LOWER SNAKE RIVER COMPENSATION PLAN

Oregon Spring Chinook Salmon Harvest Monitoring

2015 Annual Progress Report

Oregon Department of Fish and Wildlife

Grande Ronde Watershed, East Region

Kyle W. Bratcher

Jeffrey A. Yanke

Timothy D. Bailey

This report is available at: http://www.fws.gov/lsnakecomplan/Reports/ODFWreports.html

Front cover photo: Chad Dotson with his Imnaha River Catch. Photo courtesy of Chad Dotson.

ANNUAL PROGESS REPORT

FISHERIES RESEARCH PROJECT
OREGON

PROJECT TITLE: Lower Snake River Compensation Plan: Oregon Spring Chinook Harvest Monitoring

CONTRACT NUMBER: F14AC00042

PROJECT PERIOD: January 1, 2015 through December 31, 2015

PREPARED BY: Kyle W. Bratcher
Jeffrey A. Yanke
Timothy D. Bailey

December 2015

Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302

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

CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX TABLES

EXECUTIVE SUMMARY

Objectives

1. Estimate the number of spring/summer Chinook salmon handled or harvested annually, and angler effort, in recreational fisheries in the Imnaha and Grande Ronde basins.

Accomplishments and Findings

The 2015 run year of spring/summer Chinook salmon to Oregon Snake basin tributaries provided recreational (sport) harvest opportunity on Lookingglass Creek, the Grande Ronde, Wallowa and Imnaha Rivers. Daily bag limits for all fisheries were two adipose fin-clipped chinook adults and five adipose fin-clipped jacks per day, with two daily limits in possession. Anglers were required to cease angling if they had retained a daily limit of marked adults.

Lookingglass Creek – The sport fishery on Lookingglass Creek opened 23 May and closed 30 Jun (38 days). The area open to anglers extended from the mouth at the Moses Creek Lane Bridge upstream to the confluence of Jarboe Creek (RM 2). Angling was restricted to the use of artificial flies and lures to minimize impacts to bull trout. During 21 days of creel surveys, 299 anglers were contacted that had fished a total of 1,334 hours. Anglers reported an average catch of one adult Chinook for every 24.3 hours of fishing and one jack for every 88.9 hours of fishing. Effort was estimated at 4,235 angler hours for the Lookingglass Creek fishery. Estimates provided from creel surveys indicated that the Lookingglass fishery accessed 22.2% (2 of 9) of allowed natural-origin (N-O) impacts. Total recreational fishery impact resulting from handling and harvest was estimated at 43.3% (126 of 291) of the allowed limit for hatchery-origin (H-O) adults. In addition, 47 H-O jacks were harvested.

Grande Ronde River – The Grande Ronde River was open for spring chinook salmon angling from 6 Jun to 6 Jul (30 days). The area open to angling was from the State Highway 129 bridge in Washington (RM 26) to 100 yards upstream of the Wildcat/Powwatka Bridge (RM 52) on the Grande Ronde River road in Oregon. To protect wild stocks, the area immediately adjacent to the mouth of the Wenaha River was closed to angling. During seven days of creel surveys, we contacted 46 anglers who had fished 140.5 hours. Effort was estimated at 811 angler hours. Anglers did not report catching any adult or jack Chinook. Therefore; catch rates and adult and jack harvest (both N-O and H-O) were zero.

Wallowa River – The Wallowa River sport fishery was open from 6 Jun to 13 Jul (37 days) in 2015. The open area extended from Minam State Park (RM 8) upstream to the mouth of the Lostine River (RM 25). During 24 days of creel surveys, we contacted 131 anglers who had fished 276 hours. Anglers reported an average catch of one adult Chinook caught for every 10.7 hours of fishing and one jack salmon caught for every 509.7 hours of fishing. Effort was estimated at 1,529 angler hours. We estimated that the fishery accessed 17.7% (5 of 38) and 33% (4 of 13) of the total allowed N-O adult impacts from the Wallowa-Lostine and Minam populations, respectively. We estimated that 25.5% (134 of 523) of the allowed H-O adult harvest from the Lostine population was used in the Wallowa River fishery, in addition to 3 H-O Jacks.

Imnaha River – The Imnaha River fishery opened 6 Jun and closed 13 Jul (37 days). The open area extended from the confluence with the Snake River to Summit Creek Bridge (RM 45). During 22 days of creel surveys, we contacted 172 anglers who had fished a total of 660.5 hours. Anglers reported an average catch of one adult Chinook caught for every 17.4 hours of fishing, and one jack salmon caught for every 44.7 hours of fishing. Effort was estimated at 1,966 angler hours for the entire Imnaha River fishery. Estimates provided from creel surveys indicated that the fishery accessed 11.7% (14 of 120) of the allowed N-O adult impacts. Total recreational fishery harvest was estimated at 28% (73 of 262) of allowed H-O adults; in addition to 39 H-O jacks.

INTRODUCTION

The Imnaha and Grande Ronde River spring Chinook hatchery programs are components of the Lower Snake River Compensation Plan (LSRCP), funded through the U.S. Fish and Wildlife Service (USFWS), developed to mitigate for wild fish production lost as a result of construction of the four lower Snake River dams. Hatchery Chinook and steelhead smolts in the Snake River basin are produced at LSRCP hatcheries in Washington, Idaho and Oregon. Subsequent adult returns are meant to provide tribal and recreational (sport) fisheries and, in some cases, enhance natural spawner numbers. The Oregon Department of Fish and Wildlife (ODFW) initiated the Imnaha and Grande Ronde spring Chinook hatchery program in 1982 under the LSRCP. Subsequent program management has been coordinated between ODFW, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and the Nez Perce Tribe (NPT).

The Imnaha and Grande Ronde River hatchery programs are comprised of five components, each with smolt acclimation and adult collection facilities located on the Imnaha River, upper Grande Ronde River, Lookingglass and Catherine Creeks, and the Lostine River. The Lostine River program interacts with natural production within the broader Wallowa-Lostine population unit. Other hatchery program components are discrete to specific populations indicated. The Lookingglass Creek portion of the program focuses on reintroduction of spring Chinook to that stream and targets the release of 250,000 smolts. Each of the four remaining program components integrates natural-origin fish returning to each respective tributary into production. Smolt release goals, developed to meet LSRCP mitigation responsibilities; include 490,000 for the Imnaha, 250,000 for the Lostine and upper Grande Ronde rivers, and 150,000 for Catherine Creek.

Fisheries that target returns to the Imnaha and Grande Ronde hatchery programs are guided by Fishery Management and Evaluation Plans (FMEP), approved by NOAA fisheries under limit 4 of the final 4(d) rule of the Endangered Species Act (ODFW 2011, ODFW and WDFW 2012). The objective of the FMEP is to provide recreational fishing opportunities and related benefits derived from harvest of Imnaha and Grande Ronde basin hatchery-origin spring Chinook salmon in Oregon and Washington in a manner that supports the continued survival and future recovery of natural-origin Chinook salmon. Each respective FMEP utilizes a management framework for harvest of adipose-clipped, hatchery-origin Snake River spring/summer Chinook salmon using abundance-based sliding scales to set annual fishery impacts.

Fisheries are prescribed maximum impact rates for both direct and incidental mortality of natural-origin adult salmon in sport and tribal fisheries. Impacts are assessed for each population in relation to critical and minimum abundance thresholds (MAT) as described by the Interior Columbia Technical Recovery Team (ICTRT 2007). Population designations for the Imnaha and Grande Ronde Basins are listed in Table 1, and are based upon an analysis of Chinook salmon life history traits, distribution, abundance, and productivity, and geographical and ecological characteristics of the landscape within the Snake River Spring/Summer Chinook Salmon ESU (McElhany et al. 2000).

The abundance-based harvest rate schedule for Imnaha and Grande Ronde Basin fisheries to be shared by all fishing entities in the basin is described in Table 2. Harvest is not considered when hatchery run size does not exceed the number of adults identified for broodstock and supplementation needs as described by sliding scale management plans set for each population's hatchery program. Surplus is generally defined as the adult hatchery run projection less hatchery adults needed for broodstock. This approach limits sport harvest during years when wild fish runs are below MAT and hatchery fish runs are of similar size. In addition, near the lower end of the harvest rate scale, fisheries are not implemented until the allowable hatchery fish harvest exceeds 20 fish due to potential to over harvest within a single week.

Fishery impacts to listed Snake River spring/summer Chinook salmon are assessed on a collective basis (i.e., the sum of recreational and tribal fisheries) by NOAA fisheries. However, the coordination of impact amongst states and tribes is a key component of executing conservation-based fisheries in the Imnaha and Grande Ronde Basins. Co-managers within each basin have developed, and implement annually, an impact sharing agreement that is described in Table 3. Within each fishery scenario, this agreement provides tribal fisheries more of the natural-origin impacts to reflect the non-selective nature of traditional fishing techniques. Recreational fisheries are provided a larger portion of the hatchery harvest such that all available impacts (hatchery and natural collectively) are shared equally (Table 3).

Recreational fisheries administered by the states limit harvest (retention) of spring/summer Chinook hatchery-origin salmon with a clipped adipose fin (as evidenced by a healed scar). All salmon with an intact adipose fin (natural-origin) must be released back to the water. Therefore, incidental mortality impacts occur from catch and release of unclipped Snake River spring/summer Chinook salmon in fisheries targeting adipose-clipped hatchery Chinook salmon, and/or from the illegal retention of unclipped fish. It is generally assumed throughout the Columbia River Basin that the mortality rate resulting from the catch and release of salmon in fisheries is 10%. However, for Lookingglass Creek co-managers, with concurrence from NOAA fisheries, assume a slightly lower rate of 7.5% (ODFW and WDFW 2012).

As stated in the FMEP, fisheries are adjusted or terminated when the total ESA take limit identified in Table 2 and 3 has been reached. Therefore, once fisheries are initiated regular monitoring is required to ensure consistency with co-manager agreements and FMEP requirements. The objective of this LSRCP project was to conduct statistical creel surveys to determine spring Chinook and steelhead ESA impact levels, harvest and release rates, and to inform decisions regarding fishery status in the Imnaha and Grande Ronde Basins in 2015. In this report, we describe creel surveys conducted and estimates of angler effort, catch, and harvest. In addition we compare these estimates in relation to estimates of natural and hatchery-origin returns to each population to assess consistency with prescribed impacts under FMEP guidelines.

METHODS

Lookingglass Creek – The Lookingglass Creek fishery was surveyed using an access point design with a check station located at the point of entry/exit to the fishery (Figure 1). One creel clerk staffed the check station four days per week. The creel survey was stratified by weekends and weekdays, and survey dates were weighted to sample weekends at a higher rate than weekdays (both weekend days and two randomly-selected weekdays per week). An approximate 8-hour shift was applied each day. AM shifts began at 0600 hours before and ended at 1300 hours. PM shifts began at 1300 hours and ended 60 minutes after sunset. Shifts were selected randomly within strata.

All anglers leaving the fishery area during survey shifts were interviewed by the creel clerk. Each interview determined: whether the angler (or anglers) completed fishing for the day, whether they were targeting Chinook salmon, their place of origin, the predominant gear type used, and how many hours the anglers spent actively fishing. Total angler hours for each party were determined by multiplying the number of anglers in the party with the number of hours spent fishing.

Catch information was also determined from interviews and/or visual inspection of harvested fish. Jack and adult salmon were differentiated by length, whereby jacks were considered equal to or less than 61 cm (24 inches) and adults exceeded 61 cm (24 inches). Total catch of adult and jack salmon were

determined through angler interviews for each survey day. Adult and jack salmon harvested in the fishery were inspected by the creel clerk, measured for length, and scanned for the presence of a coded wire tag. If a coded wire tag was present, the snout was removed with the angler's consent. At the end of the season, snouts were forwarded to the ODFW laboratory in Clackamas, OR for tag retrieval.

Grande Ronde, Wallowa, and Imnaha rivers – The Grande Ronde Wallowa, and Imnaha fisheries were surveyed using a roving survey design that was stratified into three sections on the Grande Ronde River, and two sections on the Wallowa and Imnaha rivers. The lower section on the Grande Ronde extended from the Hwy. 129 Bridge (RM 26) upstream to the Oregon state border (hereafter, Stateline) at RM 39. The middle section extended from the Stateline upstream to the confluence of the Wenaha River (RM 45) at the town of Troy, OR. The area immediately adjacent to the mouth of the Wenaha River was closed to protect wild stocks. The uppermost section continued upstream from the Wenaha River to 100 yards above the Wildcat/Powwatka Bridge on the Grande Ronde River road at RM 52 (Figure 2).

On the Wallowa River, the lower section extended from the downstream end of Minam State Park (RM 8) to the confluence with the Minam River (RM 10). The upper section extended from the Minam River upstream to the confluence with the Lostine River (RM 25, Figure 3).

For the Imnaha River, the lower survey section extended from the FR 4260 bridge (Cow Creek Bridge) at RM 5 upstream to Horse Creek at RM 13. The upper section extended from Fence Creek (RM 20) upstream to the terminus of the fishery area at Summit Creek (RM 48). A seven-mile section between Horse Creek and Fence Creek was not surveyed (Figure 4). Referred to as the 'Box Canyon' this section is very remote, mostly privately owned, and generally receives a negligible amount of fishing effort. In addition, the section downstream of the Cow Creek Bridge to the Imnaha River's confluence with the Snake River (lower terminus of the fishery area) is accessed only by foot and was not regularly surveyed. We describe methods used to incorporate this reach into the creel estimates below.

For both the Grande Ronde, Wallowa, and Imnaha rivers, each reach was surveyed four days per week during the fishery. Creel surveys were stratified by weekends and weekdays, and survey dates were weighted to sample weekends at a higher rate than weekdays (both weekend days and two randomly-selected weekdays per week). An approximate 10-hour shift was applied each day that included drive time. Shifts were stratified into morning (AM) and evening (PM) shifts to capture variability in angling effort and catch rates. AM shifts began at 0500 or 0600 hours, and PM shifts began at 1300 or 1400 hours. Shifts were selected randomly within strata.

Roving surveys consisted of pressure counts and angler interviews. Three pressure counts were conducted every survey day, each beginning at two-hour intervals from the designated start time. Pressure counts consisted of driving along the river and counting anglers that were actively fishing (i.e., not those at their vehicles or walking to and from the river). Tying knots and baiting hooks counted as actively fishing. The starting location (either the upstream or downstream end of the fishery) of each day's first pressure count was selected at random, and subsequent counts alternated the direction of travel. Creel clerks were instructed to spend the same amount of time on each pressure count (i.e. travelling at the same rate of speed and stopping at the same vantage points) to equalize effort among counts.

Angler interviews were conducted between pressure counts, and clerks placed emphasis after counts were completed to record as many completed angler trips each day. Each interview determined: whether the angler (or anglers) completed fishing for the day, whether they were targeting Chinook salmon, the place of origin, the predominant gear type used, and how many hours the anglers spent actively fishing. Total angler hours for each party were determined by multiplying the number of anglers in the party by the number of hours spent fishing.

Catch information was determined by identical methods described above for the Lookingglass fishery.

Lookingglass Fishery Data Analysis – Total effort ($\hat{E}$), angler hours (e_i), catch (fish landed; $\hat{C}$), and harvest (fish kept; $\hat{C}$) were estimated using methods described by Pollock et al. (1994) for access point creel designs. Estimates were conducted within survey weeks and weekday/weekend strata, and summed across weeks during the fishery. Total effort was estimated for each stratum as follows:

$$\hat{E} = \sum_{i=1}^{n} (e_i / \pi_i)$$

where: $\hat{E}$ = Total effort, e_i = angler hours for the ith sample day, and π_i = probability of encountering an angler on the ith sampling day. Angler-hours (e_i) were estimated for each stratum as:

$$e_i = \sum_{i=1}^{n} (m_i)(t_i)$$

where: e_i = angler hours for the ith sample day, m_i = number of anglers on the ith sampling day, t_i = time spent fishing on the ith sampling day. Total catch or harvest ($\hat{C}$) for each stratum was estimated by:

$$\hat{C} = \sum_{i=1}^{n} (c_i / \pi_i)$$

where: $\hat{C}$ = Total catch; c_i = catch for the ith sample day, π_i = probability of encountering an angler on the ith sampling day. Consistent with guidelines established in the Grande Ronde Basin FMEP, a handling mortality rate of 7.5% was applied to the estimated catch (fish landed and released) of natural and hatchery-origin adults to estimate fishery impacts.

Within strata variance estimates for catch and effort estimates ($v(\hat{\theta}_i)$) were derived using methods described by Pollock et al. (1994):

$$v(\hat{\theta}_i) = \frac{N^2}{n} \frac{\sum_{j=1}^{n} (\theta_j - \bar{\theta})^2}{n-1}$$

Where *N* is the number of days in the strata, and *n* is the number of days surveyed. Season variance ($v(\hat{\theta})$) was estimated as the sum of the strata variance estimates. Ninety-five percent confidence intervals were estimated as (Cochran 1977):

$$\hat{\theta} \pm 1.96 \times \sqrt{v(\hat{\theta})}.$$

Estimates of catch and variance were conducted separately for each species, adults and jacks, and fish that were harvested and released.

Grande Ronde, Wallowa, and Imnaha Fishery Data Analysis – Total angler effort ($\hat{E}$), catch and harvest (fish landed or kept, respectively, $\hat{C}$) were estimated using methods described by Scheaffer et al. (1979) for stratified cluster sampling. A three-stage method was used to stratify the temporal and spatial sample frame. Days were initially stratified by week of the season, then by day type (i.e., weekday, weekend day) and section.

The lower survey section on the Imnaha River incorporates a five-mile river section accessed only by foot between the FR 4260 Bridge (Cow Creek Bridge) and the Imnaha River mouth. Due to the remote nature, regular pressure counts could not be conducted in this reach. In addition, the upper section of the Wallowa River fishery also includes a 0.4 mile public access area near the confluence with the Lostine River that is difficult to access from the road. Therefore, regular pressure counts are not conducted in either of these reaches. To adjust pressure counts for anglers fishing in these areas, vehicles were counted at the parking areas used to access these stretches of river as a surrogate. Information collected during previous years suggested that each vehicle represented 1.6 anglers in these sections. Therefore, adjusted angler counts in the lower survey section were calculated as:

$$\hat{m}_i = m_i + 1.6v_i$$

where: $\hat{m}_i$ = estimated number of anglers in the lower Imnaha and upper Wallowa survey reaches on the ith day, m_i = number of anglers observed during pressure counts on the ith day, and v_i = number of vehicles observed at the lower Imnaha trailhead on the ith day. For all other sections on the Grande Ronde, Wallowa and Imnaha rivers; m_i was not adjusted. Total angler effort (in hours) was estimated for each stratum as:

$$\hat{E} = \bar{m} \times d \times h$$

where: $\bar{m}$ = the mean angler count during the stratum (as a function of m_i for the unadjusted reaches, and $\hat{m}_i$ for adjusted reaches as described above), d = the number of survey days during the stratum, and h = hours of daylight for each survey day during the strata, assumed to be 16 hours during the fishery. Mean adjusted angler count during the stratum ($\bar{m}$) was calculated as:

$$\bar{m} = \frac{\sum m_i}{\sum p_i}$$

where: m_i= number of anglers counted during the ith sample day (or $\hat{m}_i$for adjusted sections, as described above), and p_i = total of all counts made on the ith sample day.

Total catch or harvest ($\hat{C}$) for each stratum was estimated as:

$$\hat{C} = \hat{E} \times \bar{r}$$

where: $\hat{E}$ = total estimated angler hours during the stratum, and $\bar{r}$ = the mean catch or harvest rate during the stratum. Mean catch or harvest rate (fish/angler hour) for the stratum was estimated as:

$$\bar{r} = \frac{\sum x_i}{\sum w_i}$$

where: x_i = the reported catch and/or harvest for the ith party interviewed, and w_i = total angler hours expended by the ith party when interviewed. Consistent with guidelines established in the Imnaha Basin FMEP, a handling mortality rate of 10.0% was applied to the estimated catch (fish landed and released) of natural and hatchery-origin adults to estimate fishery impacts.

Within-strata variance estimates for catch and effort estimates ($v(\hat{\theta}_i)$), season variance ($v(\hat{\theta})$) and Ninety-five percent confidence intervals were derived using methods described above (see: Lookingglass Fishery Data Analysis).

N-O adult estimates – Run projections for N-O adults in the Wallowa and Grande Ronde River tributaries outside of the upper Wallowa River basin were provided during the LSRCP annual operating plan process by ODFW and NPT research staff (LSRCP 2015).

Since the Grande Ronde and Wallowa fisheries are mixed-stock, estimates of N-O adults are required to determine fishery quotas for all stocks that may be intercepted. Estimates for N-O adults from the upper Wallowa Basin were derived based on the average proportion of total redds counted in the Lostine River, upper Wallowa River, Bear Creek and Hurricane Creek, and N-O estimates for the Lostine River. These estimates assume that N-O returns to the Lostine River are proportional to redd counts throughout the basin. Based on redd counts from 2001-2014, the amount of N-O adults returning to the Wallowa River Basin (outside the Lostine) was equivalent to 40% of the estimated Lostine River return. We estimate that N-O adults returning the Minam River were equivalent to 74% of the estimated Lostine River return.

Catch Allocation – The Grande Ronde and Wallowa fisheries have the potential to encounter N-O and H-O adults from other Grande Ronde basin populations. In order to estimate harvest and ESA impacts from in these mixed-stock fisheries, we are required to allocate catch and harvest for each population the fishery may encounter (Table 4).

Unique PIT tag detections for salmon detected at Lower Granite Dam and at subsequent weirs on the Lostine River and Catherine Creek suggested that salmon migrate at a rate of approximately 11 kilometers per day. Considering the fishery area is located approximately 161 km from Lower Granite Dam, we assume fish take approximately two weeks to reach the fishery area once detected. Therefore, we assumed that run timing in the fishery area would be representative of the run timing observed at Lower Granite Dam, with a delay of two weeks.

Based on the estimated run timing in the fishery area, combined with the total estimated returns for each stock (*i*), we estimated the total number adults from each stock present in the fishery for each week (*j*) as:

$$\widehat{N}_{ij} = x_{ij} \times y_i$$

where: $\widehat{N}_{ij}$ = total amount of fish from stock *i* that we estimated would be present on week *j* of the fishery, x_{ij} represents the proportion of stock *i* that we estimated would be present on week *j* of the fishery based on estimated run timing, and y_i represents the estimated adult return (N-O or H-O) for stock *i*.

The total estimated number of fish from all stocks present in the fishery ($\hat{R}$) during week *j* was calculated as:

$$\hat{R}_j = \sum \widehat{N}_{ij}$$

We assumed each stock would be caught at the same rate that they were present in the fishery. Therefore, the proportion of the total estimated catch ($\hat{P}$) represented by stock *i* for week *j* was calculated as:

$$\hat{P}_{ij} = \frac{\widehat{N}_{ij}}{\hat{R}_{ij}}$$

Therefore, the total estimated catch allocated (*K*) for stock *i* on week *j* was calculated as:

$$K_{ij} = \hat{P}_{ij} \times C_j$$

where: C_j= total estimated catch for the week *i* based on creel surveys. Estimated catch for each stock was rounded to the nearest whole number to remain consistent with catch estimates.

There is no available run timing information for the Wenaha River so the Minam River run timing was used as a surrogate. The upper creel section on the Grande Ronde River was above the Wenaha River; Therefore, Wenaha N-O adults were not considered part of the catch proportion for this section.

The Wallowa River fishery was broken up into two creel sections, upstream and downstream of the Minam River confluence (Figure 3). The upper section is assumed to only intercept N-O and H-O adults from the Wallowa-Lostine stock. However, the lower section has potential to intercept N-O adults from the Wallowa-Lostine and Minam stocks. Therefore, estimated encounter probabilities (see above for the Grande Ronde fishery) were used to estimate catch of Wallowa-Lostine and Minam N-O adults in this fishery section.

RESULTS AND DISCUSSION

Lookingglass Creek − In-season return estimates based on PIT tag recoveries at Bonneville Dam indicated a relatively moderate return of adult Chinook to Lookingglass Creek in 2015. State and Tribal co-managers agreed to manage fisheries in Lookingglass Creek on a total estimated return of 323 N-O and 1,249 H-O adults (Table 4).

The 2015 Lookingglass sport fishery was managed within two constraints: 1) the allowable number of N-O adults handled in the fishery, and 2) the allowable number of H-O adults harvested in the fishery. Given run estimates, FMEP guidelines allowed for a sport fishery impact of 9 natural fish (0.7% of the run) and an allowable harvest and/or incidental mortality of 291 adult H-O salmon (23.3% of the run). By applying a handling mortality rate of 7.5%; we determined sport anglers could not handle more than 120 N-O adult salmon before exceeding ESA impact limits.

The sport fishery on Lookingglass Creek opened 23 May and closed on 30 Jun (38 days). The area open to anglers extended from the mouth of Lookingglass Creek at the Moses Creek Lane Bridge upstream to the confluence of Jarboe Creek (RM 2). Daily bag limits for the Lookingglass Creek fishery was limited two adipose fin-clipped chinook adults and five adipose fin-clipped jacks per day. Anglers were required to cease angling if they had retained a daily limit of marked adults. Angling was restricted to the use of artificial flies and lures only to minimize impact on bull trout.

Creel surveys were conducted on 21 days of the fishery. During the surveys, 299 anglers were contacted who had fished a total of 1,334 hours. Anglers reported an average catch of one adult Chinook (N-O and H-O combined) for every 24.3 hours of fishing and one jack for every 88.9 hours of fishing. Total effort was estimated at 4,235 (95% CI = 3,677-4,793) angler hours for the Lookingglass fishery (Table 5). We estimated 30 (95% CI = 11-49) unmarked N-O adults and 23 (95% CI = 0-48) marked H-O adults were caught and released in the Lookingglass fishery in 2015 (Table 5). Assuming a handling mortality rate of 7.5%, we estimated an incidental mortality of two N-O and two H-O adult salmon. We estimated that sport anglers harvested 124 (95% CI = 82-166) H-O adults in the 2015 Lookingglass fishery (Table 5). Finally, we estimated that anglers handled 37 (95% CI = 13-61) bull trout during the fishery.

Based on creel surveys, the 2015 Lookingglass fishery was managed within predetermined ESA impact limits and harvest sharing agreements. Estimates provided from the creel survey indicated that 22.2% (2

incidental mortalities of 9 allowed) of the N-O impacts and 43.3% (126 harvest/impact of 291 allowed) of the H-O harvest quota were used in the fishery.

Grande Ronde / Wallowa Rivers – In 2015 we conducted a fishery in the lower Grande Ronde River to augment sport harvest of Lostine stock Chinook salmon, which are also targeted in the Wallowa River fishery. Since the Wallowa fishery first opened in 2008, harvest rates have largely underperformed expectations, accessing only 3-6% of allowable limits. Both Grande Ronde and Wallowa fisheries are mixed-stock fisheries that target the same hatchery stock, so we report them together here.

Run projections of N-O adults were 390 and 444 for the upper Grande Ronde River and Catherine Creek, respectively. Based on these data, co-managers agreed to manage the Wallowa and Grande Ronde fisheries on N-O estimates of 580, 513, and 433 unmarked adults for the Wallowa-Lostine, Minam and Wenaha rivers, respectively (Table 4). Based on FMEP guidelines, these run estimates allow for a sport fishery impact of 3 (0.8% of the run) for the upper Grande Ronde River, six for Catherine Creek (1.4% of the run), 4 for the Wenaha River (1.0% of the run), six for the Minam River (1.0% of the run), and fifteen for the Wallowa-Lostine population (1.9% of the run). After the preceding Lookingglass fishery closed 30 Jun, the remaining allowable Lookingglass N-O adult impact was seven (2.2% of the run).

H-O adult return estimates were 2,831 for the Lostine River, 348 for Catherine Creek and 740 for the upper Grande Ronde. Based on these data, co-managers agreed to manage the Wallowa and Grande Ronde fisheries on allowable harvest and/or incidental mortality of H-O adults of 523 (18.5% of the run) for the Lostine River, 31 (9.0% of the run) for Catherine Creek and 56 (7.6% of the run) for the upper Grande Ronde River. After the preceding Lookingglass fishery closed 30 Jun, the remaining allowable Lookingglass H-O adult harvest available to the Grande Ronde fishery was 165.

There was potential for the Grande Ronde River fishery to intercept upper Grande Ronde River stocks (upper Grande Ronde, Catherine, and Lookingglass populations); which limited allowable N-O or H-O impacts. Run timing analyses from PIT tag recoveries at mainstem dams and in basin weirs, suggest both H-O and N-O adults from these tributaries would have passed the fishery area prior to the opening of the Grande Ronde River fishery. We estimated the proportion of total catch to be zero for these populations (Table 4).

The 2015 Wallowa and Grande Ronde sport fisheries were managed within two constraints: 1) the allowable number of N-O adults handled collectively in both fisheries for each stock, and 2) the cumulative number of H-O adult harvest and incidental mortality from all fisheries for each stock. Given N-O adult run estimates, FMEP guidance, and an applied handling mortality of 10.0% except for Lookingglass stock where applied handling mortality was 7.5%; the amount of N-O adult salmon handled in the sport fisheries could not collectively exceed 44 for Catherine Creek, 150 for Wallowa-Lostine, 50 for the Minam River, 40 for the Wenaha River and 30 N-O fish may be handled from the upper Grande Ronde River. After the preceding Lookingglass fishery closed 30 Jun, the remaining allowable Lookingglass N-O adult that could be handled was 90.

The Grande Ronde fishery was open from 6 Jun to 6 Jun (30 days). The area open to salmon angling extended from the Washington state highway 129 bridge upstream to a deadline located 100 yards upstream of the Wildcat/Powwatka Bridge on Grande Ronde River Road in Oregon. The area immediately adjacent to the mouth of the Wenaha River was closed to protect wild stocks.

Creel surveys were conducted on 20 days of the Grande Ronde River fishery. During the survey we contacted 14 anglers that fished 36.5 hours in Oregon, and 32 anglers that fished 99 hours in Washington. Anglers did not report catching any adult or jack Chinook. Therefore; catch rates and adult

and jack harvest (both N-O and H-O) were zero. Total effort was estimated at 104 (95% CI = 6-202) and 707 (95% CI = 321-1093) angler hours in Oregon and Washington, respectively (Table 5). Anglers reported zero adults and zero jack salmon caught during the Grande Ronde fishery (Table 5). Finally, we estimated that three (95% CI = 0-8) bull trout were handled in during the fishery.

The Wallowa River fishery opened on 6 Jun and closed on 13 Jul (37 days). The area open to salmon angling extended from the downstream end of Minam State Park (RM 8) upstream to the confluence with the Lostine River (RM 25). The daily bag limit included two adult adipose fin-clipped Chinook per day and five fin-clipped jacks and anglers were required to cease angling if they had retained a daily limit of marked adults.

Creel surveys were conducted on 24 days of the Wallowa River fishery. During the survey 131 anglers were contacted that fished a total of 276 hours. Anglers reported an average catch of one adult Chinook (N-O and H-O combined) for every 10.69 hours of fishing and one jack for every 510 hours of fishing. Total effort was estimated at 1,529 (95% CI = 1,223-1,835) angler hours (Table 5). We estimated nine (95% CI = 0-24) N-O adults were caught and released in the fishery (Table 5). We estimated 134 (95% CI = 4-264) H-O adults were harvested and three (95% CI = 0-9) H-O jacks (Table 5). Applying a handling mortality rate of 10.0%, we estimated an incidental mortality of one N-O salmon in the Wallowa fishery. However, on Jun 17, one angler caught and retained an adult H-O chinook in one hour resulting in an abnormally high catch rate which expanded to nearly 100 fish for the survey period. Therefore, we believe these estimates are likely higher than actual catch. Finally, we estimated that 10 (95% CI = 0-25) bull trout were handled during the fishery.

Based on these creel surveys, the 2015 Grande Ronde and Wallowa fisheries were managed within predetermined ESA impact limits and harvest sharing agreements. Estimates provided from the creel survey indicated that 2.6% (1 of 38) of the allowable N-O impacts were used for the Wallowa-Lostine and zero for the remaining Grande Ronde and Wallowa tributaries. Allowable H-O harvest quotas used in the Grande Ronde and Wallowa fisheries were 0 for Lookingglass stock and 25.5% (134 harvested adults of 523 allowed) for the Wallowa-Lostine stock. Harvest was estimated at zero H-O adults from Catherine Creek and the upper Grande Ronde River.

Imnaha River – In-season return estimates based on PIT tag recoveries at mainstem dams indicated a modest return of adult Chinook to the Imnaha River in 2015. State and Tribal co-managers agreed to manage fisheries in the Imnaha River based on a total estimated return of 688 N-O adults and 1,500 H-O adults.

Using these run estimates, FMEP guidelines allowed for a sport fishery impact of 12 N-O adults (1.74 % of the run) and an allowable harvest of 262 adult H-O salmon (16.67% of the run). The 2015 Imnaha sport fishery was managed within three constraints: 1) the allowable number of N-O adults handled in the fishery and 2) the combined number of H-O adult harvest and incidental mortality in the fishery. Given the run estimates, FMEP guidance, and an applied handling mortality of 10.0%; sport anglers were limited to handling less than 120 N-O adult salmon. Combined H-O adult harvest and/or incidental mortality could not exceed 262 fish.

The sport fishery on the Imnaha River opened 6 Jun and closed 13 Jul (43 days). The area open to anglers extended from the confluence with the Snake River to Summit Creek Bridge (RM 45) on the Imnaha River. Daily bag limits were limited to two adult adipose fin-clipped Chinook per day and five fin-clipped jacks. Anglers were required to cease angling if they had retained a daily limit of marked adults.

Creel surveys were conducted on 22 days of the Imnaha River fishery. During the survey 172 anglers were contacted that fished a total of 661 hours. Anglers reported an average catch of one adult Chinook (N-O and H-O combined) for every 17.4 hours of fishing and one jack for every 44.7 hours of fishing. Total effort was estimated at 1,966 (95% CI = 1,359-2,572) angler hours for the Imnaha fishery (Table 5). We estimated 14 (95% CI = 0-36) N-O adults were caught and released in the fishery (Table 5). We estimated 73 (95% CI = 35-110) H-O adults were harvested. We estimated that anglers harvested 39 (95% CI = 4-64) H-O jacks, and caught and released five N-O jacks (95% CI = 0-15; Table 5). Applying a handling mortality rate of 10.0%, we estimated an incidental mortality of one and zero N-O and H-O adult salmon, respectively. Finally, we estimated that 25 (95% CI = 7-43) bull trout were handled during the fishery.

Based on these creel surveys, the 2015 Imnaha fishery was managed within predetermined ESA impact limits and harvest sharing agreements. Estimates provided from the creel survey indicated that 8.3% (1 incidental mortality of 12 allowed) of the N-O impacts and 27.8% (73 harvested of 262 allowed) of the H-O harvest quota were used in the fishery.

REFERENCES

Cochran, W. G. 1977. Sampling techniques, 3rd edition edition. Wiley, New York.

ICTRT (Interior Columbia Technical Recovery Team). 2007. Current ICTRT draft population status reports. Memorandum to C. Toole, National Marine Fisheries Service, from T. Cooney, National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

LSRCP (Lower Snake River Compensation Plan), 2015. Lower Snake River fish and wildlife compensation plan Grande Ronde and Imnaha basins annual operation plan 2015.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of Evolutionarily Significant Units. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-42, 156p.

Oregon Department of Fish and Wildlife (ODFW). 2011. Fisheries Management and Evaluation Plan for Snake River Spring/Summer Chinook – Imnaha Subbasin.

Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW). 2012. Fisheries Management and Evaluation Plan for Snake River Spring/Summer Chinook – Grande Ronde Subbasin.

Pollock, K. H., C. M. Jones, and T. L. Brown. 1994. Angler survey methods and their applications in fisheries management. American Fisheries Society Special Publication 25, Bethesda, Maryland

Scheaffer, R. L., W. Mendenhall, and L. Ott. 1979. Elementary survey sampling. Duxbury, North Sciuate, Massachusetts.

APPENDICES

Table 1. List of the natural fish populations, "Viable Salmonid Population" thresholds, and associated hatchery stocks in the Imnaha and Grande Ronde River Basins.

Natural Populations (or Management Units	Critical Threshold	Minimum Abundance Threshold (MAT)	Associated hatchery stock(s)	Hatchery stock essential for recovery?
Imnaha R (inc. Big Sheep Cr)	Abundance: 300 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance:1000 adults/yr Productivity: long term avg. replacement rate =1	Lookingglass Hatchery Imnaha stock	Y
Wallowa/ Lostine R	Abundance: 300 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance:1000 adults/yr Productivity: long term avg. replacement rate =1	Lookingglass Hatchery Lostine stock	Y
Catherine/Indian Cr[1]	Abundance: 300 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance:1000 adults/yr Productivity: long term avg. replacement rate =1	Lookingglass Hatchery Catherine Creek stock	Y
Upper Grande Ronde R	Abundance: 300 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance:1000 adults/yr Productivity: long term avg. replacement rate =1	Lookingglass Hatchery U. Grande Ronde stock	Y
Wenaha R	Abundance: 225 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance: 750 adults/yr Productivity: long term avg. replacement rate =1	None	N/A
Minam R	Abundance: 225 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance: 750 adults/yr Productivity: long term avg. replacement rate =1	None	N/A
Lookingglass Cr	Abundance: 150 adults/yr Productivity: short term avg. replacement rate <0.7	Abundance: 500 adults/yr Productivity: long term avg. replacement rate =1	Lookingglass Hatchery Catherine Creek stock	N

[1] When fisheries target only the Catherine Creek portion of the Catherine/Indian Population, then the fisheries will be managed based on a Critical Threshold of 225 with a MAT of 750 as for an Intermediate-sized population.

Table 2. Total collective natural-origin adult harvest/impact rates relative to critical and minimum abundance threshold (MAT) levels described in Table 1.

Fishery Scenario	Expected return of natural-origin fish	Total collective natural-origin mortality
A	Below Critical Threshold	**1%***
B	Critical to MAT	**A + 11% of margin above A***
C	MAT to 1.5X MAT	**B + 22% of margin above B**
D	1.5X MAT to 2X MAT	**C + 25% of margin above C**
E	Greater than 2X MAT	**D + 40% of margin above D**

* For Lookingglass Creek fisheries will be managed more liberally under fishery scenarios A & B: A = 10% total harvest (tribal 8% and sport 2%); B = A + 16% of margin above critical (tribal 12% and sport 4%).

Table 3. Natural-origin adult harvest/impact rates based on existing co-manager agreements, including collective natural-origin mortality rates as described in Table 2.

Fishery Scenario	Number of Natural Origin Fish	Annual natural-origin mortality based on co-manager agreements		Total Collective Natural-Origin Mortality (All Fisheries)
		Tribal	State	
A	Below Critical Threshold	**1%***	**0%***	**1%***
B	Critical To MAT	A + **8%** of margin above critical*	**A + 3%** of margin above critical*	**A + 11%** of margin above critical*
C	MAT To 1.5X MAT	B + **16%** of margin above MAT	B + **6%** of margin above MAT	**B + 22%** of margin above MAT
D	1.5X MAT To 2X MAT	C + **19%** of margin above 1.5X MAT	C + **6%** of margin above MAT	**C + 25%** of margin above MAT
E	Greater than 2X MAT	D + **28%** of margin above 2X MAT	D + **12%** of margin above 2X MAT	**D + 40%** of margin above 2X MAT

* For Lookingglass Creek fisheries will be managed more liberally under fishery scenarios A & B: A = 10% total harvest (tribal 8% and sport 2%); B = A + 16% of margin above critical (tribal 12% and sport 4%).

Table 4. Return estimates of spring Chinook salmon to the Imnaha and Grande Ronde Basins in 2015.

Population	Projected Run Size		
	Natural	Hatchery	Total
Imnaha Basin			
Imnaha River [a]	688	1,500	2,188
Grande Ronde Basin			
Catherine Creek [b]	444	348	792
Lookingglass Creek[a]	323	1,249	1,572
Upper Grande Ronde River [b]	390	740	1,250
Wallowa-Lostine River [a,c,]	580	2,831	4,332
Minam River [b,d]	513	–	513
Wenaha River [b, d]	433	–	433

[a] Estimates based on in-season projections utilizing PIT tag detections at mainstem dams in mid-Jun 2015

[b] Estimates based on pre-season run projections. Fisheries were not implemented on these populations; therefore in-season updates were not conducted.

[c] Natural-origin returns a function of projected returns to the Lostine River plus added natural production to the Wallowa Basin. Redd counts suggest that total returns to the Wallowa-Lostine population are 1.4X estimated returns to the Lostine River.

[d] Managed for natural production only, no hatchery returns are projected (outside of strays) for the basins.

Table 5. Estimates of effort, catch, and harvest during the 2015 Lookingglass Creek (31 May to 18 Jun), Wallowa (6 Jun to 19 Jul), Grande Ronde (6 Jun to 19 Jul), and Imnaha rivers (6 Jun to 19 Jul) fisheries. Ninety-five percent (95%) confidence limits are indicated in parentheses.

Fishery Parameter	Lookingglass Creek (95% CI)	Imnaha River (95% CI)	Wallowa River (95% CI)	Grande Ronde River (95% CI)
Fishery Days	38	43	43	43
Total Estimated Angler Hours	4235 (3677-4793)	1966 (1359-2573)	1529 (1223-1835)	811 (412-1209)
Marked Adults Harvested	124 (82-166)	73 (35-111)	134 (4-263)	–
Marked Jacks Harvested	47 (21-73)	39 (4-74)	3 (0-9)	–
Unmarked Adults Released	30 (11-49)	14 (0-36)	9 (0-4)	–
Unmarked Jacks Released	–	5 (0-15)	28 (17-39)	–
Marked Adults Released	25 (2-48)	–	–	–
Bull Trout Released	37 (13-61)	25 (7-43)	10 (1-19)	3 (0-25)

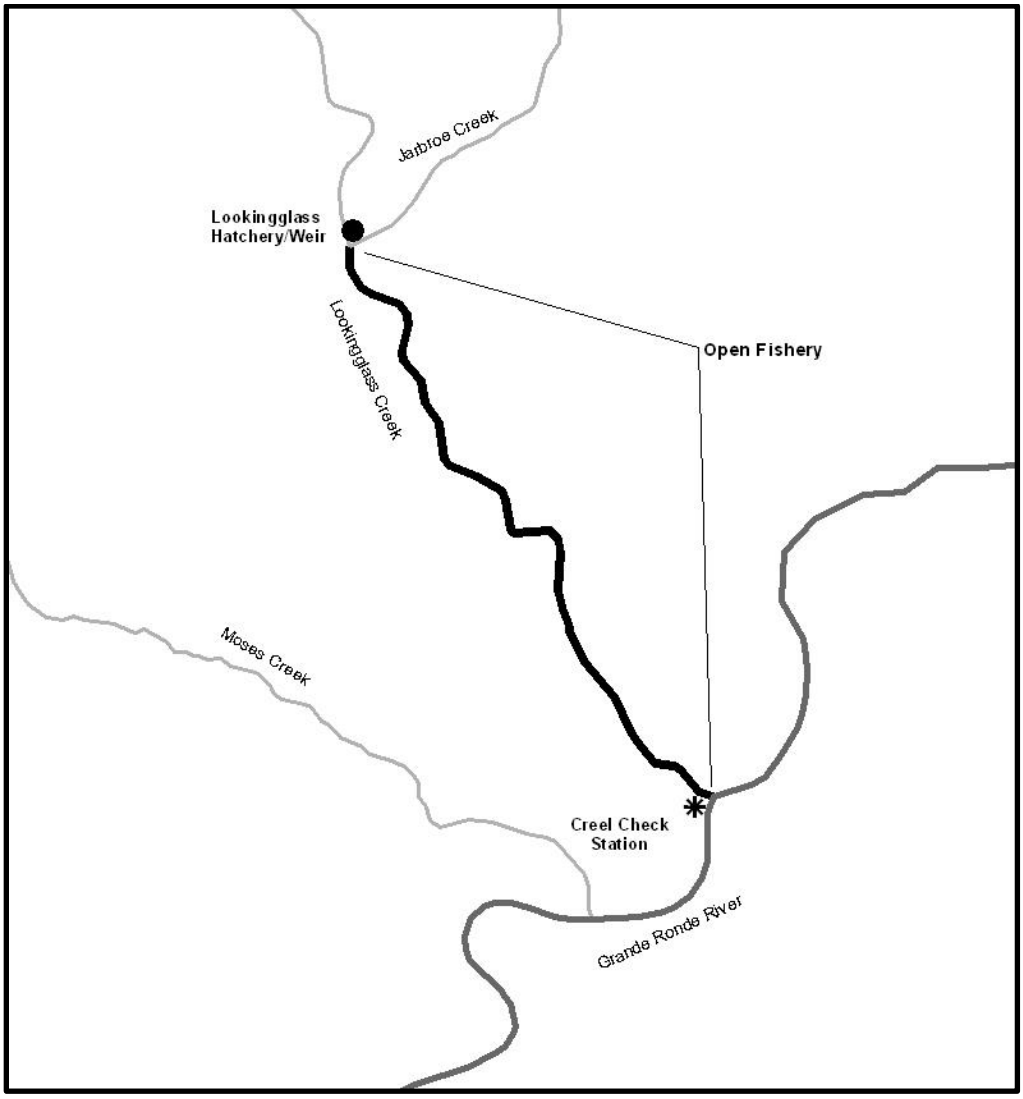

Figure 1. The Lookingglass Creek fishery management area (RM 0 to 2) showing area open to fishing and the location of the access point survey (creel check station) near the confluence with the Grande Ronde River at Palmer Junction, OR.

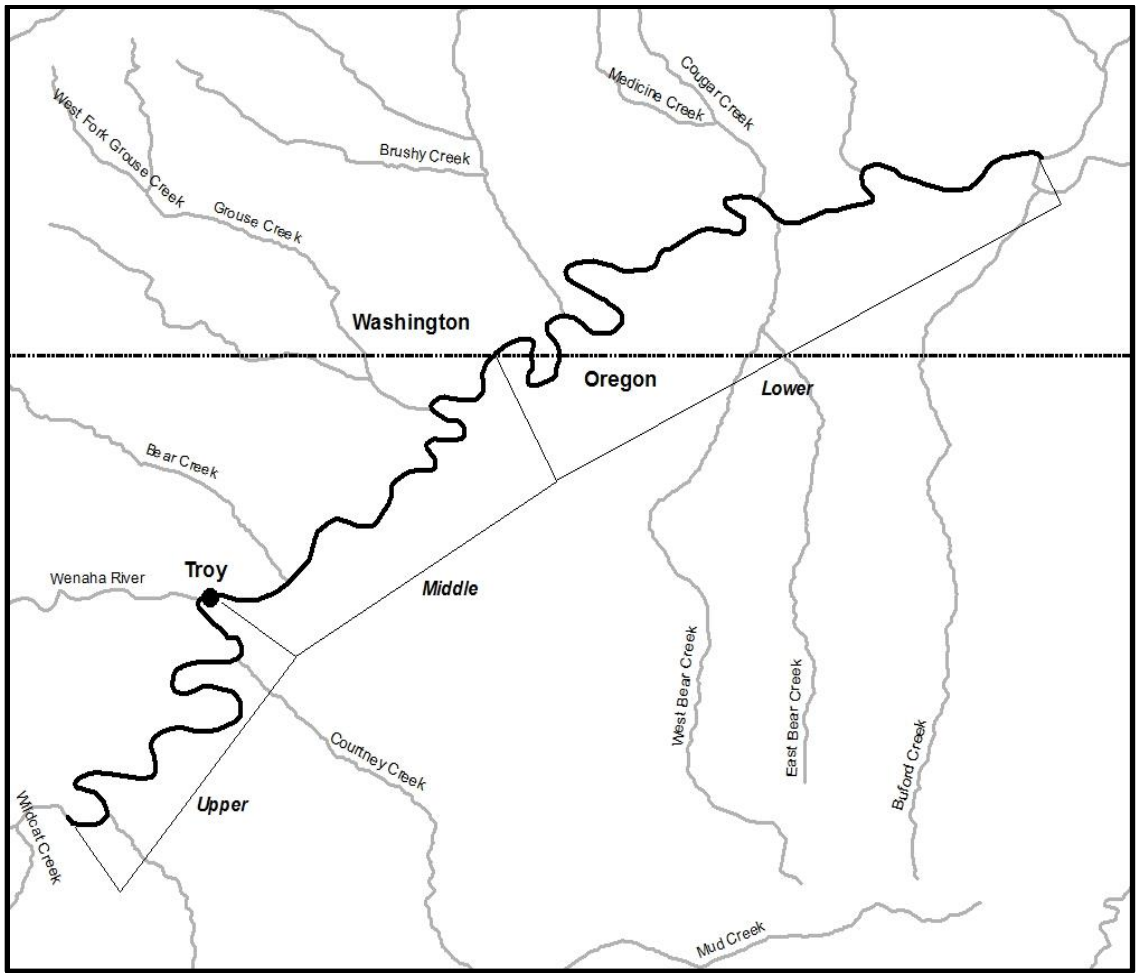

Figure 2. The Grande Ronde River fishery management area (RM 26 to 52) showing area open to fishing and creel survey sections near Troy, OR

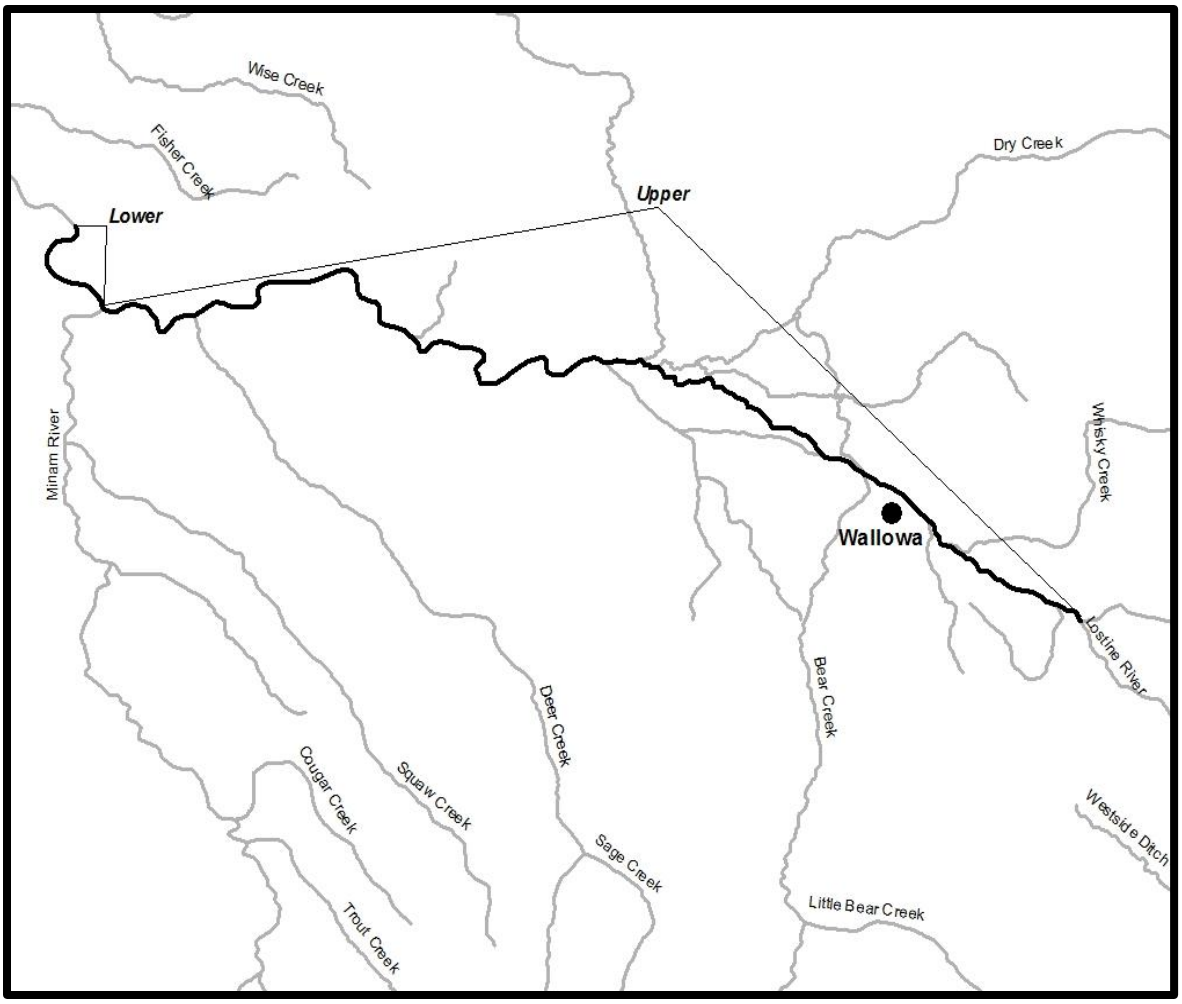

Figure 3. The Wallowa River fishery management area (RM 8 to 25) showing area open to fishing and creel survey reaches near Wallowa, OR.

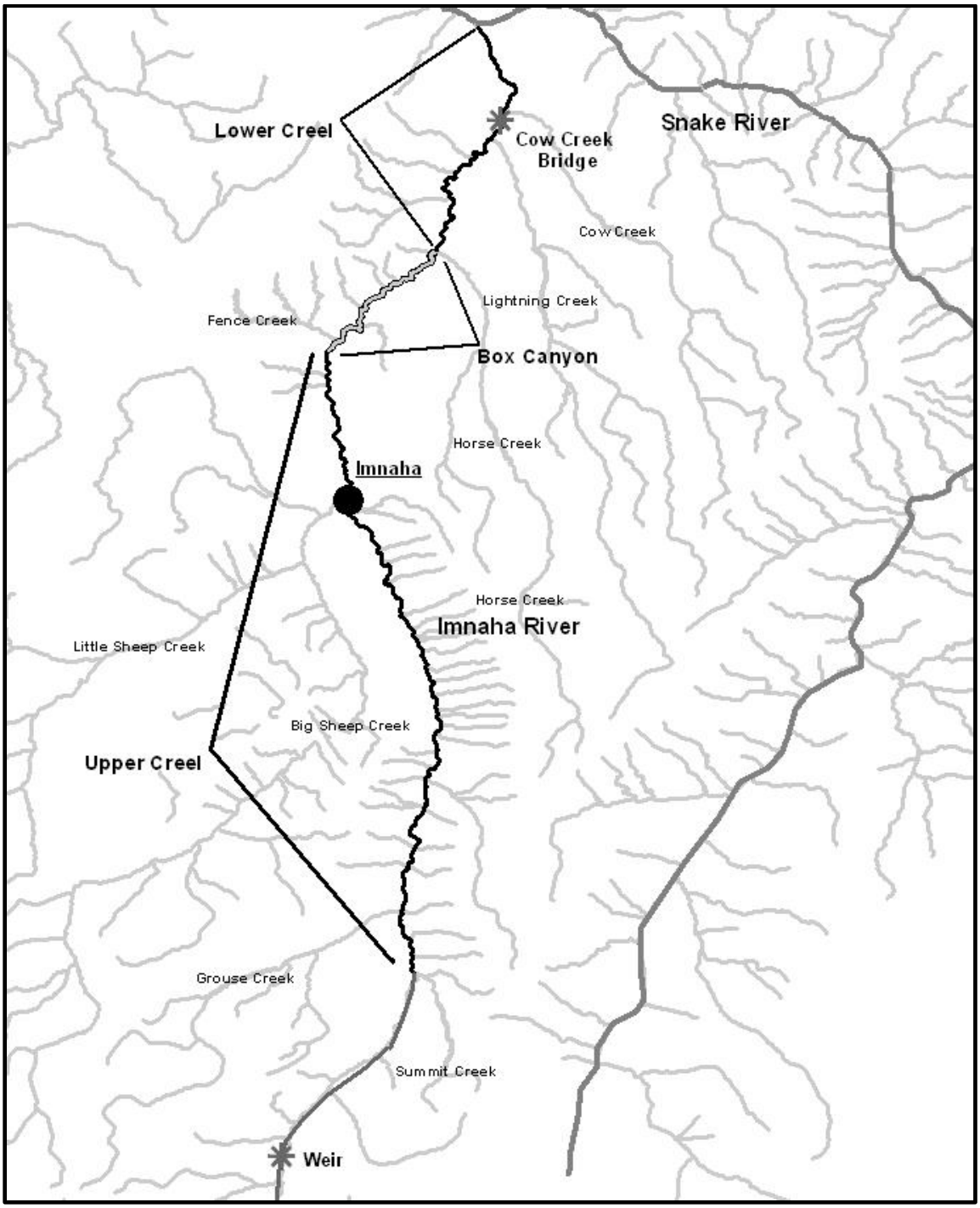

Figure 4. The Imnaha River fishery management area (RM 0 to 48) showing descriptions of surveyed reaches (lower RM 5-13, upper RM 20-48), the unsurveyed Box Canyon reach (RM 13-20), major tributaries, and the location of the adult weir and juvenile release facility upstream of the fishery area.

APPENDIX TABLES

Appendix Table 1. Lookingglass Creek spring Chinook sport fisheries adult (age-4 and 5 only) impact for years 2011 through 2015.

Year	Sport Season	Harvest (H) [1]	Released (H)	Released (N) [1]	Impact [2] (N)
2011	5/28-7/15	141	4	38	3
2012	5/26-6/12 6/22-6/25	464	20	26	4
2013 [3]	6/1-6/21	0	40	16	1
2014	5/31-6/18	197	5	53	4
2015	5/23-6/30	124	23	30	2

[1] (H) = Hatchery-origin fish, (N) = Natural-origin fish

[2] Impact includes 7.5% fishery mortality for both hatchery and wild fish caught and released

[3] The 2013 fishery was limited to retention of jacks only.

Appendix Table 2. Wallowa River spring Chinook sport fisheries adult (age-4 and 5 only) impact for years 2008 through 2015. Adult abundance did not support sport harvest in 2013.

Year	Sport Season	Est. Harvest (H) [1]	Est. Released (H)	Est. Released (N) [1]	Impact [2] (N)
2008	6/4-6/13	0	0	0	0
2009	6/13-7/12	10	0	11	1
2010	5/22-7/25	45	0	47	5
2011	5/28-8/7	25	0	28	3
2012	6/9-7/15	0	0	15	2
2014	6/21-7/27	10	0	2	0
2015	6/6-7/13	134	0	9	1

[1] (H) = Hatchery-origin fish, (N) = Natural-origin fish

[2] Impact includes 10% fishery mortality for both hatchery and wild fish caught and released

Appendix Table 3. Imnaha River spring Chinook sport fisheries adult (age-4 and 5 only) impact for years 2001 through 2015. Adult abundance did not support sport harvest in 2006 and 2007.

Year	Sport Season	Est. Harvest (H) [1]	Est. Released (H)	Est. Released (N) [1]	Impact[3] (N)
2001	6/2-6/21	302	21	433	43
2002	6/1-6/30	152	9	15	2
2003	6/7-7/1	125	22	83	8
2004	6/19-7/5	192	21	29	3
2005	6/25-7/4	22	54	22	2
2008	7/4-7/15	64	0	17	2
2009	6/13-7/12	197	0	50	5
2010	5/22-7/25	336	48	108	11
2011	5/28-7/23	519	0	153	15
2012	6/9-6/27	203	0	62	6
2013	7/5-7/19	30	0	11	1
2014	7/5-7/27	33	4	6	1
2015	6/6-7/13	73	0	14	1

[1] (H) = Hatchery-origin fish, (N) = Natural-origin fish

[2] Impact includes 10% fishery mortality for both hatchery and wild fish caught and released

Appendix Table 4. Grande Ronde River spring Chinook sport fisheries adult (age-4 and 5 only) impact for years 2014 and 2015.

Year	Sport Season	Est. Harvest (H) [1]	Est. Released (H)	Est. Released (N) [1]	Impact[3] (N)
2014	6/27-6/30 7/5-7/7	9	0	7	1
2015	6/6-7/6	0	0	0	0

[1] (H) = Hatchery-origin fish, (N) = Natural-origin fish

[2] Impact includes 10% fishery mortality for both hatchery and wild fish caught and released