

LOWER SNAKE RIVER COMPENSATION PLAN:
Summer Steelhead Creel Surveys on the
Grande Ronde, Wallowa, and Imnaha
Rivers for the 2015-16 Run Year

Oregon Department of Fish and Wildlife
Fish Research and Development, NE Region



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Front cover photo: An angler fly fishing for summer steelhead on the lower Grande Ronde River near Troy, Oregon in October 2016. Photo by Celeste Cole.

ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Summer Steelhead Creel Surveys on the
Grande Ronde, Wallowa, and Imnaha
Rivers for the 2015-16 Run Year

CONTRACT NUMBER: F16AC00030

PROJECT PERIOD: 1 October 2015 to 30 September 2016

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September, 2018

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This project was financed by the U.S. Fish and Wildlife Service under
the Lower Snake River Compensation Plan.

PREFACE

This report is for the funding period 1 October 2015 to 30 September 2016. The sampling period was from 1 September 2015 to 15 April 2016. The report summarizes statistical angler surveys conducted during the summer steelhead angling season in major fishing areas on the Grande Ronde, Wallowa, and Imnaha rivers. Hatchery adult steelhead harvested during the 2015-2016 run year were primarily from the 2012 and 2013 brood years. Results of creel surveys conducted prior to fall 2015 are reported in previous Lower Snake River Compensation Plan evaluation annual reports (Carmichael et al. 1986, 1987, 1988, 1989, 1990; Flesher et al. 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2004a, 2004b, 2005, 2007, 2008a, 2008b, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, and 2017), many of which are available at: <http://www.fws.gov/lsnakecomplan/reports/ODFWreports.html>. The steelhead angling season surveyed in this report, during which only adipose fin-clipped fish could be harvested, was open from 1 September 2015 to 30 April 2016 in the Grande Ronde and Imnaha river basins.

ACKNOWLEDGMENTS

We would like to thank Mary Buckman (retired) for the statistical design of the data, Celeste Cole and Emily Branigan for their dedication in conducting the surveys, and Rod Engle for reviewing the document. We would also like to thank Todd Miller (Washington Department of Fish and Wildlife) for coordinating and James Snook for conducting the lower Grande Ronde survey during spring 2016. This project was financed as a cooperative agreement between the Oregon Department of Fish and Wildlife and the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan.

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SUMMARY

Creel survey data for the 2015-16 run year indicate average angler participation and success for summer steelhead fisheries in the Grande Ronde basin but poor participation and success in the Imnaha River basin. For example, angler effort on the lower Grande Ronde River (13,879 hrs) was higher than the prior two seasons and harvest in 2015-16 (903 fish) was near the 10-year average (974 fish). Conversely, Imnaha River effort (2,103 hrs) and harvest (73) were the lowest observed since the mid-1990s. Anglers that participated experienced better than average fishing success in the lower Grande Ronde River as catch rates were 5.0 hrs/fish, but poorer than average catch rates (9.0 hrs/fish) on the Imnaha River.

The total catch of wild steelhead in the lower Grande Ronde River for the current run year was 1,410 fish, which was above the 10-year average of 1,303 fish. In 2015-16 wild fish comprised 50% of total catch, whereas in the prior 5 years wild steelhead were over 50% of the catch. This may be due to a decline in the hatchery steelhead run affecting the ratio of hatchery to wild steelhead in the river. Wild fish comprised 25.5% of the Wallowa River catch.

This report includes angler harvest card data (total catch, effort, and harvest) for the middle Grande Ronde River, the Wallowa River and Rondowa survey areas for the 2014-15 run year, summarized in the appendices. Based on creel and harvest card data, combined total catch in those areas was 7,281 fish, total harvest was 3,248 fish, and total effort was 37,362 hours. Catch and harvest were at least three times higher than the 2013-14 season and near to or better than the 10-year averages.

Sixty-nine percent of anglers participating in Imnaha basin fisheries were local residents whereas that number was 55 to 63% in Grande Ronde basin locations. Out-of-state persons comprised 0 to 14% of the anglers, depending on location.

The 2015-16 fishing season was the first year in which regulation changes allowed anglers to target steelhead through the end of April. However, the end dates of our 2015-16 creel survey remained unchanged from prior seasons (31 March on the lower Grande Ronde, 15 April on the Wallowa and Imnaha rivers). The regulation change likely will not meaningfully affect total catch and harvest on the lower Grande Ronde River, since fishing effort there is typically low in April. However, steelhead are often present in the Wallowa and Imnaha rivers in late April, and empirical information suggests some anglers will target them. Thus, creel surveys of these fisheries in late April are advised if funding allows.

INTRODUCTION

Summer steelhead (*Oncorhynchus mykiss*) fisheries in the Grande Ronde and Imnaha river basins were closed in 1974. This closure was prompted by declining adult returns, as indicated by adult counts at Ice Harbor Dam on the Snake River (USACOE 1996), and low steelhead redd counts on index streams in the Grande Ronde and Imnaha river basins (Oregon Department of Fish and Wildlife District Annual Reports 1949-1974). The Lower Snake River Compensation Plan (LSRCP), initiated by Congress in 1976, was developed to compensate for losses of anadromous salmonids in the Snake River basin from construction of the four lower Snake River dams built between 1962 and 1976. Thus, the focus of the LSRCP is the Snake River above Lower Granite Dam (Rkm 173), the uppermost of these four dams. One of the primary objectives of the LSRCP in Oregon is to restore historic recreational and tribal fisheries for summer steelhead in the Grande Ronde and Imnaha river basins (Carmichael 1989). Approximately 1.68 million steelhead smolts were targeted for release in Oregon each year during April and May in the Grande Ronde and Imnaha river basins between 1984 and 1999. In 2000, we reduced releases to approximately 1.2 million smolts in response to the National Marine Fisheries Service's recommendation to help reduce straying of Wallowa Hatchery stock steelhead, primarily into the Deschutes River (mid-Columbia tributary). In 2007, we further reduced smolt releases to approximately 1.065 million, partly due to an increased release size from five to four fish per pound (fpp) for Wallowa stock, which increased smolt-to-adult survival (Clarke et al. 2014), and due to a reduction of Imnaha stock Big Sheep direct stream releases. In 2009, smolt releases were reduced again to approximately 1.015 million, due to reductions in releases of Imnaha stock into Big Sheep Creek. Released smolts provide hatchery adult returns that contribute to recreational fisheries and may supplement natural spawning populations in northeast Oregon. Consumptive recreational fisheries for summer steelhead re-opened in 1986, in part as a result of increases in hatchery adult returns.

We began creel surveys for summer steelhead during the fall of 1985 in both the Grande Ronde and Imnaha river basins, the goal being to provide annual harvest information needed to assess LSRCP goals (Carmichael and Wagner 1983). In general, the number of summer steelhead in the recreational fishery has been restored to historic values, but the fishery is concentrated at different times and places (Flesher et al. 1994). This report summarizes results of creel surveys conducted during the fall of 2015 and the spring of 2016 in the Grande Ronde and Imnaha river basins. In addition, this report contains estimates of total effort, catch, and harvest for all the spring fisheries in the Grande Ronde river basin, information that was not available for inclusion in the 2014-15 annual report. The Grande Ronde and Imnaha river basins encompass the major steelhead fisheries that occur in Oregon tributaries to the Snake River upstream of Lower Granite Dam. A new regulation for the 2015-16 steelhead angling season extended the fishery an additional 15 days—from a closure date of 15 April to a 30 April 30—in the Grande Ronde and Imnaha river basins.

STUDY AREA

Creel surveys on the Grande Ronde River were conducted on a lower 24 km section from the Oregon-Washington state line (Rkm 62) upstream to Wildcat Creek (Rkm 86, Figure 1). Surveys on the Wallowa River were conducted on a 6 km section from its confluence with the Grande Ronde River at Rondowa (mouth of the Wallowa River) upstream to Howard Creek (Rkm 6) and a 50 km section from Minam State Park (Rkm 13) upstream to the mouth of Trout Creek (Rkm 63) near Enterprise. Anglers who parked their vehicles at Minam State Park to fish just below the park were included in the Wallowa survey. Because vehicle access into Rondowa was limited, anglers parked their vehicles in the Palmer Junction area, located 5.6 km upstream of Rondowa

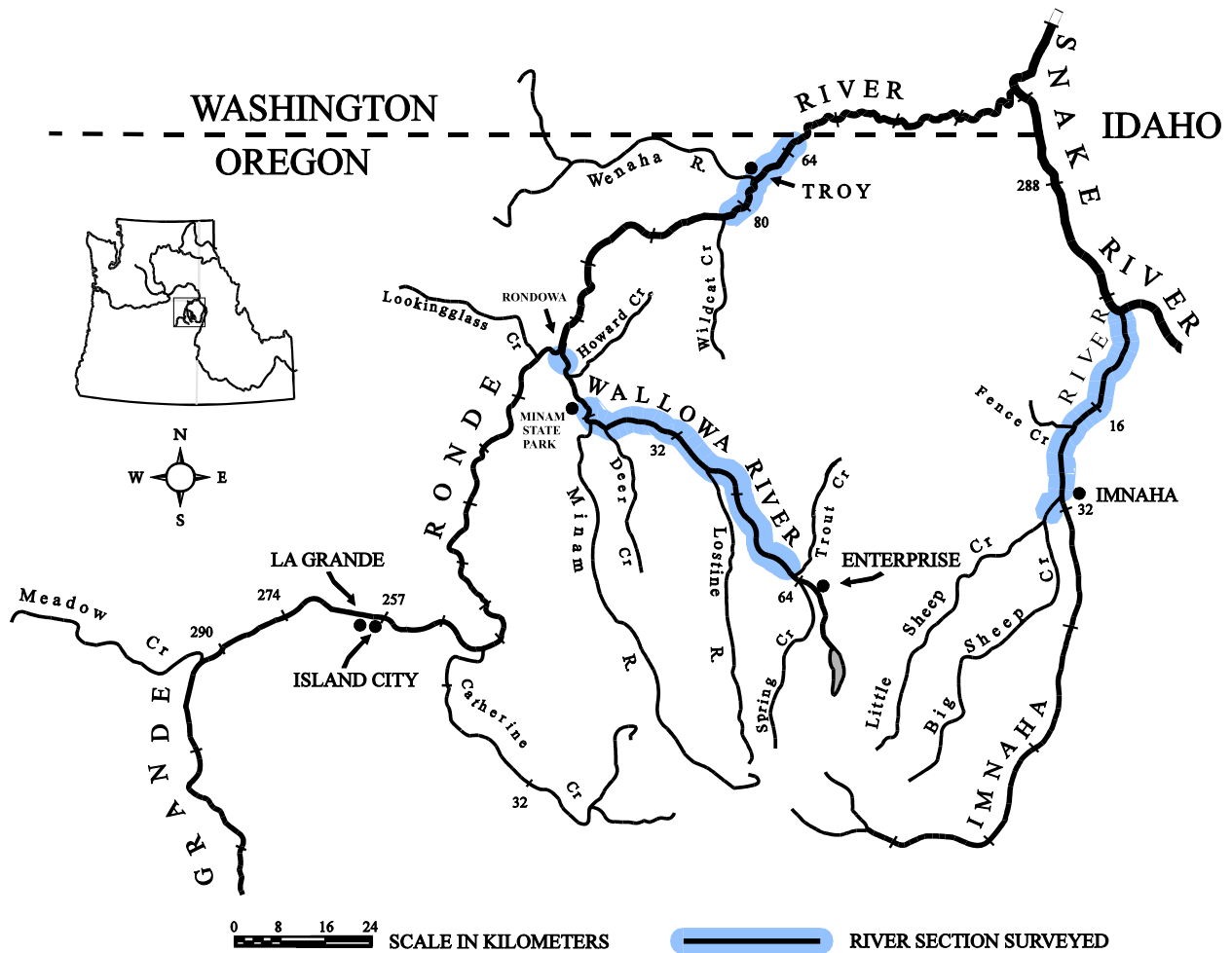


Figure 1. Map of northeastern Oregon showing where summer steelhead creel surveys were conducted in the Grande Ronde and Imnaha river basins during the 2015-16 run year.

on the Grande Ronde River, and on Smith Mountain Road at the Hancock Forest Management gate, approximately 16 km by road to Rondowa. Thus, for the Rondowa survey, we interviewed anglers leaving the parking areas near Palmer Junction and at the gate on Smith Mountain Road when they were encountered. The survey on the Imnaha River was conducted on the lower 32 km from its confluence with the Snake River (Rkm 0) upstream to the mouth of Big Sheep Creek (Rkm 32) near the town of Imnaha, and beginning in 2010, on the lower 5 km section of Big Sheep Creek from the mouth upstream to Little Sheep Creek (Rkm 5, Figure 1).

METHODS

For the lower Grande Ronde River survey, we used the methodology described by Carmichael et al. (1988). Starting in 2013 and continuing through the present creel season, the survey on the lower Grande Ronde River has been conducted from 1 September to 31 March, rather than surveying through the 15 April fishery closure. Although the fishing season has now been extended to 30 April, we still do not creel in April because prior years of data show consistently low angler effort in April. During the creel season our goal was to sample 50% of the weekends and holidays and 30% of the weekdays during each month. Sample days were chosen randomly in two-day blocks, representing two strata (weekend days and holidays, and weekdays). On each sample day, beginning at a randomly selected start time, the creel surveyor conducted a pressure count by tallying all anglers and vehicles every three hours while driving a vehicle along the entire survey route. Between pressure counts, the surveyor interviewed anglers by recording a description of each angler, what species of fish they were angling for, what type of angling gear they were using, their residence, the number of hours they had fished, and the number and species of fish caught. The surveyor also sampled all harvested fish by recording fork length (mm), gender, fin clips, and any external tags. If a hatchery fish, as indicated by an adipose (Ad) clip, was coded-wire-tagged (CWT), as indicated by either a left or right ventral fin-clip (AdLV or AdRV) or by use of a wire detector (Northwest Marine Technology, handheld wand detector), the surveyor asked permission from the angler to collect the snout, then excised the snout behind the eye and placed it with an identification number in a plastic bag for later processing.

Surveys in the Imnaha basin were conducted from 1 February through 15 April 2016. For these surveys we used a check station for the Imnaha River area below Fence Creek (Rkm 23) and a roving survey in the area above Fence Creek and at Big Sheep Creek. We selected sample days using the same methodology described for the lower Grande Ronde River survey. Our goal was to survey 50% of the weekends and 30% of the weekdays during each month of each survey. For the check station, we used the methodology described by Carmichael et al. (1988). The check station was designed so that anglers leaving the lower river area during a sample day would stop voluntarily and the surveyor would interview each angler and sample all harvested fish. At the end of the second sample day, the surveyor would drive to Cow Creek (Rkm 7) and interview all anglers encountered that fished during the two-day period and did not exit

through the check station. For the roving survey, we followed the same procedures as on the lower Grande Ronde River survey except that anglers were interviewed during pressure counts. For each pressure count, the surveyor closed the check station, interviewed and enumerated all anglers from Fence Creek to the town of Imnaha, then up Big Sheep Creek to the mouth of Little Sheep Creek and then returned. Time spent away from the check station was recorded, and catch and harvest data was expanded to account for the unsampled time.

For the Wallowa River and Rondowa survey areas, one surveyor conducted angler interviews from 1 February to 15 April 2016. We surveyed the Wallowa River area each sample day and surveyed the Rondowa area every other sample day. Beginning in 2012, we also surveyed the Rondowa area every weekend sample day to increase the number of interviews. At the Wallowa River, the surveyor drove a route from Trout Creek downstream to Minam State Park, stopping to interview anglers along the way, then waited at the park for approximately one hour and interviewed returning anglers that had hiked below the park to fish, and then repeated this sequence. On alternate sample days, the surveyor drove the survey route from Minam State Park upstream to Trout Creek, stopping to interview anglers along the way, then drove to the Smith Mountain parking area used by anglers to access Rondowa and spent an hour interviewing anglers returning from Rondowa, and then repeated the sequence. During February, 2016 the Smith Mountain road was closed to reduce vehicle disturbance of wildlife. Anglers also access Rondowa from the community of Palmer Junction on the Grande Ronde River, so our surveyor interviewed anglers there. During the rest of the season, the surveyor would occasionally drive to the Palmer Junction area to check for anglers accessing Rondowa. All harvested fish observed were sampled. From 1 February to 26 February, we surveyed five days each week (Sunday – Saturday) from 0900-1800 hours. From 27 February to 15 April, we surveyed four days each week from 0800-1900 hours.

For the lower Grande Ronde River and Imnaha River creel surveys, we estimated angler effort in hours and days, total catch, harvest, catch rate, percent hatchery fish in the catch, and the number of AdLV+CWT, AdRV+CWT, AdRV-only, and Ad+CWT marked fish harvested (see Carmichael et al. 1988). For the Wallowa and Rondowa survey areas, we estimated catch rate, percent hatchery fish in the catch, and the number of AdRV-only and CWT marked fish harvested. In addition, we determined age and gender composition and mean fork length of harvested fish in all survey areas. Catch rate was expressed as an index, hours per fish, in which lower values indicate better angling success and higher values indicate poorer angling success.

We cannot creel certain springtime fishery locations in the Grande Ronde basin (e.g., Catherine Creek), and on the Wallowa River and Rondowa our creel is limited to angler interviews and sampling their catch. In these instances we rely on angler harvest card data for additional information. For example, we estimate total monthly harvest by regressing angler harvest card estimates against creel survey harvest estimates for specific reaches in the Grande Ronde and Imnaha basins. The regression is updated annually as harvest data become available. However, there is

usually a one or two-year delay in obtaining final angler harvest card estimates. For this reason the current annual report has harvest estimates for run year 2014-2015. Total catch for these areas is estimated by multiplying total harvest estimates by the ratio of sampled catch to sampled harvest as determined by creel surveys. Total angler effort (hours) is total catch divided by the sample catch rate (fish/ hour).

Figures 8, 9, 10, and 11, and Table 6 also include data from creel surveys conducted on the upper Grande Ronde River from 1989 to 2002 and Catherine Creek in 1992, 1993, and 1997 to 1999, and were originally reported on in Carmichael et al. (1989, 1990), and Flesher et al. (1991, 1992, 1993, 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2004a, and 2004b).

ACCOMPLISHMENTS AND FINDINGS

On the lower Grande Ronde River from 1 September 2015 to 31 March 2016, we sampled 52.3% of the weekends and holidays (34 days) and 31.2% of the weekdays (44 days) for a total of 78 sample days. On the Wallowa River from 1 February to 15 April 2016, we sampled 61.9% of the weekends and holidays (13 days) and 40.7% of the weekdays (22 days) for a total of 35 sample days. During the same time period at Rondowa, we sampled 61.9% of the weekends and holidays (13 days) and 20.4% of the weekdays (11 days) for a total of 24 sample days. On the Imnaha River and Big Sheep Creek from 1 February to 15 April 2016, we sampled 52.4% of the weekends and holidays (11 days) and 29.6% of the weekdays (16 days) for a total of 27 sample days. Tables in Appendix A provide more details on sampling effort by fishing location.

We estimate that 2,708 anglers fished for 13,879 hours on the lower Grande Ronde River during the 2015-16 season. Anglers caught and released 1,369 wild and 467 hatchery steelhead, and harvested 888 hatchery steelhead for an average catch rate index of 5 hours per fish (Figures 2-6, Appendix Table A-1). The percent of steelhead caught that were hatchery origin ranged from 27% in September 2015 to 59% in February 2016 (Figure 7, Appendix Table B). Sixty-four percent of harvested hatchery steelhead spent one year in freshwater and one year in saltwater (hereafter designated 1:1), and 36% spent one year in freshwater and two years in saltwater (designated 1:2), (Table 1). Mean fork length ($\pm 95\%$ confidence interval) of harvested hatchery steelhead was 587 (± 5) mm for age 1:1, and 667 (± 10) mm for age 1:2 (Table 1). Gender composition was 38% male and 62% female (Table 1). Fifty-five percent of the anglers on the lower Grande Ronde River were local Oregon residents, 25% were non-local Oregon residents, 6% were Washington State residents and 14% resided outside the states of Oregon and Washington (Table 2). On the lower Grande Ronde River, anglers harvested an estimated 145 Ad+CWT, AdLV+CWT, or AdRV+CWT marked steelhead from our hatchery releases (Table 3).

At Rondowa, the catch rate index averaged 3 hours per fish (Figure 4, Appendix Table A-2). The percent of steelhead caught that were hatchery origin ranged from 0% in April to 82% in February (Figure 7, Appendix Table B). Age composition of harvested

hatchery steelhead was 51% 1:1 and 49% 1:2 (Table 1). Mean fork length ($\pm 95\%$ confidence interval) of harvested hatchery steelhead was 586 (± 13) mm for age 1:1 and 669 (± 14) mm for age 1:2 (Table 1). Gender composition was 22% male and 78% female (Table 1). Sixty-three percent of the anglers at Rondowa were local Oregon resident anglers, and 37% were non-local Oregon resident anglers (Table 2). At Rondowa, anglers harvested 4 Ad+CWT, AdLV+CWT, or AdRV+CWT marked steelhead from our hatchery releases; however, expanded estimates for the entire fishery, as reported on in Table 3, will not be determined until state angler harvest card data become available.

On the Willowa River, the catch rate index averaged 5 hours per fish (Figure 4, Appendix Table A-3). The percent of steelhead caught that were hatchery origin ranged from 46% in April to 87% in March (Figure 7, Appendix Table B). Age composition of harvested hatchery steelhead was 51% 1:1, 49% 1:2, 1% 1:3, and 1% spent one year in freshwater and four years in saltwater (1:4; Table 1). Mean fork length ($\pm 95\%$ confidence interval) of harvested hatchery steelhead was 590 (± 4) mm for age 1:1, 685 (± 6) mm for age 1:2, 750 (± 43) mm for age 1:3, and 770 mm for age 1:4 (Table 1). Gender composition was 47% male and 53% female (Table 1). Fifty-five percent of the anglers on the Willowa River were local Oregon residents, 40% were non-local Oregon residents, 3% were Washington State residents and 2% resided outside the states of Oregon and Washington (Table 2). On the Willowa River, anglers harvested 69 Ad+CWT, AdLV+CWT or AdRV+CWT marked steelhead from our hatchery releases; however, expanded estimates for the entire fishery, as reported on in Table 3, will not be determined until state angler harvest card data become available.

On the Imnaha River and Big Sheep Creek, we estimate that 659 anglers fished for 2,121 hours. They caught and released 119 wild and 38 hatchery steelhead, and harvested 75 hatchery steelhead for an average catch rate index of 9 hours per fish on the Imnaha and 7 hours per fish on Big Sheep Creek (Figures 2-6, Appendix Tables A-4, A-5, and A-6). The percent of steelhead caught that were hatchery origin ranged from 18% in March in Section 1 (Fence Creek to the town of Imnaha) to 100% in March on Big Sheep Creek (Figure 7, Appendix Table B). Age composition of harvested hatchery steelhead was 54% 1:1 and 46% 1:2 (Table 1). Mean fork length ($\pm 95\%$ confidence interval) of harvested hatchery steelhead was 588 (± 12) mm for age 1:1 and 677 (± 16) mm for age 1:2 (Table 1). Gender was 57% male and 43% female (Table 1). Sixty-nine percent of the anglers on the Imnaha River were local Oregon residents, 25% were non-local Oregon residents, 1% were Washington State residents and 5% resided outside the states of Oregon and Washington (Table 2). On Big Sheep Creek, 100% of the anglers were local Oregon residents (Table 2). On the Imnaha River, anglers harvested an estimated 6 Ad+CWT, or AdLV+CWT marked steelhead from our hatchery releases (Table 3).

Angler effort on the lower Grande Ronde was higher than the previous two years, but approximately 2,200 fewer hours than the 10-year average, while the Imnaha effort was the lowest observed since the mid-90's and less than half of the 10-year average (Figure 8).

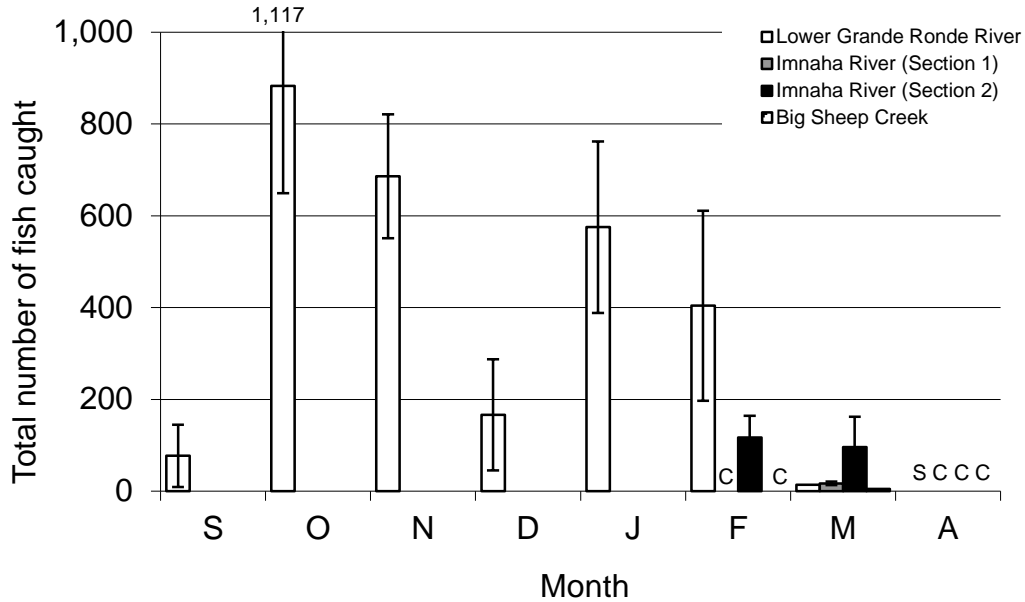


Figure 2. Estimated total catch of summer steelhead (vertical bars show 95% confidence intervals) on the lower Grande Ronde River, two sections of the Imnaha River, and Big Sheep Creek during the 2015-16 run year. “C” indicates no catch and “S” indicates no survey. Surveys were conducted from 1 September 2015 to 31 March 2016 on the lower Grande Ronde River, and from 1 February to 15 April 2016 on the Imnaha River and Big Sheep Creek.

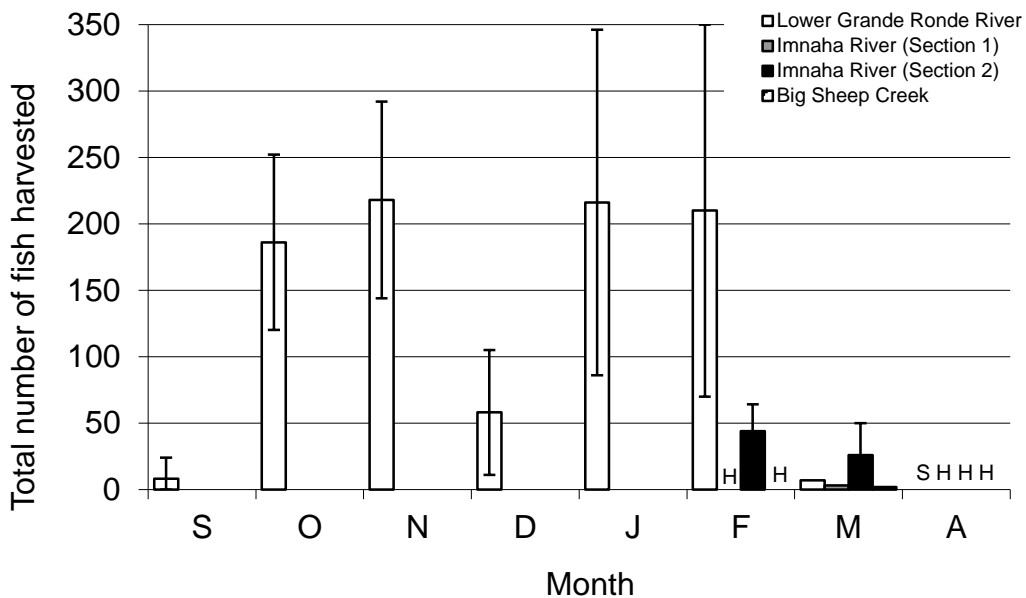


Figure 3. Estimated total harvest of summer steelhead (vertical bars show 95% confidence intervals) on the lower Grande Ronde River, two sections of the Imnaha River, and Big Sheep Creek during the 2015-16 run year. “H” indicates no harvest and “S” indicates no survey. Surveys were conducted from 1 September 2015 to 31 March 2016 on the lower Grande Ronde River, and from 1 February to 15 April 2016 on the Imnaha River and Big Sheep Creek.

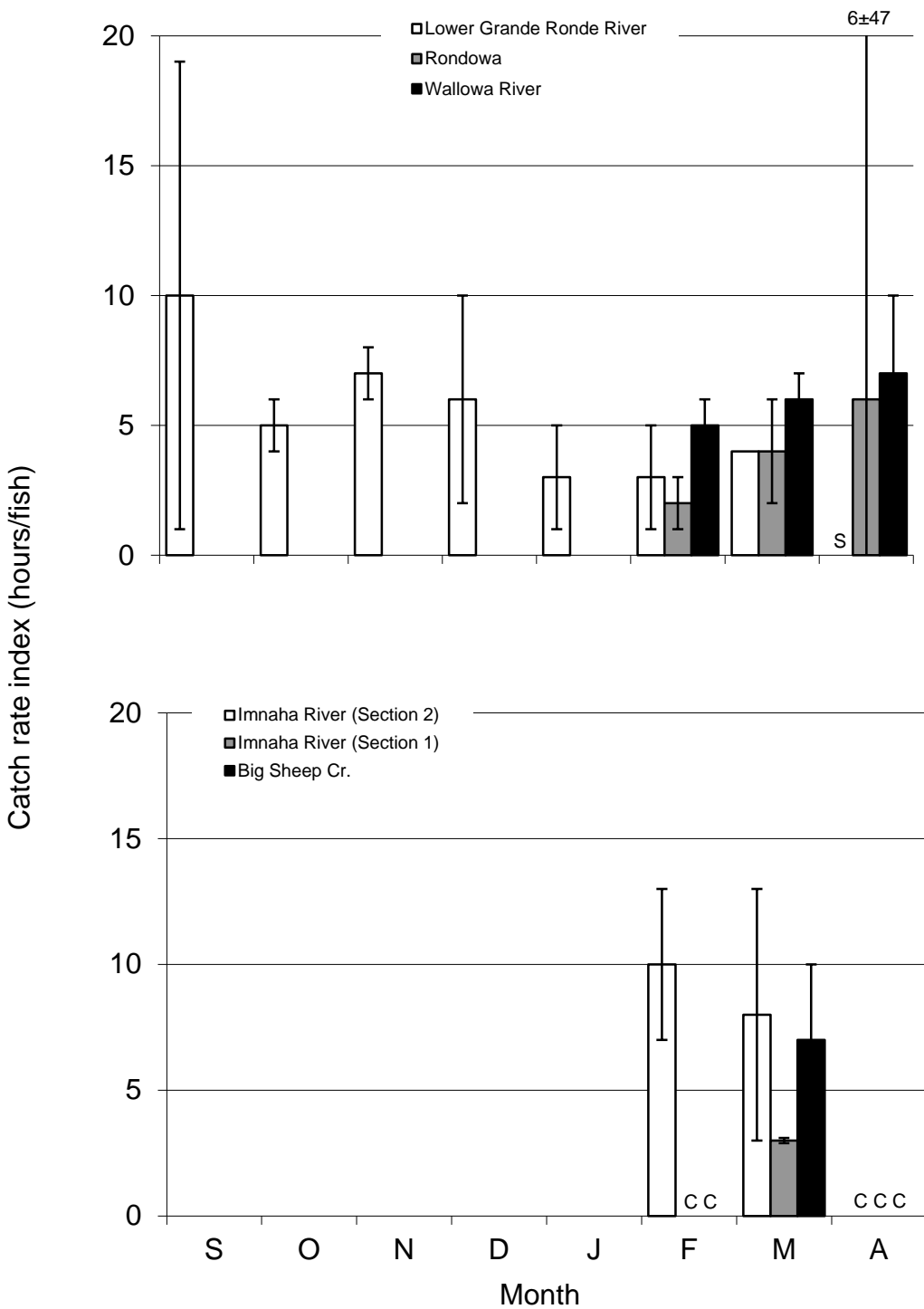


Figure 4. Estimated catch rate index (hours/fish) for summer steelhead (vertical bars show 95% confidence intervals) in the Grande Ronde and Imnaha river basins during the 2015-16 run year. "S" indicates no survey and "C" indicates no catch. Survey areas and times include the lower Grande Ronde River (1 September 2015 - 31 March 2016), and Rondowa, Wallowa River, two sections of the Imnaha River, and Big Sheep Creek (1 February - 15 April 2016). Note: A lower catch rate index implies better angling success.

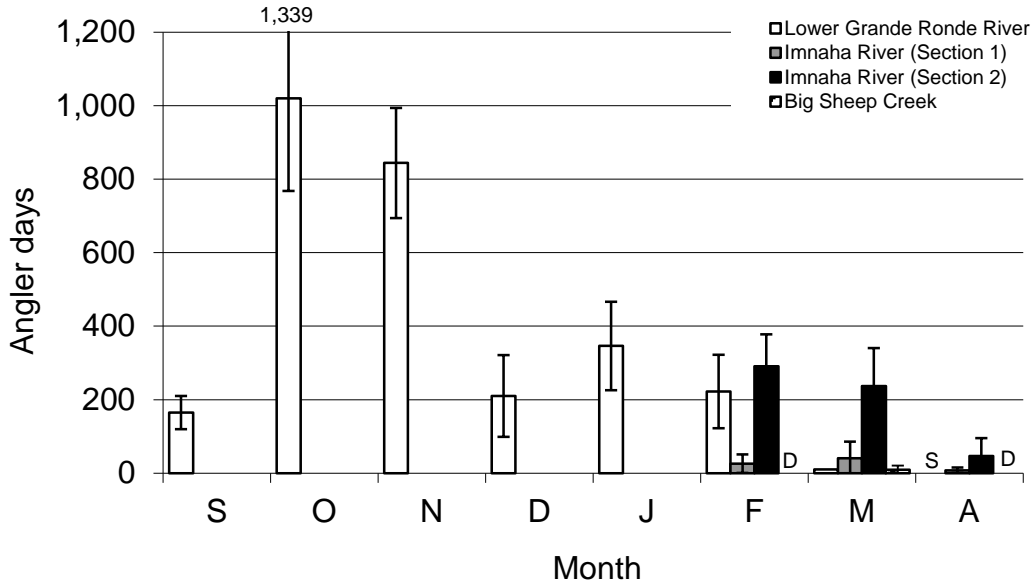


Figure 5. Estimated number of angler days for summer steelhead (vertical bars show 95% confidence intervals) on the lower Grande Ronde River, two sections of the Imnaha River, and Big Sheep Creek during the 2015-16 run year. "S" indicates no survey and "D" indicates no angler days. Surveys were conducted from 1 September 2015 to 31 March 2016 on the lower Grande Ronde River, and from 1 February to 15 April 2016 on the Imnaha River and Big Sheep Creek.

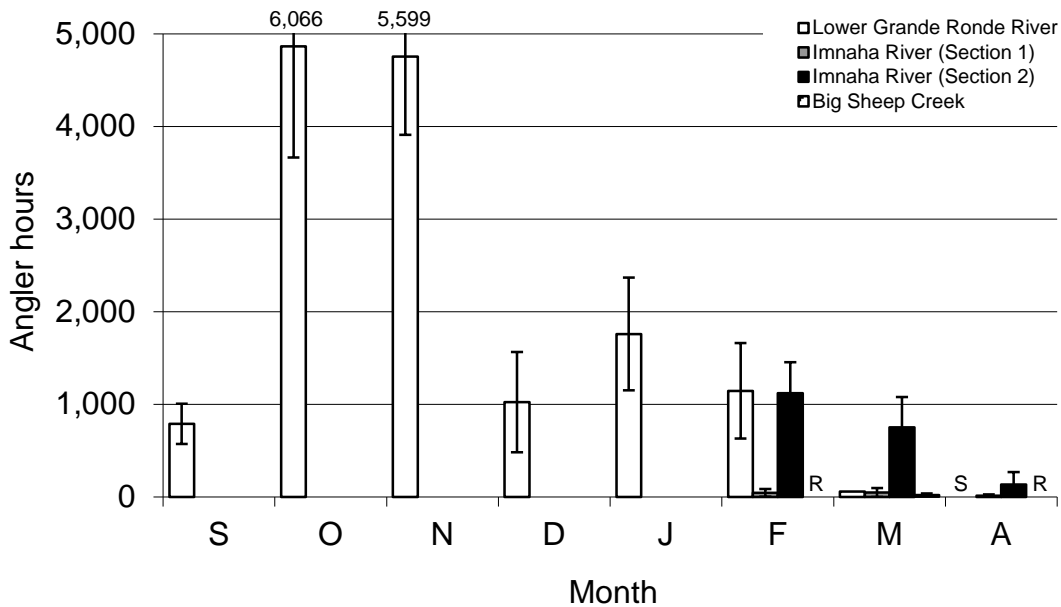


Figure 6. Estimated number of angler hours for summer steelhead (vertical bars show 95% confidence intervals) on the lower Grande Ronde River, two sections of the Imnaha River, and Big Sheep Creek during the 2015-16 run year. "S" indicates no survey and "R" indicates no angler hours. Surveys were conducted from 1 September 2015 to 31 March 2016 on the lower Grande Ronde River, and from 1 February to 15 April 2016 on the Imnaha River and Big Sheep Creek.

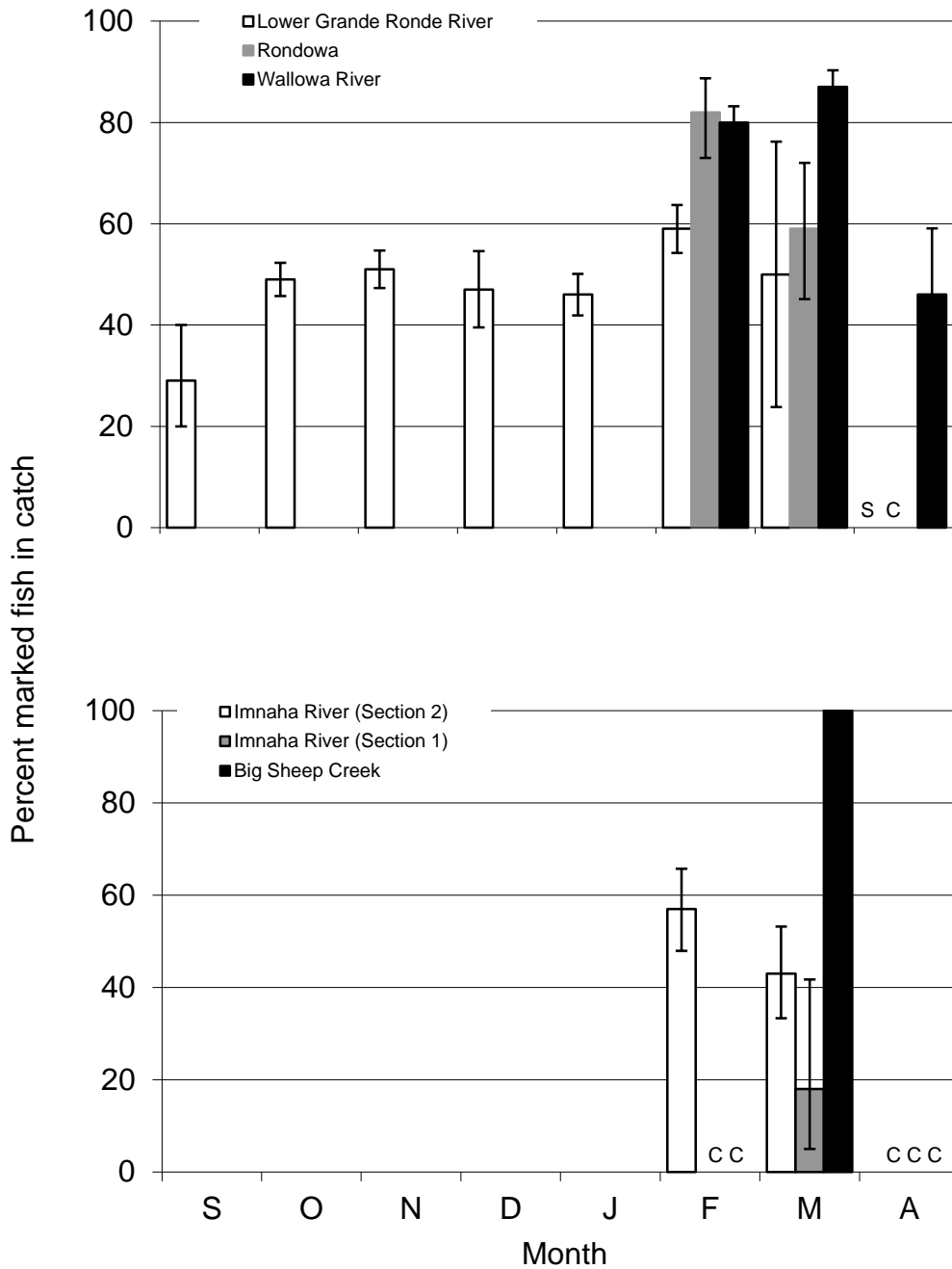


Figure 7. Estimated percent of summer steelhead caught (vertical bars show 95% confidence intervals; using a binomial distribution) in the Grande Ronde and Imnaha river basins during the 2015-16 run year that were marked. "S" indicates no survey and "C" indicates no catch. All unmarked fish were considered to be wild. Survey areas and times include the lower Grande Ronde River (1 September 2015 - 31 March 2016), and Rondowa, Wallowa River, two sections of the Imnaha River, and Big Sheep Creek (1 February - 15 April 2016).

Table 1. Percent age composition and mean fork length (\pm 95% confidence intervals) of hatchery summer steelhead sampled in creel surveys in the Grande Ronde and Imnaha river basins during the 2015-16 run year. Age composition and mean fork length by age are estimated from fork lengths of harvested fish and age-length keys developed from hatchery returns to Wallowa Hatchery in 2016 and Little Sheep Creek Facility (for the Imnaha River basin including the Imnaha River and Big Sheep Creek) in 2015 and 2016. Age is expressed as years spent in freshwater prior to ocean migration:years spent in the ocean prior to spawning migration. “-” indicates not sampled or undefined. Not shown is one 580 mm age 2:1 male from the Wallowa River creel survey area.

Creel survey area, gender	Age composition (%)					Mean fork length (mm)							
	N	1:1	1:2	1:3	1:4	N	1:1	N	1:2	N	1:3	N	1:4
Lower GR R.													
Males	61	77	23	0	0	44	596 \pm 8	13	687 \pm 17	0	-	0	-
Females	101	56	44	0	0	54	579 \pm 5	41	660 \pm 11	0	-	0	-
Total	162	64	36	0	0	98	587 \pm 5	54	667 \pm 10	0	-	0	-
Rondowa.													
Males	10	80	20	0	0	7	604 \pm 28	2	700 \pm 127	0	-	0	-
Females	35	43	57	0	0	13	575 \pm 13	18	666 \pm 15	0	-	0	-
Total	45	51	49	0	0	20	586 \pm 13	20	669 \pm 14	0	-	0	-
Wallowa R.													
Males	203	64	36	0	0	122	599 \pm 5	69	707 \pm 10	0	-	0	-
Females	227	41	57	1	1	87	578 \pm 5	125	673 \pm 7	3	750 \pm 43	1	770
Total	430	51	47	1	1	209	590 \pm 4	194	685 \pm 6	3	750 \pm 43	1	770
Imnaha R. basin													
Males	16	62	38	0	0	9	587 \pm 19	6	685 \pm 25	0	-	0	-
Females	12	42	58	0	0	5	590 \pm 12	6	670 \pm 28	0	-	0	-
Total	28	54	46	0	0	14	588 \pm 12	12	677 \pm 16	0	-	0	-

Table 2. Residence of summer steelhead anglers interviewed during creel surveys in the Grande Ronde and Imnaha river basins during the 2015-16 run year. Local Oregon resident anglers were from Union and Wallowa counties.

Creel survey area	Number of anglers	Percent			
		Local Oregon resident anglers	Non-local Oregon resident anglers	Washington resident anglers	Other out-of-state anglers
Lower GR River	599	55	25	6	14
Rondowa	62	63	37	0	0
Wallowa River	1,043	55	40	3	2
Imnaha River	219	69	25	1	5
Big Sheep Creek	6	100	0	0	0

Table 3. Number of Ad+CWT, AdLV+CWT or AdRV+CWT marked summer steelhead recovered during creel surveys in the Grande Ronde and Imnaha river basins during the 2015-16 run year. Recoveries were expanded for the entire fishery.

Creel survey area	Tag code	Release site	Experimental group ^a	Brood Year	Number recovered	
					Observed	Expanded ^b
Lower Grande Ronde River	09 05 54	Spring Cr.	Fall B/Vol/May	2012	2	19
	09 05 55	Spring Cr.	Fall Brood/April	2012	1	4
	09 05 57	Spring Cr.	Fall Brood/April	2012	1	4
	09 05 59	Spring Cr.	Production/April	2012	1	5
	09 05 60	Spring Cr.	Production/April	2012	1	10
	09 07 71	Spring Cr.	Fall Brood/April	2013	3	20
	09 07 72	Spring Cr.	Production/April	2013	2	10
	09 07 73	Spring Cr.	Fall B/Vol/May	2013	3	13
	09 07 74	Spring Cr.	Fall Brood/April	2013	4	20
	09 07 76	Spring Cr.	Prod/Vol/May	2013	1	10
	09 07 79	Deer Cr.	Fall Brood/April	2013	1	9
	09 07 80	Deer Cr.	Prod/Vol/May	2013	2	19
	09 27 45	Deer Cr.	Production/April	2013	1	2
	Wallowa River	09 05 54	Spring Cr.	Fall B/Vol/May	2012	1
09 05 55		Spring Cr.	Fall Brood/April	2012	2	ND
09 05 58		Spring Cr.	Production/April	2012	2	ND
09 05 59		Spring Cr.	Production/April	2012	1	ND
09 05 60		Spring Cr.	Production/April	2012	1	ND
09 05 61		Deer Cr.	Production/April	2012	7	ND
09 07 70		L. Sheep Cr.	Volitional/April	2013	1	ND
09 07 71		Spring Cr.	Fall Brood/April	2013	5	ND
09 07 72		Spring Cr.	Production/April	2013	2	ND
09 07 73		Spring Cr.	Fall B/Vol/May	2013	5	ND
09 07 74		Spring Cr.	Fall Brood/April	2013	10	ND
09 07 75		Spring Cr.	Production/April	2013	3	ND
09 07 76		Spring Cr.	Prod/Vol/May	2013	5	ND
09 07 79		Deer Cr.	Fall Brood/April	2013	13	ND
09 07 80	Deer Cr.	Prod/Vol/May	2013	5	ND	
09 27 45	Deer Cr.	Production/April	2013	4	ND	
Rondowa	09 05 56	Spring Cr.	Fall Brood/April	2012	1	ND
	09 07 74	Spring Cr.	Fall Brood/April	2013	2	ND
	09 07 79	Deer Cr.	Fall Brood/April	2013	1	ND
Imnaha River	09 07 70	L. Sheep Cr.	Volitional/April	2013	2	6

^a Production (Prod) and Fall Brood (Fall B) releases are forced-released over a 24-hour period. The volitional (Vol) releases are a current management strategy designed to help remove steelhead smolts that may residualize.

^b ND indicates expansions not determined until statewide annual harvest card data become available.

Harvest on the lower Grande Ronde was double that of the last two years and near to the 10-year average, while the Imnaha was the lowest observed since the late 1990s and only 26% of the 10-year average harvest (Figure 9). Total catch (harvested and released) on the lower Grande Ronde was higher than the last three years while the Imnaha was the lowest since the late 1990s (Table 4). However, catch and release of wild steelhead this year and in the last five years has been over 50% of the total catch on the lower Grande Ronde. Similarly, wild fish were over 50% of the total catch on the Imnaha River. However, it is difficult to know whether catch of wild fish is trending

upward on the Imnaha because there were unmarked hatchery fish in the returns from years 2003-2012, so anglers could not distinguish these hatchery fish from wild fish.

Total catch for the 2014-15 run year on the Wallowa, as determined by angler harvest card data that is accessible to us on a one-year delay, was the second highest estimated since surveys began, and the sixth highest at Rondowa (Table 5). Similarly, harvest on the Wallowa was also the second highest ever observed and it was the fifth highest at Rondowa. Catch and release of wild fish was the highest ever observed on the Wallowa and the sixth highest at Rondowa. Similarly, the percent of wild fish in the catch was the sixth highest observed on the Wallowa, and the fifth highest observed at Rondowa.

Catch rates in 2015-16 were higher in all Grande Ronde basin steelhead fisheries than in recent years and above the 10-year averages, while in the Imnaha basin catch rates were poorer than the prior two years and lower than the 10-year average (Table 6). The percent of local resident anglers participating in summer steelhead fisheries was lowest on the lower Grande Ronde and Wallowa rivers and highest on Big Sheep Creek (Table 2). For the Grande Ronde and Imnaha basin fisheries as a whole, the percent of local resident anglers has decreased while the percent of non-local and out-of-state anglers has increased since we began surveys in the 1985-86 run year (Figure 10). This trend is primarily due to an increase in the number of non-local and out-of-state anglers.

We continue to see a statistically significant linear relationship ($P < 0.001$) between harvest estimates generated from angler harvest cards and those from our creel surveys for summer steelhead fisheries in the Grande Ronde and Imnaha river basins (Figure 11). Total harvest estimates for spring steelhead fisheries in run year 2014-15 were 56 fish on the upper Grande Ronde River, 1,303 fish at Rondowa, 1,690 fish in the Wallowa River, 36 fish in the Wenaha River and 163 fish in the middle Grande Ronde River, for a total harvest estimate of 3,248 fish in the Grande Ronde basin, excluding the lower Grande Ronde River (Figure 9, Appendix Table C-1). We estimated 223 coded-wire-tagged fish were harvested at Rondowa, and 234 coded-wire tagged fish were harvested in the Wallowa River in run year 2014-15. Total catch estimates for spring steelhead fisheries in run year 2014-15 were 107 fish in the upper Grande Ronde River, 3,190 fish at Rondowa, 3,434 fish in the Wallowa River, 219 fish in the Wenaha River, and 331 fish in the middle Grande Ronde River, for a total catch estimate of 7,281 fish in the Grande Ronde basin, excluding the lower Grande Ronde River (Appendix Table C-2). Angler effort for run year 2014-15 was estimated to be 580 hours in the upper Grande Ronde, 14,523 hours at Rondowa, 18,232 hours in the Wallowa River, 2,259 hours in the Wenaha River, and 1,769 hours in the middle Grande Ronde River, for a total effort estimate of 37,362 hours in the Grande Ronde basin, excluding the lower Grande Ronde River (Appendix Table C-3).

MANAGEMENT IMPLICATIONS AND RECOMMENDATIONS

The 2015-16 adult Wallowa stock steelhead return to the Lower Snake River Compensation Plan Area (11,990 adults, reported in the 2016 Annual Progress Report) was comparable to the 10-year average of 11,868. Our fisheries data indicate that despite the average run, angler participation was slightly below the 10-year average but angler effort exceeded effort from the prior two years. In addition, harvest on the lower Grande Ronde River was about average but catch was above average. Conversely, the Imnaha stock steelhead return was 5,179 adults, above the 10-year average run of 3,710 adults, yet angler effort and harvest were the lowest observed since the mid-1990s. High and muddy river conditions in mid-March may best explain the disconnect between the strong run but poor fishing effort and catch on the Imnaha River.

The total catch of wild steelhead in the lower Grande Ronde River for the current run year was 1,410 fish, which was above the 10-year average of 1,303 fish. However, for the sixth year in a row (since 2010-11) catch of wild steelhead in the lower Grande Ronde River fishery comprised at least 50% of the total steelhead catch. In the 22 fishing seasons prior to the 2010-11 season there were only five years in which the wild steelhead catch approached or exceeded 50% of the total catch. Our data for upriver Grande Ronde basin fisheries (e.g., Rondowa and Wallowa River) does not indicate an obvious trend towards higher catch of wild steelhead. The high catch rates of wild fish could be explained by a changed ratio of wild fish to hatchery fish in the lower Grande Ronde River, potentially driven by better than average annual returns of wild fish. However, population estimates based on redd surveys do not suggest an increasing trend in wild fish abundance, although confidence intervals on those annual estimates were always $\geq 30\%$ (Jonasson et al. 2015). A declining run of hatchery fish and a stable run of wild fish would also change the ratio of wild to hatchery fish, potentially resulting in higher wild fish catch rates. This may be the best explanation for the observed pattern. Other factors that affect catch rates are the timing of fish entry into the lower Grande Ronde River and the amount and characteristics of the fishing pressure. We recommend continued monitoring of the wild steelhead catch to determine whether this short term trend persists into the future.

The 2015-16 fishing season was the first year in which regulation changes allowed anglers to target steelhead through the end of April; however, the end dates of our 2015-16 creel survey remained unchanged from prior seasons (31 March on the lower Grande Ronde, 15 April on the Wallowa and Imnaha rivers). We do not believe the regulation change will meaningfully affect total catch and harvest on the lower Grande Ronde River, since fishing effort there is typically low in April. However, steelhead are often present in the Wallowa and Imnaha rivers in late April, and empirical information suggests some anglers will target them. Thus, creel surveys of these fisheries in late April are advised if funding allows.

These fishery statistics continue to illustrate the importance of current hatchery programs to the success of recreational summer steelhead fisheries in both the Grande

Ronde and Imnaha river basins. Statistics for the Wallowa and Rondowa fisheries for the 2014-15 run year will be reported in the 2015-16 annual creel report.

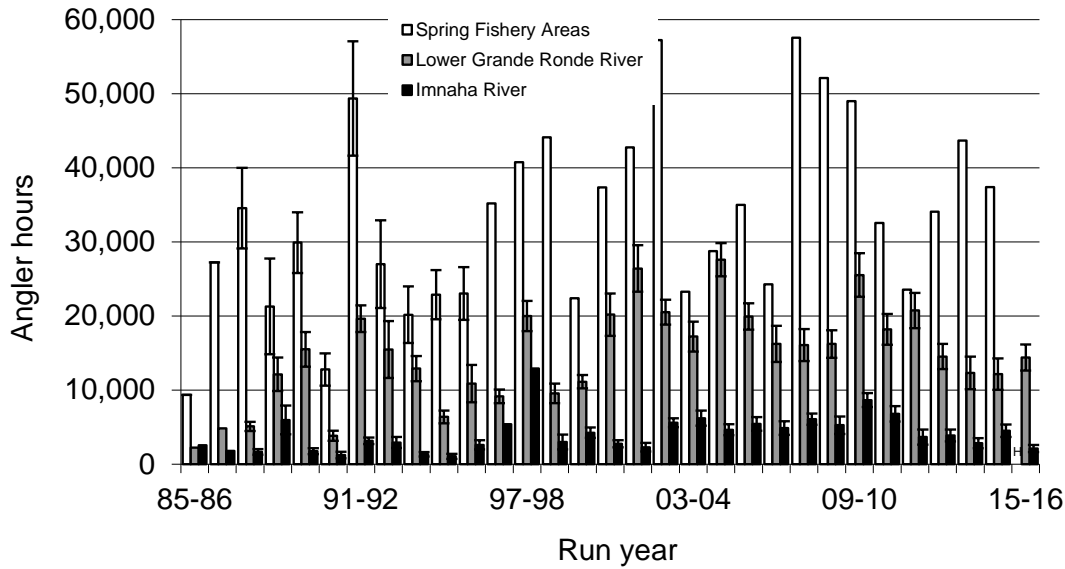


Figure 8. Angler effort (in hours) for summer steelhead in spring fishery areas (upper Grande Ronde and Wallowa rivers, Catherine Creek, and Rondowa), the lower Grande Ronde River, and the Imnaha River for the 1985-86 to 2015-16 run years. Not shown are 266, 61, 82, 57, 62, 97 and 18 angler hours on Big Sheep Creek (Imnaha basin) for the 09-10 through 15-16 run years, respectively. "H" is a value to be estimated from harvest tag data, which was not available when this report was submitted. Vertical bars are 95% confidence intervals, which are unavailable for the 85-86 and 86-87 run years, the Imnaha fishery for the 96-97 and 97-98 run years, and for spring fishery areas beginning with the 96-97 run year.

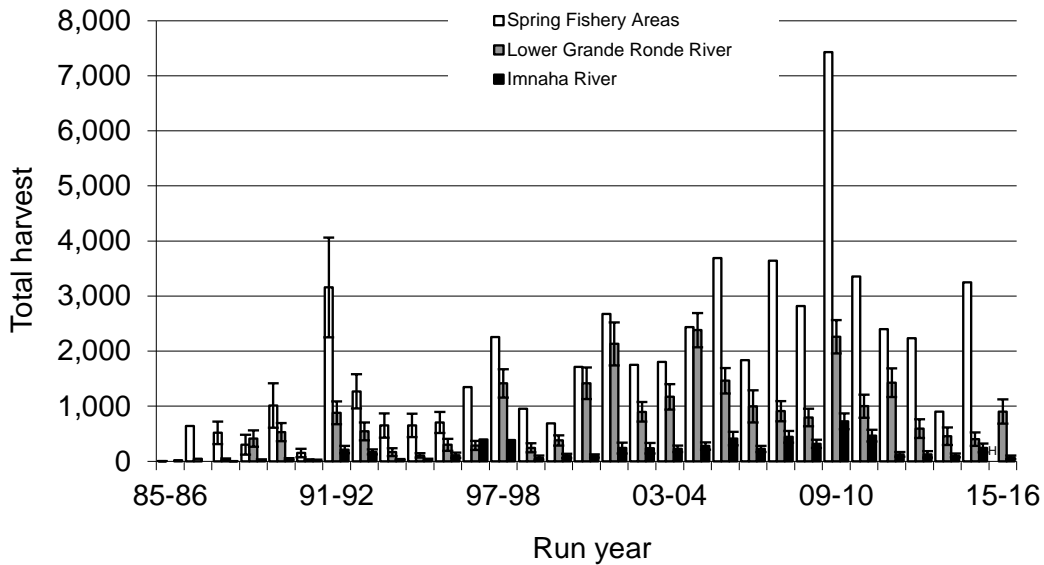


Figure 9. Number of hatchery summer steelhead harvested by recreational anglers in spring fishery areas (upper Grande Ronde and Wallowa rivers, Catherine Creek, and Rondowa), the lower Grande Ronde River, and the Imnaha River for the 1985-86 to 2015-16 run years. Not shown are 8, 0, 0, 0, 0, 6 and 2 hatchery fish harvested on Big Sheep Creek (Imnaha basin) for the 09-10 through 15-16 run years, respectively. "H" is a value to be estimated from harvest tag data, which was not available when this report was submitted. Vertical bars are 95% confidence intervals, which are unavailable for the 85-86 and 86-87 run years, the Imnaha fishery for the 96-97 and 97-98 run years, and for spring fishery areas beginning with the 96-97 run year.

Table 4. Estimated total catch (harvested and released) of hatchery and wild summer steelhead from statistical angler surveys conducted on the lower Grande Ronde River from 1 September to 15 April, and in the Imnaha River basin (includes Big Sheep Creek beginning with the 2009-10 run year) from 1 February to 15 April for the 1985-86 to 2015-16 run years. Angling regulations were not consistent among years and river sections, which may have affected the number of harvested hatchery fish. "-" indicates a statistical angler survey was not conducted.

Run year	Lower Grande Ronde River				Imnaha River Basin			
	Harvest	Released		Total catch	Harvest	Released		Total Catch
		Hatchery	Natural ^a			Hatchery	Natural ^a	
85-86 ^b	0	0	289	289	18	0	153	171
86-87 ^b	45	0	524	569	0	8	192	200
87-88 ^b	31	9	455	495	4	0	65	69
88-89 ^b	413	87	385	885	19	4	308	331
89-90 ^b	530	60	512	1,102	37	9	43	89
90-91 ^b	18	87	99	204	15	35	50	100
91-92 ^b	879	494	410	1,783	212	180	321	713
92-93 ^b	544	567	573	1,684	171	65	130	366
93-94 ^b	168	84	483	735	29	0	72	101
94-95 ^b	107	45	150	302	24	0	39	63
95-96 ^b	300	263	387	950	112	67	210	389
96-97	286	179	193	658	-	-	-	-
97-98	1,415	908	432	2,755	-	-	-	-
98-99	244	119	213	576	67	39	44	150
99-00	380	120	474	974	98	50	190	338
00-01	1,417	619	1,240	3,276	97	86	309	492
01-02	2,132	1,059	1,968	5,159	242	210	273	725
02-03	898	330	1,181	2,409	239	134	552	925
03-04	1,172	756	1,052	2,980	228	120	921	1,269
04-05	2,381	1,468	2,627	6,476	278	154	1,050	1,482
05-06	1,462	1,008	1,692	4,162	412	330	1,120	1,862
06-07	999	641	814	2,454	225	70	465	760
07-08	910	287	567	1,764	443	338	1,572	2,353
08-09	795	336	937	2,068	319	108	638	1,065
09-10	2,262	1,024	2,121	5,407	736	519	4,481	5,736
10-11	1,000	434	1,780	3,214	466	188	1,500	2,154
11-12	1,427	398	2,460	4,285	126	71	238	435
12-13 ^c	594	302	1,090	1,986	126	4	206	336
13-14 ^c	454	154	786	1,394	106	23	279	408
14-15 ^c	401	184	1,069	1,654	249	134	442	825
15-16 ^c	903	492	1,410	2,805	75	38	119	232
Average	793	404	915	2,112	178	103	551	832

^a Includes unmarked hatchery fish for run years 85-86 to 88-89 on the lower Grande Ronde River, and for run years 02-03 to 11-12 on the Imnaha River.

^b Angler surveys were conducted only during selected months (in parentheses) on the lower Grande Ronde River during run years 85-86 (Oct-Nov), 86-87 and 87-88 (Sept-Dec), 88-89 and 92-93 (Sept-Dec, 15Feb-15Apr), 89-90 and 93-94 (Sept-Dec, Feb-15Apr), 90-91 (Sept-Dec, Mar-15Apr), 95-96 (Sept-Jan, 16Feb-15Apr), and on the Imnaha River during run years 85-86 and 86-87 (Oct-Nov, Mar), 87-88 and 89-90 through 94-95 (Mar-15Apr), 88-89 (Mar-30Apr), and 95-96 (Sept-15Nov, Mar-15Apr).

^c Angler surveys on the lower Grande Ronde River beginning with the 2012-13 run year were conducted from Sept-Mar.

Table 5. Estimated total catch (harvested and released) of hatchery and wild summer steelhead from angler surveys conducted on the Wallowa River and at Rondowa from 1 February to 15 April for the 1985-86 to 2014-15 run years. Estimates for run years 1985-86 to 1995-96 are based on a statistical angler survey and estimates for run years 1996-97 to present are based on a regression between angler harvest card data and creel survey harvest data. Angling regulations were not consistent among years and river sections, which may have affected the number of harvested hatchery fish. "-" indicates that an angler survey was not conducted.

Run year	Wallowa River				Rondowa			
	Harvest	Released		Total catch	Harvest	Released		Total Catch
		Hatchery	Natural ^a			Hatchery	Natural ^a	
85-86	2	0	1,331	1,333	-	-	-	-
86-87	641	0	1,880	2,521	-	-	-	-
87-88 ^b	447	0	1,517	1,964	70	0	273	343
88-89 ^b	294	21	152	467	-	-	-	-
89-90 ^b	798	376	239	1,413	38	0	20	58
90-91 ^b	0	924	146	1,070	-	-	-	-
91-92	1,514	821	333	2,668	832	537	229	1,598
92-93 ^b	1,083	732	305	2,120	-	-	-	-
93-94 ^b	481	75	285	841	143	38	47	228
94-95 ^b	565	245	300	1,110	61	17	44	122
95-96	495	214	167	876	-	-	-	-
96-97	679	380	151	1,210	434	255	82	771
97-98	1,139	525	132	1,796	733	90	154	977
98-99	468	150	121	739	282	94	73	449
99-00	300	88	135	523	238	450	136	824
00-01	925	491	379	1,795	465	229	126	820
01-02	1,492	793	398	2,683	874	145	330	1,349
02-03	861	524	282	1,667	687	955	2,077	3,719
03-04	948	574	281	1,803	754	607	934	2,295
04-05	809	879	241	1,929	1,125	565	662	2,352
05-06	1,638	1,006	329	2,973	1,667	2,441	695	4,803
06-07	720	470	216	1,406	881	448	362	1,691
07-08	1,399	1,000	251	2,650	2,050	1,903	649	4,602
08-09	1,467	766	437	2,670	1,166	511	691	2,368
09-10	2,231	1,328	659	4,218	3,725	2,514	1,812	8,051
10-11	1,526	880	521	2,927	1,577	847	862	3,286
11-12	957	503	369	1,829	1,208	1,053	689	2,950
12-13	773	182	404	1,359	1,178	273	317	1,768
13-14	558	261	280	1,099	280	2	139	421
14-15	1,690	1,082	662	3,434	1,303	997	890	3,190
Average	897	510	430	1,836	907	624	512	2,043

^a Includes unmarked hatchery fish for run years 85-86 to 88-89.

^b Angler surveys were conducted only during selected dates (in parentheses) on the Wallowa River during run years 88-89 and 92-93 (1 Feb-30 Apr), and 90-91 (16 Feb-15 Apr), and at Rondowa during run years 87-88 and 94-95 (1 Mar-15 Apr), 89-90 (17 Mar-31 Mar), and 93-94 (16 Mar-15 Apr).

Table 6. Catch rate index (hours/fish \pm 95% confidence intervals) in summer steelhead creel survey areas in the Grande Ronde and Imnaha river basins for the 1985-86 to 2015-16 run years. Note that a lower catch rate index implies greater angling success. "-" indicates not sampled or undefined.

Run year	Catch rate index (hours/fish)						
	Lower GR River	Upper GR River	Catherine Creek	Rondowa	Wallowa River	Imnaha River	Big Sheep Creek
85-86	8 \pm 7	-	-	-	7 \pm 7	15 \pm 7	-
86-87	9 \pm 3	-	-	-	11 \pm 3	9 \pm 8	-
87-88	10 \pm 4	-	-	11 \pm 9	16 \pm 3	24 \pm 9	-
88-89	14 \pm 4	40 \pm 55	-	-	43 \pm 21	18 \pm 11	-
89-90	14 \pm 4	14 \pm 8	-	34 \pm 27	17 \pm 5	20 \pm 8	-
90-91	19 \pm 8	24 \pm 11	-	-	6 \pm 2	13 \pm 6	-
91-92	11 \pm 3	10 \pm 3	3 \pm 3	6 \pm 1	10 \pm 2	4 \pm 1	-
92-93	9 \pm 2	14 \pm 4	49 \pm 49	-	11 \pm 2	8 \pm 1	-
93-94	18 \pm 5	31 \pm 17	-	12 \pm 4	17 \pm 3	13 \pm 3	-
94-95	21 \pm 6	25 \pm 13	-	15 \pm 5	17 \pm 3	17 \pm 8	-
95-96	11 \pm 2	15 \pm 4	-	-	21 \pm 4	7 \pm 2	-
96-97	14 \pm 4	18 \pm 9	33 \pm 69	-	13 \pm 3	6 \pm 2	-
97-98	7 \pm 1	13 \pm 9	7 \pm 10	11 \pm 6	10 \pm 1	18 \pm 9	-
98-99	17 \pm 4	19 \pm 9	14 \pm 20	-	18 \pm 4	20 \pm 7	-
99-00	11 \pm 2	25 \pm 19	-	8 \pm 7	17 \pm 4	12 \pm 3	-
00-01	6 \pm 1	18 \pm 17	-	6 \pm 4	11 \pm 2	6 \pm 1	-
01-02	5 \pm 1	11 \pm 17	-	7 \pm 4	7 \pm 1	3 \pm 1	-
02-03	8 \pm 1	-	-	8 \pm 6	12 \pm 2	6 \pm 2	-
03-04	6 \pm 1	-	-	3 \pm 2	7 \pm 1	5 \pm 1	-
04-05	4 \pm 0	-	-	5 \pm 1	5 \pm 1	4 \pm 1	-
05-06	5 \pm 1	-	-	2 \pm 1	7 \pm 1	3 \pm 1	-
06-07	8 \pm 1	-	-	6 \pm 2	7 \pm 1	6 \pm 1	-
07-08	9 \pm 1	-	-	7 \pm 2	7 \pm 1	3 \pm 0	-
08-09	8 \pm 1	-	-	12 \pm 4	8 \pm 1	5 \pm 1	-
09-10	5 \pm 0	-	-	3 \pm 1	4 \pm 0	2 \pm 0	0.8 \pm 0.3
10-11	6 \pm 1	-	-	4 \pm 2	4 \pm 0	3 \pm 0	6 \pm 1
11-12	5 \pm 1	-	-	3 \pm 1	6 \pm 1	8 \pm 2	-
12-13	7 \pm 1	-	-	9 \pm 2	10 \pm 1	11 \pm 3	24 \pm 25
13-14	9 \pm 2	-	-	65 \pm 93	10 \pm 2	7 \pm 2	-
14-15	7 \pm 3	-	-	5 \pm 1	5 \pm 1	6 \pm 1	4 \pm 1
15-16	5 \pm 1	-	-	3 \pm 1	5 \pm 1	9 \pm 3	7 \pm 3
Average	10 \pm 2	20 \pm 5	21 \pm 24	11 \pm 6	11 \pm 3	9 \pm 2	8 \pm 11

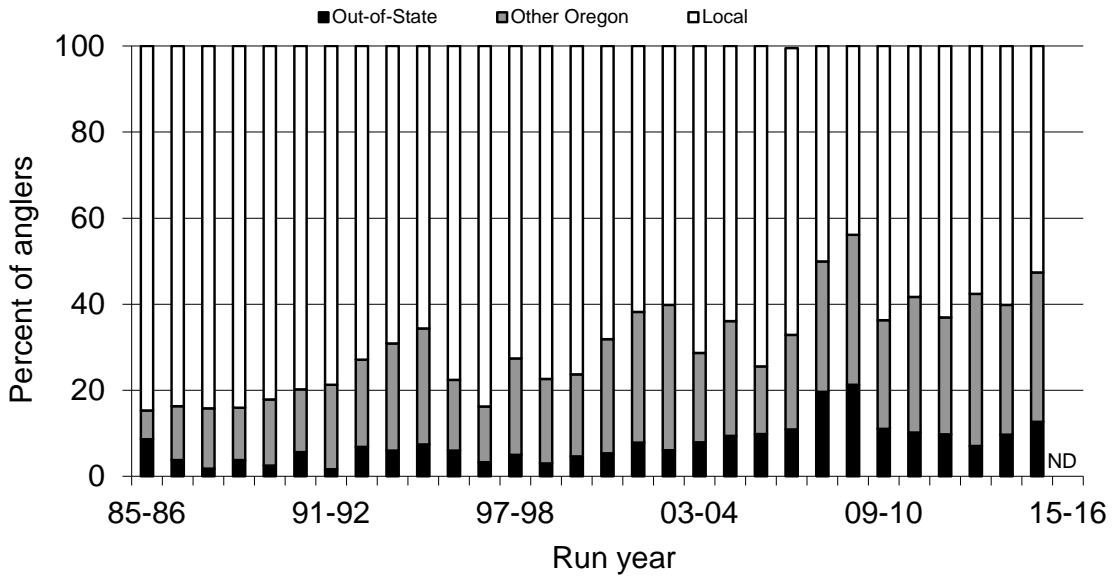


Figure 10. Percent of local resident anglers (Union or Willamette county residents), non-local Oregon resident anglers, and out-of-state anglers that fished in summer steelhead fisheries in the Grande Ronde and Imnaha river basins for the 1985-86 to 2014-15 run years. ND indicates not determined until statewide annual harvest card data become available.

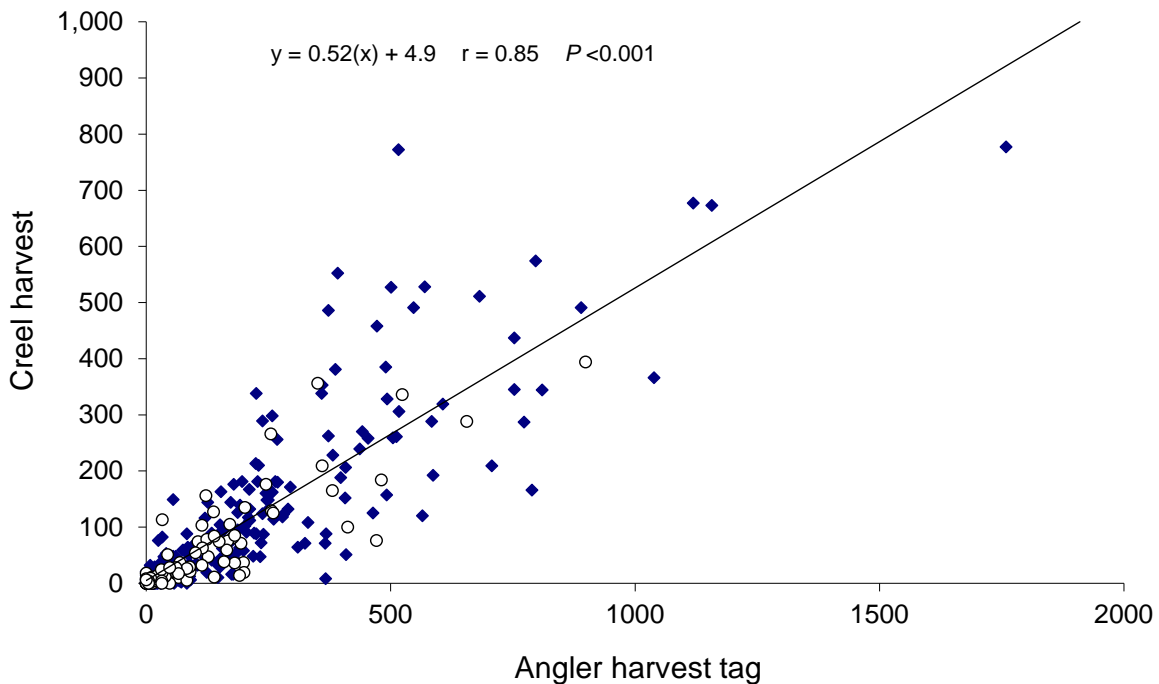


Figure 11. Relation between angler harvest tag (punch card) and creel survey harvest for summer steelhead fisheries in the Grande Ronde (♦) and Imnaha (○) river basins for years when harvest estimates for specific reaches were available (1993-1996 for the upper Grande Ronde and Willamette, 1994-1995 for Rondowa, 1992-1993 for Catherine Creek, 1993-spring 2015 for the lower Grande Ronde, and 1986-1996, 1999-2015 for the Imnaha fishery areas).

REFERENCES

- Carmichael, R.W. 1989. Lower Snake River Compensation Plan - Oregon Evaluation Studies, Five-Year Study Plan. Oregon Department of Fish and Wildlife, Fish Research Project, Portland.
- Carmichael, R.W., M.W. Flesher, and R.T. Messmer. 1989. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha Rivers for the 1988-89 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Carmichael, R.W., M.W. Flesher, and R.T. Messmer. 1990. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1989-90 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFF1-91-12, Annual Progress Report, Portland.
- Carmichael, R.W., R.T. Messmer, and B.A. Miller. 1987. Lower Snake River Compensation Plan - Oregon Evaluation Studies. Oregon Department of Fish and Wildlife, Fish Research Project FRI/LSR-88-16, Annual Progress Report, Portland.
- Carmichael, R.W., B.A. Miller, and R.T. Messmer. 1986. Lower Snake River Compensation Plan - Oregon Evaluation Studies. Oregon Department of Fish and Wildlife, Fish Research Project FRI/LSR-86-35, Annual Progress Report, Portland.
- Carmichael, R.W., B.A. Miller, and R.T. Messmer. 1988. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha Rivers for the 1987-88 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFFI-LSR-89-02, Annual Progress Report, Portland.
- Carmichael, R.W., and E.J. Wagner. 1983. Evaluation of Lower Snake River Compensation Plan Facilities in Oregon. Oregon Department of Fish and Wildlife, Fish Research Project 14-16-0001-83269, Annual Progress Report, Portland.
- Clarke, L.R., M. W. Flesher, and R. W. Carmichael. 2014. Hatchery steelhead smolt release size effects on adult production and straying. *North American Journal of Aquaculture* 76:39-44.
- Flesher, M.W., R.W. Carmichael, and R.T. Messmer. 1991. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1990-91 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFF1-92-09, Annual Progress Report, Portland.
- Flesher, M.W., M.A. Buckman, R.W. Carmichael, R.T. Messmer, and T.A. Whitesel. 1992. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1991-92 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFF1-LSR-94-07, Annual Progress Report, Portland.

- Flesher, M.W., M.A. Buckman, R.W. Carmichael, R.T. Messmer, and T.A. Whitesel. 1993. Summer steelhead creel surveys on the Grande Ronde, Wallowa and Imnaha Rivers for the 1992-93 run year. Oregon Department of Fish and Wildlife, Fish Research Project AFF1-LSR-94-14, Annual Progress Report, Portland.
- Flesher, M.W., M.A. Buckman, R.W. Carmichael, R.T. Messmer, and T.A. Whitesel. 1994. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1993-94 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1995. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1994-95 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1996. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1995-96 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1997. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1996-97 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, and T.A. Whitesel. 1999. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1997-98 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, T.A. Whitesel, and J.R. Ruzycki. 2000. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1998-99 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2001. Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 1999-2000 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Portland.
- Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2004a. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 2000-01 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, La Grande.

- Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2004b. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha Rivers for the 2001-02 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, La Grande.
- Flesher, M.W., R.W. Carmichael, and G.C. Grant. 2005. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2002-03 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and G.C. Grant. 2007. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2003-04 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, G.C. Grant, and L.R. Clarke. 2008a. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2004-05 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., G.C. Grant, RW. Carmichael, and L.R. Clarke. 2008b. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2005-06 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2009. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2006-07 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2010. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2007-08 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2011. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2008-09 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2012. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2009-10 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.

- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2013. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2010-11 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., S.M. Warren, R.W. Carmichael, and L.R. Clarke. 2014. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2011-12 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2015. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2012-13 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2016. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2013-14 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Flesher, M.W., R.W. Carmichael, and L.R. Clarke. 2017. Lower Snake River Compensation Plan: Summer steelhead creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers for the 2014-15 run year. Oregon Department of Fish and Wildlife, Fish Research Project, Annual Progress Report, Salem.
- Jonasson, B. C. and 14 coauthors. 2015. Investigations into the life history of naturally produced spring Chinook Salmon and summer steelhead in the Grande Ronde River subbasin. 2014 Annual Progress Report to the Bonneville Power Administration, Portland, Oregon.
- Oregon Department of Fish and Wildlife. District Annual Reports, La Grande and Wallowa Districts (1949-1974), Fish Division, Portland.
- USACOE (U.S. Army Corps of Engineers). 1996. Annual Fish Passage Report. Portland and Walla Walla District, Portland.

APPENDIX A

Fishery Statistics for the 2015-16 run year

Appendix Table A-1. Fishery statistics for summer steelhead on the lower Grande Ronde River during the 2015-16 run year. Statistics include mean estimates \pm 95% confidence intervals. Only adipose fin-clipped fish were harvested. "-" indicates not sampled or undefined. "h" indicates hour.

Month, day type	Sample size		Total Hours	Total Catch	Total harvest	Catch rate		Angler days
	Days	Anglers				fish/h	h/fish	
September:								
Weekday	6	25	509 \pm 212	43 \pm 66	4 \pm 8	0.084 \pm 0.131	12 \pm 19	103 \pm 43
Weekend	5	11	80 \pm 50	6 \pm 9	0	0.076 \pm 0.107	13 \pm 18	22 \pm 14
Total	11	36	589 \pm 218	49 \pm 67	4 \pm 8	0.083 \pm 0.114	12 \pm 16	125 \pm 46
October:								
Weekday	7	74	2,644 \pm 866	554 \pm 217	79 \pm 52	0.210 \pm 0.082	5 \pm 2	595 \pm 195
Weekend	5	87	1,921 \pm 709	278 \pm 72	97 \pm 38	0.145 \pm 0.038	7 \pm 2	358 \pm 132
Total	12	161	4,565 \pm 1,119	832 \pm 229	176 \pm 64	0.182 \pm 0.050	5 \pm 1	953 \pm 234
November:								
Weekday	6	79	2,589 \pm 735	394 \pm 116	94 \pm 61	0.152 \pm 0.045	7 \pm 2	452 \pm 128
Weekend	6	122	2,164 \pm 418	292 \pm 69	124 \pm 42	0.135 \pm 0.032	7 \pm 2	392 \pm 76
Total	12	201	4,753 \pm 846	686 \pm 135	218 \pm 74	0.145 \pm 0.028	7 \pm 1	844 \pm 150
December:								
Weekday	7	35	656 \pm 511	108 \pm 116	37 \pm 41	0.165 \pm 0.177	6 \pm 6	146 \pm 114
Weekend	5	39	366 \pm 181	58 \pm 34	21 \pm 22	0.157 \pm 0.093	6 \pm 4	64 \pm 32
Total	12	74	1,022 \pm 542	166 \pm 121	58 \pm 47	0.162 \pm 0.118	6 \pm 4	210 \pm 111
January:								
Weekday	5	28	1,090 \pm 537	491 \pm 177	183 \pm 127	0.450 \pm 0.163	2 \pm 1	228 \pm 112
Weekend	4	40	668 \pm 285	84 \pm 59	33 \pm 27	0.126 \pm 0.088	8 \pm 6	118 \pm 50
Total	9	68	1,758 \pm 608	575 \pm 187	216 \pm 130	0.327 \pm 0.106	3 \pm 1	346 \pm 120
February:								
Weekday	6	32	703 \pm 431	303 \pm 189	150 \pm 124	0.431 \pm 0.268	2 \pm 1	144 \pm 88
Weekend	5	24	441 \pm 284	101 \pm 86	60 \pm 66	0.228 \pm 0.194	4 \pm 3	78 \pm 50
Total	11	56	1,144 \pm 516	404 \pm 207	210 \pm 140	0.353 \pm 0.181	3 \pm 2	222 \pm 100
March:								
Weekday	7	0	0	0	0	-	-	0
Weekend	4	3	48	12	6	0.245	4	8
Total	11	3	48	12	6	0.245	4	8
Grand total	78	599	13,879 \pm 1,716	2,724 \pm 409	888 \pm 220	0.196 \pm 0.030	5 \pm 1	2,708 \pm 335

Appendix Table A-2. Catch rate ($\pm 95\%$ confidence intervals) for summer steelhead at Rondowa during the 2015-16 run year. Only adipose fin-clipped fish were harvested. "-" indicates not sampled or undefined. "h" indicates hour.

Month, day type	Sample size		Catch rate	
	Days	Anglers	fish/h	(h/fish)
February:				
Weekday	6	2	0.059 \pm 1.398	17 \pm 403
Weekend	6	28	0.476 \pm 0.220	2 \pm 1
Total	12	30	0.444 \pm 0.231	2 \pm 1
March:				
Weekday	4	0	-	-
Weekend	6	30	0.275 \pm 0.138	4 \pm 2
Total	10	30	0.275 \pm 0.151	4 \pm 2
April:				
Weekday	1	2	0.167	6
Weekend	1	0	-	-
Total	2	2	0.167 \pm 1.297	6 \pm 47
Grand total	24	62	0.361 \pm 0.139	3 \pm 1

Appendix Table A-3. Catch rate ($\pm 95\%$ confidence intervals) for summer steelhead on the Wallowa River during the 2015-16 run year. Only adipose fin-clipped fish were harvested. "h" indicates hour.

Month, day type	Sample size		Catch rate	
	Days	Anglers	fish/h	(h/fish)
February:				
Weekday	11	317	0.274 \pm 0.055	4 \pm 1
Weekend	6	210	0.143 \pm 0.030	7 \pm 1
Total	17	527	0.220 \pm 0.035	5 \pm 1
March:				
Weekday	6	196	0.188 \pm 0.050	5 \pm 1
Weekend	6	218	0.164 \pm 0.042	6 \pm 2
Total	12	414	0.175 \pm 0.033	6 \pm 1
April:				
Weekday	5	59	0.158 \pm 0.095	6 \pm 4
Weekend	1	43	0.138 \pm 0.093	7 \pm 5
Total	6	102	0.150 \pm 0.067	7 \pm 3
Grand total	35	1,043	0.198 \pm 0.023	5 \pm 1

Appendix Table A-4. Fishery statistics for summer steelhead in Section 1 (Fence Creek to town of Imnaha) of the Imnaha River during the 2015-16 run year. Statistics include mean estimates $\pm 95\%$ confidence intervals. Only adipose fin-clipped fish were harvested. "-" indicates not sampled or undefined. "h" indicates hour.

Month, day type	Sample size		Total Hours	Total catch	Total harvest	Catch rate		Angler days
	Days	Anglers				fish/h	h/fish	
February:								
Weekday	6	4	36 \pm 42	0	0	-	-	19 \pm 22
Weekend	5	4	7 \pm 8	0	0	-	-	7 \pm 8
Total	11	8	43 \pm 42	0	0	-	-	26 \pm 25
March:								
Weekday	7	5	8 \pm 10	4 \pm 3	0	0.484 \pm 0.124	2 \pm 1	4 \pm 5
Weekend	4	6	37 \pm 48	13 \pm 2	3	0.334 \pm 0.021	3 \pm 0	37 \pm 48
Total	11	11	45 \pm 49	17 \pm 4	3	0.361 \pm 0.028	3 \pm 0	41 \pm 45
April:								
Weekday	3	6	11 \pm 11	0	0	-	-	6 \pm 6
Weekend	2	1	2 \pm 3	0	0	-	-	2 \pm 3
Total	5	7	13 \pm 12	0	0	-	-	8 \pm 7
Grand total	27	26	101 \pm 66	17 \pm 4	3	0.160 \pm 0.013	6 \pm 0	75 \pm 49

Appendix Table A-5. Fishery statistics for summer steelhead in Section 2 (mouth to Fence Creek) of the Imnaha River and overall total for Section 1 and 2 combined during the 2015-16 run year. Statistics include mean estimates $\pm 95\%$ confidence intervals. Only adipose fin-clipped fish were harvested. "-" indicates not sampled or undefined. "h" indicates hour.

Month, day type	Sample size		Total Hours	Total Catch	Total harvest	Catch rate		Angler Days
	Days	Anglers				fish/h	h/fish	
February:								
Weekday	6	52	715 \pm 272	74 \pm 37	28 \pm 16	0.103 \pm 0.044	10 \pm 4	179 \pm 68
Weekend	5	70	405 \pm 191	43 \pm 28	16 \pm 12	0.107 \pm 0.043	9 \pm 4	112 \pm 53
Total	11	122	1,120 \pm 333	117 \pm 47	44 \pm 20	0.104 \pm 0.032	10 \pm 3	291 \pm 87
March:								
Weekday	7	57	684 \pm 323	92 \pm 66	26 \pm 24	0.135 \pm 0.080	7 \pm 4	187 \pm 88
Weekend	4	27	66 \pm 47	4 \pm 4	0	0.060 \pm 0.047	17 \pm 13	50 \pm 36
Total	11	84	750 \pm 326	96 \pm 66	26 \pm 24	0.128 \pm 0.073	8 \pm 5	237 \pm 103
April:								
Weekday	3	9	76 \pm 111	0	0	-	-	33 \pm 48
Weekend	2	7	56 \pm 79	0	0	-	-	14 \pm 20
Total	5	16	132 \pm 136	0	0	-	-	47 \pm 48
Grand total	27	222	2,002 \pm 485	213 \pm 80	70 \pm 31	0.106 \pm 0.033	9 \pm 3	575 \pm 139
Sec.1 + 2	27	248	2,103\pm490	230\pm81	73\pm31	0.109\pm0.031	9\pm3	650\pm151

Appendix Table A-6. Fishery statistics for summer steelhead in Big Sheep Creek (mouth to Little Sheep Creek) in the Imnaha River basin during the 2015-16 run year. Statistics include mean estimates $\pm 95\%$ confidence intervals. Only adipose fin-clipped fish were harvested. "-" indicates not sampled or undefined. "h" indicates hour.

Month, day type	Sample size		Total Hours	Total catch	Total harvest	Catch rate		Angler Days
	Days	Anglers				fish/h	h/fish	
February								
Weekday	6	0	-	-	-	-	-	-
Weekend	5	0	-	-	-	-	-	-
Total	11	0	-	-	-	-	-	-
March:								
Weekday	7	0	-	-	-	-	-	-
Weekend	4	6	18 \pm 21	2 \pm 2	2	0.136 \pm 0.055	7 \pm 3	9 \pm 11
Total	11	6	18 \pm 21	2 \pm 2	2	0.136 \pm 0.055	7 \pm 3	9 \pm 11
April:								
Weekday	3	0	-	-	-	-	-	-
Weekend	2	0	-	-	-	-	-	-
Total	5	0	-	-	-	-	-	-
Grand total	27	6	18 \pm 21	2 \pm 2	2	0.136 \pm 0.055	7 \pm 3	9 \pm 11

APPENDIX B

Percent of Summer Steelhead That Were Marked Hatchery Fish and Caught during the 2015-16 Run Year

Appendix Table B. Percent of marked hatchery summer steelhead caught during each survey month in the Grande Ronde and Imnaha River basins during the 2015-16 run year. In parentheses are total catch for the lower Grande Ronde and Imnaha rivers and Big Sheep Creek, and sampled catch for the Wallowa River and Rondowa. On the Imnaha River, Section 1 is from Fence Creek upstream to the town of Imnaha, and Section 2 is from the mouth upstream to Fence Creek. "-" indicates not sampled or undefined.

Creel survey area	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Lower GR River	27(49)	49(832)	51(686)	47(166)	46(575)	59(404)	50(12)	-
Rondowa	-	-	-	-	-	82(99)	59(51)	0(2)
Wallowa River	-	-	-	-	-	80(548)	87(296)	46(57)
Imnaha River (Section 1)	-	-	-	-	-	-(0)	18(17)	-(0)
Imnaha River (Section 2)	-	-	-	-	-	57(117)	43(96)	-(0)
Big Sheep Cr.	-	-	-	-	-	-(0)	100(2)	-(0)

APPENDIX C

Fishery Statistics for Spring Fisheries for the 2014-15 Run Year

Appendix Table C-1. Estimated harvest of summer steelhead, and observed and expanded harvest of coded-wire tagged steelhead in spring fisheries in the Grande Ronde basin for the 2014-15 run year. Total harvest = 0.521 (harvest card) + 4.859. Sample rate expansion = total harvest/sampled fish. A sample rate expansion of 25 or greater was considered unreliable; in such cases expanded = observed. Harvest estimates are only for months when steelhead angling season was open (Sept - April) and angler harvest card data was greater than zero. Does not include the lower Grande Ronde (location code 231) fishery. "-" indicates not sampled or undefined. No harvest on Catherine Creek (location code 120).

Fishery, location code, statistics, tagcode	Fishery statistics and number of tags recovered by month									Expanded tags
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total	
Upper Grande Ronde (233)										
Angler harvest cards	0	27	0	0	0	13	38	0		
Total harvest	-	19	-	-	-	12	25	-	56	
Rondowa (234)										
Angler harvest cards	0	53	11	213	500	912	659	89		
Sampled fish	0	0	0	0	0	32	32	0		
Total harvest	-	32	11	116	265	480	348	51	1,303	
Sample rate expansion	-	-	-	-	-	15.0	10.9	-		
09 04 25						1	0	0	1	15
09 04 26						1	1	0	2	26
09 04 27						0	2	0	2	22
09 04 29						2	1	0	3	41
09 04 30						1	1	0	2	26
09 05 58						3	0	0	3	45
09 05 59						1	2	0	3	37
09 05 60						0	1	0	1	11
Wallowa (235)										
Angler harvest cards	0	0	37	181	266	1,406	1,134	165		
Sampled fish	0	0	0	0	0	175	174	41		
Total harvest	-	-	24	99	143	737	596	91	1,690	
Sample rate expansion	-	-	-	-	-	4.2	3.4	2.2		
09 04 21						2	0	0	2	8
09 04 22						0	0	1	1	2
09 04 24						2	0	0	2	8
09 04 25						4	1	0	5	20
09 04 26						1	2	0	3	11
09 04 27						2	1	0	3	11
09 04 28						1	1	0	2	7
09 04 29						3	4	0	7	27
09 04 30						2	5	1	8	27
09 05 55						1	0	0	1	4
09 05 56						1	0	0	1	4
09 05 57						4	0	0	4	17
09 05 58						1	1	1	3	9
09 05 59						1	1	0	2	7
09 05 60						0	2	0	2	7
09 05 61						4	7	1	12	43
09 05 63						4	1	1	6	22
Wenaha (184)										
Angler harvest cards	0	59	0	0	0	0	0	0		
Total harvest	-	36	-	-	-	-	-	-	36	

Appendix Table C-1. Continued.

Fishery, location code, statistics, tagcode	Fishery statistics and number of tags recovered by month									Expanded tags
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total	
Middle Grande Ronde (232)										
Angler harvest cards	0	69	43	43	25	32	44	0		
Total harvest	-	41	27	27	18	22	28	-	163	
Total Grande Ronde harvest (excluding lower Grande Ronde)										3,248

Appendix Table C-2. Estimated catch of summer steelhead in spring fisheries in the Grande Ronde basin for the 2014-15 run year. Total catch = (sampled catch/sample harvest) x total harvest. For months with little or no sampling, the average proportion was used. For areas with little or no sampling, data from the survey in closest proximity was used. Does not include the lower Grande Ronde fishery. "-" indicates not sampled or undefined.

Fishery ^a , statistics	Fishery statistics by month									
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total	
Upper Grande Ronde										
Sampled harvest	-	-	-	-	-	-	-	-	-	
Sampled catch	-	-	-	-	-	-	-	-	-	
Total harvest	-	19	-	-	-	12	25	-	56	
Total catch	-	40	-	-	-	23	44	-	107	
Catherine Creek										
Sampled harvest	-	-	-	-	-	-	-	-	-	
Sampled catch	-	-	-	-	-	-	-	-	-	
Total harvest	-	-	-	-	-	-	-	-	0	
Total catch	-	-	-	-	-	-	-	-	0	
Rondowa										
Sampled harvest	-	-	-	-	-	34	36	0	70	
Sampled catch	-	-	-	-	-	92	77	0	169	
Total harvest	-	32	11	116	265	480	348	51	1,303	
Total catch	-	77	27	280	640	1,299	744	123	3,190	
Wallowa										
Sampled harvest	-	-	-	-	-	185	178	43	406	
Sampled catch	-	-	-	-	-	361	312	184	857	
Total harvest	-	-	24	99	143	737	596	91	1,690	
Total catch	-	-	51	209	302	1,438	1,045	389	3,434	
Wenaha										
Sampled harvest	-	-	-	-	-	-	-	-	-	
Sampled catch	-	-	-	-	-	-	-	-	-	
Total harvest	-	36	-	-	-	-	-	-	36	
Total catch	-	219	-	-	-	-	-	-	219	
Middle Grande Ronde										
Sampled harvest	-	-	-	-	-	-	-	-	-	
Sampled catch	-	-	-	-	-	-	-	-	-	
Total harvest	-	41	27	27	18	22	28	-	163	
Total catch	-	87	57	57	38	43	49	-	331	
Total Grande Ronde catch (excluding lower Grande Ronde)										7,281

^a Wallowa data were used for the upper Grande Ronde, middle Grande Ronde, and Catherine Creek; lower Grande Ronde data, in Flesher et al. 2017, were used for the Wenaha.

Appendix Table C-3. Estimated angler effort (hours) for summer steelhead in spring fisheries in the Grande Ronde basin for the 2014-15 run year. Angler effort in hours = Total catch/sampled catch rate in fish per hour. For months with little or no sampling, the average proportion was used. For areas with little or no sampling, data from the survey in closest proximity was used. Does not include the lower Grande Ronde fishery. "-" indicates not sampled or undefined.

Fishery ^a , statistics	Fishery statistics by month								
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Upper Grande Ronde									
Catch rate	-	-	-	-	-	-	-	-	-
Total catch	-	40	-	-	-	23	44	-	107
Angler effort	-	213	-	-	-	118	249	-	580
Catherine Creek									
Catch rate	-	-	-	-	-	-	-	-	-
Total catch	-	-	-	-	-	-	-	-	0
Angler effort	-	-	-	-	-	-	-	-	0
Rondowa									
Catch rate	-	-	-	-	-	0.297	0.157	-	0.212
Total catch	-	77	27	280	640	1,299	744	123	3,190
Angler effort	-	363	127	1,321	3,019	4,374	4,739	580	14,523
Wallowa									
Catch rate	-	-	-	-	-	0.195	0.177	0.198	0.188
Total catch	-	-	51	209	302	1,438	1,045	389	3,434
Angler effort	-	-	271	1,112	1,606	7,374	5,904	1,965	18,232
Wenaha									
Catch rate	-	-	-	-	-	-	-	-	-
Total catch	-	219	-	-	-	-	-	-	219
Angler effort	-	2,258	-	-	-	-	-	-	2,258
Middle Grande Ronde									
Catch rate	-	-	-	-	-	-	-	-	-
Total catch	-	87	57	57	38	43	49	-	331
Angler effort	-	463	303	303	202	221	277	-	1,769
Total Grande Ronde angler effort (excluding lower Grande Ronde)									37,362

^a Wallowa data were used for the upper Grande Ronde, middle Grande Ronde, and Catherine Creek; lower Grande Ronde data, in Flesher et al. 2017, were used for the Wenaha.