%.

The 1993 BY Imnaha stock juveniles were reared in nine raceways. To evaluate size-at-release (15 versus 25 fish/lb.) and release type (acclimation versus direct stream), we marked six raceways with unique CWT codes (Table 3). Smolts targeted for 15 fish/lb. were smaller than target and those targeted for 25 fish/lb. were larger. Because of the large production numbers for the 1993 BY two periods of acclimation were required resulting in a range of release dates from 28 March until 5 May 1995.

Rapid River stock Chinook juveniles were reared in eight raceways. To evaluate rearing density and exercise, we marked eight raceways with unique CWT codes (Table 3). The release size target for all smolts was 20 fish/lb. and the size-at-release ranged from 19.5-22.3 fish/lb. All smolts were released directly into Lookingglass Creek on 5 April 1995.

Smolt migration performance was monitored by measuring the percentage of each PIT-tagged group detected at mainstem dams. Detection rates for Rapid River stock were higher than rates for Imnaha stock. We observed this same relationship in past years. Two groups of Imnaha smolts released in April performed poorly in comparison to other groups released in March (Table 3).

1996

Egg to smolt survival rates for 1994 BY Imnaha and Rapid River Chinook were on the high end of the normal range observed in past years (Table 4). The smolt production goal for the 1994 brood Rapid River Chinook was set at 500,000, well below the mitigation goal of 900,000. This reduced production goal was one of the actions taken in the transition from the non-local origin Rapid River stock to local origin broodstocks. The release of 139,112 1994 BY smolts was below the production goal. This low level of production was a result of poor returns of Rapid River stock adults in 1994. The release of 91,240 1994 BY Imnaha smolts was far below the mitigation goal of 490,000. This low level of smolt production was the result of a poor return in 1994 and broodstock collection strategies that placed a significant proportion of trapped hatchery and natural fish above the weir to spawn naturally. We attempted to mark 100% of the 1994 BY Rapid River stock smolts with Ad-RV+CWT. We had a poor mark rate with the RV clip as we achieved only an 82.5% clip rate (Table 5).

The 1994 BY Imnaha Chinook were reared in six raceways at Lookingglass Fish Hatchery. To evaluate the influence of density on smolt to adult survival, we marked all six raceways with unique CWT codes. Due to the low production levels all Imnaha Chinook were reared at moderate to low densities. All Imnaha Chinook smolts were acclimated at the Imnaha Facility and released on 2 April 1996 (Table 6). Rapid River Chinook were reared in four raceways. To evaluate the benefits of moderate exercise, we marked all four raceways with unique CWT codes. Rearing densities for the 1994 BY Rapid River stock were about 50% of normal past practices. All Rapid River stock smolts were released from Lookingglass Fish Hatchery on 4 April 1996. Smolt migration success was monitored based on PIT-tag observations at mainstem dams. We observed poorer migration rates for the 1994 BY than we observed for the 1993 BY (Table 6).

Adults

1995

The Imnaha weir was installed later in 1995 than at any time in the past and far later than the target date of 15 June. We began trapping on 26 July (Table 7). Due to the late date of the start of trapping and the small predicted run size all adults that were trapped at the weir were retained for broodstock. In contrast, in 1994 we released 69% of trapped adults above the weir to spawn naturally. We were unable to make a mark-recapture estimate above the weir because no fish were released. However, based on past years' run timing we believe a majority of the run escaped above the weir location prior to weir installation. We trapped and retained 30 hatchery and 38 natural fish (Table 8).

We determined age structure of the Imnaha returns based on CWT age, scale age, and length-at-age relationships (Figure 1). Age-at-return information is presented in Table 8. Both hatchery and natural origin fish had a high proportion of age 3 males. Prespawning mortality for Imnaha Chinook held at Lookingglass Fish Hatchery was 10.3%. We spawned a total of 15 females with natural fish comprising 59% of the fish that were spawned. We collected 68,121 eggs, which was well below the egg-taking goal (Table 9). Eggs collected in 1995 were incubated at Lookingglass Fish Hatchery.

In 1995, we began trapping Lookingglass-produced Rapid River Chinook at Lower Granite Dam. A total of 138 Ad-RV+CWT Chinook were collected at Lower Granite Dam and transported to Lookingglass Fish Hatchery. In addition, 39 Rapid River and 34 natural fish were trapped at Lookingglass Fish Hatchery. We did not release any fish above the hatchery to spawn naturally due to disease concerns. Prespawning mortality for marked and unmarked fish was 7.6%, and we spawned 52 females (Table 8). We used spawning matrices to increase the number of family groups. Both natural and hatchery fish were spawned which resulted in pairing of hatchery x hatchery, natural x hatchery, and natural x natural. We collected a total of 209,357 eggs from Rapid River stock and all eggs were incubated at Lookingglass Fish Hatchery. The egg mortality rate to shocking was 5%, which is low in comparison to past years (Table 9). We determined age structure of Rapid River returns based on CWT age, scale age, and length-at-age (Figure 2). Age-at-return is presented in Table 8.

1996

The Imnaha weir was installed on 16 July in 1996, well after the target date of 15 June (Table 10). We retained about 50% of the Age 4 and Age 5 hatchery and natural fish for broodstock. The remaining fish were released above the weir to spawn naturally. We trapped a total of 99 hatchery and 145 naturally produced fish and retained 76 hatchery and 72 natural fish. We killed 15 hatchery jacks that were not used in the spawning (Table 11). Age structure was determined from CWT age, scale age, and length-at-age relationships (Figure 3). Age 3 hatchery males comprised a significant proportion of the males that returned. Age 4 wild males were the predominant age group in the wild component and few age 3 fish returned. Prespawning mortality of Imnaha Chinook held at Lookingglass for combined and natural fish was 17.3%. We spawned a total of 24 females with natural fish comprising 72.1% of fish spawned. We collected

110,146 eggs which was well below our goal (Table 12). The mortality to shocking was 7% overall for the 14 family groups spawned. Imnaha eggs collected in 1996 were incubated at Lookingglass Fish Hatchery.

In 1996 we trapped Rapid River stock Chinook at Lower Granite Dam and at Lookingglass Fish Hatchery. A total of 572 Ad-RV+CWT marked Chinook were collected at Lower Granite Dam and transported to Lookingglass and Wallowa hatcheries. In addition, 49 Rapid River and 105 natural fish were trapped at Lookingglass Hatchery. We released 50 natural fish above the Lookingglass weir to spawn naturally (Table 11). Prespawn mortality was high in 1996 at 40.1%. Much of this mortality occurred at Wallowa Hatchery. Hatchery and natural fish were spawned separately at Lookingglass Fish Hatchery (Table 12). We spawned 20 natural females and a total of 160 hatchery females. We collected a total of 72,585 eggs from natural x natural crosses, and 633,619 eggs from hatchery x hatchery crosses (Table 12). The eggs from the hatchery parents were transported to Irrigon Hatchery for incubation and early rearing, and the eggs from the natural parents were retained at Lookingglass Fish Hatchery for incubation.

Experimental group returns

1995

Adult returns and fisheries recoveries from each stock of Chinook salmon are used to evaluate hatchery treatments and to assess the success of achieving mitigation goals and management objectives. We mark experimental groups as well as groups that represent production with coded wire tags to provide information on survival, harvest, escapement, and straying.

Returns to the Imnaha basin in 1995 contained hatchery fish from three brood years. The number of recoveries of each CWT code were summarized from the CWT recovery database maintained by the Pacific States Marine Fisheries Commission and from the ODFW database. To account for hatchery fish that spawn in nature we develop expansion factors as described in Carmichael et al. (1994). We recovered 29 fish with CWT's at the Imnaha weir and none were passed to spawn naturally. We estimated that 77 CWT fish escaped above the weir prior to weir installation and 77 CWT fish spawned below the weir (Table 13).

Returns of CWT groups of Rapid River stock were also expanded to account for fish that returned to the river but were not sampled. We recovered 27 CWT fish at Lookingglass Hatchery and 130 CWT fish at Lower Granite Dam. We did not pass any fish above the hatchery to spawn naturally and 16 were estimated to have spawned naturally (Table 14). There were no Carson stock that returned in 1995. We did not capture any stray hatchery fish at the Imnaha or Lookingglass Hatchery weirs.

1996

Returns to the Imnaha basin in 1996 contained hatchery fish from three brood years. We recovered 55 fish with CWT's at the Imnaha weir and passed 23 above the weir to spawn naturally. We estimated that 39 escaped above the weir prior to installation and that 71 CWT fish spawned below the weir (Table 15).

We recovered 37 CWT fish at Lookingglass Fish Hatchery and 557 at Lower Granite Dam (Table 16). We did not pass any marked fish above the hatchery to spawn naturally and estimated that only 7 spawned below the weir. Three tagged groups of Rapid River fish of the 1992 brood year survived very poorly. One group had been released at Hells Canyon Dam and two others were released in early May well after the other groups. The delayed release date was a result of an extended rearing period to treat for Erythrocytic Inclusive Body Syndrome. No stray hatchery fish were recovered at Lookingglass Hatchery or the Imnaha River weir in 1996. Length frequency of Rapid River adults is presented in Figure 4.

Compensation goals

1995

The total number of hatchery produced fish for each stock that are recovered in fisheries, escape to the stream of release or stray within or outside the Snake River basin can be estimated based on recoveries of CWT fish. To calculate the return to the LSRCP Compensation area, which is defined as the Snake River basin above Ice Harbor Dam, we summed all estimated recoveries for the 1995 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 non-CWT fish that were released. Nearly all of the CWT recoveries for hatchery Chinook that were released in the Grande Ronde and Imnaha basins occurred in the Snake River basin (Table 17).

We did not reach the compensation goal for either Imnaha or Grande Ronde basins in 1995. We estimated that we only achieved 5.7% of our goal for the Imnaha Basin and 9.1% for the Grande Ronde Basin. Two factors contributed to the poor returns in 1995. Smolt production for the 1990 and 1991 brood years of Imnaha Chinook were at or below 30% of the production goal. However, poor smolt-to-adult survival was the primary factor causing the poor return. Similarly for Rapid River stock Chinook released in the Grande Ronde Basin poor smolt-to-adult survival was the factor that caused the low adult return.

The Imnaha supplementation evaluation program provides information to evaluate the replacement rates (progeny-to-parent ratios) of the hatchery and natural populations. The hatchery component progeny-to-parent ratio for the 1990 brood was the lowest observed since the program began in 1982 at 0.5. The ratio for the natural spawning population was 0.2. The ratio for the 1989 brood represented the seventh year in a row that the natural spawning fish did not replace themselves (Figure 5). One of the primary objectives of the Imnaha hatchery program is to enhance natural production. However, because replacement rates have been below 1.0 seven consecutive years we have seen a steady decline in the number of naturally produced fish that return to the basin (Figure 6.)

1996

We did not reach the compensation goal in 1996 for either the Imnaha or Grande Ronde basins. We estimated that we reached 5.9% of the goal for the Imnaha and 26.0% of the goal for the Grande Ronde Basin (Table 18). Similar to 1995 the two primary factors causing low returns were poor smolt-to-adult survival and smolt releases that were below the goal.

The progeny-to-parent ratio for the fish that spawned naturally in 1991 was 0.2, which was equal to the lowest value observed since monitoring began with the 1982 brood year (Figure 7). This represented the eighth year in a row that productivity has been well below replacement. Although the ratio for the hatchery component was better than for naturally spawning fish it was still poor at 1.0. The number of natural fish that returned to the basin was slightly higher than 1995, but was well below levels observed in the late 1980's (Figure 8).

Natural Escapement Monitoring

1995

Stream surveys to enumerate Chinook salmon redds and to sample salmon carcasses were conducted as in previous years (see Keefe *et al.*, 1994). During the surveys conducted in 1995, we observed a total of 80 redds and recovered 20 carcasses in the Grande Ronde River basin. We recovered one stray hatchery fish on the spawning grounds in the Wenaha River. This fish was released from Lookingglass Hatchery in 1993 (Table 19). Marked hatchery strays comprised 5.0% of the carcasses recovered on spawning grounds (Table 20). We observed far fewer marked hatchery fish in 1995 than has been observed in recent years. This reduction in stray hatchery fish spawning in nature is a result of the trapping of Lookingglass destined hatchery fish at Lower Granite Dam.

In the Imnaha basin we counted a total of 49 redds and recovered 19 carcasses. All of the marked hatchery fish recovered were Imnaha hatchery fish, thus no out-of-basin strays were observed (Table 19). The age composition of Chinook salmon recovered on spawning grounds is presented in Table 21.

1996

We observed a total of 306 redds and recovered 141 carcasses on the spawning grounds in the Grande Ronde Basin in 1996. We recovered five marked hatchery strays including three in the Lostine River, two in the Minam River, and one in the Wenaha River (Table 22). With the exception of one hatchery fish recovered in the Minam River, all hatchery fish were produced at and released from Lookingglass Hatchery. The one exception was a stray from Dworshak National Fish Hatchery. Hatchery strays comprised 3.6% of the total carcasses recovered (Table 23). The age comparison of Chinook salmon recovered on spawning grounds is presented in Table 24.

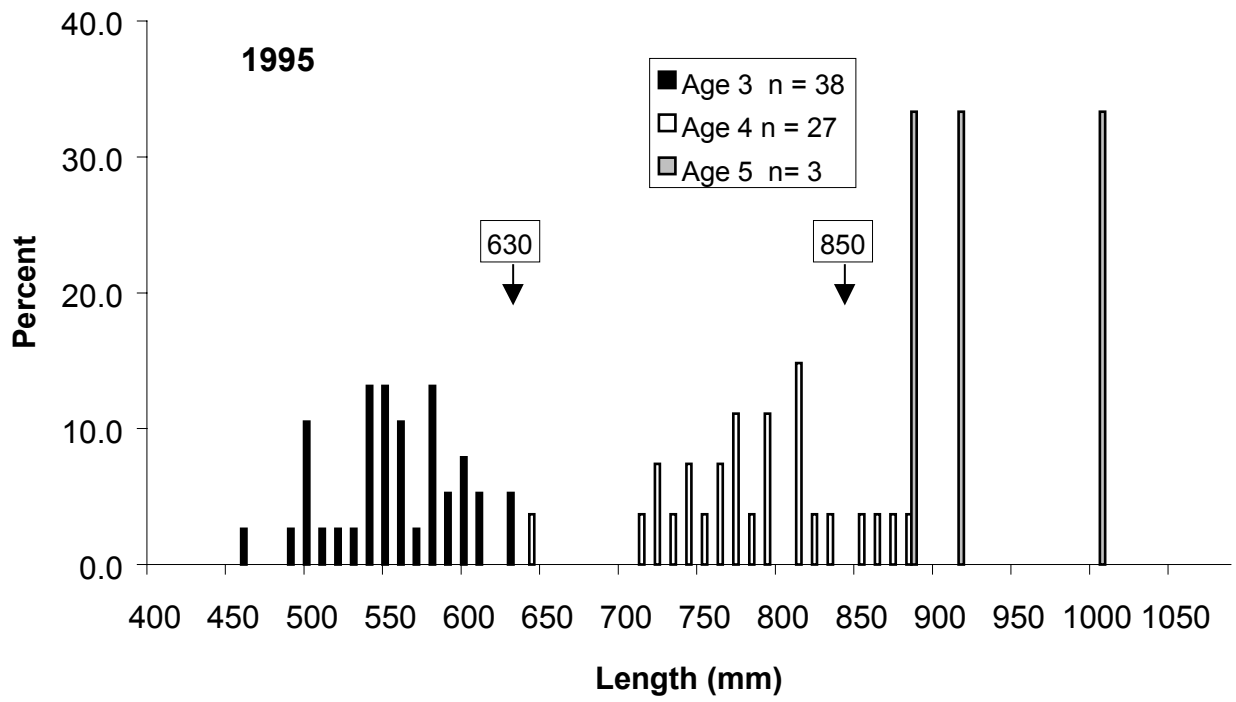
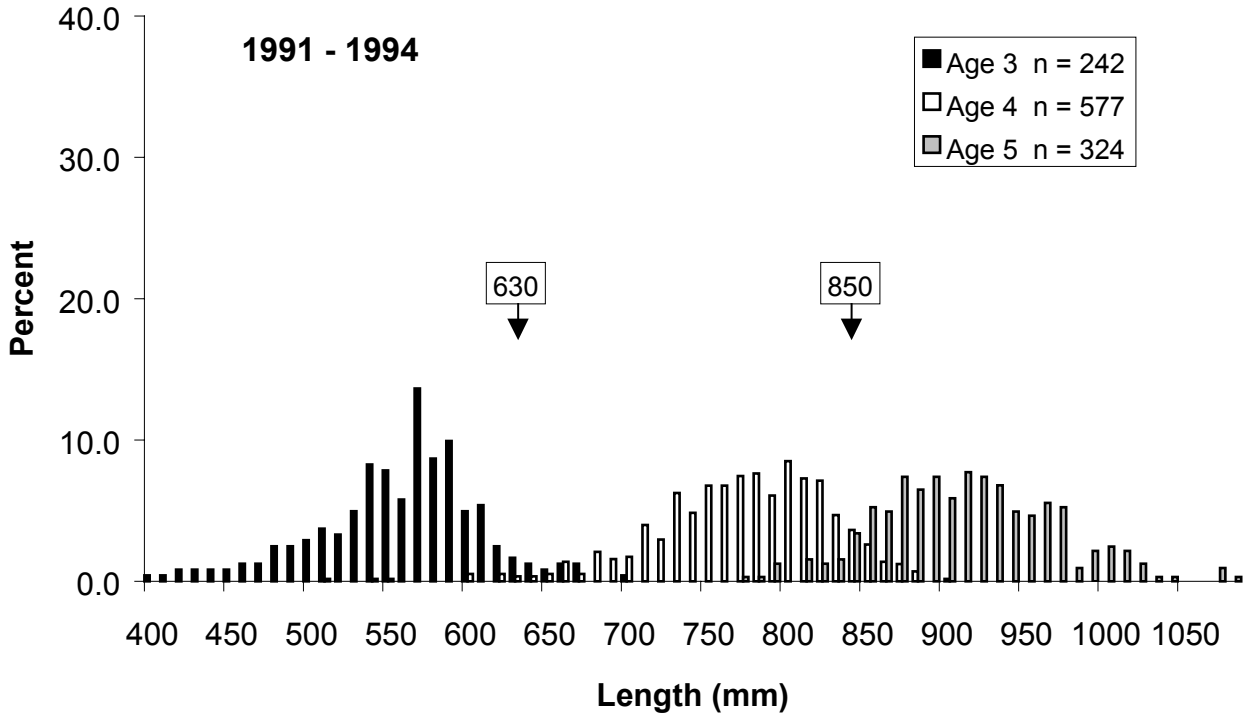


Figure 1. Length-at-age relationship for Imnaha stock Chinook salmon adults used as hatchery broodstock in 1995.

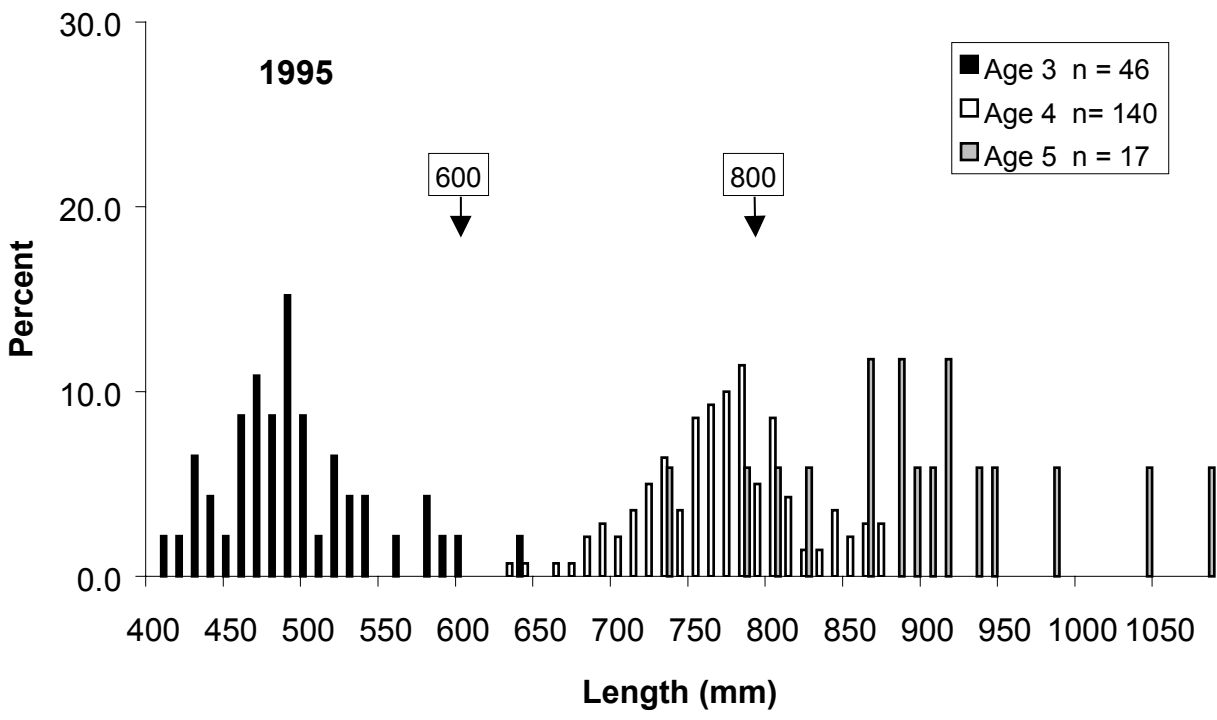
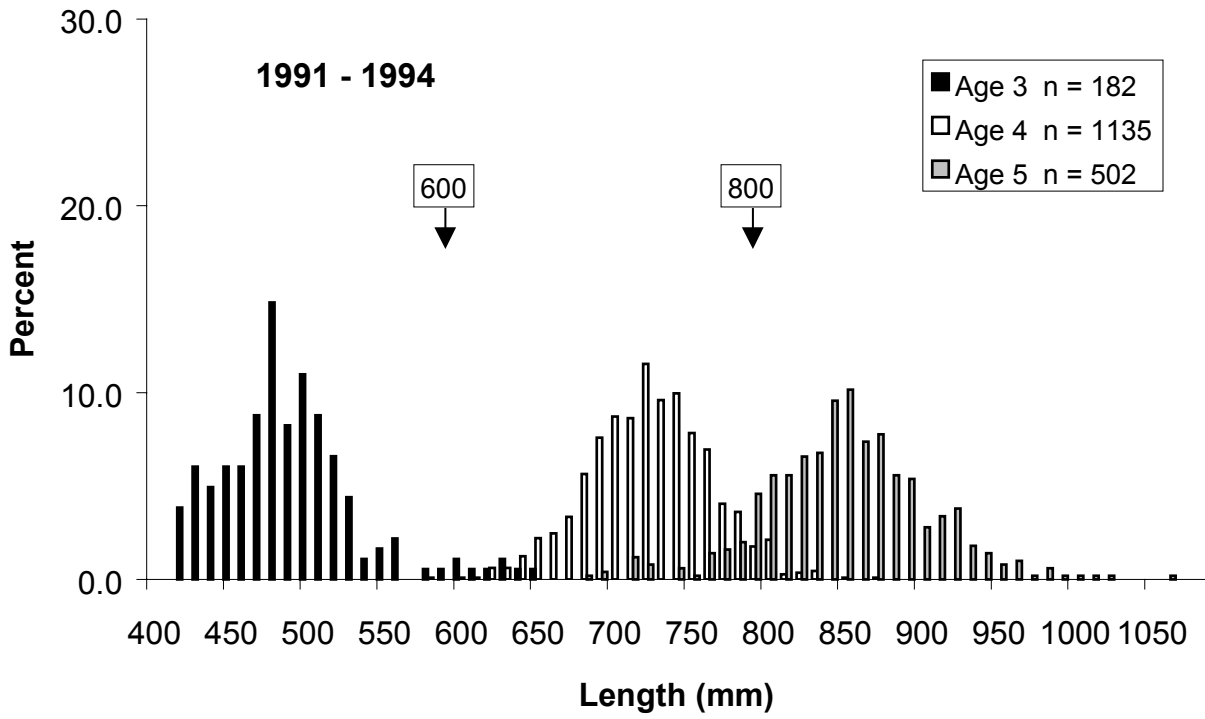


Figure 2. Length-at-age relationship for Rapid River stock Chinook salmon adults used as hatchery broodstock in 1995.

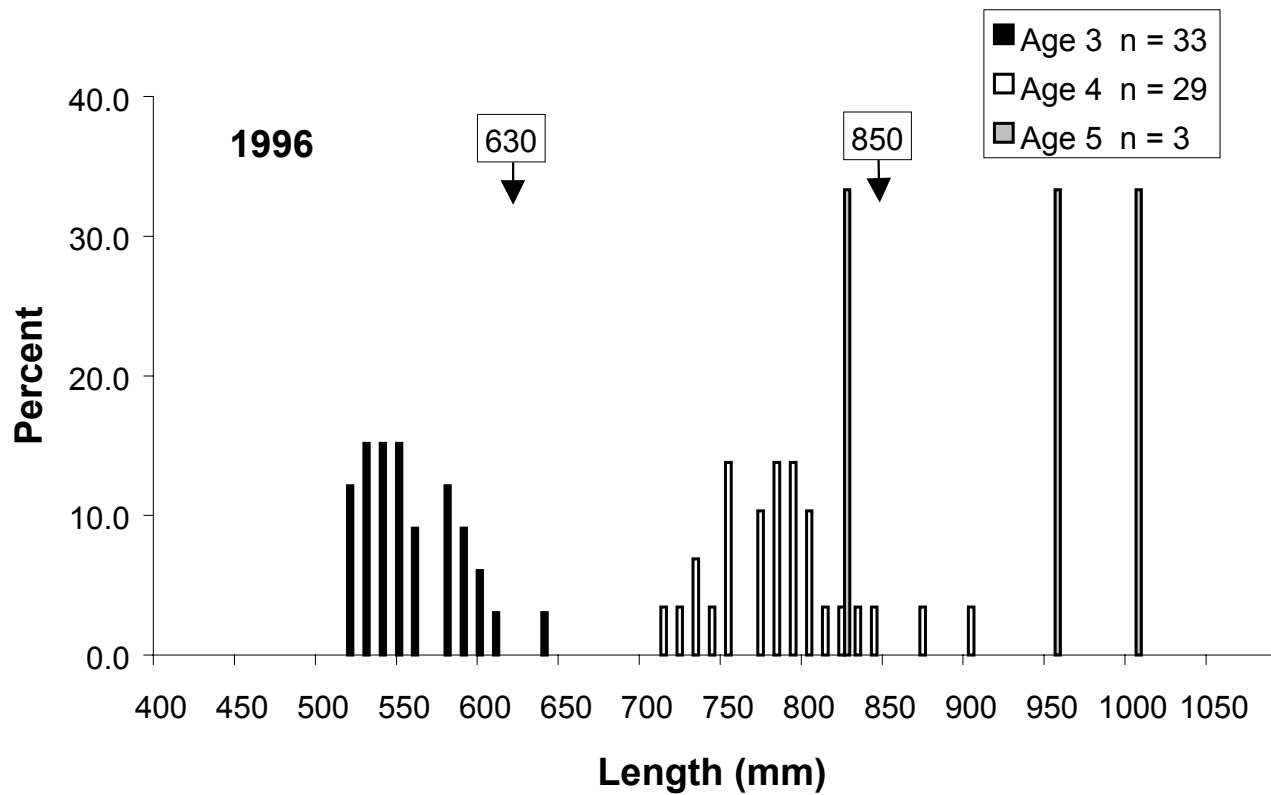
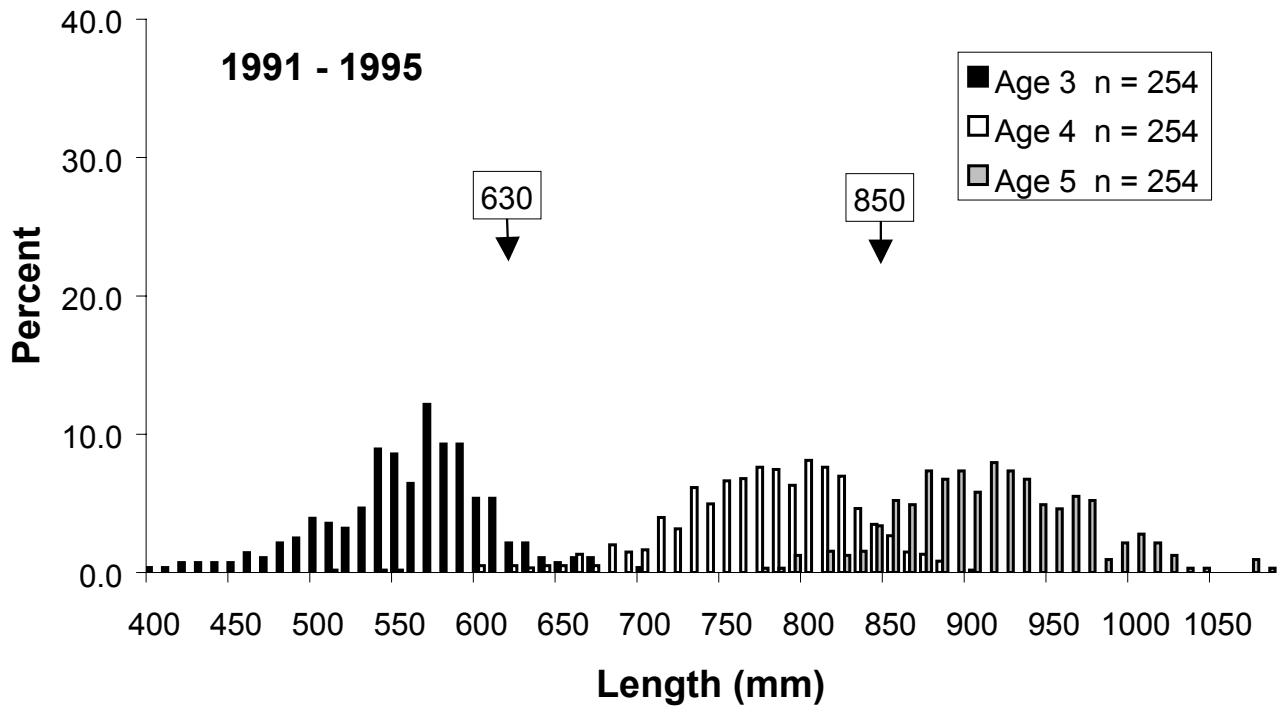


Figure 3. Length-at-age relationship for Imnaha stock Chinook salmon adults used as hatchery broodstock in 1996.

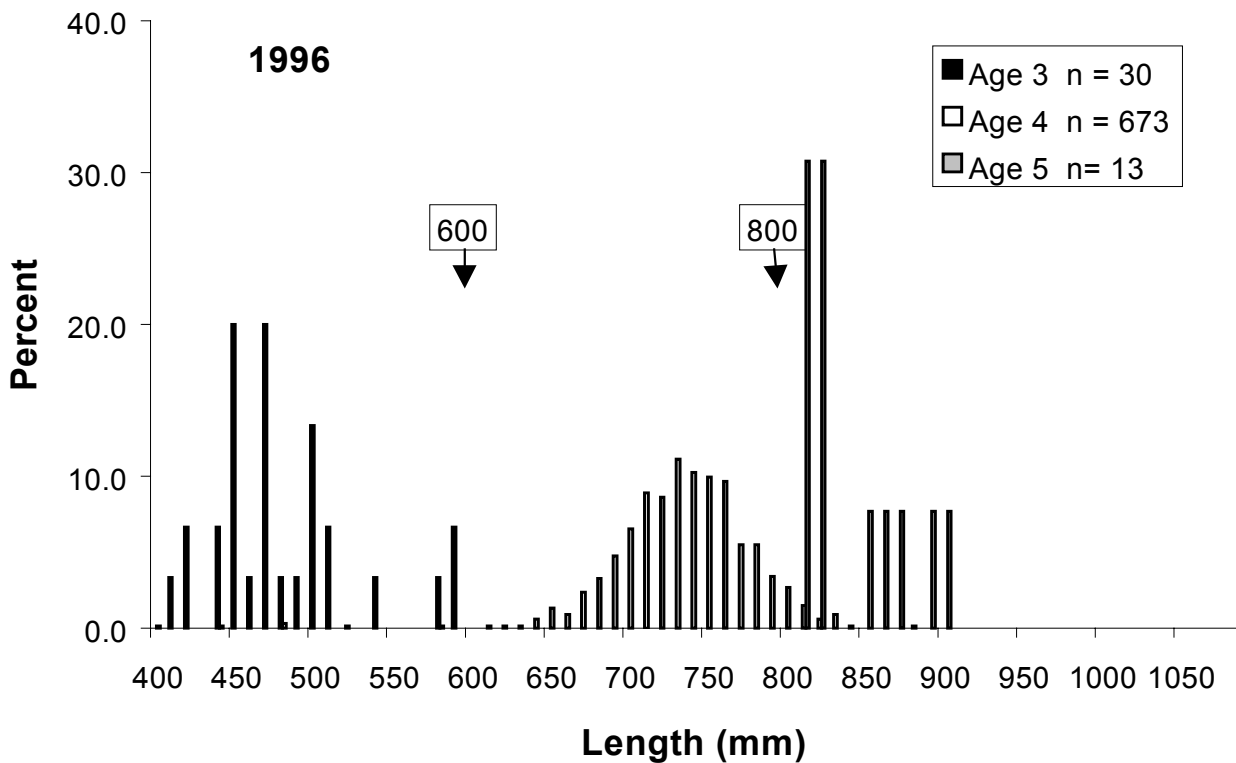
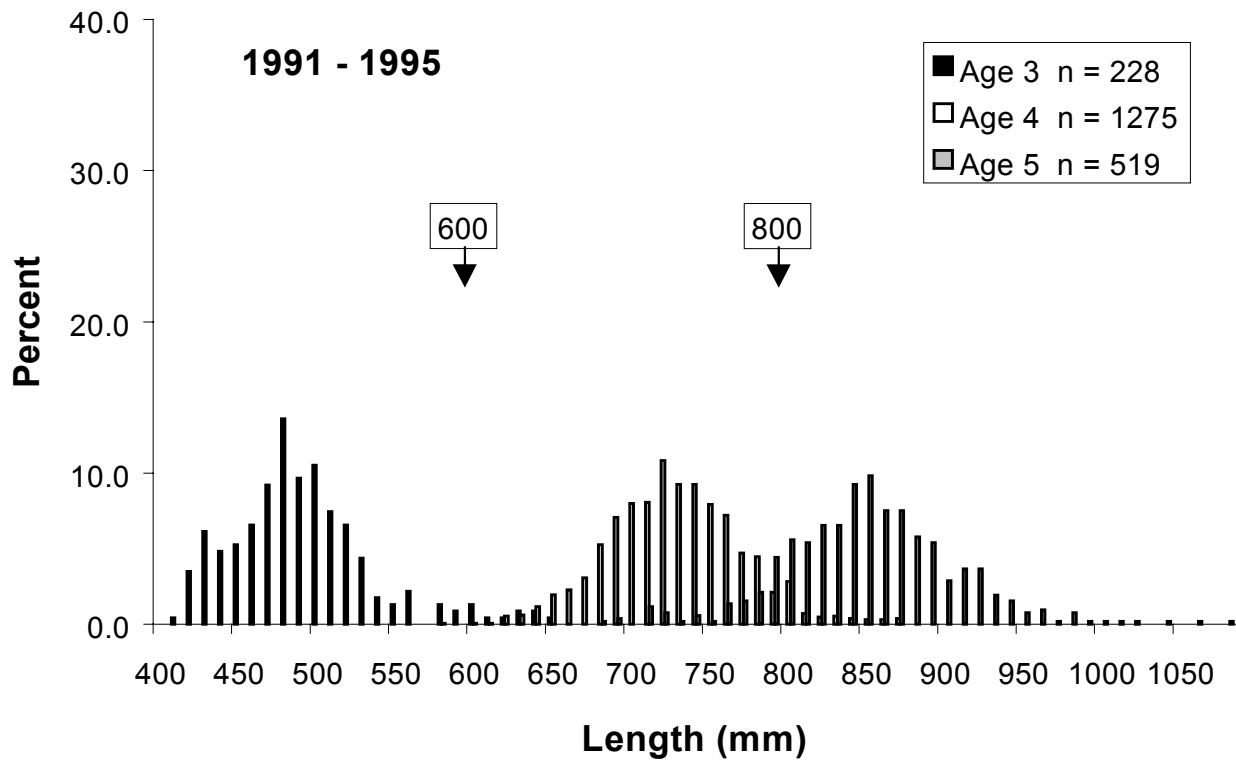


Figure 4. Length-at-age relationship for Rapid River stock Chinook salmon adults used as hatchery broodstock in 1996.

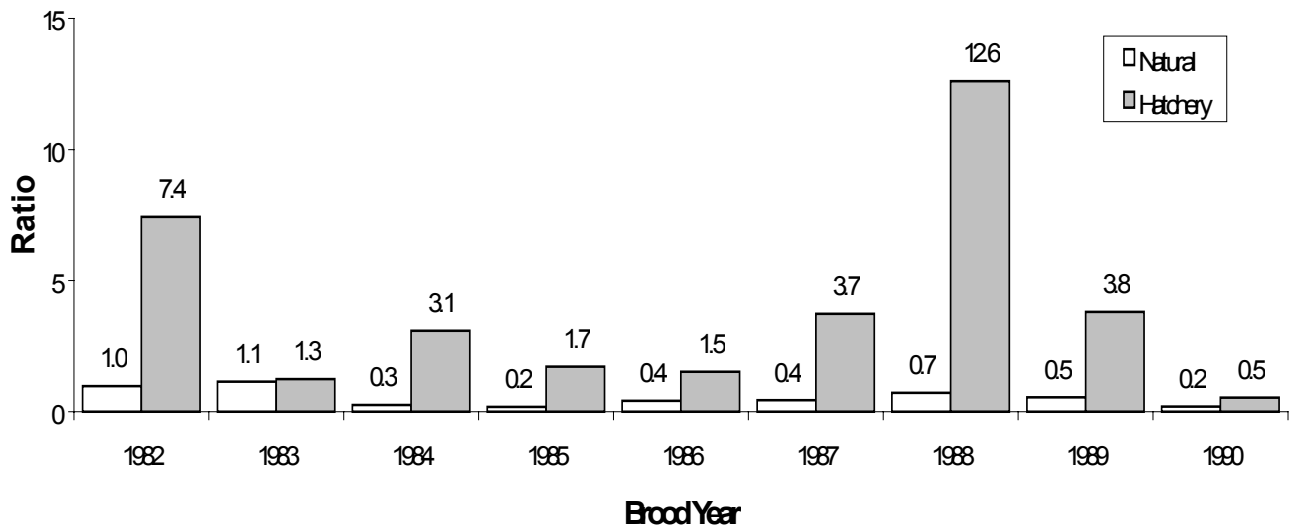


Figure 5. Progeny-to-parent ratios for completed brood years (1982-90) of Imnaha River Chinook salmon.

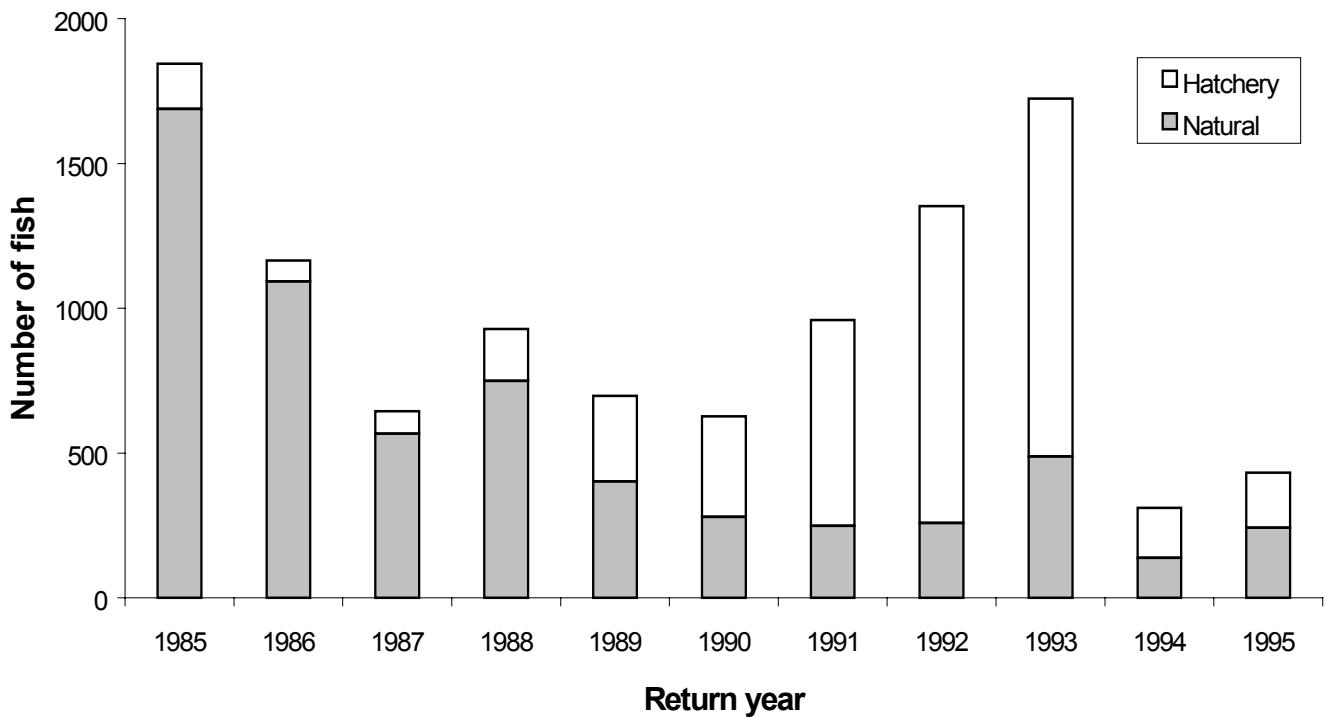


Figure 6. Estimates of natural- and hatchery-origin Chinook salmon spawning in the Imnaha River, 1985-95.

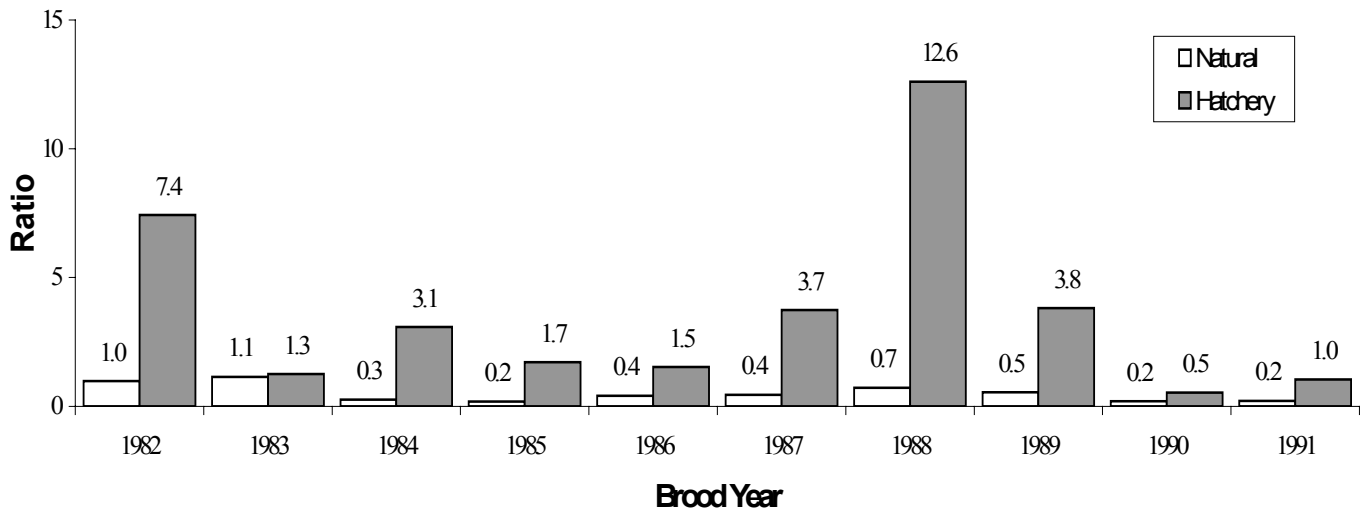


Figure 7. Progeny-to-parent ratios for completed brood years (1982-91) of Imnaha River Chinook salmon.

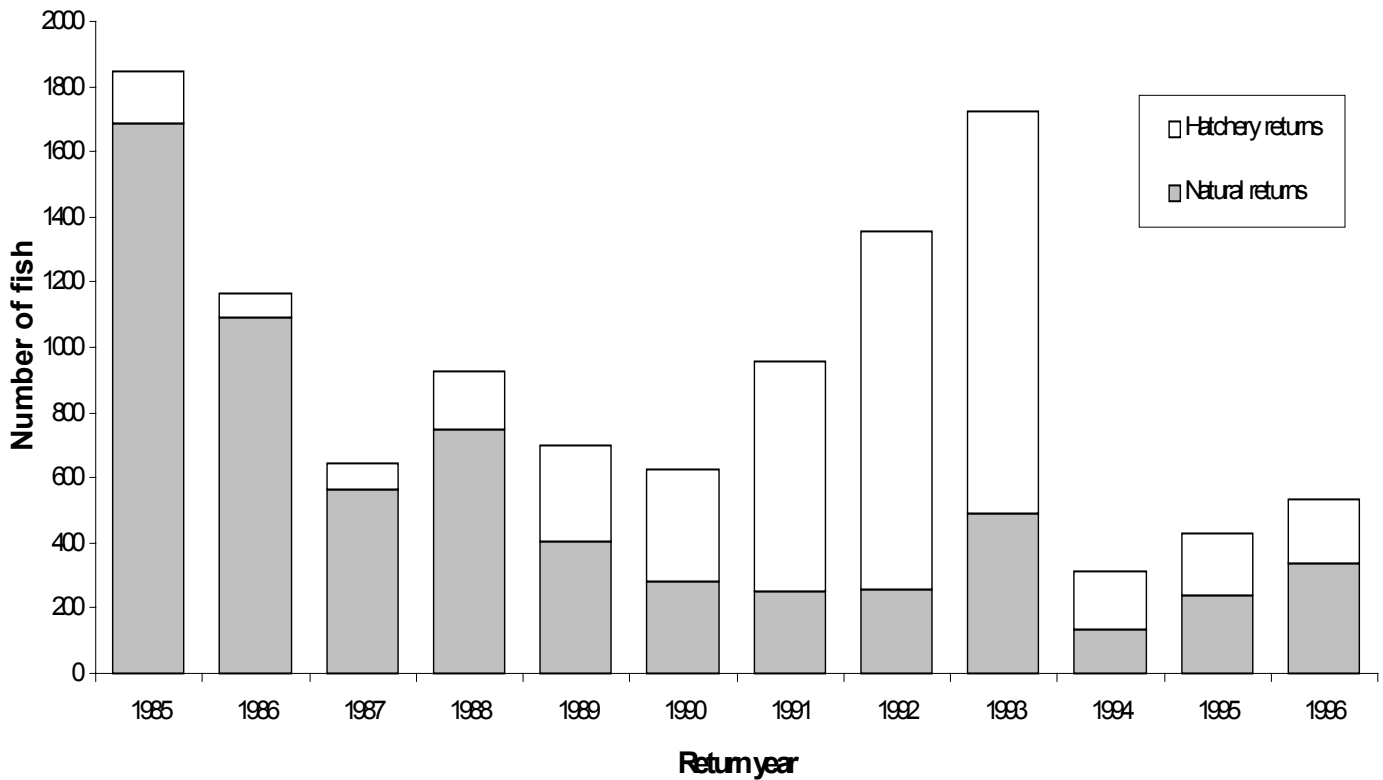


Figure 8. Estimates of natural- and hatchery-origin Chinook salmon spawning in the Imnaha River, 1985-96.

Table 1. Rearing summaries for juvenile spring Chinook salmon from the 1993 brood year released in the Grande Ronde and Imnaha river basins in 1995.

Stock	Number of eggs taken	Eyed Embryos	Estimated Survival Rate (%)		Total fish released ^a
			Egg to embryo	Embryo to smolt	
Imnaha	1,047,064	1,018,820	97.3%	80.2% ^b	590,118 ^b
Rapid River	1,071,616 ^c	999,072	93.2%	88.5% ^d	658,230

^a Includes all fish released (adipose clipped and coded-wire tagged plus unrecognizable marks, target 100% marked, see Table 2).

^b Does not include 283,047 pre-smolts released into the Imnaha River and tributaries to the Imnaha River in July 1994.

^c Does not include 236,000 eggs shipped to the Nez Perce Tribe as gametes.

^d Does not include 255,072 eyed eggs euthanized because they were excess to program needs.

Table 2. Estimates of percent fin clip and coded-wire tag application success for 1993 brood year spring Chinook salmon reared at Lookingglass Fish Hatchery and released in 1995. 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		No Ad clip		RV Clip	No RV Clip
		with CWT	Ad clip No CWT	No Ad clip with CWT	No Ad clip No CWT		
<i>Imnaha stock^a</i>							
14.0 g/l, Acclimated, 9	311	99.0	1.0	0	0	-	-
14.0 g/l, Acclimated, 16	309	98.7	1.0	0	0.3	-	-
11.0 g/l, Acclimated, 17	346	96.0	3.5	0.3	0.3	-	-
13.0 g/l, Acclimated, 18	312	98.1	1.3	0.6	0	-	-
11.0 g/l, Direct stream, 13	311	98.7	1.0	0.3	0	-	-
11.0 g/l, Direct stream, 14	327	96.6	3.1	0.3	0	-	-
Average	319	97.9	1.8	0.3	0.1	-	-
<i>Rapid River stock</i>							
16.0 g/l,20/lb,1	320	98.7	1.3	0	0	95.9	4.1
16.0 g/l,20/lb,2	314	97.5	2.5	0	0	99.0	1.0
16.0 g/l,Exercise,3	318	98.1	1.3	0.6	0	99.1	0.9
13.4 g/l,Exercise,4	299	99.7	0.3	0	0	97.3	2.7
16.0 g/l,20/lb,5	325	87.7	12.3	0	0	97.5	2.5
16.0 g/l,20/lb,6	311	89.7	10.3	0	0	99.0	1.0
16.0 g/l,Control,7	322	96.9	3.1	0	0	98.1	1.9
13.4 g/l,Control,8	309	99.7	0.3	0	0	99.0	1.0
Average	315	96.0	3.9	0.1	0	98.1	1.9

^a Fish in ponds 10, 11, and 12 were progeny of hatchery parents and did not receive CWTs. Ponds 10 and 11 were targeted at 100% AdLV. Pond 10 received 91.1% AdLV, 5.6% LV only, 3.3% Ad only and 0.0% with no mark. Fish in pond 11 were 89.7% AdLV, 5.4% LV only, 0.0% Ad only and 4.9% no mark. Pond 15 was 100% Ad only.

Table 3. Details of experimental groups of spring Chinook salmon released in the Grande Ronde and Imnaha river basins in 1995. Experimental group indicates rearing density, experimental treatment, and rearing raceway number. Standard density is 16.1 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. 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
<i>Imnaha stock</i>										
14.0 gpl, Acclimated, 9	22.2	28 Mar 95	Imnaha Weir	070745	120 (7)	20.4 (3.4)	1.18 (0.07)	77,200	499	41.1
14.0 gpl, Acclimated, 16	21.8	28 Mar 95	Imnaha Weir	070746	120 (6)	20.8 (3.4)	1.21 (0.08)	72,015	499	45.1
11.0 gpl, Direct Stream, 17	23.0	24 Apr 95	Imnaha Weir	070747	118 (6)	19.7 (3.1)	1.18 (0.06)	64,414	496	29.8
13.0 gpl, Direct Stream, 18	23.3	28 Mar 95	Imnaha Weir	070748	118 (6)	19.5 (2.6)	1.15 (0.08)	75,831	499	40.3
11.0 gpl, Acclimated, 13	17.4	28 Mar 95	Imnaha Weir	070750	129 (6)	26.1 (4.2)	1.18 (0.07)	49,576	499	53.1
11.0 gpl, Acclimated, 14	17.6	28 Mar 95	Imnaha Weir	070751	129 (7)	25.8 (3.7)	1.22 (0.05)	47,084	498	52.4
13.7 gpl, HxH, Acclim, 10-11 ^c	22.9	06 Apr 95	Imnaha Weir	-	119 (7)	19.8 (3.5)	1.16 (0.10)	156,559	984	25.0
10.5 gpl, HxH, Acclim, 15 ^c	14.9	05 May 95	Imnaha Weir	-	135 (8)	30.4 (4.6)	1.27 (0.13)	39,255	-	-
Unrecognizable marks ^e	-	28 Mar 95	Imnaha Weir	-	-	-	-	8,184	-	-
Total Released								590,118 ^d	3,974	
<i>Rapid River stock</i>										
16.0 gpl, 20 FPP, 1	21.8	05 Apr 95	Lookingglass	070829	122 (6)	20.9 (2.9)	1.13 (0.05)	87,087	-	-
16.0 gpl, 20FPP, 2	20.2	05 Apr 95	Lookingglass	070828	122 (6)	22.5 (3.0)	1.19 (0.07)	85,509	-	-
16.0 gpl, Exercise, 3	21.1	05 Apr 95	Lookingglass	070827	122 (6)	21.5 (2.9)	1.15 (0.07)	86,435	496	61.5
13.4 gpl, Exercise, 4	19.5	05 Apr 95	Lookingglass	070826	123(6)	23.3 (3.6)	1.20 (0.07)	65,983	501	65.5
16.0 gpl, 20 FPP, 5	20.6	05 Apr 95	Lookingglass	070825	121(6)	22.0 (3.5)	1.20 (0.08)	75,678	-	-
16.0 gpl, 20 FPP, 6	20.7	05 Apr 95	Lookingglass	070854	121(6)	21.9 (3.1)	1.17 (0.06)	77,133	-	-
16.0 gpl, Control, 7	22.3	05 Apr 95	Lookingglass	070823	121(6)	20.3 (3.3)	1.13 (0.08)	84,234	495	59.2
13.4 gpl, Control, 8	20.1	05 Apr 95	Lookingglass	070822	122(6)	22.6 (3.2)	1.19 (0.10)	68,558	498	62.4
Unrecognizable marks ^e	-	05 Apr 95	Lookingglass	-	-	-	-	27,613	-	-
Total Released								658,230	1,990	

^a Equals total number released in Table 1 by stock plus fish released without recognizable marks. The April 24 release group was delayed due to an EIBS outbreak. Due to an IHNV outbreak, 53,111 were euthanized on April 19th from Pond 12.

^b Includes unique detections at all dams in the Snake and Columbia Rivers.

^c HxH indicates both parents were known hatchery origin. Smolt releases were either AdLV-No CWT (15 FPP) or LV only-No CWT (25 FPP). These fish were not considered part of the normal supplementation program.

^d Does not include 283,047 1993 BY HxH pre-smolts release in July 1994 at multiple sites in the Imnaha River Basin (Carmichael et al. 1999).

^e Defined on fish that do not have adipose clip and coded-wire-tag.

Table 4. Rearing summaries for juvenile spring Chinook salmon from the 1994 brood year released in the Grande Ronde and Imnaha river basins in 1996.

Stock	Number of eggs taken	Eyed Embryos	Estimated Survival Rate (%)		Total fish released ^a
			Egg to embryo	Embryo to smolt	
Imnaha	111,794	99,225	88.8%	92.0%	91,240
Rapid River	171,958	153,176	89.1%	90.8%	139,112

^a Includes all fish released (adipose clipped and coded-wire tagged plus unrecognizable marks, target 100% marked, see Table 2).

Table 5. Estimates of percent fin clip and coded-wire tag application success for 1994 brood year spring Chinook salmon reared at Lookingglass Fish Hatchery and released in 1996. 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		No Ad clip		RV Clip	No RV Clip
		with CWT	Ad clip No CWT	with CWT	No CWT		
<i>Imnaha stock</i>							
2.0 g/l, Acclimated, 2	311	99.7	0.3	0	0	-	-
4.0 g/l, Acclimated, 3	339	98.5	1.5	0	0	-	-
4.0 g/l, Acclimated, 4	352	96.0	3.7	0	0.3	-	-
2.0 g/l, Acclimated, 5	340	98.2	1.8	0	0	-	-
4.0 g/l, Direct stream, 6	421	98.8	1.2	0	0	-	-
4.0 g/l, Direct stream, 7	415	96.6	3.4	0	0	-	-
Average		97.9	2.0	0.0	0.1	-	-
<i>Rapid River stock</i>							
7.0 g/l, Exerc, 14	318	99.1	0.6	0.3	0	82.4	17.6
7.0 g/l, Control, 15	348	97.4	2.6	0	0	81.3	18.7
7.0 g/l, Exerc, 16	355	96.3	3.1	0.6	0	88.2	11.8
7.0 g/l, Control, 17	350	94.9	4.6	0.6	0	78.0	22.0
Average		96.9	2.7	0.4	0	82.5	17.5

Table 6. Details of experimental groups of spring Chinook salmon released in the Grande Ronde and Imnaha river basins in 1996. Group indicates experimental treatment, target size and rearing pond number. Standard density is 16.1 grams per liter at release (equal to 80,000 fish at 20 fish per pound). Sample size for Imnaha stock for length was approximately 300, and 100 for weight and condition factor. Sample size for Rapid River stock for length, weight, and condition factor was approximately 1300.

<i>Stock</i> , BY, group	Fish / lb.	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 detected ^b
<i>Imnaha</i> , 1994 Brood										
2.0 g/l,20/lb,P02	16.4	02 Apr 96	Imnaha Weir	071227	127 (9.1)	27.7 (6.6)	1.23 (0.10)	6,847	514	43.0%
4.0 g/l,20/lb,P03	17.8	02 Apr 96	Imnaha Weir	071225	129 (7.5)	25.5 (3.7)	1.33 (0.06)	13,635	710	41.7%
4.0 g/l,20/lb,P04	16.3	02 Apr 96	Imnaha Weir	071226	130 (10.0)	27.9 (10.6)	1.20 (0.08)	13,376	716	39.9%
2.0 g/l,20/lb,P05	19.1	02 Apr 96	Imnaha Weir	071230	126 (7.2)	23.8 (3.3)	1.16 (0.08)	10,695	710	42.3%
4.0 g/l,20/lb,P06	19.5	02 Apr 96	Imnaha Weir	071228	124 (7.9)	23.3 (4.3)	1.14 (0.09)	22,643	943	46.0%
4.0 g/l,20/lb,P07	20.4	02 Apr 96	Imnaha Weir	071229	124 (8.7)	22.3 (5.7)	1.12 (0.09)	22,069	1,004	41.7%
Unrecognizable marks ^c								1,975	4,596	
Total released								91,240		
<i>Rapid River</i> , 1994 Brood										
7g/l,Exercise,P14	20.1	04 Apr 96	Lookingglass Cr.	071231	126 (7.4)	22.6 (4.1)	1.12 (0.09)	33,902	1,800	44.7%
7g/l, Control,P15	20.5	04 Apr 96	Lookingglass Cr.	071232	124 (7.8)	22.2 (4.1)	1.16 (0.08)	34,379	1,804	44.5%
7g/l,Exercise,P16	19.9	04 Apr 96	Lookingglass Cr.	071233	125 (8.0)	22.8 (4.1)	1.15 (0.10)	33,534	1,794	47.0%
7g/l, Control,P17	20.5	04 Apr 96	Lookingglass Cr.	071234	125 (8.5)	22.1 (4.2)	1.13 (0.09)	32,997	1,774	47.9%
Unrecognizable marks ^c								4,300	7,172	
Total released								139,112		

^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 4,300 Rapid River stock and 1,975 Imnaha stock fish were released without recognizable marks.

^b Includes unique detections at all dams in the Snake and Columbia Rivers.

^c Defined as fish that do not have adipose clip and coded-wire tag.

Table 7. Timing of adult spring Chinook salmon returns to LSRCP facilities in 1995 by origin.

Period	Week of year	Number of fish trapped ^a				
		Rapid River stock				Lower Granite Dam ^b AdRV
		Imnaha		Lookingglass weir		
		Marked	Unmarked	Marked	Unmarked	
Apr 09-15	15	-	-	-	-	0
Apr 16-22	16	-	-	-	-	0
Apr 23-29	17	-	-	-	-	2
Apr 30-May 06	18	-	-	-	-	14
May 07-13	19	-	-	-	-	25
May 14-20	20	-	-	-	-	18
May 21-27	21	-	-	-	-	31
May 28-Jun 03	22	-	-	0	1	26
Jun 04-10	23	-	-	0	0	7
Jun 11-17	24	-	-	8	2	1
Jun 18-24	25	-	-	6	7	3
Jun 25-Jul 01	26	-	-	13	7	2
Jul 02-08	27	-	-	5	2	5
Jul 09-15	28	-	-	2	6	0
Jul 16-22	29	-	-	0	0	1
Jul 23-29	30	-	-	3	0	2
Jul 30-Aug 05	31	14	6	2	2	0
Aug 06-12	32	6	7	1	0	1
Aug 13-19	33	1	5	0	0	0
Aug 20-26	34	8	12	0	0	0
Aug 27-Sep 02	35	1	8	5	0	0
Sep 03-09	36	0	0	1	0	0
Sep 10-16	37	-	-	-	-	-
Sep 17-23	38	-	-	-	-	-
Sep 24-30	39	-	-	-	-	-
Sep 31-Oct 07	40	-	-	-	-	-
Total		30	38	46 ^c	27	138

^a The Imnaha River weir was operational from July 26th through September 7st, the Lookingglass Creek weir was operational from June 2st to September 7st.

^b Beginning in 1995, all AdRV marked Chinook salmon trapped at Lower Granite Dam will be removed and transported to Lookingglass fish Hatchery. Some missed AdRV and non-AdRV marked fish will continue to be collected at the Lookingglass Creek weir. Any unmarked fish trapped at Lookingglass Creek weir were likely 5-year-old unmarked hatchery fish. After 1994, all hatchery fish returning to Lookingglass Creek should be marked AdRV.

^c Seven marked fish were considered to be unmarked at final sampling and are reported as unmarked in Table 5.

Table 8. Numbers of adult spring Chinook salmon returning to LSRCP facilities in 1995 by origin, age, and sex. Hatchery origin includes all marked fish. M=Male, F=Female.

Stock, Disposition	Hatchery							Natural							Grand Total
	3		4		5		Total	3		4		5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<i>Imnaha River</i>															
Trapped	16	0	5	7	0	2	30	22	0	8	7	1	0	38	68
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	16	0	5	7	0	2	30	22	0	8	7	1	0	38	68
Actual spawned	11	0	5	7	0	2	25	21	0	8	6	1	0	36	61
Killed, not spawned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-spawn mortality	5	0	0	0	0	0	5	1	0	0	1	0	0	2	7
Mean length (mm) ^a	552	-	744	783	-	892		554	-	765	810	1000	-		
Standard Deviation (mm)	44	-	32	73	-	19		39	-	35	53	-	-		
Age composition (%)	53.3	0.0	16.7	23.3	0.0	3.3	100%	32.4	0.0	11.8	10.3	1.5	0.0	100%	
<i>Rapid River</i>															
Total Trapped	43 ^b	0	78	44	8	4	177	8	1	14	6	4	1	34	211
Trapped at LG Dam ^c	38	0	67	33	0	0	138	0	0	0	0	0	0	0	138
Trapped at Lookingglass	5	0	11	11	8	4	39	8	1	14	6	4	1	34	73
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	43	0	78	44	8	4	177	8	1	14	6	4	1	34	211
Actual spawned	34	0	70	40	7	4	155	7	1	13	6	4	1	32	187
Killed-not spawned	7	0	0	1	0	0	8	0	0	0	0	0	0	0	8
Pre-spawn mortality	2	0	8	3	1	0	14	1	0	1	0	0	0	2	16
Mean length (mm)	475	-	779	752	883	795		547	633	739	717	1001	890		
Standard Deviation (mm)	33	-	47	41	43	54		47	-	59	31	77	-		
Age composition (%)	24.3	0.0	44.1	24.9	4.5	2.3	100%	23.5	2.9	41.2	17.6	11.8	2.9	100%	

^a Mean length per age class determined from known age fish based on either CWT or scale data.

^b Six of the 43 were two year old males, which were all KNS. They are not included in the mean length data.

^c AdRV fish were collected at Lower Granite Dam beginning in 1995. Both AdRV and Ad-Only fish collected at the Lookingglass Creek weir are included as hatchery returns.

Table 9. Timing of spawning and spawning summaries for 1995 brood spring Chinook salmon at LSRCP facilities.

Date	Hatchery spawn code	Origin of parents in matrices	Number of parents F, M	Number of eggs taken	Percent mortality to shocking ^a
<i>Imnaha stock at Lookingglass Fish Hatchery</i>					
August 17, 1995	185	Hatchery Natural Mixed	1,2	4,585	4
August 24, 1995	186	Hatchery Natural Mixed	4,4	18,508	13
August 31, 1995	187	Hatchery Natural Mixed	1,2 8,27	4,561 35,598	9 22
September 07, 1995	188	Hatchery Natural Mixed	1,11	4,869	2
Total			9 Family groups	68,121	16
<i>Rapid River stock at Lookingglass Fish Hatchery</i>					
August 24, 1995	408	Hatchery Natural Mixed	1,2 1,2 ^b 0	7,794	1
August 31, 1995	409	Hatchery Natural Mixed	12,36 0 8,24	84,674	4
September 07, 1995	410	Hatchery Natural Mixed	14,28 0 8,16	88,047	6
September 14, 1995	411	Hatchery Natural Mixed	1,2 0 5,19	22,237	4
September 21, 1995	412	Hatchery Natural Mixed	0 0 2,6	6,607	5
Total			52 Family groups	209,357	5

^a Embryos were shocked on September 18th and November 7th.

^b Records of the number of eggs collected on August 24th do not distinguish origin of the parents.

Table 10. Timing of adult spring Chinook salmon returns to LSRCF facilities in 1996 by origin.

Period	Week of year	Number of fish trapped ^a				
		Rapid River stock				Lower Granite Dam ^b AdRV
		Imnaha		Lookingglass weir		
		Marked	Unmarked	Marked	Unmarked	
Apr 09-15	15	-	-	-	-	-
Apr 16-22	16	-	-	-	-	-
Apr 23-29	17	-	-	-	-	-
Apr 30-May 06	18	-	-	-	-	7
May 07-13	19	-	-	-	-	17
May 14-20	20	-	-	-	-	124
May 21-27	21	-	-	1	0	107
May 28-Jun 03	22	-	-	0	0	140
Jun 04-10	23	-	-	12	45	64
Jun 11-17	24	-	-	11	16	28
Jun 18-24	25	-	-	3	9	21
Jun 25-Jul 01	26	-	-	10	10	30
Jul 02-08	27	-	-	6	9	19
Jul 09-15	28	-	-	1	5	6
Jul 16-22	29	-	-	0	0	5
Jul 23-29	30	28	33	1	1	0
Jul 30-Aug 05	31	48	44	1	0	3
Aug 06-12	32	9	17	0	2	1
Aug 13-19	33	3	14	1	1	-
Aug 20-26	34	10	20	0	3	-
Aug 27-Sep 02	35	1	12	1	0	-
Sep 03-09	36	0	5	2	1	-
Sep 10-16	37	0	0	2	0	-
Sep 17-23	38	-	-	-	-	-
Sep 24-30	39	-	-	-	-	-
Sep 31-Oct 07	40	-	-	-	-	-
	Total	99	145	52 ^b	102 ^b	572

^a Fish trapped at Lower Granite Dam were Rapid River stock Chinook salmon released in Lookingglass Creek and identified at Lower Granite Dam by AdRV fin-clips. Fish trapped at Lookingglass Fish Hatchery were Rapid River stock fish that were either unmarked or were missed at the Lower Granite trap. Imnaha weir operational from July 16-September 11.

^b Three fish included here as marked were considered unmarked at final sampling and are reported as unmarked in Table 5.

Table 11. Numbers of adult spring Chinook salmon returning to LSRCP facilities in 1996 by origin, age, and sex (M=Male, F=Female).

Stock, Disposition	Hatchery							Natural							Grand Total
	3		4		5		Total	3		4		5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<i>Imnaha River</i>															
Trapped	39 ^a	0	29	11	2	3	84	6	0	86	38	10	5	145	229
Passed	0	0	15	6	1	1	23	2	0	43	19	6	3	73	96
Outplants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	39	0	14	5	1	2	61	4	0	43	19	4	2	72	133
Actual spawned	5	0	11	5	0	2	23	3	0	35	15	2	2	57	79
Killed, not spawned	28	0	0	0	0	0	28	0	0	1	1	0	0	2	30
Pre-spawn mortality	6	0	3	0	1	0	10	1	0	7	3	2	0	13	23
Mean length (mm) ^b	552	NA	779	800	882	883		547	NA	770	801	898	906		
Standard Deviation (mm)	31.1	NA	55.4	24.1	-	92.6		69.2	NA	40.2	31.3	67.5	43.1		
Age composition (%)	46.4	0	34.5	13.1	2.4	3.6	1	4.1	0	59.3	26.2	6.9	3.4	1	
<i>Rapid River</i>															
Total Trapped	37	0	317	264	2	1	621	1	0	42	52	10	0	105	726
Trapped at LG Dam ^c	31	0	300	239	1	1	572	0	0	0	0	0	0	0	572
Trapped at LOOH	6	0	17	25	1	0	49	1	0	42	52	10	0	105	154
Passed	0	0	0	0	0	0	0	0	0	17	25	8	0	50	50
Outplants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	37	0	317	264	2	1	621	1	0	25	27	2	0	55	676
Actual spawned	9	0	153	159	0	1	322	1	0	20	20	0	0	41	363
Killed-not spawned	6	0	31	5	0	0	42	0	0	0	0	0	0	0	42
Pre-spawn mortality	22	0	133	100	2	0	257	0	0	5	7	2	0	14	271
Mean length (mm) ^b	474	NA	736	719	848	861		586	NA	745	729	828	NA		
Standard Deviation (mm)	42.9	NA	50.5	38.6	51.6	-		-	NA	43.7	27.6	30.8	NA		
Age composition (%)	6.0	0	51.0	42.5	0.3	0.2	1	1.0	0	40.0	49.5	9.5	0	1	

^a An additional 15 AdLV/LV only or Ad-no CWT jacks were killed at the weir, and not included here.

^b Mean length per age class determined from known age fish based on either CWT or scale data.

^c AdRV fish were collected at Lower Granite Dam beginning in 1995. Both AdRV and Ad-only fish collected at the Lookingglass Creek weir are included as hatchery returns.

Table 12. Timing of spawning and spawning summaries for 1996 brood spring Chinook salmon at LSRCF facilities. Matrix symbols indicate the origin and numbers of parents used in each family group.

Date	Hatchery spawn code	Origin of Parents in matrices	Number of Parents F, M ^{a,b}	Number of eggs taken	Percent mortality to shocking ^c
<i>Imnaha stock at Lookingglass Fish Hatchery</i>					
August 14, 1996	189	Mixed	3,6	11,021	10
August 22, 1996	190	Mixed	6,12	29,419	8
August 29, 1996	191	Natural	2,3	27,781	2
September 05, 1996	192	Mixed	4,8	33,539	2
		Natural	2,1		
September 12, 1996	193	Mixed	5,10	8,386	22
		Mixed	2,13		
Total			14 Family Groups	110,146	7
<i>Rapid River stock at Lookingglass Fish Hatchery^d</i>					
August 20, 1996	101	Hatchery	1,0	4,000 (BKD+destroyed)	
August 20, 1996	413	Natural	1,2	3,856	12
August 27, 1996	102	Hatchery	3,5	10,672	4
August 27, 1996	414	Natural	4,6	16,617	14
August 28, 1996	113W	Hatchery	3,3	13,141	25
September 03, 1996	103	Hatchery	39,40	149,196	5
September 03, 1996	415	Natural	9,10	31,632	5
September 04, 1996	114W	Hatchery	29,29	114,474	12
September 10, 1996	104	Hatchery	49,49	191,085	2
September 10, 1996	416	Natural	6,12	20,480	1
September 11, 1996	115W	Hatchery	25,25	105,653	14
September 17, 1996	105	Hatchery	9,11	38,753	4
September 26, 1996	106	Hatchery	2,2	6,645	17
Total			96 Family Groups	706,204	9.6

^a Some Imnaha parent groups include males who were spawned more than once so there are five more individual males reported here than the total number actually spawned.

^b Some Rapid River parent groups include males who were spawned more than once so there are more males reported as spawned in both the marked and unmarked groups than the total number actually spawned.

^c Imnaha embryos were shocked on October 30 & 31, 1996 and Rapid River embryos were shocked on October 10 & 11 & 31 and November 01, 1996.

^d Rapid River stock were usually spawned in a 2X2 matrix.

Table 13. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha River stock, spring Chinook for the 1995 return year.

Brood year	Experimental group ^a	CWT code	Recoveries at weir ^b	Other in-basin recoveries ^c	Out-of-basin recoveries ^d	Total recoveries ^e
1990	Acclim., 25 fpp, 8.0 gpl	075844	0	0	0	0
	Acclim., 25 fpp, 8.0 gpl	075845	0	0	0	0
	Acclim., 15 fpp, 14.0 gpl	075846	1	5	0	6
	Acclim., 15 fpp, 14.0 gpl	075847	0	0	0	0
	Direct, 20 fpp, 8.0 gpl	075848	0	0	0	0
	Direct, 20 fpp, 8.0 gpl	075849	0	0	0	0
1991	Acclim., 15 fpp, 8.0 gpl	071538	6	32	1	39
	Acclim., 15 fpp, 8.0 gpl	071539	5	27	0	32
	Acclim., 25 fpp, 8.0 gpl	071540	1	5	0	6
	Acclim., 25 fpp, 8.0 gpl	071541	0	0	0	0
1992	Acclim., 15 fpp, 12.8 gpl	070118	3	16	0	19
	Acclim., 15 fpp, 12.8 gpl	070119	0	0	0	0
	Acclim., 25 fpp, 12.8 gpl	076362	8	43	1	52
	Acclim., 25 fpp, 12.8 gpl	076363	4	21	0	25
	Direct, 25 fpp, 12.8 gpl	070116	1	5	1	7
	Direct, 25 fpp, 12.8 gpl	070117	0	0	1	1
1993	Acclim., 15 fpp, 12.8 gpl	070750	0	0	1	1
Grand total of recoveries in 1995			29	154	5	188

^a Experimental groups include the release strategy and the target release size (fpp = fish per pound), and density (gpl = grams per liter).

^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. No fish were passed above the weir in 1995. We estimated that 77 CWT fish escaped before the weir was operating. We estimated that 77 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 14. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Rapid River spring Chinook for the 1995 return year. All CWT fish were from releases of hatchery fish into Lookingglass Creek.

Brood year	Experimental group ^a	CWT code	Recoveries at weir	Recoveries at Lower Granite	Other in-basin recoveries ^b	Out-of-basin recoveries ^c	Total recoveries
1990	12 fpp, 16.0 gpl	074746	1	0	0	0	1
	12 fpp, 16.0 gpl	075055	3	0	1	4	8
	20 fpp, 8.6 gpl	075305	0	0	0	0	0
	20 fpp, 8.6 gpl	075306	2	0	1	1	4
				0			
1991	20 fpp, 16.0 gpl	071546	0	5	0	0	5
	20 fpp, 16.0 gpl	071547	0	6	0	0	6
	20 fpp, 8.0 gpl	071548	5	11	1	2	19
	20 fpp, 8.0 gpl	071549	0	7	0	0	7
	20 fpp, 16.0 gpl	071550	2	6	1	0	9
	20 fpp, 16.0 gpl	071551	1	8	0	0	9
	20 fpp, 8.0 gpl	071552	1	7	0	3	11
	20 fpp, 8.0 gpl	071553	1	8	0	0	9
	20 fpp, 8.0 gpl	071554	1	4	0	0	5
	20 fpp, 8.0 gpl	071555	2	14	1	0	17
	20 fpp, 8.0 gpl	071556	1	4	0	0	5
	20 fpp, 8.0 gpl	071557	1	6	0	0	7
	20 fpp, 8.0 gpl	071558	1	12	1	0	14
1992	20 fpp, 16.0 gpl	070441	0	2	0	0	2
	20 fpp, 16.0 gpl	070440	0	0	0	0	0
	20 fpp, 16.0 gpl	070439	1	3	0	0	4
	20 fpp, 16.0 gpl	070438	0	0	0	0	0
	20 fpp, 16.0 gpl	070437	0	11	0	0	11
	20 fpp, 16.0 gpl	070436	1	3	0	0	4
	20 fpp, 16.0 gpl	070435	0	0	0	0	0
	20 fpp, 16.0 gpl	070434	0	0	0	0	0
	20 fpp, 16.0 gpl	075308	1	1	0	0	2
	20 fpp, 16.0 gpl	075307	1	6	0	0	7
	20 fpp, 16.0 gpl	070448	0	2	0	0	2
	20 fpp, 16.0 gpl	070447	1	4	0	0	5
		Grand total of recoveries in 1995		27	130	6	10

^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 Estimated number (based on spawning ground survey data) of CWT fish that spawned naturally in Lookingglass Creek. Five redds were observed during spawning ground surveys. Using a fish per redd estimate of 3.26 (average of '92 – '94) sixteen fish spawned in Lookingglass Creek in 1995.

^c Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered in the ocean, mainstem Columbia, Deschutes or Snake rivers 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.

Table 15. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha River stock, spring Chinook for the 1996 return year.

Brood year	Experimental group ^a	CWT code	Recoveries at weir ^b	Other in-basin recoveries ^c	Out-of-basin recoveries ^d	Total recoveries ^e
1991	Acclim., 15 fpp, 10 gpl	071538	1	3	0	4
	Acclim., 15 fpp, 10 gpl	071539	0	0	0	0
	Acclim., 25 fpp, 10 gpl	071540	0	0	0	0
	Acclim., 25 fpp, 10 gpl	071541	1	3	0	4
1992	Acclim., 15 fpp, 14 gpl	070118	1	4	0	5
	Acclim., 15 fpp, 14 gpl	070119	0	0	0	0
	Acclim., 25 fpp, 14 gpl	076362	13	54	0	67
	Acclim., 25 fpp, 14 gpl	076363	2	8	1	11
	Direct, 25 fpp, 14 gpl	070116	3	13	0	16
	Direct, 25 fpp, 14 gpl	070117	0	0	0	0
1993	Acclim., 25 fpp, 12 gpl	070745	2	3	0	5
	Acclim., 25 fpp, 12 gpl	070746	5	7	0	12
	Direct, 25 fpp, 12 gpl	070747	9	13	0	22
	Direct, 25 fpp, 12 gpl	070748	1	1	3	5
	Acclim., 15 fpp, 12 gpl	070750	5	7	0	12
	Acclim., 15 fpp, 12 gpl	070751	12	17	0	29
Grand total of recoveries in 1996			55	133	4	192

^a Experimental groups include the release strategy and the target release size (fpp = fish per pound), and density (gpl = grams per liter).

^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 23 CWT fish were passed above the weir in 1996. We estimated that 39 CWT fish escaped before the weir was operating. We estimated that 71 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 16. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Rapid River spring Chinook for the 1996 return year. All CWT fish were from releases of hatchery fish into Lookingglass Creek.

Brood year	Experimental group ^a	CWT code	Recoveries at weir	Recoveries at Lower Granite	Other in-basin recoveries ^b	Out-of-basin recoveries ^c	Total recoveries
1991	Accl, 20 fpp, 16.0 g/l	071546	0	0	0	0	0
	Accl, 20 fpp, 16.0 g/l	071547	0	0	0	0	0
	Accl, 20 fpp, 8.0 g/l	071548	0	1	0	0	1
	Accl, 20 fpp, 8.0 g/l	071549	0	0	0	0	0
	Accl, 20 fpp, 16.0 g/l	071550	0	0	0	0	0
	Accl, 20 fpp, 16.0 g/l	071551	0	0	0	0	0
	Accl, 20 fpp, 8.0 g/l	071552	0	0	0	0	0
	Accl, 20 fpp, 8.0 g/l	071553	0	1	0	0	1
	Accl, 20 fpp, 8.0 g/l	071554	0	0	0	1	1
	Accl, 20 fpp, 8.0 g/l	071555	0	0	0	0	0
	Accl, 20 fpp, 8.0 g/l	071556	0	1	0	0	1
	Accl, 20 fpp, 8.0 g/l	071557	0	0	0	0	0
	Accl, 20 fpp, 8.0 g/l	071558	0	0	0	0	0
1992	Accl, 20 fpp, 16.0 g/l	070441	2	44	1	5	52
	Accl, 20 fpp, 16.0 g/l	070440	1	14	0	0	15
	Accl, 20 fpp, 16.0 g/l	070439	6	55	1	2	64
	Accl, 20 fpp, 16.0 g/l	070438	0	5	0	0	5
	Accl, 20 fpp, 16.0 g/l	070437	5	108	1	3	117
	Accl, 20 fpp, 16.0 g/l	070436	4	71	1	2	78
	Accl, 20 fpp, 16.0 g/l	070435	0	0	0	0	0
	Accl, 20 fpp, 16.0 g/l	070434	7	34	1	1	43
	Accl, 20 fpp, 16.0 g/l	075308	2	68	1	1	72
	Accl, 20 fpp, 16.0 g/l	075307	4	68	1	4	77
	Accl, 20 fpp, 8.0 g/l	070448	3	31	0	3	37
	Accl, 20 fpp, 8.0 g/l	070447	2	23	0	3	28
1993	Accl, 20 fpp, 16.0 g/l	070829	0	2	0	0	2
	Accl, 20 fpp, 16.0 g/l	070828	0	3	0	0	3
	Accl, 20 fpp, 16.0 g/l	070827	0	11	0	1	12
	Accl, 20 fpp, 13.4 g/l	070826	0	2	0	0	2
	Accl, 20 fpp, 16.0 g/l	070825	1	1	0	0	2
	Accl, 20 fpp, 16.0 g/l	070824	0	3	0	0	3
	Accl, 20 fpp, 16.0 g/l	070823	0	1	0	0	1
	Accl, 20 fpp, 13.4 g/l	070822	0	2	0	0	2
Grand total of recoveries in 1995			37 ^d	549 ^e	7	26	619

^a Experimental groups include the target release size (fpp = fish per pound) and the target density (gpl = grams per liter) at release.

^b Estimated number of CWT fish that spawned naturally in Lookingglass Creek.

^c Estimated number (from PSMFC and ODFW databases) of total CWT fish that were recovered outside the Lookingglass Creek drainage. When CWT expansion factors were greater than 24 (because of a low sampling rate) unexpanded data were used.

^d An additional 5 precocious male Rapid River stock Chinook were trapped.

^e An additional 8 fish with CWT were collected at Lower Granite Dam including 6 fish from other basins and 2 Rapid River stock "precocious" male mortalities at Lower Granite trap.

Table 17. Catch and escapement distribution of hatchery adult spring Chinook salmon by recovery location in 1995. (Data summarized through January 2000 from the PSMFC and ODFW CWT recovery databases.)

Location	Imnaha Stock		Rapid River Stock	
	Percent of total	Expanded adults	Percent of total	Expanded adults
Ocean catch		0		0
Columbia River				
Treaty net		0	4.7	10
Non-treaty net		0		0
Sport		0		0
Deschutes River				
Traps	1.6	3	0.5	1
Sport		0		0
C and S ^a		0		0
Strays				
Outside Snake R. Basin	1.1	2	5.3	11
Within Snake R. Basin ^b		0	0.5	1
Recruitment to river ^b	97.3	183	89.0	186
Total estimated return		188		209
Return to compensation area		183		187
Percent of compensation goal		5.7		9.1

^a C and S indicates ceremonial and subsistence tribal fisheries.

^b 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 1995 is calculated in Tables 13 and 14.

Table 18. Catch and escapement distribution of hatchery adult spring Chinook salmon by recovery location in 1996. (Data summarized through January 2000 from the PSMFC and ODFW CWT recovery databases.)

Location	Imnaha Stock		Rapid River Stock	
	Percent of total	Expanded adults	Percent of total	Expanded adults
Ocean catch	1.6	3	0	0
Columbia River				
Treaty net	0.0	0	2.5	15
Non-treaty net	0.0	0	0.0	0
Sport	0.0	0	0.0	0
Deschutes River				
Traps	0.0	0	0.2	1
Sport	0.0	0	0.3	2
C and S ^a	0.0	0	0.0	0
Strays				
Outside Snake R. Basin	0.5	1	0.7	4
Within Snake R. Basin ^b	0.0	0	0.7	4
Recruitment to river ^b	97.9	188	95.7	593 ^c
Total estimated return		192		619
Return to compensation area		188		597
Percent of compensation goal		5.9		26.0

^a C and S indicates ceremonial and subsistence tribal fisheries.

^b 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 1996 is calculated in Tables 15 and 16.

^c Includes 549 fish trapped at Lower Granite Dam and trucked to Lookingglass Fish Hatchery.

Table 19. Summary of adipose-clipped Chinook salmon carcass recoveries during spawning ground surveys in 1995. The multiple tag recoveries in each group are shown in parentheses next to the location.

Location (number)	CWT code	Release site
Imnaha River (1)	075847	Imnaha Acclimation Pond (Brood Year 1990)
Imnaha River (1)	071539	Imnaha Acclimation Pond (Brood Year 1991)
Imnaha River (1)	070117	Imnaha Acclimation Pond (Brood Year 1992)
Imnaha River (2)	No Tag	Unknown Origin
Imnaha River (1)	No Snout	Unknown Origin
Wenaha River (1)	071548	Lookingglass Fish Hatchery (Brood Year 1991)

Table 20. Summary of marked and unmarked spring Chinook salmon carcasses recovered by stream during spawning ground surveys in 1995. 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 1990 brood year was not marked.

Stream	Marked	Unmarked	Percent marked
<i>Grande Ronde River Basin</i>			
Bear Creek	0	0	0
Hurricane Creek	0	0	0
Lostine River	0	4	0
Wallowa River	0	0	0
Grande Ronde River	0	1	0
Catherine Creek	0	7	0
Lookingglass Creek	0	0	0
Minam River	0	5	0
Wenaha River	1	2	33
<i>Imnaha River Basin</i>			
Big Sheep Creek	0	0	0
Imnaha River	6	17	26
Lick Creek	0	0	0

Table 21. Age composition of Chinook salmon carcasses recovered in 1995 during surveys in the Imnaha and Grande Ronde river basins. M=Male, F=Female.

Statistic	Age 3		Age 4		Age 5	
	M	F	M	F	M	F
	<i>Grande Ronde River Basin</i>					
Number ^a	1	1	10	5	0	0
Percent of total	5	5	50	25	0	0
Mean length (mm)	480	570	673	687	-	-
Standard deviation	-	-	89	59	-	-
	<i>Imnaha River Basin</i>					
Number	4	0	8	2	3	6
Percent of total	17	0	35	9	13	26
Mean length (mm)	609	-	834	768	1017	906
Standard deviation	17	-	81	25	25	44

^a Sex could not be determined for an additional three four-year-olds in the Grande Ronde Basin.

Table 22. Summary of adipose-clipped Chinook salmon carcass recoveries during spawning ground surveys in 1996. The multiple tag recoveries in each group are shown in parentheses next to the location.

Location (number)	CWT code	Release site
Imnaha River (1)	070751	Imnaha Acclimation Pond (Brood Year 1993)
Imnaha River (4)	076362	Imnaha Acclimation Pond (Brood Year 1992)
Imnaha River (1)	076363	Imnaha Acclimation Pond (Brood Year 1992)
Imnaha River (2)	No Tag	Unknown Origin
Lostine River (1)	070439	Lookingglass Creek (Brood Year 1992)
Lostine River (1)	070447	Lookingglass Creek (Brood Year 1992)
Lostine River (1)	No Snout	Unknown Origin
Minam River (1)	053205	Dworshak National Fish Hatchery (Brd.Yr. 1992)
Minam River (1)	075307	Lookingglass Creek (Brood Year 1992)
Minam River (1)	No Tag	Unknown Origin
Wenaha River (1)	070441	Lookingglass Creek (Brood Year 1992)
Wenaha River (1)	No Tag	Unknown Origin

Table 23. Summary of marked and unmarked spring Chinook salmon carcass recoveries by stream during spawning ground surveys in 1996.

Stream	Marked	Unmarked	Percent marked
<i>Grande Ronde River Basin</i>			
Bear Creek	0	0	0
Hurricane Creek	0	1	0
Lostine River	3	21	12.5
Wallowa River	0	0	0
Grande Ronde River	0	1	0
Catherine Creek	0	5	0
Lookingglass Creek	0	3	0
Minam River	2	60	3.2
Wenaha River	1	47	2.1
<i>Imnaha River Basin</i>			
Big Sheep Creek	0	0	0
Imnaha River	6	62	8.8
Lick Creek	0	0	0

Table 24. Age composition of Chinook salmon carcasses recovered in 1996 during surveys in the Imnaha and Grande Ronde river basins. M=Male, F=Female.

Statistic	Age 3		Age 4		Age 5	
	M	F	M	F	M	F
	<i>Grande Ronde River Basin^a</i>					
Number	5	1	45	90	1	1
Percent of total	3	1	31	63	1	1
Mean length (mm)	563	640	770	733	960	810
Standard deviation	125	-	45	45	-	-
	<i>Imnaha River Basin</i>					
Number	4	0	37	21	2	4
Percent of total	6	0	54	31	3	6
Mean length (mm)	602	-	768	800	915	896
Standard deviation	59	-	46	47	7	39

^a *There was one 2-year-old precocial male (460 mm) recovered in the Grande Ronde Basin.*

SECTION II

SUMMER STEELHEAD

The main objectives of this report section are to document fish culture practices, describe adult returns, and assess success towards meeting LSRCP goals. In this section we report on juvenile steelhead rearing and release activities for the 1994 and 1995 brood years (BY) released in 1995 and 1996, respectively. Included are collection, spawning, and adult characteristics for the 1995 and 1996 returns, returns from experimental releases, supplementation in Little Sheep Creek, and success toward achieving compensation goals.

Juveniles

1995

Green egg-to-smolt survival for the 1994 BY was within the normal range observed in the past (Table 25) for both Wallowa and Imnaha stocks. The reported embryo-to-smolt survival of 100% is greater than the actual value. The error is a result of variance in the life stage specific inventories. We achieved our Wallowa stock production goal of 1,350,000 smolts and our Imnaha stock production goal of 330,000 smolts in 1995. We marked 100% of the smolts with an adipose fin clip. To evaluate different rearing and release strategies, we marked and released five groups of Wallowa stock and three groups of Imnaha stock fish with adipose-left ventral clips and coded-wire-tags (AdLV and CWT) (Table 26). Tag retention and fin clip quality were normal for all groups except for two of the Wallowa stock groups, which had below normal levels of tag retention and recognizable clips. Details of production and experimental releases of the 1994 BY are printed in Tables 27 and 28.

1996

Green egg-to-smolt survival for the 1995 BY was normal (Table 29) for both Wallowa and Imnaha stocks. We achieved our smolt production goal for Wallowa stock, however we were slightly below the goal for Imnaha stock. We marked 100% of the smolts released in the Grande Ronde and Imnaha basins with an adipose fin clip. To evaluate the influence of acclimation and volitional release on smolt-to-adult survival and to monitor survival of major production releases, we marked (AdLV and CWT) six groups of Wallowa stock and four groups of Imnaha stock smolts (Table 30). Fin clip quality and tag retention were excellent for Wallowa stock and within normal range for Imnaha stock. Release information for production and experimental releases of 1995 BY are presented in Tables 31 and 32.

Adults

1995

All weirs were installed and operational before March 1, 1995 (Table 33). Returns to Little Sheep Creek Facility were predominately hatchery fish and only 17 natural fish returned. Similar to Little Sheep Creek, most of the adults that returned to Big Canyon Facility were hatchery origin and only 31 natural fish returned. Run timing of hatchery fish was similar to natural fish at Little Sheep Creek. The majority of hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon spent one year in the ocean (Table 34). In contrast, a majority of the natural fish that returned to Big Canyon spent two years in the ocean. At Little Sheep Creek, a majority of the hatchery and natural fish spent one year in the ocean.

All but 30 hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon in 1995 were retained for spawning. In addition, we hauled 248 Wallowa stock adults from Washington Department of Fish and Wildlife's (WDFW) Cottonwood Facility on the lower Grande Ronde River for spawning. At Big Canyon all natural fish and 30 hatchery fish were passed above the weir to spawn naturally. We retained 87.8% of the hatchery fish and 29.4% 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 73.9% of the fish released above the weir at Little Sheep Creek. Length-at-age data for Wallowa stock adults are presented in Figure 9 and Imnaha stock adult data are presented in Figure 10.

We did not achieve our egg take goal for Wallowa or Imnaha stock in 1995 due to low adult returns. The percent mortality from green egg-to-eyed embryo for both stocks was similar to past years (Table 35).

1996

Weirs were installed in late February at Wallowa Fish Hatchery and Big Canyon Facility. The weir was installed later than normal, on March 6, at Little Sheep Creek. Hatchery fish comprised 90.4% of the returns to Little Sheep Creek with only 47 natural fish. Most of the adults that returned to Big Canyon were hatchery origin with only 29 natural fish (Table 36). 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 37). We did observe a higher proportion of fish that spent two years in the ocean at Big Canyon than at Wallowa Fish Hatchery. A majority of the natural fish at Big Canyon also spent one year in the ocean. At Little Sheep Creek, a majority of the hatchery and natural adults spent one year in the ocean; however, we observed a higher proportion of hatchery fish that spent two years in the ocean, similar to Big Canyon.

A majority of the hatchery adults that returned to Wallowa Fish Hatchery and Big Canyon were retained for spawning. We did outplant 164 to local ponds for harvest opportunity. We passed all natural fish above the weir at Big Canyon for natural production. We retained a majority of the hatchery fish and 25.5% of the natural fish at

Little Sheep Creek for spawning. Hatchery fish comprised 66.0% of the adults released above the weir to spawn naturally. Length-at-age data for Wallowa stock adults are presented in Figure 11, and Imnaha stock data are presented in Figure 12.

Egg take goals for both Wallowa and Imnaha stocks were exceeded in 1996. Excess Wallowa stock eyed embryos were euthanized (Table 38). The percent mortality from green egg-to-eyed embryo for Wallowa stock was normal; however, the survival rate for Imnaha stock was higher than normal.

Experimental group returns

The number of coded-wire-tagged and adipose clipped adults that are harvested and return to recapture sites are 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 numbers 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 WDFW and Idaho Department of Fish and Game. We enumerated the actual number of CWTed fish that returned to each hatchery facility. Our protocol was to collect all fish marked with a CWT when they were spawned or died.

1995

Wallowa and Imnaha adults that returned in 1995 were from groups released to evaluate the survival benefits of acclimation. Adult returns from brood years 1990-1992 occurred in 1995. We had Wallowa stock recoveries from 19 CWT codes (Table 39) and Imnaha stock recoveries from 7 CWT codes (Table 40).

1996

Wallowa and Imnaha stock adults that returned in 1996 were from releases to evaluate the benefits of acclimation. Adult returns were from brood years 1991-1993. We had Wallowa stock recoveries from 13 CWT codes (Table 41) and Imnaha stock recoveries from eight CWT codes (Table 42).

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 Ice Harbor 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.

1994-1995 run year

For the Wallowa stock, we estimated that in the 1994-95 run year 2,232 hatchery origin adults returned to the compensation area (Table 43). This represented 24.3% of the compensation goal. For the Imnaha stock, we estimated that 320 hatchery origin adults returned to the compensation area, accounting for only 16% of the compensation goal.

1995-1996 run year

For the Wallowa stock, we estimated that in the 1995-96 run year 3,976 hatchery origin adults returned to the compensation area, representing 43.3% of the compensation goal (Table 44). For the Imnaha stock, we estimated that 626 adults returned to the compensation area, accounting for 31.3% 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 have yet to reach our compensation goals. For both the Grande Ronde and Imnaha programs we have met our smolt production goals in most years, thus falling short of our adult compensation goals cannot be attributed to this factor. Returns in the 1994-1995 run year represented completed returns for the 1990 BY. Returns in the 1995-1996 run year represented the final returns of the 1991 BY. Total smolt-to-adult survival rates for the 1990 BY Wallowa and Imnaha stocks were 1.11% and 0.99%, respectively. For the 1991 BY, Wallowa and Imnaha stocks survival rates were 0.08% and 0.01%, respectively. For the Wallowa stock 47% of the recoveries for the 1994-1995 run year occurred downstream of the compensation area, and for the 1995-1996 run year 50% occurred downstream. A smaller percentage of Imnaha stock were recovered downstream of the compensation area; 32% for the 1994-1995 run year and 37% for the 1995-1996 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 1987-1991 (Figure 13). Hatchery fish progeny-per-parent ratios have been above 1.0 for all brood years except 1991. 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 14).

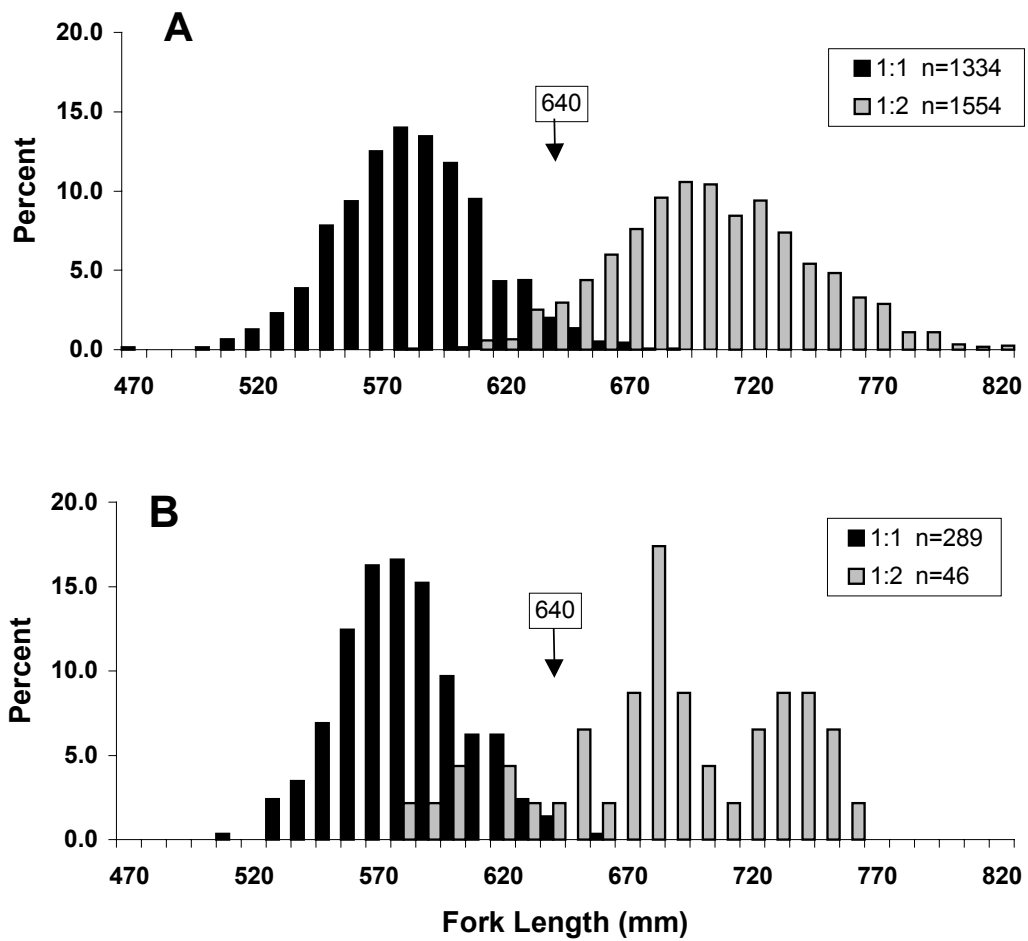


Figure 9. Length-at-age relationships for Wallowa stock summer steelhead for the A) 1991-1994 and B) 1995 broodstocks. Guidelines that were developed from 1990-1994 broodstock and used as visual indications of age are presented in boxes.

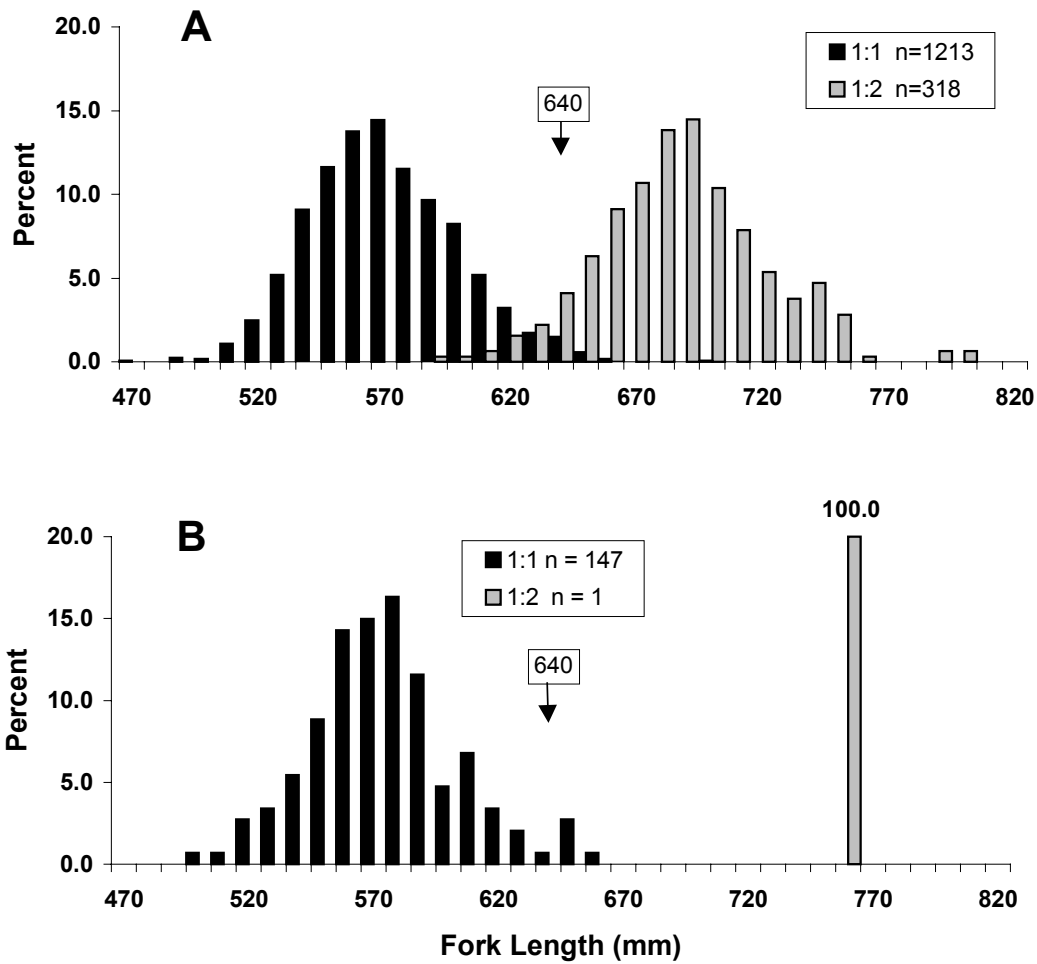


Figure 10. Length-at-age relationships for Imnaha stock summer steelhead for the A) 1991-1994 and B) 1995 broodstocks. Guidelines that were developed from 1990-1994 broodstock and used as visual indications of age are presented in boxes.

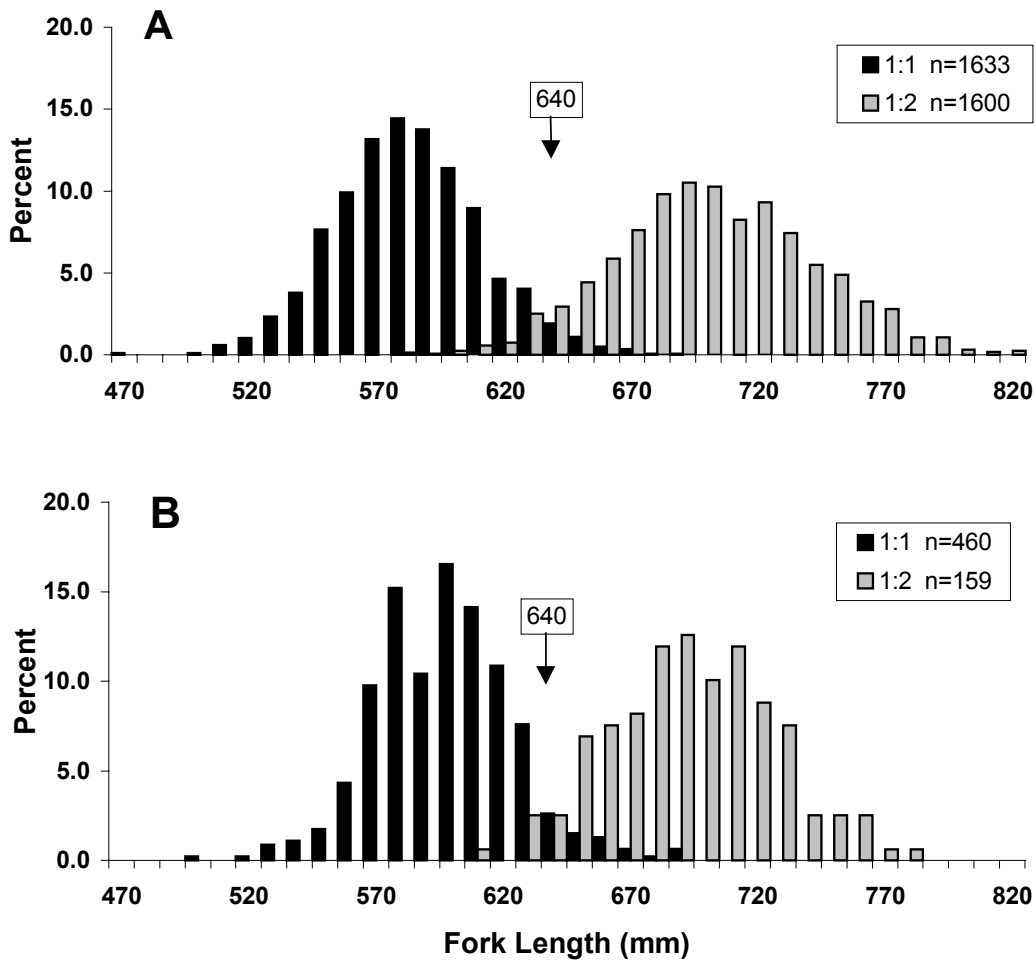


Figure 11. Length-at-age relationships for Wallowa stock summer steelhead for the A) 1991-1995 and B) 1996 broodstocks. Guidelines that were developed from 1990-1994 broodstock and used as visual indications of age are presented in boxes.

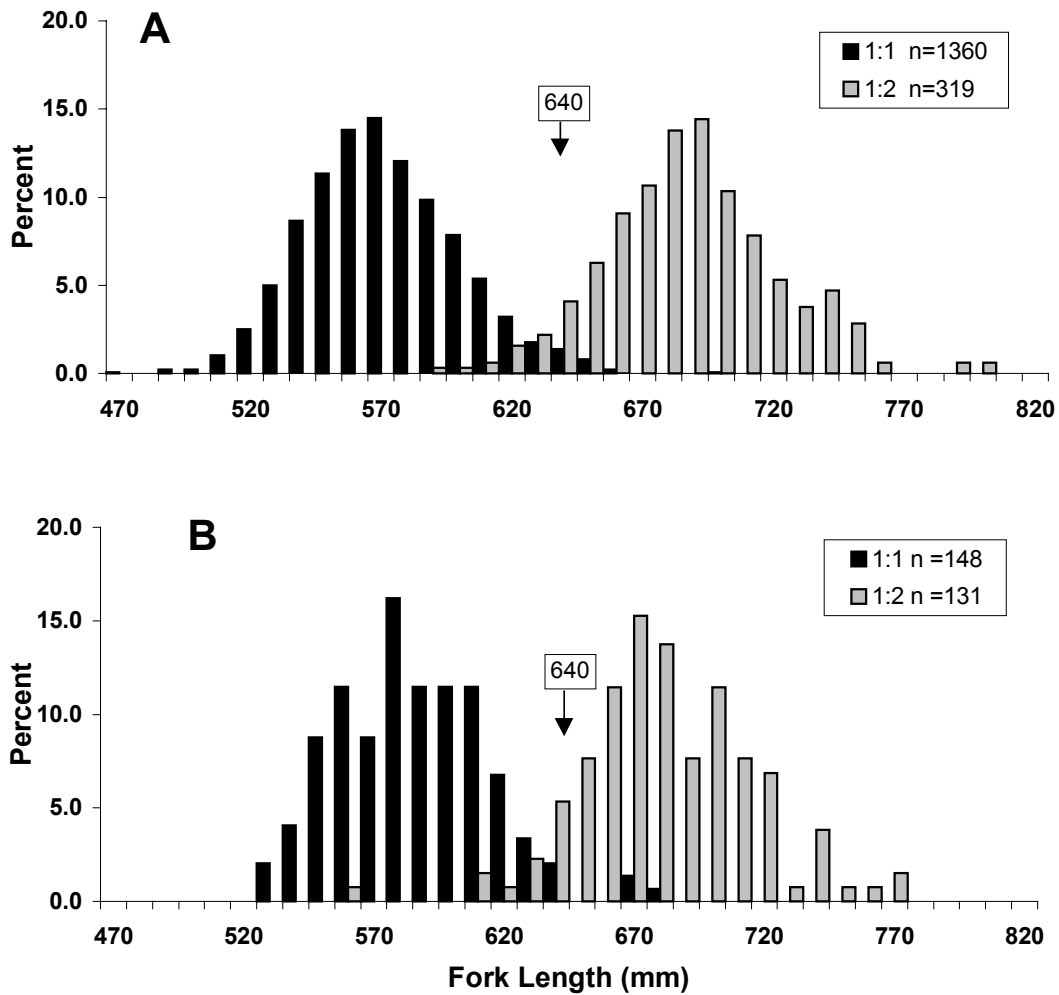


Figure 12. Length-at-age relationships for Imnaha stock summer steelhead for the A) 1991-1995 and B) 1996 broodstocks. Guidelines that were developed from 1990-1994 broodstock and used as visual indications of age are presented in boxes.

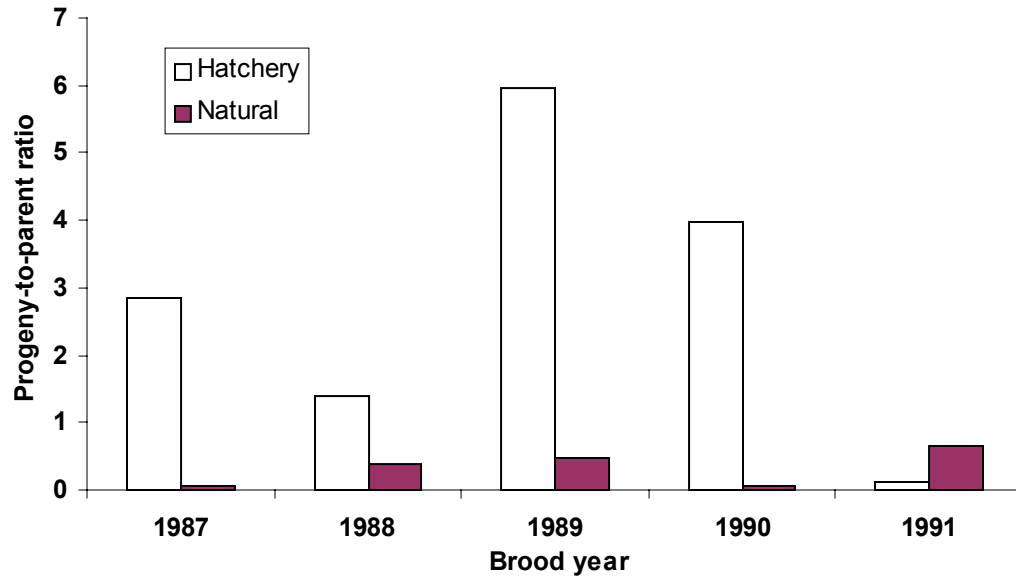


Figure 13. Progeny-to-parent ratios for Little Sheep Creek summer steelhead, brood years 1987-1991.

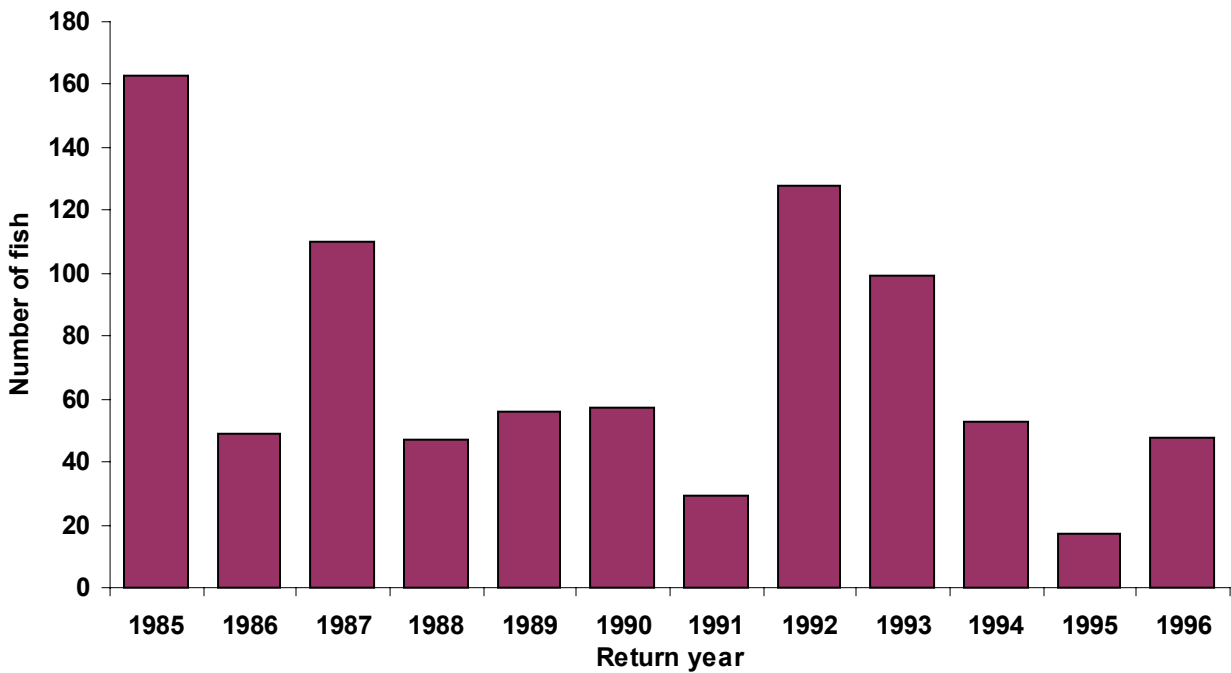


Figure 14. Returns of naturally produced summer steelhead to Little Sheep Creek, 1985-1996.

Table 25. Summary of egg collection and juvenile survival for 1994 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 1995.

Stock	Number of eggs taken	Eyed embryos	Estimated survival rate		Total fish released
			Egg-to-embryo ^a	Embryo-to-smolt ^b	
Wallowa	3,300,240 ^c	2,669,600 ^d	79.9	100.0	1,402,994 ^e
Imnaha	454,140	352,420 ^f	77.6	100.0	338,512

^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.

^b 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.

^c Includes 303,880 eggs taken for the Washington Department of Fish and Wildlife (WDFW).

^d Includes 277,000 eyed embryos shipped to Lyons Ferry Fish Hatchery (WDFW) and 1,064,535 embryos that, after hatching, were euthanized as gradeouts or as excess to program needs.

^e Includes 50,051 Wallowa stock smolts received from WDFW and released on the lower Grande Ronde River at Wildcat Creek.

^f Includes 15,696 embryos that, after hatching, were euthanized as gradeouts or as excess to program needs.

Table 26. Estimates of fin clip quality and coded-wire tag retention for 1994 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 1995. 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
<i>Wallowa stock</i>					
Production, 3	075822 ^a	402	92.5	6.5	1.0
Production, 5	075823	345	98.5	0.3	1.2
Acclimated, 7	075824	406	98.5	0.5	1.0
Acclimated, 9	075825	363	98.9	0.5	0.6
Direct stream, 19	070920	359	93.9	1.7	4.4
Average		375	96.5	1.9	1.6
<i>Imnaha stock</i>					
Acclimated, 27	075820	401	96.8	0.5	2.7
Acclimated, 28	075821	352	95.7	1.4	2.9
Direct stream, 31	070919	376	96.5	1.1	2.4
Average		376	96.3	1.0	2.7

^a During tagging, 5.2% of fish with tag code 075822 were incorrectly marked AdRV.

Table 27. Details of experimental and production groups of 1994 brood, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 1995. Experimental group indicates release strategy and rearing raceway number. All production fish were acclimated. 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, 23-25	5.0	Apr 10-12	Gr. Ronde R.	-	202 (18)	-	-	200,023	-	-
Direct stream, 26	5.3	Apr 12	Catherine Cr.	-	202 (18)	-	-	62,513	-	-
Direct stream	5.0	Apr 24	Wildcat Cr.	-	-	-	-	50,051	-	-
Production, 3	4.8	Apr 16	Spring Cr.	075822	202 (17)	95 (24)	1.11 (0.07)	24,729	61.4	-
Production, 5	4.8	Apr 16	Spring Cr.	075823	204 (20)	94 (29)	1.10 (0.07)	27,155	61.8	-
Production, 1-6,8,10, 12,14	4.7	Apr 16	Spring Cr.	-	201 (18)	96 (20)	1.14 (0.08)	443,253	-	-
Direct stream, 19	4.5	Apr 21	Deer Cr.	070920	206 (19)	102 (40)	1.11 (0.12)	50,524	-	72.6
Direct stream, 19	4.5	Apr 21	Deer Cr.	-	-	-	-	3,298	-	-
Acclimated, 7	3.9	Apr 21	Deer Cr.	075824	208 (17)	111 (32)	1.11 (0.08)	26,990	-	73.1
Acclimated, 9	3.9	Apr 21	Deer Cr.	075825	^e	^e	^e	27,281	-	69.4
Acclimated, 7,9,11, 13,14	4.2	Apr 21	Deer Cr.	-	208 (18)	107 (29)	1.10 (0.08)	170,685	-	-
Production, 15-17,22	4.6	May 5	Spring Cr.	-	211 (16)	99 (24)	1.00 (0.07)	162,296	-	-
Production, 17,18,20	4.4	May 8	Deer Cr.	-	208 (19)	103 (25)	1.10 (0.07)	154,196	-	-
Total released ^f								1,402,994		

^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 156-159. 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-J-1, RA-J-1 represent tag codes 075822 and 075823.

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

^e CWT codes 075824 and 075825 were held in the same acclimation pond and were not distinguishable based on an external mark.

^f Wallowa stock steelhead male releases were 1% precocial.

Table 28. Details of experimental and production groups of 1994 brood, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 1995. 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, 29	6.9	Apr 28	Imnaha R.	-	182 (24)	-	-	50,676	-	-
Direct stream, 31	5.2	May 1	L. Sheep Cr.	070919	202 (20)	87 (26)	1.07 (0.08)	54,985	1.6	51.1
Direct stream, 31	5.2	May 1	L. Sheep Cr.	-	-	-	-	1,969	-	-
Acclimated, 27	5.0	May 1	L. Sheep Cr.	075820	201 (18)	91 (24)	1.09 (0.07)	26,980	60.2	65.4
Acclimated, 28	5.0	May 1	L. Sheep Cr.	075821	200 (19)	91 (24)	1.11 (0.06)	26,630	76.6	71.3
Acclimated, 27,28, 30,32	5.0	May 1	L. Sheep Cr.	-	202 (17)	91 (24)	1.08 (0.07)	177,272	-	-
Total released ^e								338,512		

^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-J-2, LA-J-2, and RA-J-4 represent tag codes 075820, 075821, and 070919, respectively.

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

^e Imnaha stock steelhead male releases were 2% precocial.

Table 29. Summary of egg collection and juvenile survival for 1995 brood year summer steelhead released in the Grande Ronde and Imnaha river basins at LSRCP facilities in 1996.

Stock	Number of eggs taken	Eyed embryos	Estimated survival rate		Total fish released
			Egg-to-embryo ^a	Embryo-to-smolt ^b	
Wallowa	1,602,367	1,381,350 ^c	86.2	98.3	1,359,348 ^d
Imnaha	341,925	310,330	90.8	100.0	322,103

^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.

^b 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.

^c Includes 12,992 embryos that, after hatching, were euthanized as gradeouts or as excess to program needs.

^d Includes 13,919 Wallowa stock smolts received from WDFW and released on the lower Grande Ronde River at Mud Creek and 3,004 fish held back and reared as rainbow trout.

Table 30. Estimates of fin clip quality and coded-wire tag retention for 1995 brood year summer steelhead reared at Irrigon Fish Hatchery and released in 1996. 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
<i>Wallowa stock</i>							
Forced, 3	071163	316	99.4	0.3	0.3	99.7	0.3
Volitional, 5	071216	302	99.7	0.3	0.0	99.7	0.3
Acclimated, 9	071159	311	99.4	0.3	0.3	100.0	0.0
Acclimated, 11	071160	305	100.0	0.0	0.0	100.0	0.0
Direct stream, 18	071161	340	97.1	0.3	2.7	99.1	0.9
Direct stream, 18	071162	330	99.4	0.3	0.3	99.1	0.9
Average		317	99.2	0.2	0.6	99.6	0.4
<i>Imnaha stock</i>							
Acclimated, 29	071217	315	95.2	1.0	3.8	99.7	0.3
Acclimated, 31	071218	329	97.9	0.3	1.8	100.0	0.0
Direct stream, 30	071219	310	97.7	0.7	1.6	99.4	0.7
Direct stream, 30	071220	355	98.9	0.0	1.1	99.4	0.7
Average		327	97.4	0.5	2.1	99.6	0.4

Table 31. Details of experimental and production groups of 1995 brood, Wallowa stock hatchery summer steelhead released in the Grande Ronde River Basin in 1996. Experimental group indicates release strategy and rearing raceway number. All production fish were acclimated. 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, 16,17, 19,20	5.3	Apr 8-11	Gr. Ronde R.	-	199(19)	-	-	200,021	-	-
Direct stream, 15,16	5.7	Apr 10-11	Catherine Cr.	-	195(18)	-	-	62,481	-	-
Direct stream	5.1	Apr 19	Mud Cr.	-	-	-	-	13,919	-	-
Forced, 3	5.1	Apr 8	Spring Cr.	071163	206(19)	89.4(25.1)	1.00(0.09)	27,311	64.7	-
Volitional, 5	5.0	Apr 9-23	Spring Cr.	071216	206(16)	90.9(26.5)	1.10(0.08)	26,755	55.8	-
Production, 1-8, 10,12	5.4	Apr 8-23	Spring Cr.	-	202(17)	84.3(22.0)	0.99(0.07)	440,415	-	-
Direct stream, 18	5.3	Apr 17	Deer Cr.	071161	198(15)	85.0(16.5)	1.06(0.06)	24,759	-	68.8
Direct stream, 18	5.3	Apr 17	Deer Cr.	071162	^e	^e	^e	25,280	-	^e
Direct stream, 18	5.3	Apr 17	Deer Cr.	-	^e	^e	^e	904	-	-
Acclimated, 9	4.8	Apr 17	Deer Cr.	071159	209(17)	94.7(23.9)	1.02(0.06)	27,223	-	63.2
Acclimated, 11	4.8	Apr 17	Deer Cr.	071160	^f	^f	^f	27,289	-	69.0
Production, 9,11, 13,14	5.0	Apr 17	Deer Cr.	-	205(18)	90.9(23.2)	1.03(0.11)	168,325	-	-
Production, 21-23	4.3	May 15	Spring Cr.	-	216(19)	110(39.5)	1.04(0.09)	161,894	-	-
Production, 24-26	4.9	May 6	Deer Cr.	-	208(22)	93.4(28.8)	1.00(0.08)	149,768	-	-
Total released ^g								1,356,344	-	-

^a All fish were reared at Irrigon Fish Hatchery (ODFW), except for Mud Cr. releases reared at Lyon's Ferry Fish Hatchery (WDFW).

^b Grande Ronde River releases were at river mile 156-159. Catherine Creek releases were at river mile 17-18. Mud Creek releases were in the Lower Grande Ronde River at river mile 52.

^c Brand detections are expanded detections at Lower Granite Dam. Fish branded RA-A-1 and LA-A-1 represent tag codes 071163 and 071216, respectively.

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

^e CWT codes 071161 and 071162 were held in the same raceway. PIT- tagged fish represent both CWT codes.

^f CWT codes 071159 and 071160 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 32. Details of experimental and production groups of 1995 brood, Imnaha stock hatchery summer steelhead released in the Imnaha River Basin in 1996. 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	CWT code	Length mm	Weight g	Condition factor	Total fish released	Percent detected	
									Brand ^b	PIT ^c
Direct stream, 30	5.2	Apr 29	L. Sheep Cr.	071219	202(16)	86.6(20.3)	1.04(0.07)	26,342	44.9	55.5
Direct stream, 30	5.2	Apr 29	L. Sheep Cr.	071220	^d	^d	^d	26,315	-	^d
Direct stream, 30	5.2	Apr 29	L. Sheep Cr.	-	^d	^d	^d	909	-	-
Acclimated, 29	5.5	Apr 29	L. Sheep Cr.	071217	201(16)	91.5(24.0)	1.08(0.06)	26,025	20.8	58.8
Acclimated, 31	5.5	Apr 29	L. Sheep Cr.	071218	206(16)	97.9(20.4)	1.10(0.06)	26,986	28.5	64.6
Acclimated, 27-29, 31,32	5.5	Apr 29	L. Sheep Cr.	-	194(17)	81.9(19.8)	1.08(0.07)	<u>215,526</u>	-	-
Total released ^e								322,103		

^a All fish were reared at Irrigon Hatchery (ODFW).

^b Brand detections are expanded detections at Lower Granite Dam. Fish branded LA-A-2 and RA-A-2 represent tag codes 071217 and 071218. Fish branded RA-A-4 represent tag codes 071219 and 071220.

^c Percent PIT tag detections are unique detections at all mainstem Columbia and lower Snake river dams.

^d CWT codes 071219 and 071220 were held in the same raceway. PIT- tagged fish represent both CWT codes.

^e Imnaha stock steelhead male releases were 2% precocial.

Table 33. Timing of adult steelhead returns to LSRCP facilities in 1995 by location and origin.

Period	Week of the year	Number of fish trapped ^a					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural ^b	Hatchery	Natural	Hatchery	Natural
Feb 05-11	6	-	-	-	-	-	-
Feb 12-18	7	-	-	0	0	-	-
Feb 19-25	8	4	-	12	1	-	-
Feb 26-Mar 04	9	0	-	1	0	-	-
Mar 05-11	10	17	-	1	0	2	0
Mar 12-18	11	29	-	25	1	20	0
Mar 19-25	12	52	-	51	5	35	4
Mar 26-Apr 01	13	8	-	25	0	20	2
Apr 02-08	14	88	-	44	0	77	7
Apr 09-15	15	60	-	74	10	40	2
Apr 16-22	16	15	-	15	0	27	1
Apr 23-29	17	35	-	13	2	19	0
Apr 30-May 06	18	5	-	67	8	28	1
May 07-13	19	3	-	12	1	1	0
May 14-20	20	1	-	6	2	3	0
May 21-27	21	1	-	1	1	5	0
May 27-Jun 03	22	0	-	2	0	1	0
Jun 04-10	23	-	-	-	-	-	-
	Total	318	-	349	31	278	17

^a Weirs installed February 8 at Big Canyon (Deer Cr.), and February 28 at Little Sheep, as well as ladder opened February 17 at Wallowa Fish Hatchery. Adult collections stopped June 1, June 1, and June 2 at Wallowa, Big Canyon, and Little Sheep, respectively.

^b Natural fish were not distinguished from hatchery fish at Wallowa.

Table 34. Numbers and disposition of adult steelhead that returned to LSRCF facilities, including those transferred to Wallowa Hatchery from WDFW's Cottonwood Facility in 1995 by stock, origin, age (FW:SW), and sex (M=Male, F=Female).

Stock, Disposition ^a	Hatchery									Natural					Grand Total
	1:1		1:2		1:3		2:1		Total	2:1		2:2		Total	
	M	F	M	F	M	F	M	F		M	F	M	F		
<i>Wallowa Hatchery (Wallowa stock)</i>															
Trapped	181	74	31	20	4	6	2	0	318	0	0	0	0	0	318
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	181	74	31	20	4	6	2	0	318	0	0	0	0	0	318
Mortality	7	1	0	0	0	0	0	0	8	0	0	0	0	0	8
Spawned	147	72	27	20	3	6	1	0	276	0	0	0	0	0	276
Killed	27	1	4	0	1	0	1	0	34	0	0	0	0	0	34
Fork Length (mm)	583	574	691	689	755	726	-	-		-	-	-	-		
Standard deviation	(25)	(21)	(56)	(40)	(22)	(39)	-	-		-	-	-	-		
<i>Big Canyon Facility (Wallowa stock)</i>															
Trapped	138	144	18	35	2	9	1	2	349	3	3	6	19	31	380
Passed	18	7	3	2	0	0	0	0	30	3	3	6	19	31	61
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept ^b	120	137	15	33	2	9	1	2	319	0	0	0	0	0	319
Mortality	2	2	1	0	0	0	0	0	5	0	0	0	0	0	5
Spawned	101	133	13	33	2	9	1	2	294	0	0	0	0	0	294
Killed	17	2	1	0	0	0	0	0	20	0	0	0	0	0	20
Fork Length (mm)	576	572	642	673	-	747	655	578		-	-	-	-		
Standard deviation	(24)	(25)	(46)	(39)	-	(15)	-	-		-	-	-	-		

Table 34. Continued.

Stock, Disposition ^a	Hatchery									Natural					Grand Total
	1:1		1:2		1:3		2:1		Total	2:1		2:2		Total	
	M	F	M	F	M	F	M	F	Total	M	F	M	F	Total	Total
<i>Cottonwood Facility (Wallowa stock)</i>															
Trapped ^c	81	109	20	24	4	6	0	0	244	3	1	0	0	4	248
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	81	109	20	24	4	6	0	0	244	3	1	0	0	4	248
Mortality	11	9	3	4	1	1	0	0	29	0	1	0	0	1	30
Spawned	59	97	16	19	2	5	0	0	198	3	0	0	0	3	201
Killed	11	3	1	1	1	0	0	0	17	0	0	0	0	0	17
Fork Length (mm)	603	592	702	719	803	-	-	-		-	-	-	-		
Standard deviation	(26)	(27)	(15)	(35)	-	-	-	-		-	-	-	-		
<i>Little Sheep Creek Facility (Imnaha stock)</i>															
Trapped	172	103	1	0	0	0	2	0	278	1	10	2	4	17	295
Passed	28	6	0	0	0	0	0	0	34	1	7	1	3	12	46
Outplanted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kept	144	97	1	0	0	0	2	0	244	0	3	1	1	5	249
Mortality	7	0	0	0	0	0	0	0	7	0	0	0	0	0	7
Spawned	98	95	1	0	0	0	2	0	196	0	3	1	1	5	201
Killed	39	2	0	0	0	0	0	0	41	0	0	0	0	0	41
Fork Length (mm)	579	563	755	-	-	-	-	-		-	544	-	715		
Standard deviation	(29)	(28)	-	-	-	-	-	-		-	-	-	-		

^a Adults that were misidentified during spawning at Wallowa Hatchery included 21 male and 35 female Big Canyon returns, and 7 male and 19 female WDFW Cottonwood Facility returns.

^b All fish kept at Big Canyon Facility were transferred to Wallowa Hatchery for spawning.

^c Fish trapped at WDFW's Cottonwood Facility on the lower Grande Ronde River were hauled to Wallowa Hatchery for spawning.

Table 35. Spawning summaries for summer steelhead at LSRCP facilities in 1995.

Spawn date, Lot number	Parental origin ^a	Number of eggs	Eyed embryos ^b	% mortality to shocking
<i>Wallowa Hatchery (Wallowa stock)</i>				
3/14, wa295	Hatchery	52,000	44,500	14
3/21, wa296	Hatchery	119,100	106,800	10
3/28, wa297	Hatchery	61,782	60,000	3
4/4, wa298	Hatchery	132,000	116,900	11
4/11, wa299	Hatchery	335,500	285,200	15
4/12, wa300	Hatchery	103,000	88,000	15
4/18, wa301	Hatchery	232,900	183,100	21
4/25, wa302	Hatchery	214,400	197,700	8
5/2, wa303	Hatchery	231,200	185,700	20
5/9, wa304	Hatchery	76,830	72,000	6
5/16, wa305	Hatchery	32,750	30,750	6
5/23, wa306	Hatchery	7,065	7,000	1
5/31, wa307	Hatchery	3,840	3,700	4
Total		1,602,367	1,381,350	13.8
<i>Little Sheep Creek Facility (Imnaha stock)</i>				
3/30, li304	Hatchery	39,068	36,470	14
3/30, li304	Mixed	3,552		
4/6, li305	Hatchery	44,230	40,760	8
4/13, li306	Hatchery	45,130	42,750	5
4/20, li307	Hatchery	70,455	67,260	9
4/20, li307	Mixed	3,355		
4/27, li308	Hatchery	30,576	32,670	13
4/27, li308	Mixed	6,794		
5/4, li309	Hatchery	45,895	41,330	10
5/11, li310	Hatchery	11,150	10,450	6
5/18, li311	Hatchery	3,980	7,040	12
5/18, li311	Mixed	3,980		
5/23, li312	Hatchery	30,100	28,100	7
5/31, li313	Hatchery	3,660	3,500	4
Subtotal	Hatchery	324,244		
Subtotal	Mixed	17,681		
Total		341,925	310,330	9.2

^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 4/6, 4/21, 4/28, 5/1, 5/5, 5/12, 5/19, 5/24, 5/29, 6/5, 6/7, 6/15, and 6/16/95.

Table 36. Timing of adult steelhead returns to LSRCP facilities in 1996 by location and origin.

Period	Week of the year	Number of fish trapped ^a					
		Wallowa		Big Canyon		Little Sheep	
		Hatchery	Natural ^b	Hatchery	Natural	Hatchery	Natural
Feb 05-11	6	-	-	-	-	-	-
Feb 12-18	7	-	-	-	-	-	-
Feb 19-25	8	-	-	-	-	-	-
Feb 26-Mar 04	9	7	-	26	1	-	-
Mar 05-11	10	22	-	78	1	-	-
Mar 12-18	11	47	-	103	0	50	7
Mar 19-25	12	112	-	14	1	117	9
Mar 26-Apr 01	13	178	-	27	0	30	3
Apr 02-08	14	164	-	77	8	102	1
Apr 09-15	15	153	-	52	6	74	13
Apr 16-22	16	72	-	17	1	32	7
Apr 23-29	17	100	-	76	7	17	1
Apr 30-May 06	18	74	-	6	2	9	3
May 07-13	19	34	-	13	2	5	2
May 14-20	20	16	-	6	0	5	1
May 21-27	21	8	-	3	0	1	0
May 27-Jun 03	22	1	-	0	0	0	0
Jun 04-10	23	0	-	0	0	-	-
	Total	988	-	498	29	442	47

^a Weirs installed February 19 at Big Canyon (Deer Cr.), and March 6 at Little Sheep as well as ladder opened February 22 at Wallowa Fish Hatchery. Adult collections stopped June 5, June 4, and June 3 at Big Canyon, Little Sheep, and Wallowa, respectively.

^b Natural fish were not distinguished from hatchery fish at Wallowa.

Table 37. Numbers and disposition of adult steelhead that returned to LSRCF facilities in 1996 by stock, origin, age (FW:SW), and sex (M=Male, F=Female).

Stock, Disposition	Hatchery								Natural					Grand Total	
	1:1		1:2		1:3		2:1		Total	2:1		2:2			Total
	M	F	M	F	M	F	M	F	Total	M	F	M	F	Total	
<i>Wallowa Fish Hatchery (Wallowa stock)</i>															
Trapped	509	309	38	128	0	2	2	0	988	0	0	0	0	0	988
Passed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outplants	7	21	1	12	0	0	0	0	41	0	0	0	0	0	41
Kept	502	288	37	116	0	2	2	0	947	0	0	0	0	0	947
Mortality	9	0	0	1	0	0	0	0	10	0	0	0	0	0	10
Spawned	455	263	33	114	0	2	2	0	869	0	0	0	0	0	869
Killed	38	25	4	1	0	0	0	0	68	0	0	0	0	0	68
Fork Length (mm)	599	587	706	684	-	752	520	-	-	-	-	-	-	-	-
Standard deviation	(27)	(25)	(37)	(29)	-	-	-	-	-	-	-	-	-	-	-
<i>Big Canyon Facility (Wallowa stock)</i>															
Trapped	130	141	45	180	2	0	0	0	498	9	15	3	2	29	527
Passed	2	1	0	0	0	0	0	0	3	9	15	3	2	29	32
Outplants ^a	29	38	9	47	0	0	0	0	123	0	0	0	0	0	123
Kept ^b	99	102	36	133	2	0	0	0	372	0	0	0	0	0	372
Mortality	3	0	0	0	0	0	0	0	3	0	0	0	0	0	3
Spawned	79	84	34	129	2	0	0	0	328	0	0	0	0	0	328
Killed	17	18	2	4	0	0	0	0	41	0	0	0	0	0	41
Fork Length (mm)	594	585	707	685	831	-	-	-	-	-	-	-	-	-	-
Standard deviation	(29)	(26)	(43)	(30)	-	-	-	-	-	-	-	-	-	-	-
<i>Little Sheep Creek Facility (Imnaha stock)</i>															
Trapped	139	108	30	163	0	0	1	1	442	22	24	0	1	47	489
Passed	33	23	3	9	0	0	0	0	68	16	19	0	0	35	103
Outplants	18	17	4	29	0	0	0	0	68	0	0	0	0	0	68
Kept	88	68	23	125	0	0	1	1	306	6	5	0	1	12	318
Mortality	1	0	1	0	0	0	0	0	2	0	0	0	0	0	2
Spawned	86	54	21	99	0	0	1	0	261	6	5	0	1	12	273
Killed	1	14	1	26	0	0	0	1	43	0	0	0	0	0	43
Fork Length (mm)	587	576	694	675	-	-	531	518	-	-	564	-	695	-	-
Standard deviation	(25)	(33)	(43)	(30)	-	-	-	-	-	-	(11)	-	-	-	-

^a Includes 12 hatchery females outplanted from Wallowa Fish Hatchery. Also includes one male and five females (three AdLV+CWT and two Ad-only marked fish) taken to the Pendleton Sportsman Show for a display.

^b Only 126 males and 237 females were transferred to Wallowa Fish Hatchery for spawning.

Table 38. Spawning summaries for summer steelhead at LSRCP facilities in 1996.

Spawn date, Lot number	Parental origin ^a	Number of eggs	Excess eyed embryos ^b	Eyed embryos ^c	% mortality to shocking
<i>Wallowa Fish Hatchery (Wallowa stock)</i>					
3/13, wa308	Hatchery	104,800	0	93,500	11
3/19, wa309	Hatchery	383,200	0	279,700	27
3/26, wa310	Hatchery	515,700	0	464,300	10
4/2, wa311	Hatchery	453,700	19,500	400,000	8
4/9, wa312	Hatchery	427,900	104,300	280,000	10
4/16, wa313	Hatchery	398,100	260,000	120,000	5
4/23, wa314	Hatchery	223,700	0	206,100	8
4/30, wa315	Hatchery	156,045	0	137,945	12
5/7, wa316	Hatchery	57,900	0	55,250	5
5/14, wa317	Hatchery	48,700	0	35,400	27
5/21, wa318	Hatchery	11,820	0	11,590	2
Total		2,781,565	383,800	2,083,785	11
<i>Little Sheep Creek Facility (Imnaha stock)</i>					
3/22, li314	Hatchery	168,600	0	104,550	38
3/28, li315	Hatchery	113,580	0	99,960	12
4/3, li316	Hatchery	97,144	0	44,010	57
4/3, li316	Mixed	4,626	-	-	-
4/11, li317	Hatchery	141,388	0	142,177	8
4/11, li317	Mixed	12,855	-	-	-
4/18, li318	Hatchery	75,447	0	78,081	8
4/18, li318	Mixed	9,432	-	-	-
4/25, li319	Hatchery	31,024	0	42,457	9
4/25, li319	Mixed	15,513	-	-	-
5/2, li320	Hatchery	18,210	0	15,020	18
5/9, li321	Hatchery	10,717	0	10,680	25
5/9, li321	Mixed	3,573	-	-	-
5/16, li322	Hatchery	4,300	0	10,050	22
5/16, li322	Mixed	8,600	-	-	-
5/23, li323	Hatchery	13,235	0	11,770	11
Subtotal	Hatchery	673,645			
Subtotal	Mixed	54,599			
Total		728,244	0	558,755	23

^a In general, family groups were pooled (three 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 euthanized because they were excess to program needs.

^c Eyed embryos were inventoried on 4/11, 4/22, 5/3, 5/13, 5/24, 5/31, and 6/7.

Table 39. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Wallowa stock summer steelhead for the 1994-95 return year. All CWT fish were from releases of hatchery fish into either Deer or Spring creek. Data was summarized as available through May 1999.

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
1990						
Deer Cr.	Acclimated, 5 fpp	075351	0	4	0	4
	Acclimated, 5 fpp	075352	1	0	0	1
	Direct stream, 5 fpp	075354	1	0	1	2
Spring Cr.	Acclimated, 4 fpp	075359	0	0	1	1
	Acclimated, 4 fpp	075360	3	4	6	13
	Acclimated, 5 fpp	075443	1	0	0	1
	Acclimated, 5 fpp	075444	0	0	2	2
1991						
Deer Cr.	Acclimated, 5 fpp	075855	5	11	14	30
	Acclimated, 5 fpp	075856	1	0	4	5
	Direct stream, 5 fpp	075857	1	8	9	18
	Direct stream, 5 fpp	075858	0	0	9	9
Spring Cr.	Production, 5 fpp	075853	4	0	7	11
	Production, 5 fpp	075854	3	0	9	12
1992						
Deer Cr.	Acclimated, 5 fpp	076102	14	19	26	59
	Acclimated, 5 fpp	076103	10	21	51	82
	Direct stream, 5 fpp	076104	11	1	31	43
	Direct stream, 5 fpp	076105	16	15	73	104
Spring Cr.	Production, 5 fpp	076106	15	8	26	49
	Production, 5 fpp	076107	9	0	42	51
Grand total of recoveries in 1995			95	91	311	497

^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 40. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1994-95 return year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through May 1999.

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	Direct stream	075355	0	0	2	2
1991	Direct stream	075861	1	0	0	1
	Acclimated	075862	0	0	1	1
1992	Acclimated	076061	28	4	5	37
	Acclimated	076062	16	0	10	26
	Direct stream	076063	17	0	19	36
	Direct stream	076101	22	0	21	43
Grand total of recoveries in 1995			84	4	58	146

^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 41. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Wallowa stock summer steelhead for the 1995-96 return year. All CWT fish were from releases of hatchery fish into either Deer or Spring creek. Data was summarized as available through May 1999.

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
1991						
Deer Cr.	Acclimated, 5 fpp	075855	0	1	0	1
1992						
Deer Cr.	Acclimated, 5 fpp	076102	10	0	20	30
	Acclimated, 5 fpp	076103	11	1	25	37
	Direct stream, 5 fpp	076104	17	3	46	66
	Direct stream, 5 fpp	076105	8	1	18	27
Spring Cr.	Production, 5 fpp	076106	4	1	24	29
	Production, 5 fpp	076107	5	0	25	30
1993						
Deer Cr.	Acclimated, 5 fpp	070325	39	6	100	145
	Acclimated, 5 fpp	070326	42	3	84	129
	Direct stream, 5 fpp	070327	28	6	53	87
	Direct stream, 5 fpp	070328	18	5	82	105
Spring Cr.	Production, 5 fpp	070329	33	3	97	133
	Production, 5 fpp	070330	39	5	92	136
Grand total of recoveries in 1996			254	35	666	955

^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 42. Summary of anadromous adult recoveries of coded-wire tagged (CWT), Imnaha stock summer steelhead for the 1995-96 return year. All CWT fish were from releases of hatchery fish into Little Sheep Creek. Data was summarized as available through May, 1999.

Brood year	Experimental group ^a	CWT code	Recoveries at weirs ^b	Other in-basin recoveries ^c	Out-of-basin recoveries ^d	Total recoveries ^e
1992	Acclimated	076061	15	1	8	24
	Acclimated	076062	10	0	22	32
	Direct stream	076063	10	1	4	15
	Direct stream	076101	11	2	1	14
1993	Acclimated	070321	17	0	45	62
	Acclimated	070322	12	1	0	13
	Direct stream	070323	8	0	19	27
	Direct stream	070324	7	1	5	13
Grand total of recoveries in 1996			90	6	104	200

^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 43. Catch and escapement distribution of adult summer steelhead by recovery location for the 1994-95 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through May 1999.

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	2	14	0.3	1	2	0.4
Columbia River						
Treaty net	100	900	21.4	20	62	13.1
C and S						
Sport	75	654	15.5	20	58	12.3
Test						
Tributary sport				1	3	0.6
Deschutes River						
Sport	24	264	6.3	5	19	4.0
C and S						
Strays						
Outside Snake R. Basin	19	143	3.4	4	9	1.9
Within Snake R. Basin ^a	6	46	1.1	2	7	1.5
Snake River sport, tribs. ^a	89	759	18.0	5	11	2.3
Oregon tributaries ^a	87	760	18.1	4	24	5.1
Hatchery weir ^a	95	667	15.9	84	278	58.8
Total estimated return	497	4,207	100.0	146	473	100.0
Return to compensation area	277	2,232		95	320	
Percent of compensation goal		24.3			16.0	

^a 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 are actual numbers. Total returns to Oregon tributaries are harvest estimates based on angler surveys.

Table 44. Catch and escapement distribution of adult summer steelhead by recovery location for the 1995-96 run year using the PSMFC and ODFW CWT databases. "C and S" indicates ceremonial and subsistence tribal fisheries. Data was summarized as available through May 1999.

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	157	1,365	17.3	24	89	9.0
C and S						
Sport	141	1,262	16.0	51	252	25.5
Test						
Tributary sport	1	2	<0.1	1	5	0.5
Deschutes River						
Sport	49	367	4.7	3	6	0.6
C and S	1	13	0.2	0	0	0.0
Strays						
Outside Snake R. Basin	88	903	11.5	5	11	1.1
Within Snake R. Basin ^a	10	87	1.1	3	12	1.2
Snake River sport, tribs. ^a	226	1,398	17.7	17	60	6.1
Oregon tributaries ^a	28	1,005	12.7	6	112	11.3
Hatchery weir ^a	254	1,486	18.8	90	442	44.7
Total estimated return	955	7,888	100.0	200	989	100.0
Return to compensation area		3,976			626	
Percent of compensation goal		43.3			31.3	

^a 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 are actual numbers. Total returns to Oregon tributaries are harvest estimates based on angler surveys.

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